PRELIMINARY DRAINAGE REPORT

Magnolia Avenue Business Center
City of Corona, County of Riverside, California

PREPARED FOR:

Western Realco
500 Newport Center Drive, #630
Newport Beach, CA 92660
(949) 720-0369

PREPARED BY:

KWC Engineers
1880 Compton Avenue, Suite 100
Corona, CA 92881
Tel: (951) 734-2130
www.kwcengineers.com

October 13, 2023

TABLE OF CONTENTS

Section Name **Page Number**

LIST OF TABLES 3

LIST OF FIGURES 3

LIST OF APPENDICES 4

Section 1 - Introduction 4

1.1 Purpose of Study 4

1.2 Project Description 4

1.3 Floodplain Mapping 5

1.4 Design Criteria 5

Section 2 – Hydrologic Data and Model Development 6

2.1 Existing Condition Model 6

2.2 Proposed Condition Model 7

2.3 Onsite Drainage Facilities 8

Section 3 – Conclusions 9

Section 4 – References 10

LIST OF TABLES

Table 1. Existing Condition Peak Flow Summary 7

Table 2. Proposed Condition Peak Flow Summary 8

Table 3. Proposed vs Existing Condition Peak Flow Summary 8

LIST OF FIGURES

Figure 1: Vicinity Map

Figure 2: Existing Condition Hydrology Key Map

Figure 3: Proposed Condition Hydrology Key Map

Figure 4: FEMA FIRM Panel

LIST OF APPENDICES

Appendix A: Vicinity Map

Appendix B: NOAA Precipitation Data

Appendix C: Existing Condition Hydrology Rational Method & Key Map

Appendix D: Proposed Condition Hydrology Rational Method & Key Map

Appendix E: FEMA Flood Insurance Rate Maps

Appendix F: Hydraulics

Appendix G: Reference Plans

Section

1

INTRODUCTION

1.1 PURPOSE OF STUDY

The purpose of this study is to hydrologically model the project site's onsite tributary watersheds to determine the existing and proposed peak runoffs. The hydrologic analysis was prepared using the Rational Method as specified in the Riverside County Hydrology Manual. The flows are used to estimate the size of the proposed drainage facilities that support the proposed project development.

1.2 PROJECT DESCRIPTION

The Magnolia Avenue Business Center project is comprised of 16.58 acres of developed land at 1375 Magnolia Ave. in the City of Corona in Riverside County, California, adjacent to El Camino Ave. **Appendix A** shows a vicinity map of the area illustrating the location of the project.

The Magnolia Avenue Business Center project is generally bounded to the north and east by Temescal Wash, a fully developed concrete paved channel. Bounded on the south by Magnolia Ave., and to the west railroad and El Camino Ave.

The project site existing conditions is flat and consists of several improvements, including several large industrial/warehouse type buildings, office buildings, material racks, parking area with asphalt pavements, concrete slabs, landscapes areas, and unpaved areas. The existing project gross acreage is 16.58 acres. The site has been developed decades ago with import soils. The site's drainage area flows towards the existing Temescal Wash.

The proposed improvements are to remove all existing structures and landscape material except perimeter trees. Two new buildings, , landscape areas, driveways, and parking lots are proposed. Building 1 is 231,370 sf and building 2 is 90,157 sf. The proposed buildings will consist of a warehouse and office space with the necessary improvements to facilitate the business. The onsite drainage areas will be captured and routed through MWS Units before discharging into the existing Temescal Wash bordering the project. Magnolia Avenue will be improved on the project frontage. The half width drainage of Magnolia Avenue will be captured within a catch basin located at the low point and discharged into an existing storm drain system on Sherborn Street..

1.3 FLOODPLAIN MAPPING

The National Flood Insurance Act (1968) established the National Flood Insurance Program, which is based on the minimal requirements for floodplain management and is designed to minimize the flood damage within Other Flood Areas. The Federal Emergency Management Agency (FEMA) is the agency which administrates the National Flood Insurance Program. Other Flood Areas are defined as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. Flood Insurance Rate Maps (FIRMs) were developed to identify areas of flood hazards within a community.

According to the Flood Insurance Rate Map (FIRM) catalog, there are FIRMs produced by FEMA for the project site:

MAP Number: 06065C1356G

MAP Revised: August 28, 2008

FEMA FIRM Panel (**Figure 4**) is attached in **Appendix E** shows the floodplain limits and mapped flood zones for the Magnolia Avenue Business Center project area. The project is located within Zone X, which is an area within the flood hazard areas subject to inundation by the 0.2% annual chance flood.

1.4 DESIGN CRITERIA

The following are design criteria for this project, based on the Riverside County Hydrology Manual.

Protection Levels

1. The 100-year flood shall be contained 1’ below the building pads.

2. The 10-year flood shall be contained within the top of curbs.

1) Loss rates are to be determined for the 2- and 5-year events using an AMC I condition, while an AMC II are used for the 10-year event and 100-year event.

Section

2

HYDROLOGIC DATA AND MODEL DEVELOPMENT

2.1 EXISTING CONDITION MODEL

The project site existing conditions is flat and consists of several improvements, including several large industrial/warehouse type buildings, office buildings, material racks, parking area with asphalt pavements, concrete slabs, landscapes areas, and unpaved areas. The site has been developed decades ago. The site drains to existing Temescal Wash.

The site is comprised of three (3) major drainage areas and one (1) offsite drainage area to describe the existing drainage conditions. Refer to Existing Condition Hydrology Key Map **Figure 2** in **Appendix C** for locations of the drainage sub-areas and peak flows. Hydrologic calculations to evaluate surface water runoff associated with the 10-year and 100-year storm frequency were performed for the on-site drainage areas. The Riverside County Rational Method Hydrologic calculations (as described in the RCHM) were performed using the CivilDesign Hydrology / Hydraulics computer program package 2005 by Bonadiman and Associates, Inc.

Precipitation point values for the 10-year and 100-year durations obtained from National Oceanic and Atmospheric Administration (NOAA) point precipitation frequency estimates (see **Appendix B**).

There are three existing 24" RCP storm drain pipes that convey storm water from the existing site to Temescal Wash. Refer to Temescal Creek Channel Stage III plan in **Appendix G** for asbuilt drawings of the existing storm drain pipes.

In order to proceed with analysis of the proposed developed condition, it is necessary to first establish the pre-developed peak runoff rates. **Table 1** summarizes the data and results for the 10-year and 100-year storm event for on-site and off-site flows. All calculations can be found in **Appendix C** of the report.

Table 1. Existing Condition Peak Flow Summary

Drainage Area	Area (AC)	Q10 (CFS)	Q100 (CFS)
A	3.10	5.98	9.32
B	7.87	15.52	24.44
C	7.42	17.19	27.06
D	0.58	1.15	1.79

2.2 PROPOSED CONDITION MODEL

In the proposed condition, the proposed improvements are to remove all existing structures and landscape material except perimeter trees. Per the preliminary geotechnical report by Petra Geosciences dated December 9, 2022 all existing subsurface utility lines running through the CAP area will be encased in 6 inches of concrete to protect against any contamination with the soil. Refer to Appendix B for Petra Geoscience's response to the proposed storm drain system within the CAP limits. Two new buildings, landscape areas, driveways, new drainage system and parking lots are proposed. The site grading requires soil import. Street improvements are proposed for Magnolia Avenue.

The developed condition site consists of three (3) major drainage areas and one (1) offsite drainage area. The project site runoff will be picked up by a system of gutters and inlets that will discharge through a storm drain system into one of the existing 24" RCP that outlets to the Temescal Wash. The flows will discharge and continue as it does in its current conditions. Drainage Area D is an offsite drainage area that will not comingle with onsite flows. Flows from street improvements within Magnolia Avenue will be directed in a system of gutters to a catch basin placed at the low point of the street and discharge to the existing 30" RCP on Sherborn Street. Refer to Proposed Condition Hydrology Key Map **Figure 3** in **Appendix D** for locations of the drainage sub-areas and peak flows. Hydrologic calculations were evaluated for surface water runoff associated with the 10-year and 100-year storm frequency. The proposed condition watershed boundaries were delineated using the project's conceptual grading plan. Hydrologic land cover for the development is considered as commercial.

Table 2 summarizes the proposed condition 10 and 100-year rational method results. Proposed condition rational method calculations can be found in **Appendix D** of the report.

Table 2. Proposed Condition Peak Flow Summary

Drainage Area	Area (AC)	Q10 (CFS)	Q100 (CFS)
A	5.32	11.27	17.70
B	6.73	14.57	22.73
C	5.32	8.72	13.63
D	1.53	2.77	4.32

Table 3 summarizes the comparison between the Existing Condition and Proposed Condition Hydrology results.

Table 3. Existing vs. Proposed Condition Peak Flow Summary

Drainage Area	Existing Condition			Proposed Condition			Note
	Area (Acres)	Q10 (CFS)	Q100 (CFS)	Area (Acres)	Q10 (CFS)	Q100 (CFS)	
A	3.10	5.98	9.32	5.32	11.27	17.70	*$Q_{Proposed} > Q_{Existing}$
B	7.87	15.52	24.44	6.73	14.57	22.73	$Q_{Proposed} < Q_{Existing}$
C	7.42	17.19	27.06	5.32	8.72	13.63	$Q_{Proposed} < Q_{Existing}$
D	0.58	1.15	1.79	1.53	2.77	4.32	**$Q_{Proposed} > Q_{Existing}$

*Note 1: Existing 24" RCP is capable of conveying the proposed Q100 to the Temescal Creek Channel. See **Appendix F** for hydraulic calculations.

Note 2: Difference in flows is due to widening of Magnolia Avenue to its intended right-of-way. Existing 30" SD has the capacity to intake the Q100 flow from this area. See **Appendix F for hydraulic calculations.

2.3 ONSITE DRAINAGE FACILITIES

Preliminary onsite drainage facilities for the project were calculated utilizing the rational method hydrology program and are presented on the Proposed Condition Hydrology Key Maps. The approximate locations of drainage facilities are intended for conceptual purposes only and will be refined in the design review and final engineering process. Pipe sizes are based on the design criteria presented in Section 1.4. Pipes were designed as reinforced concrete pipe, with a roughness coefficient of 0.013. Preliminary hydraulic calculations were done with the computer program OpenFlows Flowmaster by Bentley for the existing 24" RCP storm drain pipes (see **Appendix F**). The proposed onsite storm drain system calculations will be performed in the Final Engineering phase.

Section

3

CONCLUSIONS

This preliminary drainage study has evaluated the potential effects of runoff on the proposed project. In addition, the report has addressed the methodology used to analyze the existing and proposed conditions, which was based on the Riverside County Hydrology Manual. This section provides a summary discussion that evaluates the potential effects of the proposed project.

- The project is 16.58 acres of developed industrial land.
- There are no offsite tributary areas. All surrounding properties are developed land.
- Magnolia Avenue half width improvements will be captured by a catch basin at the low point and discharged into an existing storm drain within Sherborn Street.
- Underground utilities within the CAP area boundary will be encased in 6 inches of concrete to prevent contamination.
- Preliminary alignment and pipe sizes of storm drain lines were presented.

All storm water runoff will be carried via gutters, catch basins, or onsite storm drain system to three existing storm drain pipes that will outlet into the fully developed Temescal Wash. The computed 10-year storm event is contained below the top of curb and the computed 100-year storm event is contained within 1’ below the building pads.

Section

4

REFERENCES

Riverside County Flood Control and Water Conservation District. Hydrology Manual. April 1978

Riverside County Flood Control and Water Conservation District. Increased Runoff Mitigation Workshop. August 24, 1995

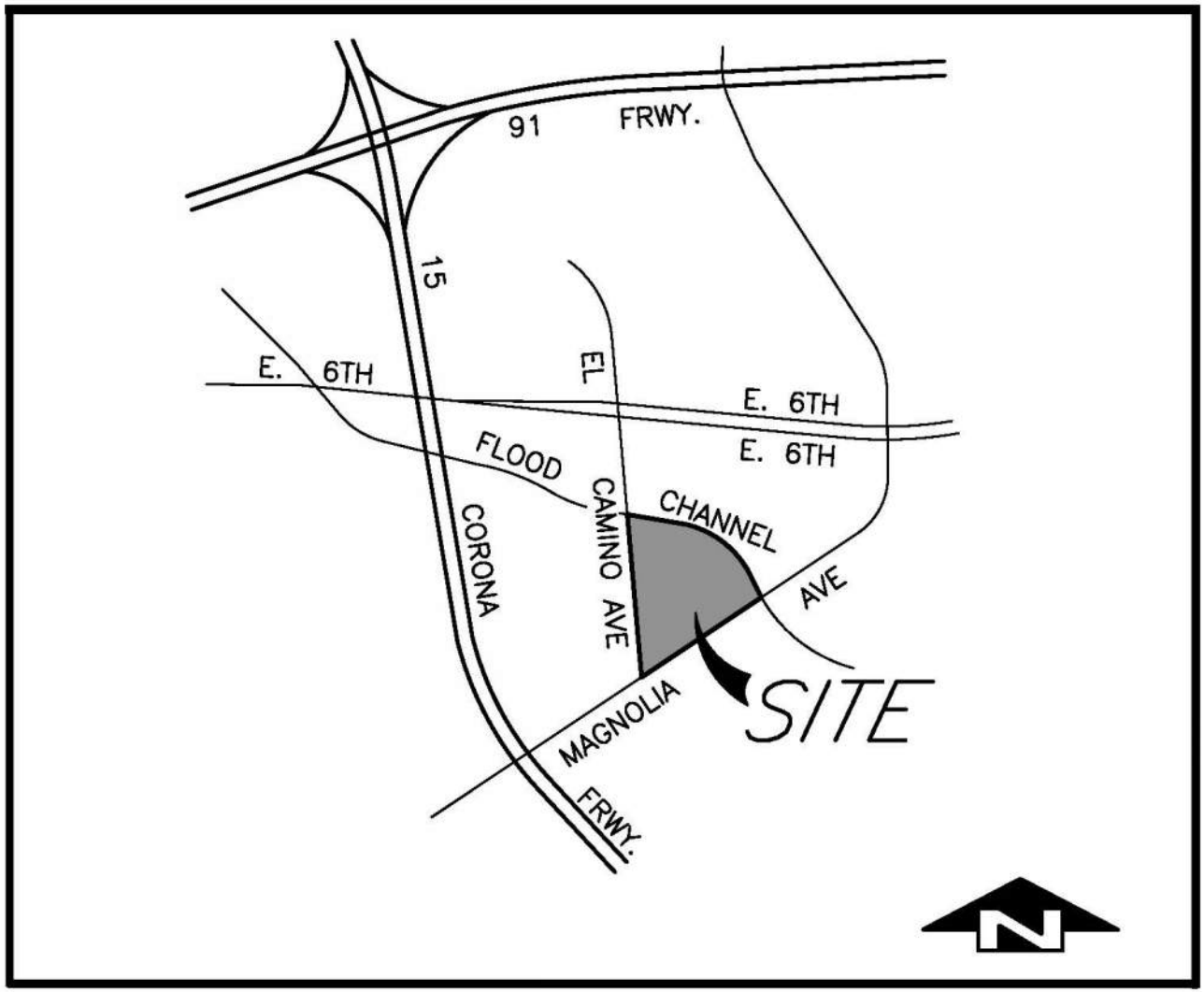
Riverside County Flood Control and Water Conservation District, Temescal Creek Channel Stage III Drainage Plans, December 3, 1984

City of Corona, Corona Crossroads Business Park P.M. No. 31369 Public Improvement Plans, September 18, 2003

Appendix

A

VICINITY MAP



VICINITY MAP

NOT TO SCALE

Appendix

B

NOAA PRECIPITATION DATA & PETRA GEOSCIENCES LETTER

NOAA Atlas 14, Volume 6, Version 2
Location name: Corona, California, USA*
Latitude: 33.8698°, Longitude: -117.5392°
Elevation: 644.44 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.101** (0.084-0.121)	**0.135** (0.113-0.163)	**0.182** (0.152-0.221)	**0.222** (0.183-0.271)	**0.277** (0.221-0.351)	**0.322** (0.251-0.416)	**0.368** (0.280-0.489)	**0.417** (0.308-0.571)	**0.486** (0.343-0.695)	**0.541** (0.369-0.802)
10-min	**0.144** (0.121-0.174)	**0.194** (0.162-0.234)	**0.261** (0.218-0.317)	**0.318** (0.262-0.389)	**0.398** (0.317-0.504)	**0.461** (0.359-0.597)	**0.527** (0.401-0.701)	**0.598** (0.441-0.818)	**0.696** (0.492-0.996)	**0.776** (0.529-1.15)
15-min	**0.174** (0.146-0.210)	**0.234** (0.196-0.283)	**0.316** (0.263-0.383)	**0.384** (0.317-0.470)	**0.481** (0.383-0.609)	**0.557** (0.435-0.722)	**0.638** (0.485-0.847)	**0.723** (0.533-0.989)	**0.842** (0.595-1.20)	**0.938** (0.639-1.39)
30-min	**0.258** (0.215-0.311)	**0.346** (0.289-0.419)	**0.467** (0.389-0.566)	**0.568** (0.469-0.695)	**0.710** (0.566-0.900)	**0.824** (0.642-1.07)	**0.942** (0.716-1.25)	**1.07** (0.788-1.46)	**1.25** (0.879-1.78)	**1.39** (0.945-2.06)
60-min	**0.383** (0.320-0.462)	**0.515** (0.430-0.623)	**0.694** (0.578-0.841)	**0.844** (0.697-1.03)	**1.06** (0.842-1.34)	**1.23** (0.955-1.59)	**1.40** (1.07-1.86)	**1.59** (1.17-2.17)	**1.85** (1.31-2.65)	**2.06** (1.40-3.06)
2-hr	**0.567** (0.474-0.684)	**0.751** (0.628-0.909)	**1.00** (0.834-1.21)	**1.21** (0.999-1.48)	**1.50** (1.20-1.90)	**1.74** (1.35-2.25)	**1.98** (1.50-2.63)	**2.23** (1.65-3.06)	**2.59** (1.83-3.70)	**2.88** (1.96-4.26)
3-hr	**0.703** (0.588-0.849)	**0.930** (0.777-1.13)	**1.24** (1.03-1.50)	**1.49** (1.23-1.83)	**1.85** (1.48-2.34)	**2.13** (1.66-2.76)	**2.43** (1.85-3.23)	**2.74** (2.02-3.75)	**3.17** (2.24-4.53)	**3.51** (2.39-5.21)
6-hr	**0.988** (0.826-1.19)	**1.32** (1.10-1.59)	**1.76** (1.46-2.13)	**2.12** (1.75-2.60)	**2.63** (2.10-3.33)	**3.03** (2.36-3.93)	**3.45** (2.62-4.58)	**3.88** (2.86-5.31)	**4.49** (3.17-6.41)	**4.97** (3.38-7.36)
12-hr	**1.27** (1.06-1.53)	**1.74** (1.45-2.10)	**2.37** (1.97-2.87)	**2.88** (2.38-3.53)	**3.60** (2.87-4.56)	**4.16** (3.24-5.38)	**4.73** (3.60-6.29)	**5.33** (3.93-7.30)	**6.16** (4.35-8.80)	**6.81** (4.64-10.1)
24-hr	**1.66** (1.47-1.92)	**2.35** (2.08-2.72)	**3.26** (2.88-3.78)	**4.01** (3.51-4.68)	**5.04** (4.26-6.07)	**5.83** (4.84-7.17)	**6.65** (5.38-8.38)	**7.50** (5.91-9.71)	**8.66** (6.56-11.7)	**9.58** (7.01-13.4)
2-day	**2.10** (1.85-2.42)	**2.98** (2.63-3.44)	**4.14** (3.65-4.80)	**5.10** (4.46-5.96)	**6.42** (5.43-7.74)	**7.44** (6.17-9.15)	**8.49** (6.88-10.7)	**9.58** (7.55-12.4)	**11.1** (8.39-14.9)	**12.3** (8.98-17.1)
3-day	**2.28** (2.02-2.63)	**3.24** (2.87-3.75)	**4.52** (3.99-5.24)	**5.58** (4.88-6.51)	**7.03** (5.95-8.48)	**8.16** (6.77-10.0)	**9.33** (7.56-11.8)	**10.5** (8.31-13.6)	**12.2** (9.24-16.5)	**13.5** (9.90-18.9)
4-day	**2.48** (2.20-2.86)	**3.54** (3.13-4.09)	**4.95** (4.36-5.73)	**6.11** (5.34-7.13)	**7.71** (6.52-9.29)	**8.96** (7.43-11.0)	**10.2** (8.30-12.9)	**11.6** (9.14-15.0)	**13.5** (10.2-18.1)	**14.9** (10.9-20.8)
7-day	**2.86** (2.53-3.30)	**4.07** (3.59-4.70)	**5.68** (5.01-6.58)	**7.03** (6.14-8.20)	**8.89** (7.52-10.7)	**10.4** (8.59-12.7)	**11.9** (9.62-15.0)	**13.5** (10.6-17.4)	**15.7** (11.9-21.1)	**17.4** (12.8-24.3)
10-day	**3.09** (2.73-3.56)	**4.38** (3.87-5.06)	**6.13** (5.40-7.10)	**7.59** (6.63-8.86)	**9.62** (8.15-11.6)	**11.2** (9.32-13.8)	**12.9** (10.5-16.3)	**14.7** (11.6-19.0)	**17.1** (13.0-23.1)	**19.1** (14.0-26.6)
20-day	**3.70** (3.27-4.27)	**5.25** (4.63-6.06)	**7.36** (6.49-8.53)	**9.16** (8.00-10.7)	**11.7** (9.90-14.1)	**13.7** (11.4-16.9)	**15.9** (12.9-20.0)	**18.2** (14.3-23.6)	**21.4** (16.2-28.9)	**24.1** (17.6-33.6)
30-day	**4.38** (3.88-5.05)	**6.19** (5.46-7.14)	**8.69** (7.65-10.1)	**10.8** (9.46-12.6)	**13.9** (11.8-16.8)	**16.4** (13.6-20.2)	**19.1** (15.4-24.0)	**21.9** (17.3-28.4)	**26.0** (19.7-35.1)	**29.4** (21.5-40.9)
45-day	**5.22** (4.62-6.02)	**7.30** (6.45-8.43)	**10.2** (9.00-11.8)	**12.7** (11.1-14.9)	**16.4** (13.9-19.8)	**19.5** (16.1-23.9)	**22.7** (18.4-28.6)	**26.3** (20.7-34.0)	**31.4** (23.8-42.3)	**35.7** (26.1-49.7)
60-day	**6.01** (5.32-6.94)	**8.31** (7.34-9.60)	**11.6** (10.2-13.4)	**14.4** (12.6-16.8)	**18.6** (15.7-22.4)	**22.1** (18.3-27.2)	**25.8** (20.9-32.6)	**30.0** (23.6-38.8)	**36.0** (27.3-48.6)	**41.1** (30.1-57.3)

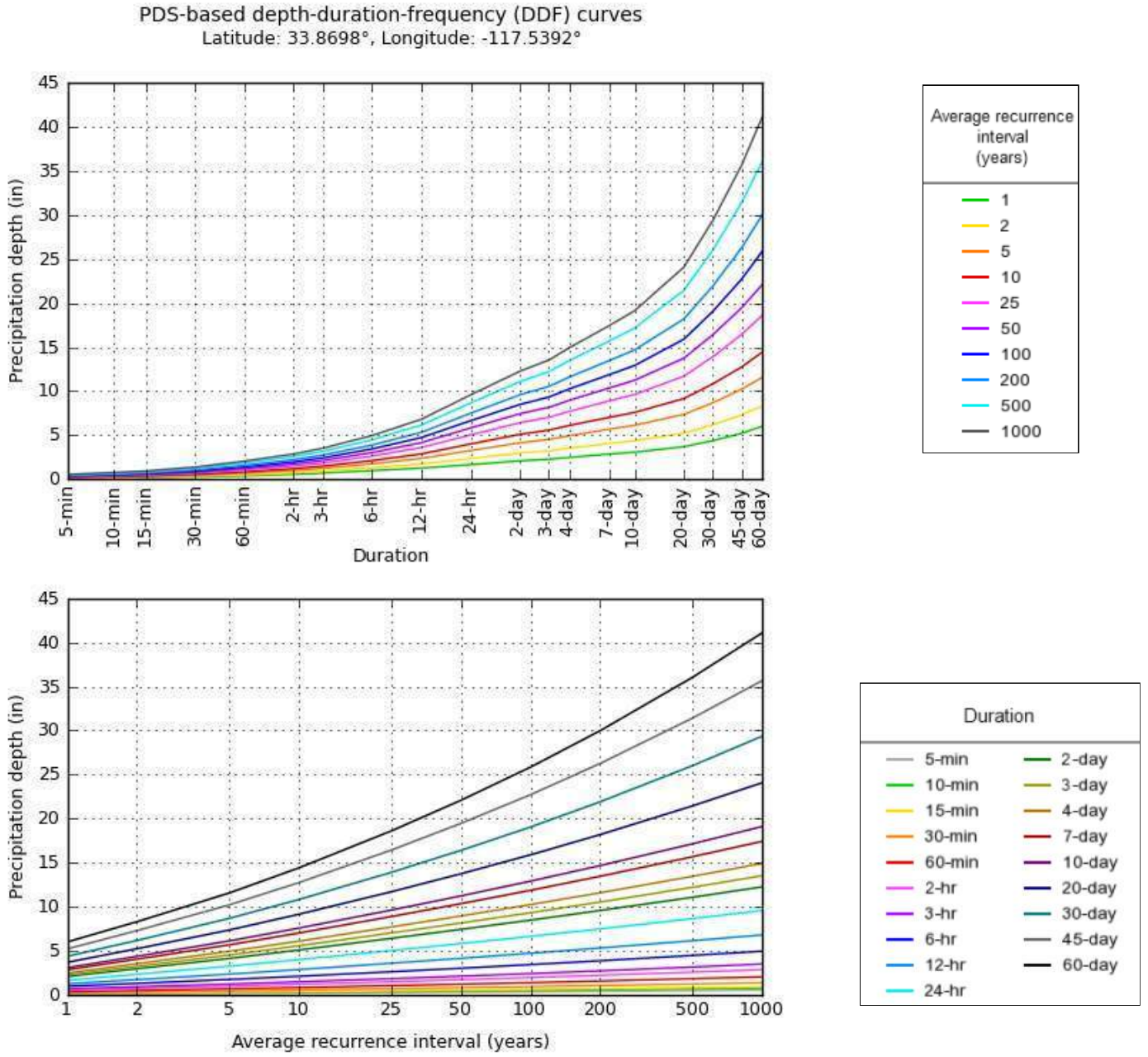
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



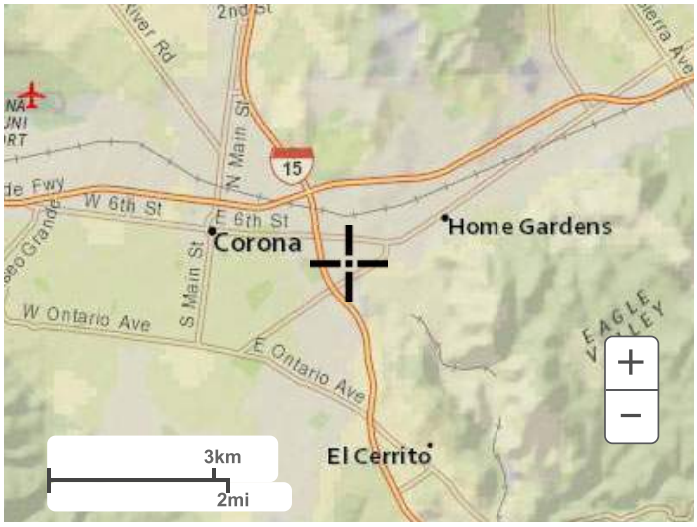
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Mon Apr 11 16:59:37 2022

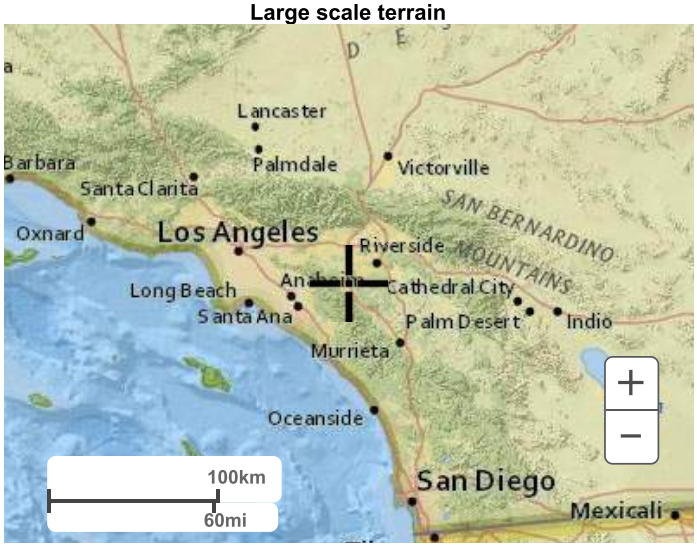
Back to Top

Maps & aerials

Small scale terrain



Large scale terrain



Large scale map

Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

PETRA GEOSCIENCES INC.

SOLID AS A ROCK

ENGINEERS + GEOLOGISTS + ENVIRONMENTAL SCIENTISTS

UPDATED PRELIMINARY GEOTECHNICAL EVALUATION PROPOSED MAGNOLIA AVENUE BUSINESS CENTER 16.5-ACRE SITE AT 1375 MAGNOLIA AVENUE CITY OF CORONA, RIVERSIDE COUNTY, CALIFORNIA

WESTERN REALCO

December 9, 2022
J.N. 19-433

December 9, 2022
J.N. 19-433

WESTERN REALCO
500 Newport Center Drive, Suite #630
Newport Beach, California 92660

Attention: Mr. Jeremy Mape

Subject: Updated Preliminary Geotechnical Evaluation, Proposed Magnolia Avenue Business Center, 16.5-Acre Site at 1375 Magnolia Avenue, City of Corona, Riverside County, California

Dear Mr. Mape:

Petra Geosciences, Inc. (Petra) is submitting an update of our previous Preliminary Geotechnical Evaluation report, dated February 19, 2020, for the proposed business center facility in the city of Corona, California. The original work was performed in accordance with the scope of work outlined in our Proposal No. 19-433P dated December 20, 2019. This supplemental work is based on the new Preliminary Grading Plan, prepared by KWC Engineers. As with our previous report, this update is based on the requirements of the 2019 California Building Code (CBC), as well as our findings, engineering judgment, opinions, conclusions, and recommendations pertaining to geotechnical design aspects of the proposed development. It should be noted that this geotechnical and geological evaluation does not address soil contamination or other environmental issues, which may affect the property.

It has been a pleasure to be of service to you on this project. Please contact us if you have any questions regarding the contents of this report or require additional information.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

Douglass Johnston, CEG
Senior Associate Geologist

Grayson Walker, GE
Principal Engineer

TABLE OF CONTENTS

Page

INTRODUCTION 1
SCOPE OF WORK 1
LOCATION AND SITE DESCRIPTION 2
PROPOSED DEVELOPMENT 2
Literature and Online Imagery Review 3
Field Exploration 3
Laboratory Testing 4
FINDINGS 4
Regional Geologic Setting 4
Local Geology and Subsurface Soil Conditions 5
Groundwater 6
Faulting 6
Secondary Seismic Effects 6
Liquefaction and Seismically Induced Settlement 7
Dry Sand Settlement 8
Compressible Soils 8
CONCLUSIONS AND RECOMMENDATIONS 9
Development Feasibility 9
Seismic Shaking 9
Seismically Induced Settlement Analysis 9
Soil Settlement and Remedial Grading 9
Earthwork Recommendations 10
General Recommendations 10
Geotechnical Observations and Testing 10
Demolition, Clearing and Grubbing 10
Boundary Conditions 11
Suitability of On-Site Materials for Use as Engineered Fill 11
Excavation Characteristics 11
Ground Preparation 11
Geotechnical Observations 11
Unsuitable Soil Removals and Bottom Processing 12
Fill Placement 12
Disposal of Oversize Rock 13
Temporary Excavations 13
Slot Cutting 13
Import Soils for Grading 14
Volumetric Changes - Shrinkage and Subsidence 14
Tentative Foundation Design Considerations 15
Seismic Design Coefficients 15
Discussion 17
Expansive Soil Conditions 18
Foundation System 18
Allowable Soil Bearing Capacity 18
Lateral Resistance 18
Static Settlement 19
Dynamic Settlement 19
Building Floor Slabs 19
General Corrosivity Screening 20
Concrete in Contact with Site Soils 21
Metals Encased in Concrete 22
Metallic Elements in Contact with Site Soils 23
Post-Grading Considerations 23

Utility Trenches....23
Site Drainage....24
Masonry Screen Walls....25
Construction on Level Ground....25
Construction Joints....25
Exterior Concrete Flatwork....25
General....25
Thickness and Joint Spacing....26
Reinforcement....26
Subgrade Preparation....26
Drainage....27
Tree Wells....27
Preliminary Pavement Design Recommendations....27
Loading Docks....28
GRADING AND STRUCTURAL PLAN REVIEW....28
REPORT LIMITATIONS....29
REFERENCES....31

ATTACHMENTS

FIGURE 1 – SITE LOCATION MAP

FIGURE 2 – EXPLORATION LOCATION MAP

APPENDIX A – EXPLORATION LOGS (PETRA AND FERO ENGINEERING)

APPENDIX B – LABORATORY TESTING PROCEDURES / LABORATORY DATA SUMMARY

APPENDIX C – EARTHQUAKE-INDUCED SETTLEMENT ANALYSIS AND SEISMIC DESIGN PARAMETERS

APPENDIX D – STANDARD GRADING SPECIFICATIONS

UPDATED PRELIMINARY GEOTECHNICAL EVALUATION
PROPOSED MAGNOLIA AVENUE BUSINESS CENTER
16.5-ACRE SITE AT 1375 MAGNOLIA AVENUE
CITY OF CORONA, RIVERSIDE COUNTY, CALIFORNIA

INTRODUCTION

Petra Geosciences, Inc. (Petra) is presenting herein the results of our updated preliminary geotechnical evaluation for the proposed re-development of an approximately 16.5-acre property situated at the northeasterly corner of Magnolia and El Camino Avenues, in the city of Corona, California. The purpose of this study was to obtain preliminary information on the general geologic and geotechnical conditions within the project area in order to provide conclusions and recommendations for the feasibility of the proposed project, and preliminary geotechnical recommendations for site grading and assumed improvements.

SCOPE OF WORK

The scope of our evaluation consisted of the following.

- Both an initial and update site reconnaissance of surface conditions and review of the recent preliminary grading plan prepared by KWC Engineers.
- Review of available published and unpublished reports, maps and data concerning geologic and soil conditions within the site and nearby area that could have an impact on the proposed development (see References).
- Review readily available satellite imagery of the site and surrounding area.
- Coordinate with Underground Service Alert [USA] and representatives of the onsite tenant to obtain an underground-utility clearance, prior to commencement of the subsurface exploration.
- Geotechnical drilling, logging, and sampling of five (5) exploratory soil borings utilizing a hollow-stem auger drill rig and advance five (5) Cone Penetrometer Test soundings (CPT). Log and visually classify soil and materials encountered in the borings in accordance with the Unified Soil Classification System (USCS).
- Conduct preliminary laboratory testing of representative samples (bulk and undisturbed) obtained from the borings to determine their engineering properties.
- Engineering and geologic analysis of the research, field exploration findings and laboratory data with respect to the proposed site development.
- Preparation of this geotechnical report presenting the results of our evaluation and providing recommendations for the proposed site development in general conformance with the requirements of the 2019 CBC, as well as in accordance with applicable state and local jurisdictional requirements.

LOCATION AND SITE DESCRIPTION

The subject property is irregularly shaped and approximately 16.5 acres in size, situated north-northwest of Magnolia Avenue, east of El Camino Avenue and south-southwest of Temescal Wash flood control channel in the city of Corona, California. The property is also identified as Assessor Parcel Number 107-030-022. Figure 1 depicts the general site location. Temescal Wash adjacent to the site consists of a concrete-lined flood control channel along the north-northeast boundary built several decades ago. A rail line is present between the site westerly boundary and El Camino Avenue. Existing commercial/industrial developments are located in the general area.

The majority of the site is currently occupied with various improvements, including several large industrial/warehouse type buildings, office buildings, material racks, loading docks, asphalt pavements, concrete slabs etc. that appear to have been constructed several decades ago. Lesser, unimproved areas expose soil materials at grade. Chain link fencing is present along the property line with the flood control channel and along Magnolia Avenue. We estimate the north-northeast property line is setback approximately 25 to 30 feet from the top of the flood control channel. A rail line extends into a portion of the site at the west-central boundary and a shallow drainage ditch is present along the northwestern property line. Existing underground utilities such as sewer, water, gas, electric and possibly storm drain liens are present throughout the property and based on the previous site usage, it is possible that other buried structures could be present. Overhead electric lines are also present in the central portion of the site. The site was an active business operation at the time of our 2020 fieldwork.

Mature trees are randomly present within the site, predominantly on the property boundaries, as well as minor landscaping. The property is relatively flat, sloping very gently towards the north/northwest with site elevations ranging from approximately 645 feet above mean sea level (msl) in the southeast corner to approximately 640 feet in the northwest corner.

Based on the recent site reconnaissance, this site remains essentially unchanged since our last work in January 2020, with the exception of some minor new pavements as generally described by Geotechnical Professionals Inc. last year (GPI, 2021)

PROPOSED DEVELOPMENT

Based on the recent preliminary grading plan prepared by KWC Engineers, the planned development will consist of two commercial buildings with ancillary site improvements including underground utilities (sewer, water, storm drain and dry utilities), loading docks, asphalt and/or concrete pavements, perimeter

masonry walls, sidewalks and landscaping. The westerly Building No. 1 will be approximately 231,4000 square feet in size and the easterly Building No. 2 will be approximately 90,100 square feet in size. The buildings are presumed to be of concrete tilt-up construction and although foundation loads are currently unknown, we have assumed 2- to 5-kip per foot line loads for continuous footings and 25- to 50-kip point loads for columns.

Review of the KWC earthwork exhibit indicates the proposed site grading will generally entail fills on the order of 2 to 7 feet from existing grades to create the two buildings pads and cuts up to approximately 2.5 feet maximum in the parking lot/driveway areas, remedial grading notwithstanding. Raw earthwork quantities indicate about 36,000 cubic yards of import. No notable cut or fill slopes, or retaining walls are currently anticipated.

Literature and Online Imagery Review

Petra researched and reviewed available published and unpublished geologic data and reports pertaining to regional geology, groundwater, faulting and geologic hazards that may affect the site. The results of this review are included in this report and noted references are attached. Based on readily available online aerial imagery, the site's current conditions/existing improvements appear to be in a similar condition for at least the past several decades with the exception of some remedial excavations and new pavements as described by Geotechnical Professionals Inc. last year (GPI, 2021).

Field Exploration

A subsurface exploration program was conducted under the supervision of an engineering geologist from Petra on January 2, 2020. Subsurface exploration involved the drilling of five (5) exploratory borings, designated B-1 through B-5, to depths between 19 to 25.5 feet below existing site grades where refusal to drilling occurred at all locations by the presence of cobbles or boulders. Drilling was performed with a conventional truck-mounted drill rig equipped with 8-inch outside diameter, hollow-stem augers. Earth materials encountered within the exploratory borings were classified and logged in accordance with the visual-manual procedures of the Unified Soil Classification System (USCS). Additionally, five (5) Cone Penetration Test (CPT) soundings, designated CPT-1 through CPT-5 were advanced to approximate depths between 22 and 23 feet below surface grades utilizing a truck-mounted CPT rig. The CPT soundings also encountered refusal at all locations. The approximate locations of the exploratory test borings and CPT soundings are shown on the attached Figure 2. Descriptive logs of the borings/CPT logs are presented in Appendix A.

Subsurface exploration also included the collection of bulk samples and relatively undisturbed samples of soil materials for classification, laboratory testing and geotechnical engineering analyses. Bulk samples consisted of selected soil materials obtained from the exploratory borings. Relatively undisturbed samples were obtained using a 3-inch outside diameter modified California split-spoon soil sampler lined with brass rings. The sampler was mechanically driven to a depth of 18 inches with successive 30-inch drops of a 140-pound automatic trip hammer and the number of blows required to drive the sampler for each 6-inch increment inches are noted in the boring logs in Appendix A. The driven core samples were placed in sealed containers and transported to Petra's laboratory for laboratory testing.

Standard Penetration Tests (SPT) were also performed at selected depth intervals in accordance with ASTM D1586. This method consists of mechanically driving an unlined, 2.0-inch outside diameter (OD) standard penetrometer split-barrel sampler 18 inches into the soil with successive 30-inch drops of the 140-pound automatic trip hammer. Incremental blow counts are also noted on the exploration logs. Disturbed soil samples from the unlined standard split-spoon samplers were placed in sealed plastic bags and transported to our laboratory for testing.

Laboratory Testing

Laboratory testing for selected samples of onsite soils materials included in-situ dry density and moisture content, maximum dry density and optimum moisture content, expansion index, grain-size sieve analysis and #200 wash, shear strength and general soil corrosivity potential (sulfate content, chloride content, pH/resistivity). A description of laboratory test methods and laboratory testing are presented in Appendix B and the results of in-situ moisture content and dry density tests are summarized on the boring logs presented in Appendix A.

FINDINGS

Regional Geologic Setting

Geologically, the site lies within the northerly portion of the Peninsular Ranges Geomorphic Province (CGS, 2002). The Peninsular Range Province extends from the tip of Baja California north to the Transverse Ranges Geomorphic Province and is characterized by northwest trending mountain ranges separated by subparallel fault zones. The San Bernardino Mountains, located on the north side of the valley, provides the boundary between the Peninsula Range Province and the Transverse Ranges Province. In general, the province is underlain primarily of plutonic rock of the Southern California Batholith. These rocks formed from the cooling of molten magma deep within the earth's crust. Intense heat associated with the plutonic

magma metamorphosed the ancient sedimentary rocks into which the plutons intruded. The Peninsular Range Geomorphic Province is generally characterized by alluviated basins and elevated erosional surfaces.

Local Geology and Subsurface Soil Conditions

The geologic map of the Corona North and South quadrangles depicts the subject property near the central portion of a relatively narrow northwesterly trending active alluvial valley, Temescal Wash, locally underlain by alluvial fan deposits and at depth, granitic bedrock. The local hillsides further to the north, east and southeast are generally comprised of Cretaceous-aged granitic bedrock units. Subsurface conditions observed in our exploratory borings, and a well boring near our B-3 boring (Ferro Engineering, 2006) indicates the surface of the site is mantled by undocumented fill soils on the order of 5 to 7.5 feet thick, that are underlain by Holocene to Late Pleistocene alluvium to depths of at least 65 feet below the ground surface (bgs). A general description of the units is provided below.

Undocumented Fill – Undocumented fill soils, presumably placed with the existing development, are present within the upper approximately 5 to 7.5 feet of the subject property. These fills may also be variable in depth at other random areas throughout the site. Additionally, any active or abandoned utility lines will likely encounter localized undocumented trench backfill that could be deeper than 5 to 7 feet bgs. The fills soils encountered in the exploratory borings generally consisted of dry to slightly moist, medium dense, fine- to coarse-grained sand with gravels and lesser occurrences of silty sand.

Alluvium – Alluvium of Holocene age is present beneath the undocumented fills across the site, to depths of at least 19 to 25 feet. These upper alluvial soils predominantly consisted of slightly moist to occasional moist, medium dense to occasionally dense, sand with gravel with minor interbeds of silty sands and clayey sands to possible sandy silts. A concentrated layer of cobbles to possibly boulders was encountered at approximately 19 to 25.5 feet bgs where refusal was encountered to all of our borings and CPT soundings. Below the approximate depths of 19 to 25 feet bgs, Fero Engineering's boring log FB1 (FE, 2006), near our boring B-3, generally encountered very dense sands with gravel and minor interbeds of silty sand to a depth of 49± feet bgs and dense, saturated sands with some gravel from 50 to 65 feet bgs. A copy of Fero's FB1 boring/well log is included in Appendix A. Based on the reported density of the sandy soils below the layer of cobble/boulders, we interpret this lower alluvial unit as either older alluvium and/or older alluvial fan deposits, likely of Late Pleistocene age.

Groundwater

Although we didn't encounter in our exploration to a maximum of 25.5 feet bgs, Fero Engineering (FE, 2009) measured groundwater at monitoring well FB1 generally between 45.0 and 50.3 feet bgs between October 2006 and February 2009. Based on Figures 26 and 27 from Todd Engineers' (TE, 2008) groundwater management plan for the City of Corona, the historic high groundwater levels beneath the site may have been around 65± feet bgs in the spring of 1964 and may have been as shallow as 40± feet bgs in the spring of 1984. Subsurface groundwater flow direction beneath the subject site is likely to be northwesterly within the general trend of Temescal Wash valley.

Groundwater is not likely to be encountered, however, as with any project site, there is the possibility of encountering localized perched water and/or minor seepage during remedial grading.

Faulting

Based on our review of published and unpublished geotechnical maps and literature pertaining to site geology, no active or potentially active faults are known to project through the site and the site does not lie within the bounds of an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo (AP) Earthquake Fault Hazard Zoning Act (Bryant and Hart, 2007) nor a Riverside County fault zone. In addition, we did not observe any features in the field that would indicate active faulting. The closest known active faults is the Elsinore Fault zone which lies approximately 3.4 miles to the southwest. The potential for active fault rupture at the site is considered to be very low.

Secondary Seismic Effects

Secondary effects of seismic activity normally considered as possible hazards to a site include several types of ground failure and seismically induced flooding. Various general types of ground failures, which might occur as a consequence of severe ground shaking at the site, include landsliding, ground subsidence, ground lurching and lateral spreading. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, subsurface soil and groundwater conditions, in addition to other factors. The subject property proposed for development exhibits nearly level topography that is not subject to landsliding, and the potential for ground lurching and lateral spreading are considered very low. The potential for seismically-induced flooding due to tsunami or seiche (i.e., a wave-like oscillation of the surface of water in an enclosed basin) is considered negligible at this site.

Liquefaction and Seismically Induced Settlement

Liquefaction occurs when strong seismic shaking of a saturated sand or silt causes intergranular fluid (pore-water) pressures to increase to levels where grain-to-grain contact is lost, and material temporarily behaves as a viscous fluid. Liquefaction can cause settlement of the ground surface, loss of bearing, settlement and tilting of structures, flotation and buoyancy of buried structures and fissuring of the ground surface. A common surface manifestation of liquefaction is the formation of sand boils – short-lived fountains of soil and water that emerge from fissures or vents and leave freshly deposited, usually conical mounds of sand or silt on the ground surface.

For sandy soils above the water table, strong seismic shaking can also result in rearrangement of the granular soil structure leading to densification of sandy soils, ground settlement and settlement and tilting of superstructures.

Assessment of liquefaction or dry sand settlement potential for a particular site requires knowledge of a number of regional as well as site-specific parameters, including the estimated design earthquake magnitude, and the associated probable peak horizontal ground acceleration at the site, subsurface stratigraphy and soil characteristics. Parameters such as estimated probable peak horizontal ground acceleration can readily be determined using published references, or by utilizing a commercially available computer program specifically designed to perform a probabilistic analysis. On the other hand, stratigraphy and soil characteristics can only be accurately determined by means of a site-specific subsurface investigation combined with appropriate laboratory analysis of representative samples of onsite soils.

Riverside County has identified located the subject property area within a high liquefaction zone. Groundwater has been reported at depths between 45 and 50 feet bgs (FE, 2009), and historic high groundwater may have been as shallow as 40 feet bgs (TE, 2008). Beneath the surface fills, medium dense to occasionally dense alluvium was encountered in our borings to depths ranging from 19 to 25.5 feet bgs, underlain by an estimated 5- to 6-foot layer of concentrated cobbles to boulders. Beneath the layer of cobbles, Fero (FE, 2006) reported very dense sandy soils to approximately 49 feet bgs and dense, saturated sandy soils from 50 to 65 feet bgs, which we interpret as an older alluvial unit.

Based upon the very dense nature of the older alluvial soils below the cobble/boulder zone, the liquefaction potential at the site is considered low. As such, surface manifestation of liquefaction such as ground fissures, sand boils, loss of bearing, liquefaction-induced settlement, etc. is considered very low.

Due to the very dense alluvial soils reported by Fero (FE, 2006) below 25 feet, the most likely scenario for dynamic settlements is the dry sand settlement within the upper 25 feet of the site. This is due primarily to the presence of unconsolidated granular sandy soils and to the proximity of seismic sources. For this reason, a site-specific dry sand settlement analysis was performed as part of this study.

Dry Sand Settlement

Propagating earthquake waves induce shearing stresses and strains in soil materials during strong ground shaking. This process rearranges the structure of granular soils such that there is an increase in density, with a corresponding decrease in volume, which results in vertical settlement. Dynamic settlement has been well documented in wet, sandy deposits undergoing liquefaction (see Tokimatsu and Seed, 1987) and in relatively dry sediments as well (Stewart et al, 1996). Specific methods to analyze potential wet and dry dynamic settlement are reported in Tokimatsu and Seed (1987), and specifically dry settlement in Pradel (1998) and Stewart et al. (2001; 2002) respectively. Most of the referenced papers focus on the seismic effects on dry, clean sands of a uniform grain size, though several reports extend the literature to fine-grained soils (Stewart et al., 2001 & 2002). State guidelines for evaluating dynamic settlement are provided in the California Geological Survey Special Publication 117A (CGS, 2008).

Dry sand settlement was calculated with the continuous CPT data utilizing the computer program GeoLogismiki, Cliq V.3.0.1.6 based on. The largest calculated settlement was in the order of 0.3 inch (CPT-5) based on the PGA of 0.87g and an earthquake magnitude of 6.47. Tabulated results of the estimated settlements are provided in Appendix C of this report. It should be noted that our estimated settlement is for free field condition. Depending on proposed structures foundation, height and stiffness, the dynamic settlement during the design earthquake may vary from those estimated herein due to soil-structure interaction.

Differential Dynamic Settlement

As stated above total seismic settlements are estimated to be less than 0.3 inches. Differential dynamic settlement is estimated to be less than 0.2 inches over a span of 30 feet.

Compressible Soils

A geotechnical factor affecting the project site is the presence of existing fill soils ranging in depth from approximately 5 to 7.5 feet bgs across the site. In view of the undocumented nature of the fill, and likely disturbance with site demolition, these materials in their current state are not considered suitable for support of proposed fills or fill or structural loads. Accordingly, these materials will require removal (over-

excavation) to expose the underlying competent alluvial deposits, to be verified in the field by the geotechnical consultant. The removed soils are considered to be suitable for re-use as engineered fill.

CONCLUSIONS AND RECOMMENDATIONS

Development Feasibility

Based on our preliminary field exploration, research and review of pertinent geologic literature, and preliminary laboratory testing and analysis, development of the project site is considered feasible for the proposed commercial development from a geotechnical standpoint. The following geotechnical factors should be considered during the design process.

Seismic Shaking

The site is located within an active tectonic area of southern California with several significant faults capable of producing moderate to strong earthquakes. The site will likely be subjected to very strong seismically related ground shaking during the anticipated life span of the project and structures within the site should therefore be designed and constructed to resist the effects of strong ground motion in accordance with the most current edition of the 2019 California Building Code.

Seismically Induced Settlement Analysis

The minimum goal of dynamic (i.e., seismic) settlement mitigation should be to provide a foundation system that can withstand the expected movement without causing such structural damage, so as to pose a life-safety hazard (such as structural collapse from excessive drift). The conclusions expressed herein are reached based on conventional boring and continuous CPT data.

As noted previously, the data retrieved from the CPTs was utilized in our dynamic settlement analysis. The results of our preliminary analysis using available subsurface data indicate that the highest total seismically induced settlement at the site is anticipated to be to be less than 0.3 inches at CPT-5 and the analysis are presented in Appendix C. Liquefaction nor dynamic settlement is not a significant factor in site development.

Soil Settlement and Remedial Grading

The upper site soils consisting of undocumented artificial fill and the roughly upper one foot of native alluvial soils are inconsistent due to their variable nature and are subject to static settlement due to dead and live loading conditions of structures. Accordingly, remedial grading of the all of the undocumented fill soils and the upper 1± foot of native alluvium will be necessary for support of engineered fills for the

structure foundation system. In general, in all areas where structures are proposed, all existing undocumented fill and any subsurface compressible alluvial soils will need to be removed (over-excavated), to be subsequently placed as properly compacted (engineered) fill.

Earthwork Recommendations

General Recommendations

Earthwork should be performed in accordance with the Grading Code of the City of Corona, to the applicable provisions of the 2019 CBC and should also be performed in accordance with the following site-specific recommendations prepared by Petra herein based on the proposed construction.

Geotechnical Observations and Testing

Prior to the start of earthwork, a meeting should be held at the site with the owner, contractor and geotechnical consultant to discuss the work schedule and geotechnical aspects of the grading. Earthwork, which in this instance will generally entail removal and re-compaction of existing unsuitable soils and/or over-excavation, should be accomplished under full-time observation and testing of the geotechnical consultant. A representative of the project geotechnical consultant should be present onsite during all earthwork operations to document proper placement and compaction of fills, as well as to document compliance with the other recommendations presented herein.

Demolition, Clearing and Grubbing

All existing buildings, foundations, asphalt or concrete pavements, vegetation and subsurface utility lines throughout the site should be demolished and removed from the site. Following demolition, clearing operations should also include the removal of any remaining trash, debris, vegetation and similar deleterious materials including the root balls for any trees. Any cavities or excavations created upon removal of any unknown subsurface structures should be cleared of loose soil, shaped to provide access for backfilling and compaction equipment and then backfilled with engineered fill. Note that buried deleterious materials are likely to be encountered within the site (i.e., buried organics or debris) due to the past site usage and may need to be removed by hand (i.e. root pickers), during grading operations.

The project geotechnical consultant should provide periodic observation and testing services during final clearing and grubbing operations to document compliance with the above recommendations. In addition, should unusual or adverse soil conditions or buried structures be encountered during grading that are not described herein, these conditions should be brought to the immediate attention of the project geotechnical consultant for corrective recommendations.

Boundary Conditions

Average remedial removals within the building pad areas of the subject site are anticipated to be on the order of 6 to 8 feet± below the existing ground surface, although locally deeper over-excavation may be warranted. Temporary backcut slopes adjacent to the tract boundaries should generally be restricted to a slope ratio of 1:1 (horizontal to vertical) or flatter to protect adjacent offsite improvements (including pavement, sidewalks, walls, buried utilities, etc.) along the property boundaries. Depending on the actual horizontal extent of remedial grading that is achievable by the grading contractor, it is likely that a wedge of unsuitable soil will remain in place along the site perimeter that will extend into the site to a horizontal distance equal to twice the depth of remedial removals (i.e., approximately 10 feet). Since new perimeter site improvements are anticipated to be within this zone, such improvements may need to be designed and constructed with deepened and/or strengthened foundation systems designed to withstand relative movement that is likely to result from settlement of these likely compressible surficial soils. More specific recommendations for remedial grading or alternative foundation design would be provided as field conditions are better defied during grading.

Suitability of On-Site Materials for Use as Engineered Fill

Based on our field observations and subsurface soil conditions encountered in our borings, the onsite soil materials would be suitable for use as engineered fill, provided they are clean of organics, construction debris or other deleterious materials. Boulders greater than 12 inches in diameter, if encountered during remedial grading, may be placed in an engineered fashion is fills as recommended further herein. Soils exposed at or near the surface will likely require significant moisture-conditioning, i.e. pre-watering, to near optimum moisture for use as engineered fill during the onset of grading.

Excavation Characteristics

The existing site soils consisting of undocumented fill and native alluvium are expected to be readily excavated with conventional earthmoving equipment.

Ground Preparation

Geotechnical Observations

A representative of the project geotechnical consultant should also be present on site during major grading operations to document that proper placement and adequate compaction of fills has been achieved, as well as to observe compliance with the other recommendations presented herein. Exposed bottom surfaces in remedial removal areas should be observed and approved by a representative of the project geotechnical

consultant ***prior to the placement of fill***. It is the grading contractor's responsibility to notify the project geotechnical consultant at least 24 hours prior to requiring observation (including excavation bottom verification).

Unsuitable Soil Removals and Bottom Processing

The existing surficial undocumented fills and roughly the upper 1 foot of native alluvial soils are considered unsuitable for support of proposed fills, structures, flatwork, pavement or other improvements and should be removed to underlying competent alluvial materials as approved by the project geotechnical consultant. The estimated depth of removal of alluvial soils is recommended to be approximately 6 to 8 feet below the existing ground surface in proposed building areas, but *no less than 4 feet below bottom of the proposed footings*. Soil removals may need to be locally deeper depending upon the exposed conditions encountered during grading. The actual depths and horizontal limits of removals and over-excavations should be evaluated during grading on the basis of observations and testing performed by the project geotechnical consultant.

Prior to placing engineered fill, the exposed bottom surfaces in the removal areas should be approved by a representative of project geotechnical consultant. The exposed bottom(s) should be scarified to a minimum depth of 12 inches, moisture-conditioned or air-dried to achieve approximately two percent above optimum moisture content and then compacted with a heavy construction equipment prior to placement of fill. Minimum compaction of the upper 12 inches of the removal bottom should meet or exceed 90 percent relative compaction. The laboratory maximum dry density, the standard for determining relative compaction, and optimum moisture content for each change in soil type should be determined in accordance with Test Method ASTM D1557.

Fill Placement

Fill materials should be placed in approximately 6- to 8-inch thick loose lifts, watered or air-dried as necessary to achieve a moisture content of at least above optimum moisture condition, and then compacted in-place to a minimum relative compaction of 90 percent with the exception of the building foundation zone. *All engineered fill to be placed within the building foundation zone shall be compacted to no less than 95 percent relative compaction.* The foundation zone is defined as extending vertically from the top of the footing to the bottom of the over-excavation (minimum 4 feet) and laterally a distance of 5 feet beyond the sides of the footing. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with ASTM D 1557.

Disposal of Oversize Rock

If oversize rock (rock greater than 12 inches in dimension) is encountered, it may be disposed of onsite by placing the rock in the lower portions of the deeper fills in a manner to avoid nesting. Placement of oversize rock should be restricted from the upper 10 feet of building pads, within 15 feet of a slope face, and areas to receive deep utilities.

Where placed in deep fill areas, the oversize rock should be placed individually or in windrows and then completely covered with clean finer-grained (SE equal to or greater than 30), onsite earth materials. The finer-grained materials should be thoroughly watered and rolled to infill voids. A typical rock disposal detail is shown on Plate SG-2 (Appendix D). Oversize rock shall not be placed shallower than 10 feet from pad grade or less than 15 feet, measured horizontally, from a slope face. Petra recommends that rock no greater than 8 inches be placed in the upper 3 feet of the building pad to facilitate excavating for building foundations and utilities.

Temporary Excavations

Temporary excavations varying up to a depth of up to roughly 8 feet below existing grades may be required to accomplish the recommended over-excavation of existing soils. Based on the physical properties of the onsite soils, temporary excavations which are constructed exceeding 4 feet in height should be cut back to an inclination of 1:1 (h:v) or flatter for the duration of the over-excavation of unsuitable soil material and replacement as compacted fill, as well as placement of underground utilities. The 1:1 (h:v) recommendation may possibly be steepened, depending of conditions observed by a representative of the project geotechnical consultant. Other factors which should be considered with respect to the stability of the temporary slopes include construction traffic and/or storage of materials on or near the tops of the slopes, construction scheduling, presence of nearby walls or structures on adjacent properties and weather conditions at the time of construction. Applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health act of 1970 and the Construction Safety Act should also be followed.

Slot Cutting

To mitigate potential off-site ground instability due to over-excavation operations along the project boundaries, a slot cutting technique, commonly referred to as the "ABC" method, may be utilized. This method consists of first excavating a temporary excavation at a 1:1 (h:v) maximum inclination along the length of the existing fencing/block wall or toe-of-slope, with the top of the temporary backcut slope located a minimum of approximately 3 feet horizontally from the outside edge of the existing boundary

improvements. The 1:1 (h:v) backcut slope is then divided into approximately equal sections not exceeding a width of approximately 10 feet, depending largely upon the nature of the exposed alluvial soils. Every third section is then excavated at a vertical inclination and the section then brought to design grade with compacted fill prior to excavating the next series of 10-foot wide slot cuts.

Continuous observations should be provided by the project geotechnical consultant during excavation of the initial 1:1 (h:v) backcut slope. If any evidence of potential instability is observed, revised recommendations such as flatter (h:v) backcut slopes and/or narrower slot cuts may be necessary. Continuous observations should also be provided by the project geotechnical consultant during excavation of the individual vertical slot cuts. If any evidence of potential instability is observed, immediate revised recommendations for performing the slot cuts may become necessary.

Import Soils for Grading

If import soils are needed to achieve final design grades the soils should be free of deleterious materials, oversize rock and any hazardous materials. The soils should also be non-expansive, consistent with the on-site soils, and essentially non-corrosive and approved by the project geotechnical consultant *prior* to being brought onsite. The geotechnical consultant should visit the potential borrow site and conduct testing of the soil at least three days before the commencement of import operations.

Volumetric Changes - Shrinkage and Subsidence

Volumetric changes in earth quantities will occur when onsite soils are excavated and replaced as properly compacted fill. Based on our observations of earth materials encountered in the borings, a shrinkage factor on the order of 5 to 10 percent may be considered during removal and re-compaction for the undocumented fills and native alluvial soils. The actual shrinkage that will occur during grading will depend on the average degree of relative compaction achieved. A subsidence of approximately 0.1 to 0.2 feet may be anticipated as a result of the scarification and re-compaction of the exposed bottom surfaces within the removal areas.

The above estimates of shrinkage and subsidence are intended for use by project planners in estimating earthwork quantities and should not be considered absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that will occur during site grading.

Tentative Foundation Design Considerations

Seismic Design Coefficients

Earthquake loads on earthen structures and buildings are a function of ground acceleration which may be determined from the site-specific ground motion analysis. Alternatively, a design response spectrum can be developed for certain sites based on the code guidelines. To provide the design team with the parameters necessary to construct the design acceleration response spectrum for this project, we used two computer applications. Specifically, the first computer application, which was jointly developed by Structural Engineering Association of California (SEAOC) and California's Office of Statewide Health Planning and Development (OSHPD), the SEA/OSHPD Seismic Design Maps Tool website, https://seismicmaps.org, is used to calculate the ground motion parameters. The second computer application, the United Stated Geological Survey (USGS) Unified Hazard Tool website, https://earthquake.usgs.gov/hazards/interactive/, is used to estimate the earthquake magnitude and the distance to surface projection of the fault.

To run the above computer applications, site latitude and longitude, seismic risk category and knowledge of site class are required. The site class definition depends on the direct measurement of certain soil properties and the ASCE 7-16 recommended procedure for calculating the average value within the upper 30 meters (approximately 100 feet) of site soils. One such parameter is the soil strength/resistance as measured by standard blow count of the standard soil sampler, commonly referred to as standard penetration testing (SPT) blow count.

Based on an analysis of the field sampler penetration resistance from our borings, the boring FB1 reported by Fero (FE, 2006), or N-Value per Table 20.3-1 and Section 20.4.2 of ASCE 7-16, and our CPT and shear wave data, Site Class D has been assigned to the subject site. A seismic risk category of II was assigned to the proposed buildings in accordance with 2019 CBC, Table 1604.5. The following table provides parameters required to construct the design acceleration response spectrum based the 2019 CBC guidelines.

While the Fero FB1 boring only extends to a depth of 65 feet, it is our opinion that the soil consistency and density would be higher with increasing depth. Therefore, it is our professional opinion that the geotechnical data obtained is a reasonable representation of the upper 100 feet of existing ground with respect to shear wave velocity.

TABLE 1

Seismic Design Parameters

Ground Motion Parameters	Specific Reference	Parameter Value	Unit
Site Latitude (North)	-	33.8699	°
Site Longitude (West)	-	-117.5377	°
Site Class Definition	Section 1613.2.2 (1), Chapter 20 (2)	D (4)	-
Assumed Risk Category	Table 1604.5 (1)	II	-
M_w - Earthquake Magnitude	USGS Unified Hazard Tool (3)	6.5 (3)	-
R – Distance to Surface Projection of Fault	USGS Unified Hazard Tool (3)	5.4 (3)	km
S_s - Mapped Spectral Response Acceleration Short Period (0.2 second)	Figure 1613.2.1(1) (1)	1.872 (4)	g
S_1 - Mapped Spectral Response Acceleration Long Period (1.0 second)	Figure 1613.2.1(2) (1)	0.732 (4)	g
F_a – Short Period (0.2 second) Site Coefficient	Table 1613.2.3(1) (1)	1 (4)	-
F_v – Long Period (1.0 second) Site Coefficient	Table 1613.2.3(2) (1)	Null (4)	-
S_{MS} – MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (0.2 second)	Equation 16-36 (1)	1.872 (4)	g
S_{M1} - MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (1.0 second)	Equation 16-37 (1)	Null (4)	g
S_{DS} - Design Spectral Response Acceleration at 0.2-s	Equation 16-38 (1)	1.248 (4)	g
S_{D1} - Design Spectral Response Acceleration at 1-s	Equation 16-39 (1)	Null (4)	g
$T_o = 0.2\ S_{D1}/\ S_{DS}$	Section 11.4.6 (2)	Null	s
$T_s = S_{D1}/\ S_{DS}$	Section 11.4.6 (2)	Null	s
T_L - Long Period Transition Period	Figure 22-14 (2)	8 (4)	s
PGA - Peak Ground Acceleration at MCE_G (*)	Figure 22-9 (2)	0.788 (4)	g
F_{PGA} - Site Coefficient Adjusted for Site Class Effect (2)	Table 11.8-1 (2)	1.1 (4)	-
PGA_M –Peak Ground Acceleration (2) Adjusted for Site Class Effect	Equation 11.8-1 (2)	0.867 (4)	g
Design PGA ≈ (⅔ PGA_M) - Slope Stability (†)	Similar to Eqs. 16-38 & 16-39 (2)	0.57	g
Design PGA ≈ (0.4 S_{DS}) – Short Retaining Walls (‡)	Equation 11.4-5 (2)	0.50	g
C_{RS} - Short Period Risk Coefficient	Figure 22-18A (2)	0.918 (4)	-
C_{R1} - Long Period Risk Coefficient	Figure 22-19A (2)	0.905 (4)	-
SDC - Seismic Design Category (§)	Section 1613.2.5 (1)	Null (4)	-

References:

(1) California Building Code (CBC), 2019, California Code of Regulations, Title 24, Part 2, Volume I and II.

(2) American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI), 2016, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, Standards 7-16.

(3) USGS Unified Hazard Tool - https://earthquake.usgs.gov/hazards/interactive/

(4) SEI/OSHPD Seismic Design Map Application – https://seismicmaps.org

Related References:

Federal Emergency Management Agency (FEMA), 2015, NEHERP (National Earthquake Hazards Reduction Program) Recommended Seismic Provision for New Building and Other Structures (FEMA P-1050).

Notes:

* PGA Calculated at the MCE return period of 2475 years (2 percent chance of exceedance in 50 years).

† PGA Calculated at the Design Level of ⅔ of MCE; approximately equivalent to a return period of 475 years (10 percent chance of exceedance in 50 years).

‡ PGA Calculated for short, stubby retaining walls with an infinitesimal (zero) fundamental period.

§ The designation provided herein may be superseded by the structural engineer in accordance with Section 1613.2.5.1, if applicable.

Discussion

Owing to the characteristics of the subsurface soils, as defined by Site Class D-Stiff Soil designation, and proximity of the site to the sources of major ground shaking, the site is expected to experience strong ground shaking during its anticipated life span. Under these circumstances, where the code-specified design response spectrum may not adequately characterize site response, the 2019 CBC typically requires a site-specific seismic response analysis to be performed. This requirement is signified/identified by the "null" values that are output using SEA/OSHPD software in determination of short period, but mostly, in determination of long period seismic parameters, see Table 1.

For conditions where a "null" value is reported for the site, a variety of design approaches are permitted by 2019 CBC and ASCE 7-16 in lieu of a site-specific seismic hazard analysis. For any specific site, these alternative design approaches, which include Equivalent Lateral Force (ELF) procedure, Modal Response Spectrum Analysis (MRSA) procedure, Linear Response History Analysis (LRHA) procedure and Simplified Design procedure, among other methods, are expected to provide results that may or may not be more economical than those that are obtained if a site-specific seismic hazards analysis is performed. These design approaches and their limitations should be evaluated by the project structural engineer.

Notwithstanding the above discussion, should the Equivalent Lateral Force (ELF) method is used for seismic design of structural elements, the value of Constant Velocity Domain Transition Period, T_s, is estimated to be 0.674 and the value of Long Period Transition Period, T_L, is provided in Table 1 for construction of Seismic Response Coefficient – Period (C_s -T) curve that is used in the ELF procedure.

Please note that the Seismic Design Category, SDC, is also designated as "null" in Table 1. For condition where the mapped spectral response acceleration parameter at 1 – second period, S_1, is less than 0.75, the 2019 CBC, Section 1613.2.5.1 allows that seismic design category to be determined from Table 1613.2.5(1) alone provided that all 4 requirements concerning fundamental period of structure, story drift, seismic response coefficient, and relative rigidity of the diaphragms are met. Our interpretation of ASCE 7-16 is that for conditions where one or more of these 4 conditions are not met, seismic design category should be assigned based on: 1) 2019 CBC, Table 1613.2.5(1), 2) structure's risk category and 3) the value of S_{DS}, at the discretion of the project structural engineer.

As stated herein, the subject site is within a Site Class D-Stiff Soil. A site-specific ground motion hazard analysis is not required for structures on Site Class D-Stiff Soil with $S_1 \geq 0.2$ provided that the Seismic Response Coefficient C_s is determined in accordance with ASCE 7-16, Article 12.8 and structural design is performed in accordance with Equivalent Lateral Force (ELF) procedure.

Expansive Soil Conditions

Based on our initial laboratory test, near-surface soils encountered in our borings are granular and Very Low in expansion potential (Expansion Index less than 20). Additional sampling and testing should be performed during site grading for determining actual expansion potential of the supporting building pad soils.

Foundation System

In consideration of the existing granular soils and the recommended remedial grading herein, conventional shallow foundations, consisting of isolated column footings and continuous footings, may be used for support of the commercial structures. Foundation loads for the presumed two-story concrete tilt-up buildings are currently unknown, however Petra has assumed 2- to 5-kip per foot line loads for continuous footings and 25- to 50-kip point loads for columns.

Allowable Soil Bearing Capacity

Isolated Column Footings

A basic allowable soil bearing capacity of 2,500 pounds per square foot, including dead and live loads, may be utilized for design of minimum 24-inch square pad footing founded no less than 18 inches below lowest adjacent finish grade. The bearing capacity may be increased by 20 percent for each additional foot of embedment and/or 10 percent for each additional foot of width to a maximum of 3,500 pounds per square foot. The recommended allowable bearing value includes both dead and live loads, and may be increased by one-third for short-duration wind and seismic forces.

Continuous Footings

A basic allowable soil bearing capacity of 2,000 pounds per square foot, including dead and live loads, may be utilized for design of minimum 12-inch wide continuous footing founded no less than 18 inches below lowest adjacent finish grade. The bearing capacity may be increased by 20 percent for each additional foot of embedment and/or 10 percent for each additional foot of width to a maximum of 3,000 pounds per square foot. The recommended allowable bearing value includes both dead and live loads, and may be increased by one-third for short-duration wind and seismic forces.

Lateral Resistance

A passive earth pressure of 350 pounds per square foot per foot of depth, to a maximum value of 2,000 pounds per square foot, may be used to determine lateral bearing resistance for footings. In addition, a coefficient of friction of 0.40 times the dead load forces may be used between concrete and the supporting

soils to determine lateral sliding resistance. The above values may be increased by one-third when designing for transient wind or seismic forces. It should be noted that the above values are based on the condition where footings are cast in direct contact with compacted fill. In cases where the footing sides are formed, all backfill placed against the footings upon removal of forms should be compacted to at least 90 percent of the applicable maximum dry density.

Static Settlement

Based on the allowable bearing values provided above, total settlement of the footings is anticipated to be less than 1 inch. Differential settlement is expected to be approximately two-thirds of the total settlement over 40 feet (angular distortion of 1:720). The majority of static settlement is likely to take place as footing loads are applied or shortly thereafter.

Dynamic Settlement

As previously noted, the total seismic settlements are estimated to be less than 0.3 inches. Differential dynamic settlement is estimated to be less than 0.2 inches over a span of 30 feet.

Building Floor Slabs

1. Concrete floor slabs should be a minimum 5 inches thick and reinforced with a minimum No. 3 bars spaced a maximum of 18 inches on centers, both ways. All slab reinforcement should be properly supported to ensure placement near mid-depth.

2. Where a moisture barrier is not needed, as is likely the case in the warehouse and manufacturing areas of the buildings, the concrete may be placed directly upon the prepared subgrade soils. The preparation shall include compaction of the subgrade soils to achieve 95 percent relative per ASTM D1557 prior to foundation trenching, as described in the Fill Placement section. Following the construction of foundations and installation of interior utilities, the backfill of excavations shall be compacted to no less than 90 percent relative compaction prior to slab concrete placement.

3. Concrete floor slabs to receive moisture sensitive floor covering should be underlain with a moisture vapor retarder consisting of a minimum 10-mil-thick polyethylene or polyolefin membrane that meets the minimum requirements of ASTM E96 and ASTM E1745 for vapor retarders (such as Husky Yellow Guard®, Stego® Wrap, or equivalent). All laps within the membrane should be sealed, and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface cannot be achieved by grading, consideration should be given to lowering the pad finished grade an additional inch and then placing a 1-inch-thick leveling course of sand across the pad surface prior to the placement of the membrane.

   At the present time, some slab designers, geotechnical professionals and concrete experts view the sand layer below the slab (blotting sand) as a place for entrapment of excess moisture that could adversely impact moisture-sensitive floor coverings. As a preventive measure, the potential for moisture intrusion into the concrete slab could be reduced if the concrete is placed

directly on the vapor retarder. However, if this sand layer is omitted, appropriate curing methods must be implemented to ensure that the concrete slab cures uniformly. A qualified materials engineer with experience in slab design and construction should provide recommendations for alternative methods of curing and supervise the construction process to ensure uniform slab curing. Additional steps would also need to be taken to prevent puncturing of the vapor retarder during concrete placement.

4. Prior to placing concrete, the subgrade soils below the slab should be pre-watered to achieve a moisture content that is at least optimum moisture content, but not overly wet.

5. Slab dimension, reinforcement type, size and spacing need to account for internal concrete forces (e.g., thermal, shrinkage and expansion) as well as external forces (e.g., applied loads), as deemed necessary. The minimum dimensions and reinforcement recommended herein for building floor slabs may be modified (increased or decreased) by the structural engineer responsible for foundation design based on his/her calculations and engineering experience and judgment. A modulus of subgrade reaction of 125 pci may be used for slab design.

General Corrosivity Screening

As a screening level study, limited chemical and electrical tests were performed on representative samples of onsite soils to identify potential corrosive characteristics of these soils. The following sections present the test results and an interpretation of current codes and guidelines that are commonly used in our industry as they relate to the adverse impact of chemical contents and electrical resistance of the site soils on various components of the proposed structures in contact with site soils.

A variety of test methods are available to quantify corrosive potential of soils for various elements of construction materials. Depending on the test procedures adopted, characteristics of the leachate that is used to extract the target chemicals from the soils and the test equipment; the results can vary appreciably for different test methods in addition to those caused by variability in soil composition. The testing procedures referred to herein are considered to be typical for our industry and have been adopted and/or approved by many public or private agencies. In drawing conclusions from the results of our chemical and electrical laboratory testing and providing mitigation guidelines to reduce the detrimental impact of corrosive site soils on various components of the structure in contact with site soils, heavy references were made to 2016 California Building Code (2016 CBC) and American Concrete Institute publication (2014 Building Code Requirements for Structural Concrete, ACI 318-14). Where relevant information was not available in these codes, references were made to guidelines developed by California Department of Transportation (Caltrans), Post-Tensioning Institute (PTI DC10.5-12) and other reputable institutions and/or publications. Specifically, the reference to Caltrans approach were made because their risk management protocol for highway bridges are considered comparable to those for residential or commercial structures and that Post

Tensioning Institute (PTI), in part, accepts and uses Caltrans' relevant corrosivity criteria for post-tensioned slabs on-grade.

It should be noted that Petra does not practice corrosion engineering; therefore, the test results, opinion and engineering judgment provided herein should be considered as general guidelines only. Additional analyses would be warranted, especially, for cases where buried metallic building materials (such as copper and cast or ductile iron pipes) in contact with site soils are planned for the project. In many cases, the project geotechnical engineer may not be informed of these choices. Therefore, for conditions where such elements are considered, we recommend that other, relevant project design professionals (e.g., the architect, landscape architect, civil and/or structural engineer) also consider recommending a qualified corrosion engineer to conduct additional sampling and testing of near-surface soils during the final stages of site grading to provide a complete assessment of soil corrosivity. Recommendations to mitigate the detrimental effects of corrosive soils on buried metallic and other building materials that may be exposed to corrosive soils should be provided by the corrosion engineer as deemed appropriate.

Concrete in Contact with Site Soils

Soils containing soluble sulfates beyond certain threshold levels as well as acidic soils are considered to be detrimental to long-term integrity of concrete placed in contact with such soils. For the purpose of this study, soluble sulfates (SO_4^{2-}) concentration in soils determined in accordance with California Test Method No. 417. Soil acidity, as indicated by hydrogen-ion concentration (pH), was determined in accordance with California Test Method No. 643. The soil acid severity rating is adopted from The United States Department of Agriculture, Natural Resources Conservation Service classification.

Article 1904.1 of Section 1904 of the 2016 CBC indicates that structural concrete shall conform to the durability requirements of ACI 318. Concrete durability is impacted by exposure to water soluble chemicals and its resistance to fluid penetration. Section 19.3 of Chapter 19 of ACI 318-14 provides guidelines for assigning exposure categories and classes for various conditions. **Exposure Category S**, which is subdivided to four Exposure Classes of S0, S1, S2 and S3, applies to concrete in contact with soil or water containing deleterious amounts of water soluble ions.

The results of our limited in-house laboratory testing indicates that on-site soils contain a water-soluble ***sulfate content of 0.005 to 0.0006 percent by weight***. Based on Table 19.3.1.1 of ACI 318-14, the **Exposure Class S0** is appropriate for onsite soils. For this exposure class, Table 19.3.2.1 of ACI 318-14 provides that no restriction for cement type or maximum water-cement ratio for the fresh concrete would be required.

Further, this table indicates that the concrete minimum unconfined strength should not be less than 2,500 psi.

The results of limited in-house testing of a representative sample indicates that soils exhibit a ***moderately alkaline pH of 8.6 to 8.7***. Based on this finding and according to Table 8.22.2 of Caltrans' 2003 Bridge Design Specifications (2003 BDS) requirements (which consider the combined effects of soluble sulfates and soil pH), a commercially available Type II Modified cement may be used.

The guidelines provided herein should be evaluated and confirmed, or modified, in its entirety by the project structural engineer and the contractor responsible for concrete placement for structural concrete used in exterior and interior footings, interior slabs on-ground, garage slabs, walls foundation and concrete exposed to weather such as driveways, patios, porches, walkways, ramps, steps, curbs, etc.

Metals Encased in Concrete

Soils containing a soluble chloride concentration beyond a certain threshold level are considered corrosive to metallic elements such as reinforcement bars, tendons, cables, bolts, anchors, etc. that are encased in concrete that, in turn, is in contact with such soils. For the purpose of this study, soluble chlorides (Cl) in soils were determined in accordance with California Test Method No. 422.

As stated Earlier, Article 1904.1 of Section 1904 of the 2016 CBC indicates that structural concrete shall conform to the durability requirements of ACI 318. Concrete durability is impacted by exposure to water soluble chemicals and its resistance to fluid penetration. Section 19.3 of Chapter 19 of ACI 318-14 provides guidelines for assigning exposure categories and classes for various conditions. **Exposure Category C**, which is subdivided to three Exposure Classes of C0, C1, and C2, applies to nonprestressed and prestressed concrete exposed to conditions that require additional protection against corrosion of reinforcement.

According to Table 19.3.1.1 of ACI 318-14, the **Exposure Class C0** is appropriate for reinforced concrete that remains dry or protected from moisture. Similarly, the **Exposure Class C1** is appropriate for reinforced concrete that is exposed to moisture but not to external sources of chlorides. And, lastly, the **Exposure Class C2** is appropriate for reinforced concrete that is exposed to moisture and external sources of chlorides as "deicing chemicals, salt, brackish water, seawater, or spray from these sources".

Based on our understanding of the project, it is our professional opinion that the **Exposure Class C1** is appropriate for reinforced concrete, to be placed at the site, that are in contact with site soils.

The results of our limited laboratory testing indicate that onsite soils contain a water-soluble ***chloride concentration of 66 to 99 parts per million (ppm)***. No maximum water/cement ratio for the fresh concrete is prescribed by ACI 318 for **Exposure Class C1** condition. Table 19.3.2.1 of ACI 318-14 indicates that concrete minimum unconfined compressive strength, f'_c, should not be less than 2,500 psi.

The guidelines provided herein should be evaluated and confirmed, or modified, in its entirety by the project structural engineer for reinforced concrete placement for structural concrete used in exterior and interior footings, interior slabs on-ground, garage slabs, walls foundation and concrete exposed to weather such as driveways, patios, porches, walkways, ramps, steps, curbs, etc.

Metallic Elements in Contact with Site Soils

Elevated concentrations of soluble salts in soils tend to induce low level electrical currents in metallic objects in contact with such soils. This process promotes metal corrosion and can lead to distress to building metallic components that are in contact with site soils. The minimum electrical resistivity measurement provides a simple indication of relative concentration of soluble salts in the soil and, therefore, is widely used to estimate soil corrosivity with regard to metals. For the purpose of this investigation, the minimum resistivity in soils is measured in accordance with California Test Method No. 643. The soil corrosion severity rating is adopted from the Handbook of Corrosion Engineering by Pierre R. Roberge.

The onsite soils were found to exhibit a ***minimum electrical resistivity of 4,800 to 15,000 ohm-cm*** based on limited testing. The result indicates that on-site soils are **moderately to mildly Corrosive** to ferrous metals and copper. As such, any ferrous metal or copper components of the subject buildings (such as cast iron or ductile iron piping, copper tubing, etc.) that are expected to be placed in direct contact with site soils should be protected against detrimental effects of corrosive soils. Such protection could include the use of galvanized tubing, coated pipes, wrapping or encasing these metallic objects in special protection wrappings or conduits or devising a cathodic protection system. It should be noted that at this time Petra is not aware of any plans to incorporate such items for the proposed buildings. Should such elements be considered for these building, we recommend that a qualified corrosion engineer to be consulted to provide appropriate recommendations for long term protection of metallic elements in contact with site soils.

Post-Grading Considerations

Utility Trenches

All utility trench backfill should be compacted to a minimum relative compaction of 90 percent. Trench backfill materials should be free of oversize rock and placed in lifts no greater than approximately 12 inches

in thickness, watered or air-dried as necessary to achieve near optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90 percent. A representative of the project geotechnical consultant should probe and test the backfills to verify adequate compaction.

As an alternative for shallow trenches where pipe or utility lines may be damaged by mechanical compaction equipment, such as under building floor slabs, clean sand having a sand equivalent (SE) value of 30 or greater may be utilized. The sand backfill materials should be watered to achieve near optimum moisture conditions and then tamped into place. No specific relative compaction will be required; however, observation, probing, and if deemed necessary, testing should be performed by a representative of the project geotechnical consultant to verify an adequate degree of compaction.

If clean, imported sand is to be used for backfill of exterior utility trenches, it is recommended that the upper 12 inches of trench backfill materials consist of properly compacted onsite soil materials. This is to mitigate infiltration of irrigation and rainwater into granular trench backfill materials.

Where an exterior and/or interior utility trench is proposed in a direction parallel to a building footing, the bottom of the trench should not extend below a 1:1 (horizontal to vertical) plane projected downward from the bottom edge of the adjacent footing. Where this condition occurs, the adjacent footing should be deepened or the utility constructed and the trench backfilled and compacted prior to footing construction. Where utility trenches cross under a building footing, these trenches should be backfilled with on-site soils at the point where the trench crosses under the footing to reduce the potential for water to migrate under the floor slabs.

Site Drainage

Positive surface drainage systems consisting of a combination of sloped concrete flatwork/asphalt pavement, sheet flow gradients, swales and surface area drains (where needed) should be provided around the building and within the planter areas to collect and direct all surface waters to an appropriate drainage facility as determined by the project civil engineer. The ground surfaces of planter and landscape areas that are located within 10 feet of building foundations should be sloped at a minimum gradient of 5 percent away from the foundations and towards the nearest area drains. The ground surface of planter and landscape areas that are located more than 10 feet away from building foundations may be sloped at a minimum gradient of 2 percent away from the foundations and towards the nearest area drains.

Concrete flatwork surfaces that are located within 10 feet of building foundations should be inclined at a minimum gradient of one percent away from the building foundations and towards the nearest area drains.

Concrete flatwork surfaces that are located more than 10 feet away from building foundations may be sloped at a minimum gradient of 1 percent towards the nearest area drains. Surface waters should not be allowed to collect or pond against building foundations and within the level areas of the site. All drainage devices should be properly maintained throughout the lifetime of the development. Future changes to site improvements, or planting and watering practices, should not be allowed to cause over-saturation of site soils adjacent to the structures.

Masonry Screen Walls

Construction on Level Ground

Where masonry walls are proposed on level ground and 5 feet or more from the tops of descending slopes, the footings for these walls may be founded 18 inches or more below the lowest adjacent final grade. These footings should also be reinforced with two No. 4 bars, one near top and one near bottom.

Construction Joints

In order to reduce the potential for unsightly cracking related to the effects of differential settlement, positive separations (construction joints) should be provided in the walls at horizontal intervals of approximately 20 to 25 feet and at each corner. The separations should be provided in the blocks only and not extend through the footings. The footings should be placed monolithically with continuous rebars to serve as effective "grade beams" along the full lengths of the walls.

Exterior Concrete Flatwork

General

Near-surface compacted fill soils within the site are expected to exhibit an expansion index of 0 to 20, i.e. non-expansive. We recommend that all exterior concrete flatwork such as sidewalks, patio slabs, large decorative slabs, concrete subslabs that will be covered with decorative pavers, private and/or public vehicular driveways and/or access roads within and adjacent to the site be designed by the project architect and/or structural engineer with consideration given to mitigating the potential cracking and uplift that can develop in soils exhibiting expansion index values that fall in the very low category.

The guidelines that follow should be considered as minimums and are subject to review and revision by the project architect, structural engineer and/or landscape consultant as deemed appropriate.

Thickness and Joint Spacing

To reduce the potential of unsightly cracking, concrete walkways, patio-type slabs, large decorative slabs and concrete subslabs to be covered with decorative pavers should be at least 4 inches thick and provided with construction joints or expansion joints every 6 feet or less.

Reinforcement

All concrete flatwork having their largest plan-view panel dimension exceeding 10 feet should be reinforced with a minimum of No. 3 bars spaced 24 inches on centers, both ways. Alternatively, the slab reinforcement may consist of welded wire mesh of the sheet type (not rolled) with 6x6/W1.4xW1.4 designation in accordance with the Wire Reinforcement Institute (WRI). The reinforcement should be properly positioned near the middle of the slabs.

> *The reinforcement recommendations provided herein are intended as guidelines to achieve adequate performance for anticipated soil conditions. The project architect, civil and/or structural engineer should make appropriate adjustments in reinforcement type, size and spacing to account for concrete internal (e.g., shrinkage and thermal) and external (e.g., applied loads) forces as deemed necessary.*

Subgrade Preparation

Compaction

To reduce the potential for distress to concrete flatwork, the subgrade soils below concrete flatwork areas to a minimum depth of 12 inches (or deeper, as either prescribed elsewhere in this report or determined in the field) should be moisture conditioned to at least equal to, or slightly greater than, the optimum moisture content and then compacted to a relative compaction of no less than 90 percent. Where concrete public roads, concrete segments of roads and/or concrete access driveways are proposed, the upper 6 inches of subgrade soil should be compacted to no less than 95 percent relative compaction.

Pre-Moistening

As a further measure to reduce the potential for concrete flatwork cracking, subgrade soils should be thoroughly moistened prior to placing concrete. The moisture content of the soils should be approximately 1.2 times the optimum moisture content and penetrate to a minimum depth of 12 inches into the subgrade. Flooding or ponding of the subgrade is not considered feasible to achieve the above moisture conditions since this method would likely require construction of numerous earth berms to contain the water. Therefore, moisture conditioning should be achieved with a light spray applied to the subgrade over a period

of few to several days just prior to pouring concrete. Pre-watering of the soils is intended to promote uniform curing of the concrete, reduce the development of shrinkage cracks and reduce the potential for differential expansion pressure on freshly poured flatwork. A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soils, and the depth of moisture penetration prior to pouring concrete.

Drainage

Drainage from patios and other flatwork areas should be directed to local area drains and/or graded earth swales designed to carry runoff water to the adjacent streets or other approved drainage structures. The concrete flatwork should be sloped at a minimum gradient of one percent, or as prescribed by project civil engineer or local codes, away from building foundations, retaining walls, masonry garden walls and slope areas.

Tree Wells

Tree wells are not recommended in concrete flatwork areas since they introduce excessive water into the subgrade soils and allow root invasion, both of which can cause heaving and cracking of the flatwork.

Preliminary Pavement Design Recommendations

The final pavement section should be designed once rough grading has occurred and the R-Value of the resulting subgrade can be determined. For the purposes of this preliminary evaluation, we assumed an R-value of 50 based on the soil types encountered. The following pavement sections have been computed in accordance with Caltrans design procedures and presented in the following table, Table 2. Based upon our experience, the thicker pavement section is provided below is recommended due to increased performance and life.

TABLE 2

Preliminary Structural Pavement Sections

Location	Design R-value	Traffic Index	Pavement Section
Auto Parking Spaces	50	4.5	3 in. AC / 4 in. AB
Auto Driveways	50	5.0	3 in. AC / 4 in. AB
Truck Driveways/Parking	50	8.0	4.5 in. AC / 6 in. AB

Notes: AC = Asphalt Concrete AB = Aggregate Base

Final pavement design recommendations should be provided based on sampling and testing at the completion of rough grading and the values of traffic indices that should be provided by the project civil engineer. Subgrade soils should be properly compacted, smooth, and non-yielding prior to pavement construction. The subgrade soils should be compacted to at least 95 percent of ASTM D 1557.

Aggregate base materials should be Crushed Aggregate Base, Crushed Miscellaneous Base, or Processed Miscellaneous Base conforming to Section 200-2 of the Standard Specifications for Public Works Construction (Greenbook). The base materials should be brought to uniform moisture near optimum moisture then compacted to at least 95 percent of the applicable maximum density standard as determined per ASTM D 1557. Asphaltic concrete materials and construction should conform to Section 203 of the Greenbook.

Loading Docks

1. The slab subgrade should be graded such that it accommodates placement of 7-inch thick concrete pavement section. Subgrade compaction shall be no less than 95 percent relative compaction with reference to ASTM D1557.

2. Prior to placing concrete, the subgrade soils below the slab should be pre-watered to achieve a moisture content that is at least optimum moisture content, but not overly wet.

3. The concrete pavement section should be a minimum 7 inches thick and reinforced with No. 3 bars spaced a maximum of 18 inches on centers (both ways). The reinforcement should be properly positioned near the middle of the slabs.

4. Concrete shall exhibit an unconfined compressive strength of no less than 3,250 psi.

5. The minimum dimensions and reinforcement recommended herein for equipment slab may be modified (increased or decreased subject to the constraints of the 2019 CBC) by the Structural Engineer based on his/her calculations, engineering experience and judgment.

GRADING AND STRUCTURAL PLAN REVIEW

This report is based on the existing site conditions as we understand and the preliminary conceptual grading plan by KWC Engineers. We recommend that our firm be retained to review the grading plan and structural foundation plans once when they become available. Additional recommendations and/or modification of the recommendations provided herein will be provided if necessary, depending on the results of the plan reviews.

If additional or alternative improvements are considered in the future, our firm should be notified so that we may provide design recommendations. It is further recommended that we be engaged to review the final

design drawings, specifications and grading plan prior to any new construction. If we are not provided the opportunity to review these documents with respect to the geotechnical aspects of new construction and grading, it should not be assumed that the recommendations provided herein are wholly or in part applicable to the proposed construction.

We recommend that Petra be retained to provide soil-engineering services during excavation, grading, construction and foundation phases of the work. This is to observe compliance with the design, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

REPORT LIMITATIONS

This report is based on the project site and our ten preliminary subsurface borings/CPT's, laboratory testing and geotechnical analysis. The materials encountered on the project site and utilized in our laboratory evaluation are believed representative of the total area; however, soil and groundwater conditions can vary in characteristics between excavations, both laterally and vertically, especially when considering the historical site undocumented grading, development and use.

The conclusions and opinions contained in this report are based on the results of the described geotechnical evaluations and represent our professional judgment. This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and in the same time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes. In addition, this report should be reviewed and updated after a period of 1 year or if the site ownership or project concept changes from that described herein.

It has been a pleasure to be of service to you on this project. Should you have questions regarding the contents of this report or should you require additional information, please contact this office.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

Douglass Johnston
Senior Associate Geologist
CEG 2477

PROFESSIONAL GEOLOGIST
DOUGLASS L. JOHNSTON
NO. 2477
CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

12/9/22

Grayson R. Walker
Principal Engineer
GE 871

REGISTERED PROFESSIONAL ENGINEER
GRAYSON R. WALKER
GE 871
GEOTECHNICAL
STATE OF CALIFORNIA

DJ/GW/lv

Distribution: (1) Addresses (electronic copy)
(1) Ms. Kimberly Thienes, T&B Planning
(1) Mr. Nick Nguyen, KWC Engineers

W:\2014-2019\2019\400\19-433\Reports\19-433 110 Updated Preliminary Geotechnical Evaluation.docx

REFERENCES

American Concrete Institute, 2014, Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary, Committee 318.

Bryant and Hart, E.W., W.A., 2007, Fault-rupture hazard zones in California, Alquist-Priolo earthquake fault zoning act with index to earthquake fault zones maps; California Geological Survey, Special Publication 42, interim revision.

California Geological Survey, 2018, Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, Special Publication 42.

California Geologic Survey, 2020, Earthquake Zones of Required Investigation, accessed January, https://maps.conservation.ca.gov/cgs/EQZApp/app/

California Department of Water Resources, 2020, Water Data Library, accessed January. http://www.water.ca.gov/waterdatalibrary/groundwater/

California State Water Resources Control Board, GeoTracker, 2020, accessed January, http://geotracker.waterboards.ca.gov/

County of Riverside, 2020, Map My County System, version 9.2, accessed January. https://gis.countyofriverside.us/Html5Viewer/?viewer=MMC_Public

Engineering Association of California (SEAOC) and California's Office of Statewide Health Planning and Development (OSHPD), Seismic Design Maps, with ASCE 7-16 Design Code Reference Document, https://seismicmaps.org/

Ferro Engineering, 2006, Report of Findings, Clow Value Company, 1375 Magnolia Avenue, Corona, California 93446, EPA ID Number CAD063115133, dated December 18.

_____, 2009, Groundwater Well Monitoring Report, Clow Value Company, 1375 Magnolia Avenue, Corona, California 93446, EPA ID Number CAD063115133, dated March 11.

Geologismiki Software, Cliq V.3.0.1.6 liquefaction assessment software

Google Earth™ 2019, by Google Earth, Inc., accessed December http://www.google.com/earth/index.html/

Geotechnical Professionals, Inc., 2021, Report of Geotechnical Observation During Construction, Pavement Project, Clow Valve Facility, 1375 Magnolia Avenue, Corona, California, prepared for Earthcon Consultants CA, Inc., dated September 13.

International Building Code, 2019 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, California Building Standards Commission.

KWC Engineers, 2022a, Magnolia Avenue Business Center Preliminary Grading Plan, Sheet 2 of 4, 60-scale, plot dated November 14.

REFERENCES

_____, 2022b, Magnolia Avenue Business Center Earthwork Exhibit, sheet 1 of 1, plot dated February 16.

Morton, D.M., Gray, C.H. Jr. and Gray, Webber, F. H. Jr., 2002, Geologic Map of the Corona South 7.5' Quadrangle, Riverside and Orange Counties, California, USGS Open-file Report 02-21.

Morton, D.M. and Gray, C.H. Jr., 2002, Geologic Map of the Corona North 7.5' Quadrangle, Riverside and San Bernardino Counties, California, USGS Open-file Report 02-22.

Petra Geosciences, Inc., 2020, Preliminary Geotechnical Evaluation, Proposed Magnolia Avenue Commercial Development, 17±-Acre Site at 1375 Magnolia Avenue, City of Corona, Riverside County, California, J.N. 19-433, dated February 19.

_____, 2022, Response to Plan Check Comment, Preliminary Grading Plan, Sheet 3 of 4, Magnolia Avenue Business Center, 1375 Magnolia Avenue, City of Corona, Riverside County, California, J.N. 19-433, dated September 12.

Post-Tensioning Institute, 2012, Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundation on Expansive Soils, Publication PTI DC1010.5-12.

Pradel, D., 1998, Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils: *in Journal of Geotechnical and Geoenvironmental Engineering*: Vol. 124, No. 4.

Standard Specifications for Public Works Construction (Greenbook), 2018 Edition, BNI Publishers.

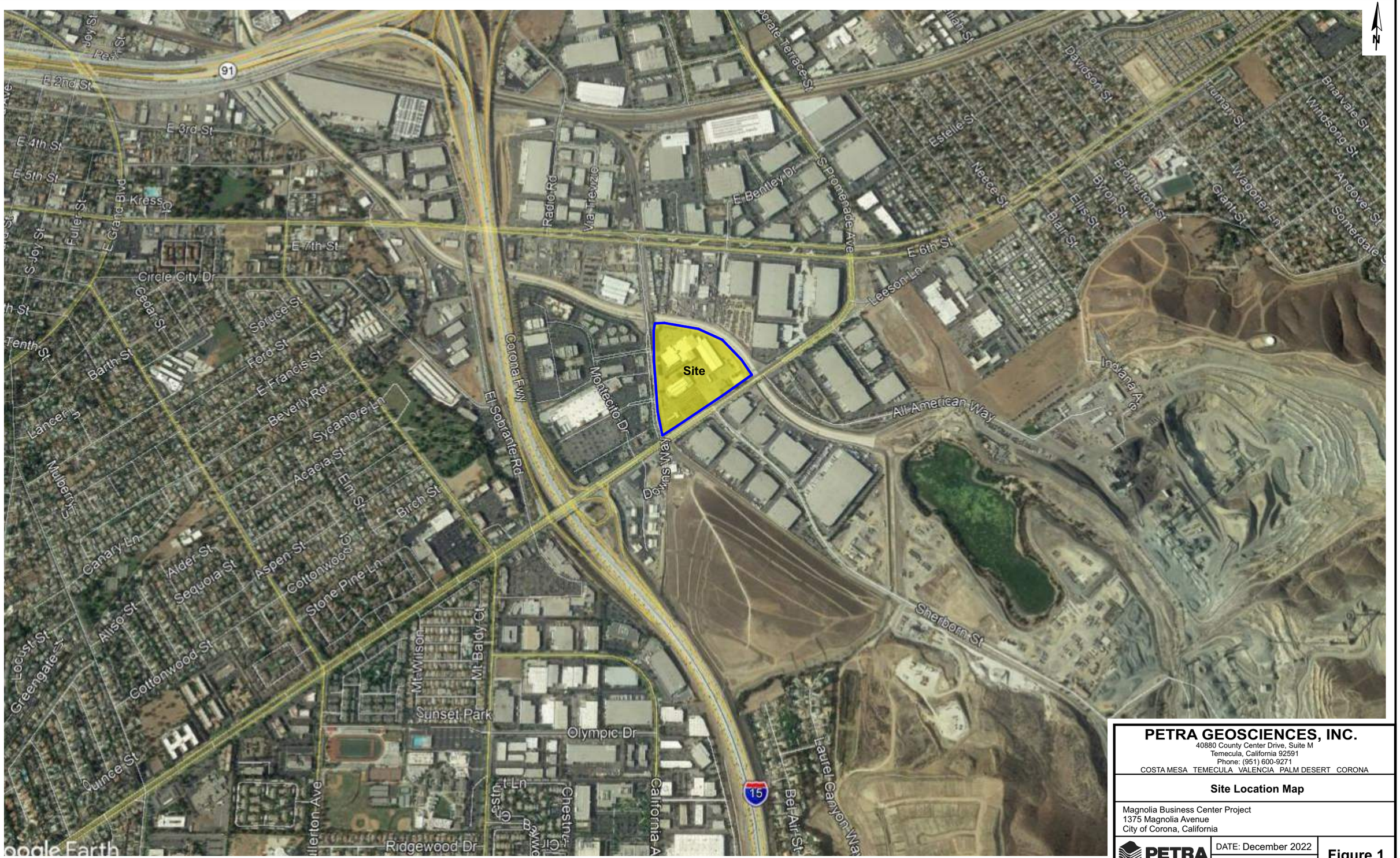
Todd Engineers, 2008, Groundwater Management Plan, prepared for the City of Corona, AB3030, dated June.

Tokimatsu, K. and Seed, H.B., 1987; Evaluation of Settlements in Sands due to Earthquake Shaking: *in Journal of Geotechnical Engineering*, Vol. 113, No. 8, p. 861-879.

United States Geological Survey (USGS), 2014, Unified Hazard Tool, https://earthquake.usgs.gov/hazards/interactive/

Wire Reinforcement Institute (WRI), 1996, Design of Slabs on Ground.

FIGURES



Reference: Google Earth, 2020 Image

PETRA GEOSCIENCES, INC.
40880 County Center Drive, Suite M
Temecula, California 92591
Phone: (951) 600-9271
COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

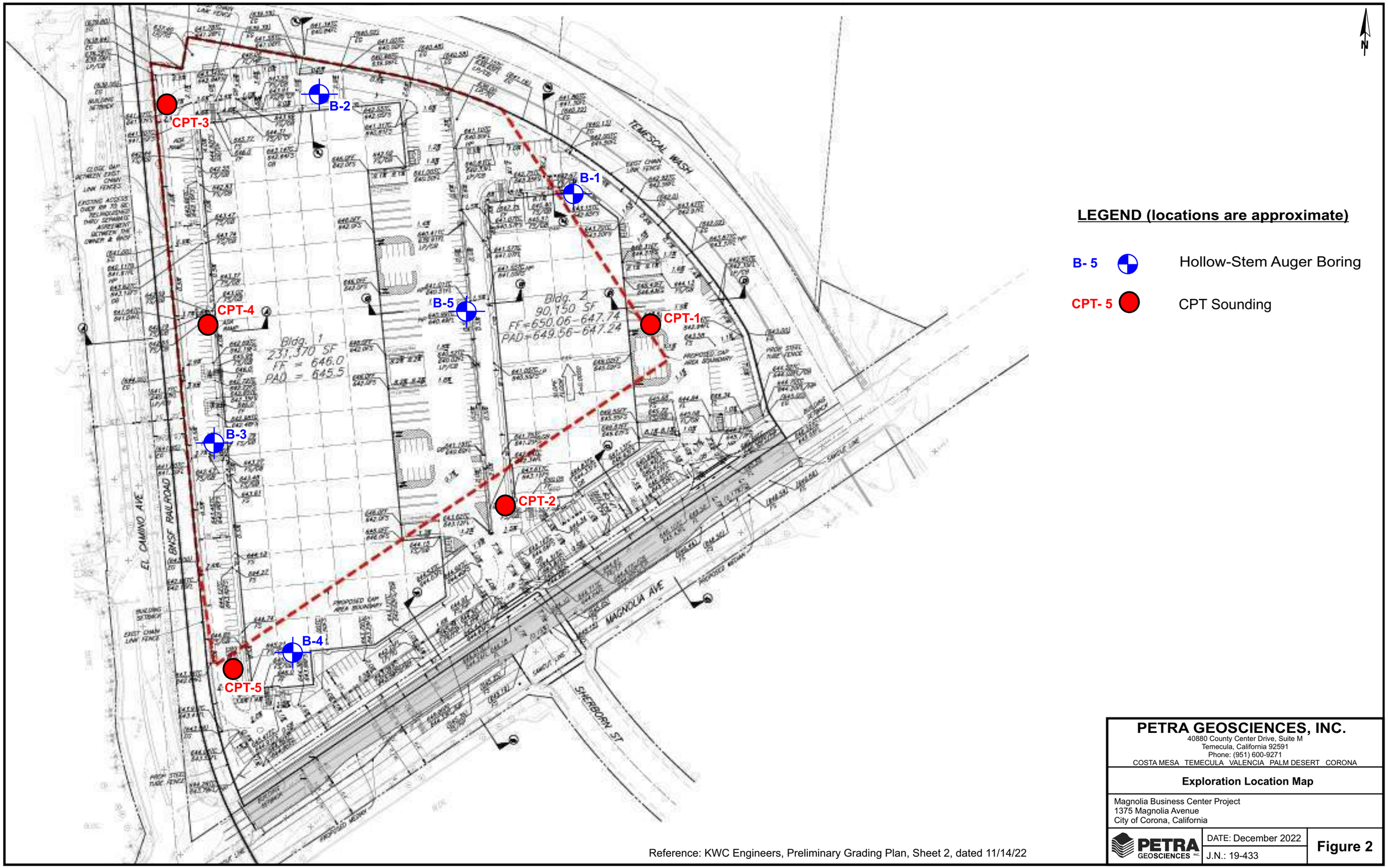
Site Location Map

Magnolia Business Center Project
1375 Magnolia Avenue
City of Corona, California

PETRA GEOSCIENCES INC.

DATE: December 2022
J.N.: 19-433

Figure 1



LEGEND (locations are approximate)

B- 5 — Hollow-Stem Auger Boring

CPT- 5 — CPT Sounding

Reference: KWC Engineers, Preliminary Grading Plan, Sheet 2, dated 11/14/22

PETRA GEOSCIENCES, INC.
40880 County Center Drive, Suite M
Temecula, California 92591
Phone: (951) 600-9271
COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

Exploration Location Map

Magnolia Business Center Project
1375 Magnolia Avenue
City of Corona, California

PETRA GEOSCIENCES INC.

DATE: December 2022

J.N.: 19-433

Figure 2

APPENDIX A

EXPLORATION LOGS

EXPLORATION LOG

Project:	**1375 Magnolia Ave.**		Boring No.: **B-1**
Location:	**Corona**		Elevation: **±643'**
Job No.:	**19-433**	Client: **Western Realco**	Date: **1/2/2020**
Drill Method:	**8" Hollow Stem Auger**	Driving Weight: **140lbs/30"**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL, undocumented (afu)**							
		Sand (SP): Dark brown, moist, loose to medium-dense, fine- to coarse-grained sand.							MAX, S04, CL, RES, pH, DSR
				12 17 23	■	■	6.2	101.4	
5		Becomes dark yellowish-brown.		11 15 24	■		4.9	120.3	
		YOUNGER ALLUVIUM (Qya)		18 18 20	■		3.3	116.6	
		Sand (SP): Yellowish-brown to gray, dry to slighlu moist, medium-dense to dense, fine- to coarse-grained sand, poorly graded, trace gravel up to 0.5" in diameter.							
10		Same as above.		11 18 30	■		5.5	111.6	
15		Same as above.		7 7 10	■		8.2	129.7	
		Silty Sand (SM): Brown, moist, medium-dense, fine- to coarse-grained sand, trace gravel up to 2.5" in diameter.							
		Gravelly Sand (SP/GP): Yellowish-brown, moist, medium-dense, fine- to ocarse-grained sand, gravel up to 3" in diameter.							
20		Disturbed sample, same as above.		26 23 43	■		3.4	107.3	
		Drill begins to chatter.							
25		Becomes very dense with trace cobbles up to 4" in diameter.		27 50/1"	■		3.2	107.7	
		Total Depth= 25'7" No groundwater encountered Boring backfilled with cuttings and tamped.							
30									

PLATE A-1

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**1375 Magnolia Ave.**		Boring No.: **B-2**
Location:	**Corona**		Elevation: **±641'**
Job No.:	**19-433**	Client: **Western Realco**	Date: **1/2/2020**
Drill Method:	**8" Hollow Stem Auger**	Driving Weight: **140lbs/30"**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ASPHALT** 3" thick.							
		ARTIFICIAL FILL, undocumented (afu) Sand (SP): Dark brown to black, moist, loose to medium-dense, fine- to coarse-grained sand, few gravel up to 2" in diameter, trace brick debris.							
		Becomes brown.		9 10 13	■		1.6	106.8	
		Concrete storm drain pipe encountered, obstruction was not identified until after drilling of B-2 had completed.							
5		Becomes medium-dense to dense.		11 19 21	■		2.3	118.0	
		Becomes gray and dry.							
		YOUNGER ALLUVIUM (Qya) Sand (SP): Yellowish-brown to gray, slightly moist, medium-dense to dense, medium- to coarse-grained sand.		13 17 19	■		1.7	115.2	
10		Same as above with few gravel up to 2" in diameter No recovery.		13 19 19	▨				
15		Becomes yellowish-brown to brown, slightly moist, dense to very dense, fine-grained, no gravel.		19 30 46	■		2.2	111.6	
20		Gravelly Sand (SP/GP): Yellowish-brown to brown, dry, very dense, fine- to coarse-grained sand, gravel up to 3" in diameter No recovery Drill begins to chatter.		50/3"	▨				
25		Same as above with few cobbles up to 6" in diameter No recovery.		50/2"	▨				
		Total Depth= 25'2" Refusal due to cobble content No groundwater encountered Boring backfilled with cuttings and capped with asphalt patch.							
30									

PLATE A-2

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**1375 Magnolia Ave.**		Boring No.: **B-3**
Location:	**Corona**		Elevation: **±644'**
Job No.:	**19-433**	Client: **Western Realco**	Date: **1/2/2020**
Drill Method:	**8" Hollow Stem Auger**	Driving Weight: **140lbs/30"**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ASPHALT** 3.5" thick.							
		ARTIFICIAL FILL, undocumented (afu) Sand (SP): Dark grayish-brown, moist, medium-dense, fine- to coarse-grained sand, poorly graded, few gravel up to 3" in diameter. Becomes brown.		19 23 20	■	■	4.4	116.8	EI, S04, CL, RES, pH, DSR
5		**YOUNGER ALLUVIUM (Qya)** Sand (SP): Yellowish-brown to brown, very moist, medium-dense, medium- to coarse-grained sand, trace cobbles up to 4" in diameter.		8 11 11	■		3.7	104.1	
		Becomes very dense. Strong hydrocarbon odor.		9 40 50	■		4.5	98.1	
10		Becomes gray, fine- to coarse-grained, dense, poorly graded, strong hydrocarbon odor.		10 19 20	■		8.1	108.4	
15		Becomes reddish-brown, moist, fine- to medium-grained, medium-dense, strong hydrocarbon odor.		9 16 13	■		7.2	117.8	
		Silty Sand (SM): Dark gray, moist, medium-dense, fine-grained sand, strong hydrocarbon odor. Drill begins to struggle Cobbles encountered.							
20		Total Depth= 19' Refusal due to cobble content No groundwater encountered Boring backfilled with cuttings and capped with asphalt patch.							
25									
30									

PLATE A-3

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**1375 Magnolia Ave.**		Boring No.: **B-4**
Location:	**Corona**		Elevation: **±646'**
Job No.:	**19-433**	Client: **Western Realco**	Date: **1/2/2020**
Drill Method:	**8" Hollow Stem Auger**	Driving Weight: **140lbs/30"**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ASPHALT** 3.5" thick.							
		ARTIFICIAL FILL, undocumented (afu) Sand (SP): Grayish-brown, moist, medium-dense, fine- to coarse-grained sand, few gravel up to 2" in diameter. Becomes brown.							
5		**YOUNGER ALLUVIUM (Qya)** Sand (SP): Yellowish-brown to brown, slightly moist, dense, fine- to coarse-grained sand.		12 16 20	■		2.5	122.6	
		Same as above.		18 20 34	■		2.3	107.4	
10		Same as above.		18 18 29	■		4.0	122.6	
15		Sandy Clay (CL): Brown, very moist, soft to firm, fine- to medium-grained sand, trace gravel up to 3" in diameter Disturbed sample.		2 4 12	■		6.2		
		Sand (SP): Brown, moist, medium-dense, fine- to coarse-grained sand, few gravel up to 3" in diameter.							
20		Same same as above with trace cobbles up to 6" in diameter No recovery.		50/3"	▨				
		Total Depth= 20'5" Refusal due to cobble content No groundwater encountered Boring backfilled with cuttings and capped with asphalt patch.							
25									
30									

PLATE A-4

Petra Geosciences, Inc.

EXPLORATION LOG

Project:	**1375 Magnolia Ave.**		Boring No.: **B-5**
Location:	**Corona**		Elevation: **±642'**
Job No.:	**19-433**	Client: **Western Realco**	Date: **1/2/2020**
Drill Method:	**8" Hollow Stem Auger**	Driving Weight: **140lbs/30"**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ASPHALT** 3.5" thick.							
		ARTIFICIAL FILL, undocumented (afu) Sand (SP): Yellowish-brown, to grayish-brown, moist, medium-dense, fine- to coarse-grained sand, few gravel up to 2" in diameter.							
5		**YOUNGER ALLUVIUM (Qya)** Sand (SP): Yellowish-brown, moist, medium-dense, fine- to coarse-grained sand, poorly graded, trace gravel up to 2" in diameter.		12 15 16	■	■	3.9	118.8	
		Becomes fine- to medium-grained.		11 18 14	■	■	3.1	110.0	#200
10		Silty Sand (SM): Brown, moist, medium-dense, fine- to coarse-grained sand, trace gravel up to 2" in diameter.		5 7 7	■		5.5	105.3	
15		Becomes silty fine-grained sand, and very dense.		5 11 50/5"	■		6.8	129.1	
20		Sand (SP): Gray, slightly moist, very dense, fine- to coarse-grained sand, poorly graded, few gravel up to 3" in diameter Disturbed sample.		28 50/4"	■		2.3		
		Total Depth= 23' Refusal due to cobble content No groundwater encountered Boring backfilled with cuttings and capped with asphalt patch.							
25									
30									

PLATE A-5

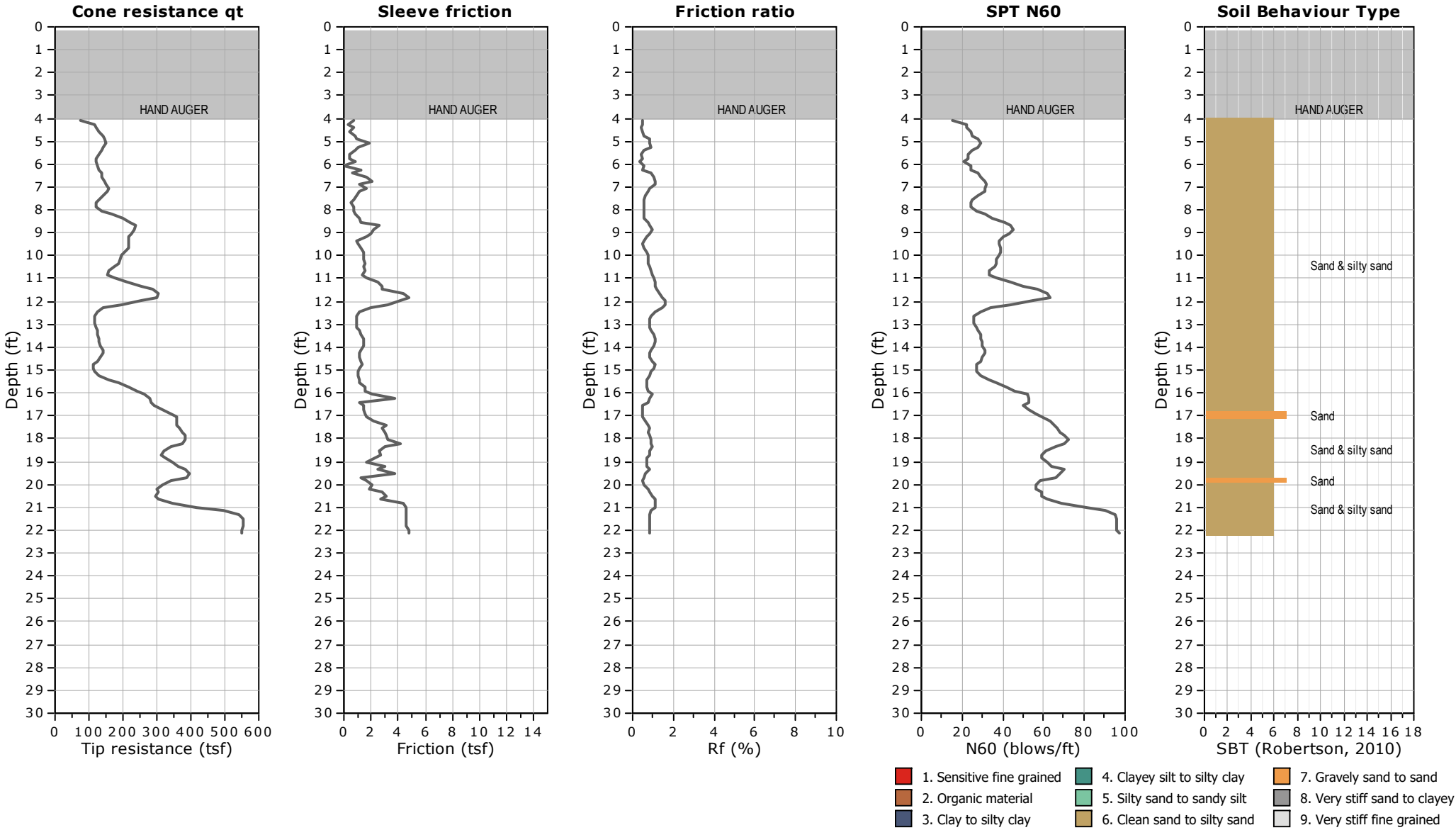
Petra Geosciences, Inc.

Gregg Drilling, LLC
www.greggdrilling.com

CPT: CPT-1

CLIENT: PETRA GEOSCIENCES
SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT
Total depth: 22.15 ft, Date: 1/2/2020

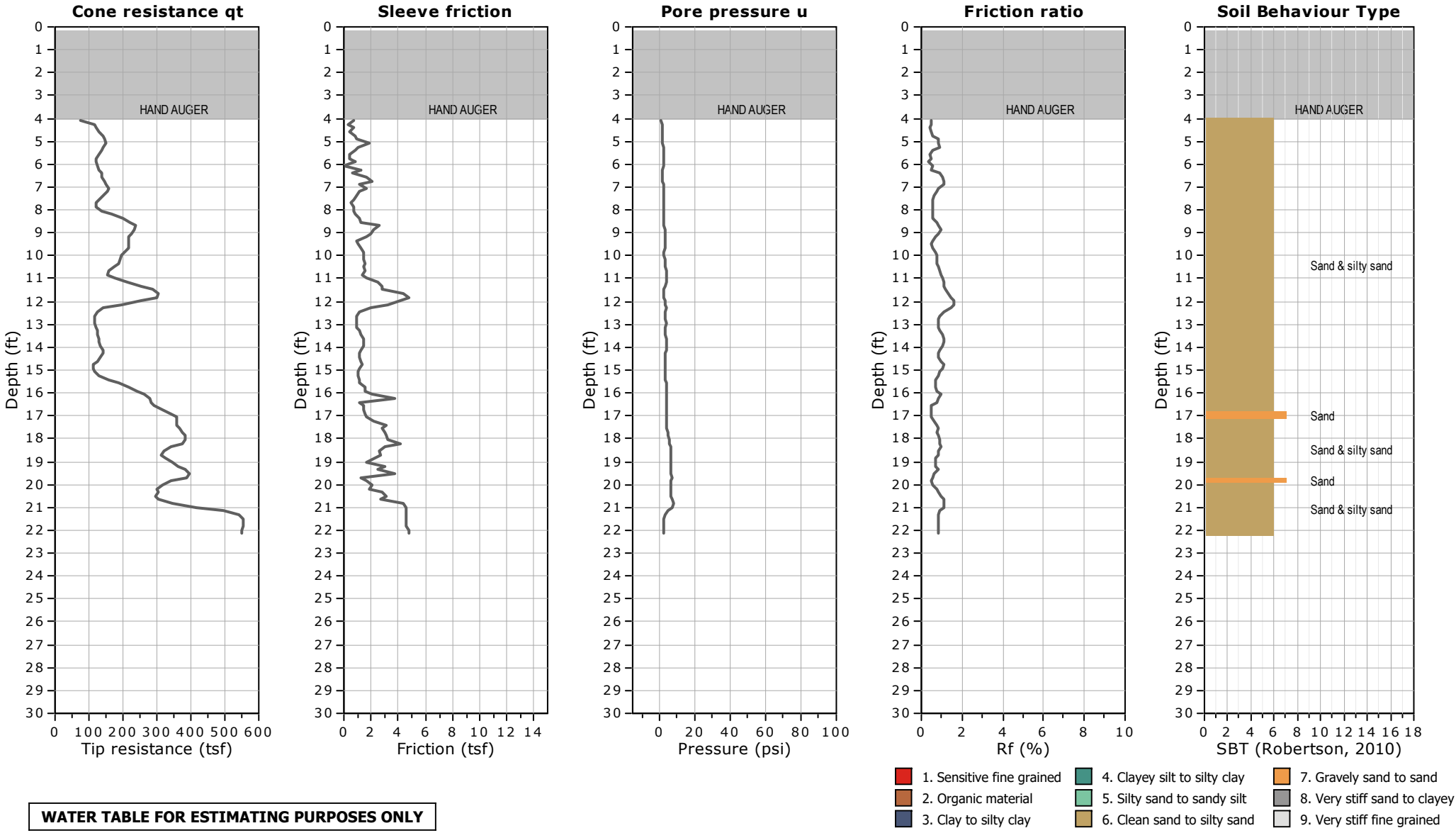


Gregg Drilling, LLC
www.greggdrilling.com

CPT: CPT-1

CLIENT: PETRA GEOSCIENCES
SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT
Total depth: 22.15 ft, Date: 1/2/2020



WATER TABLE FOR ESTIMATING PURPOSES ONLY

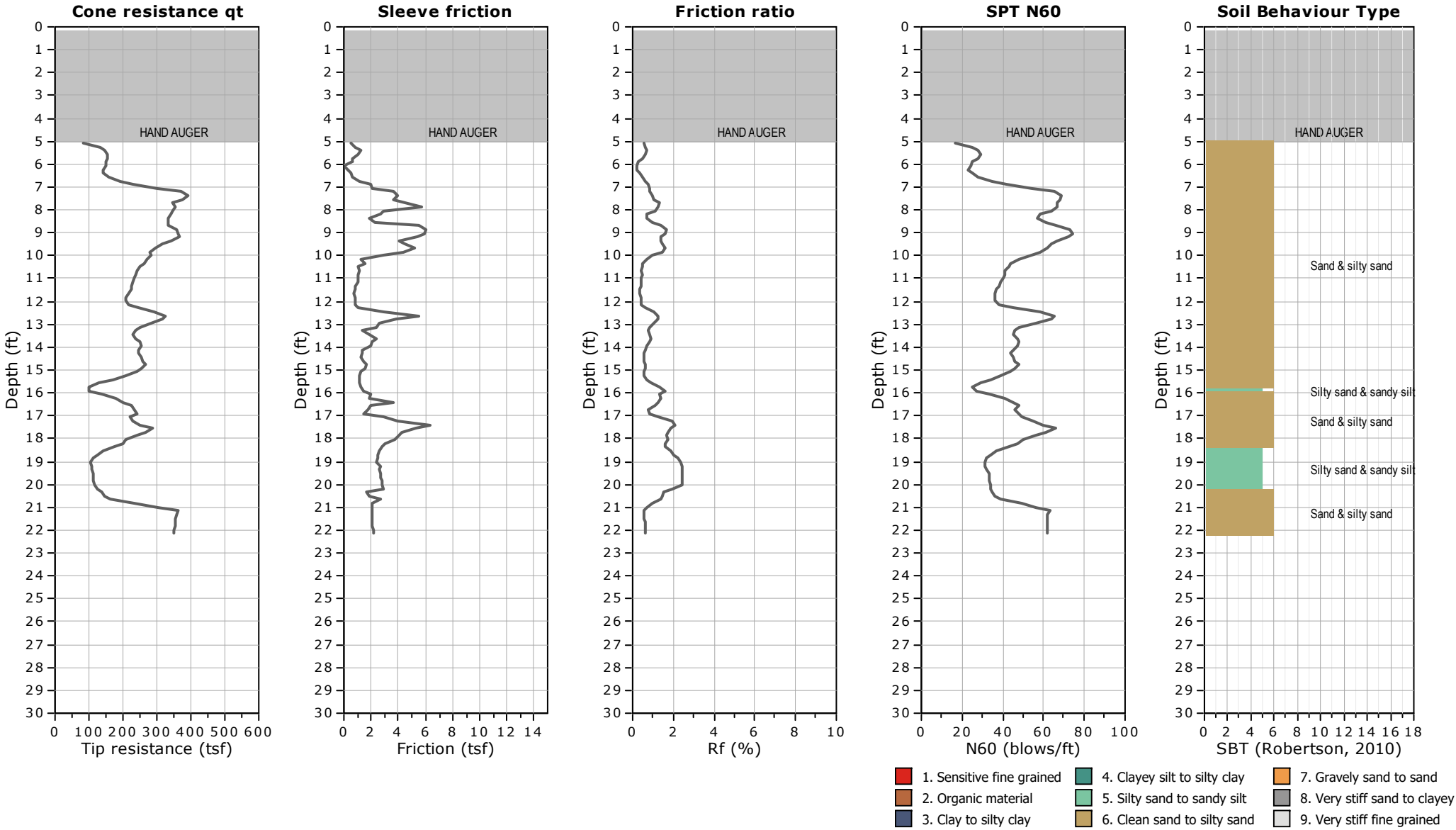
CPT: CPT-3

CLIENT: PETRA GEOSCIENCES

SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT

Total depth: 22.15 ft, Date: 1/2/2020

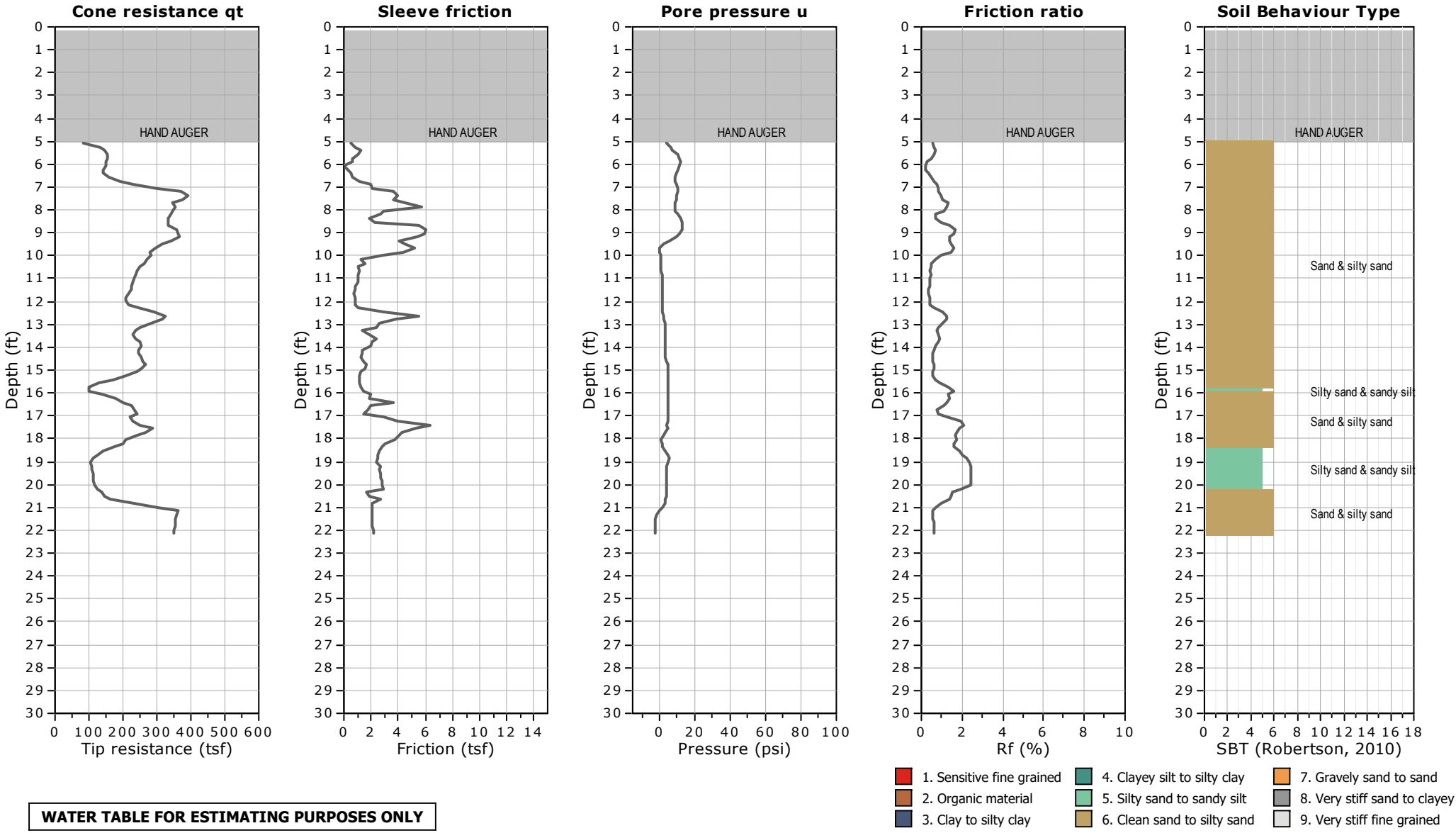


Gregg Drilling, LLC
www.greggdrilling.com

CPT: CPT-3

CLIENT: PETRA GEOSCIENCES
SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT
Total depth: 22.15 ft, Date: 1/2/2020



WATER TABLE FOR ESTIMATING PURPOSES ONLY

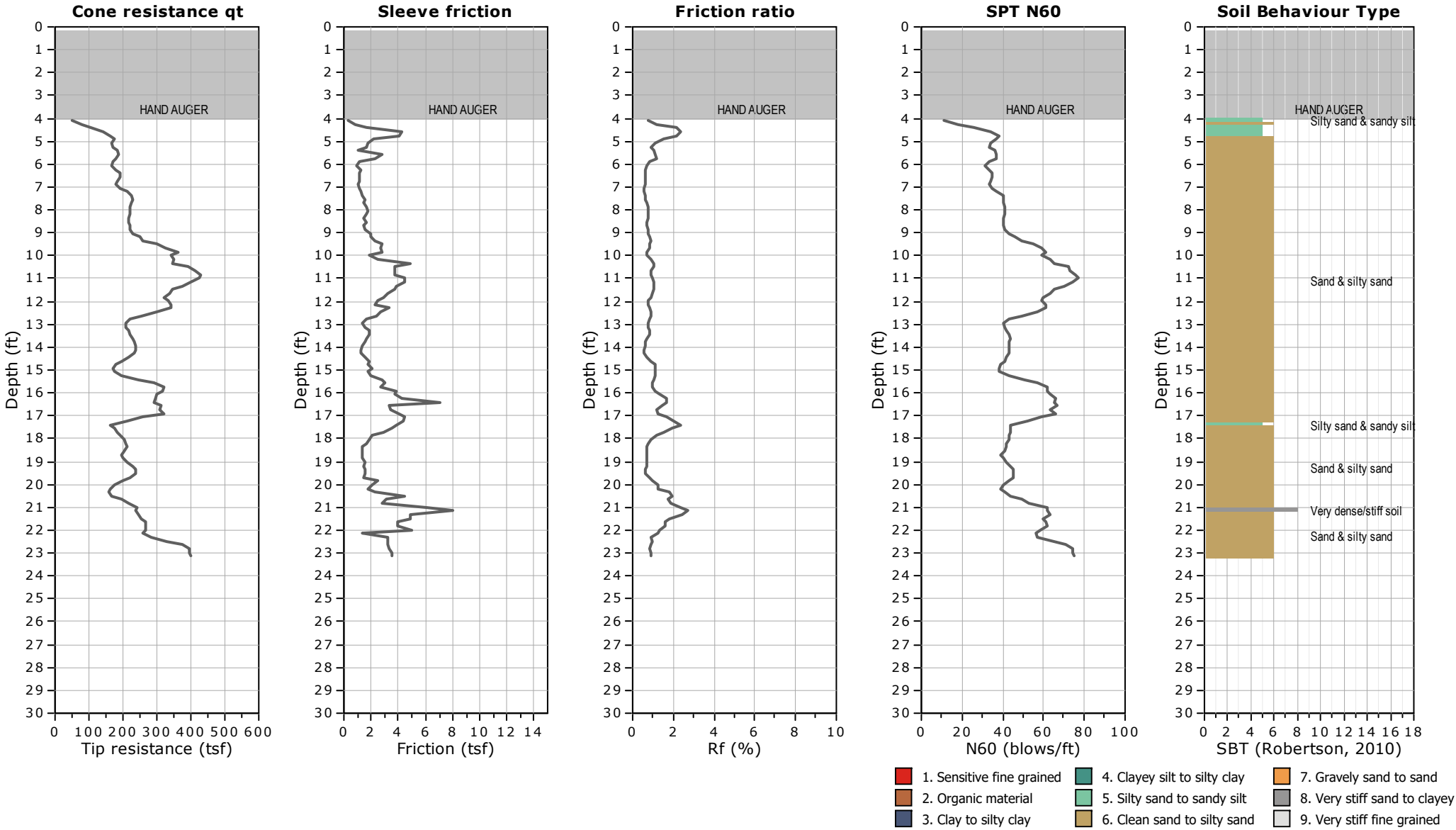
CPT: CPT-4

CLIENT: PETRA GEOSCIENCES

SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT

Total depth: 23.13 ft, Date: 1/2/2020



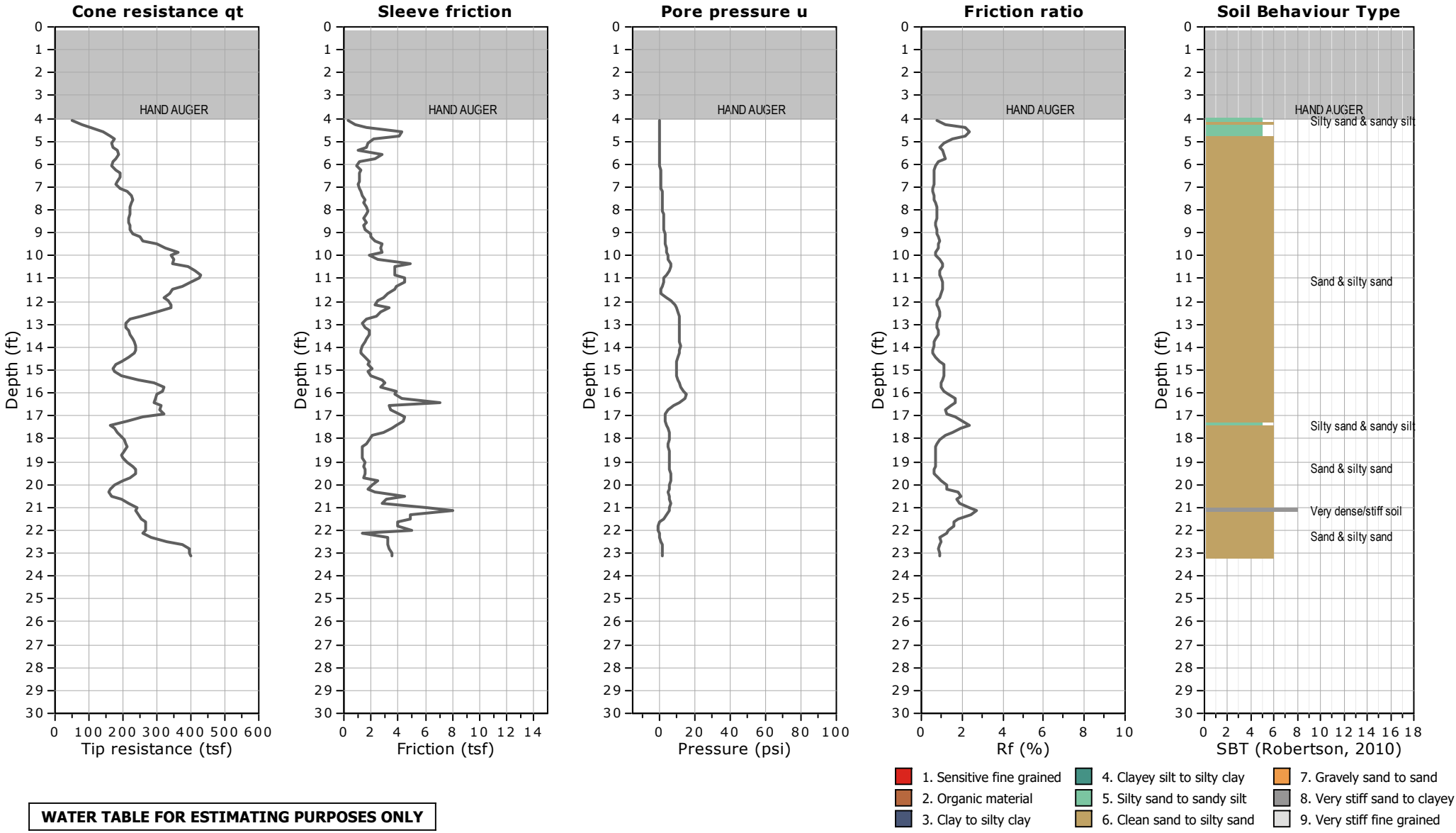
CPT: CPT-4

CLIENT: PETRA GEOSCIENCES

SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT

Total depth: 23.13 ft, Date: 1/2/2020



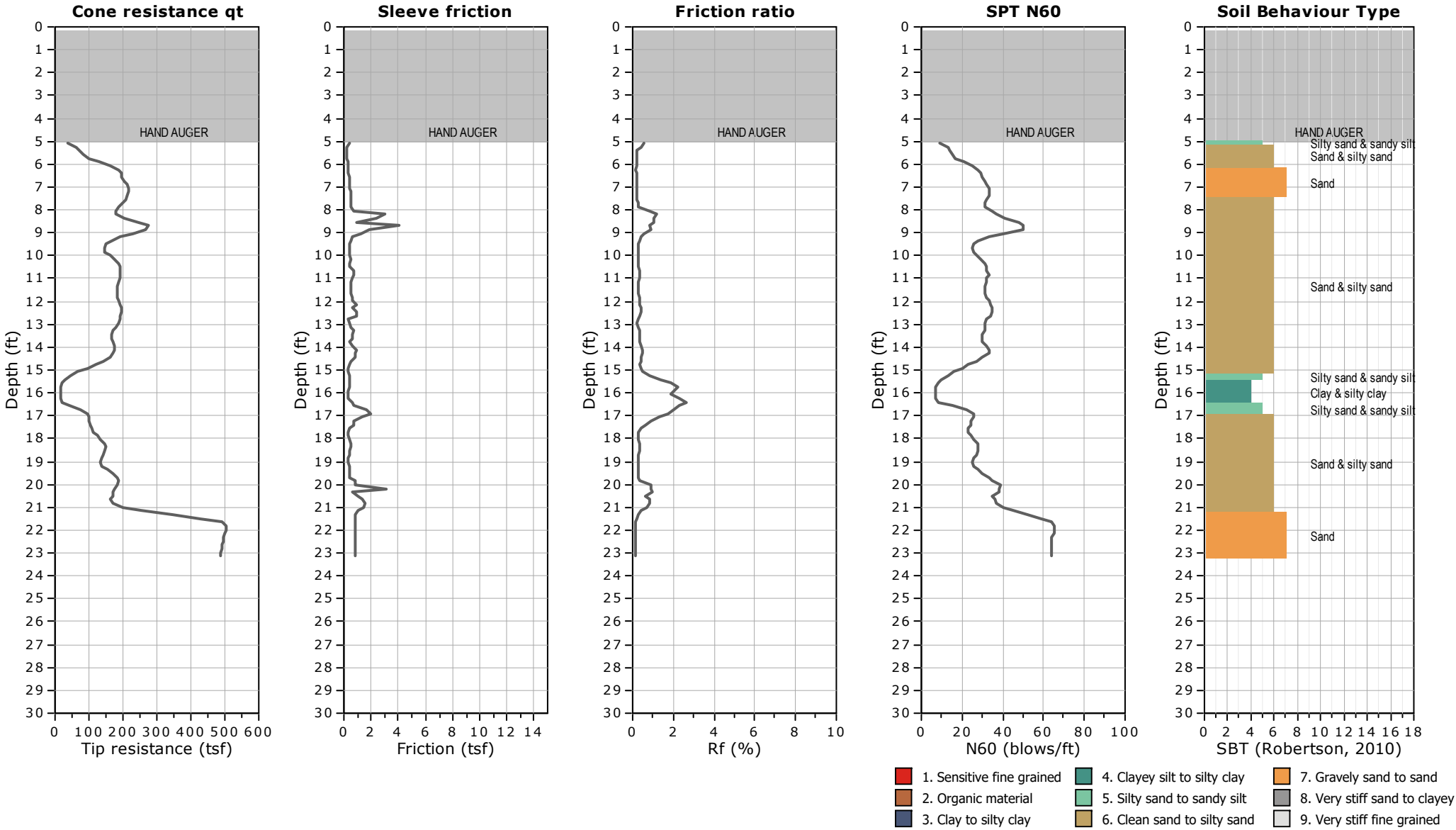
WATER TABLE FOR ESTIMATING PURPOSES ONLY

Gregg Drilling, LLC
www.greggdrilling.com

CPT: CPT-5

CLIENT: PETRA GEOSCIENCES
SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT
Total depth: 23.13 ft, Date: 1/2/2020

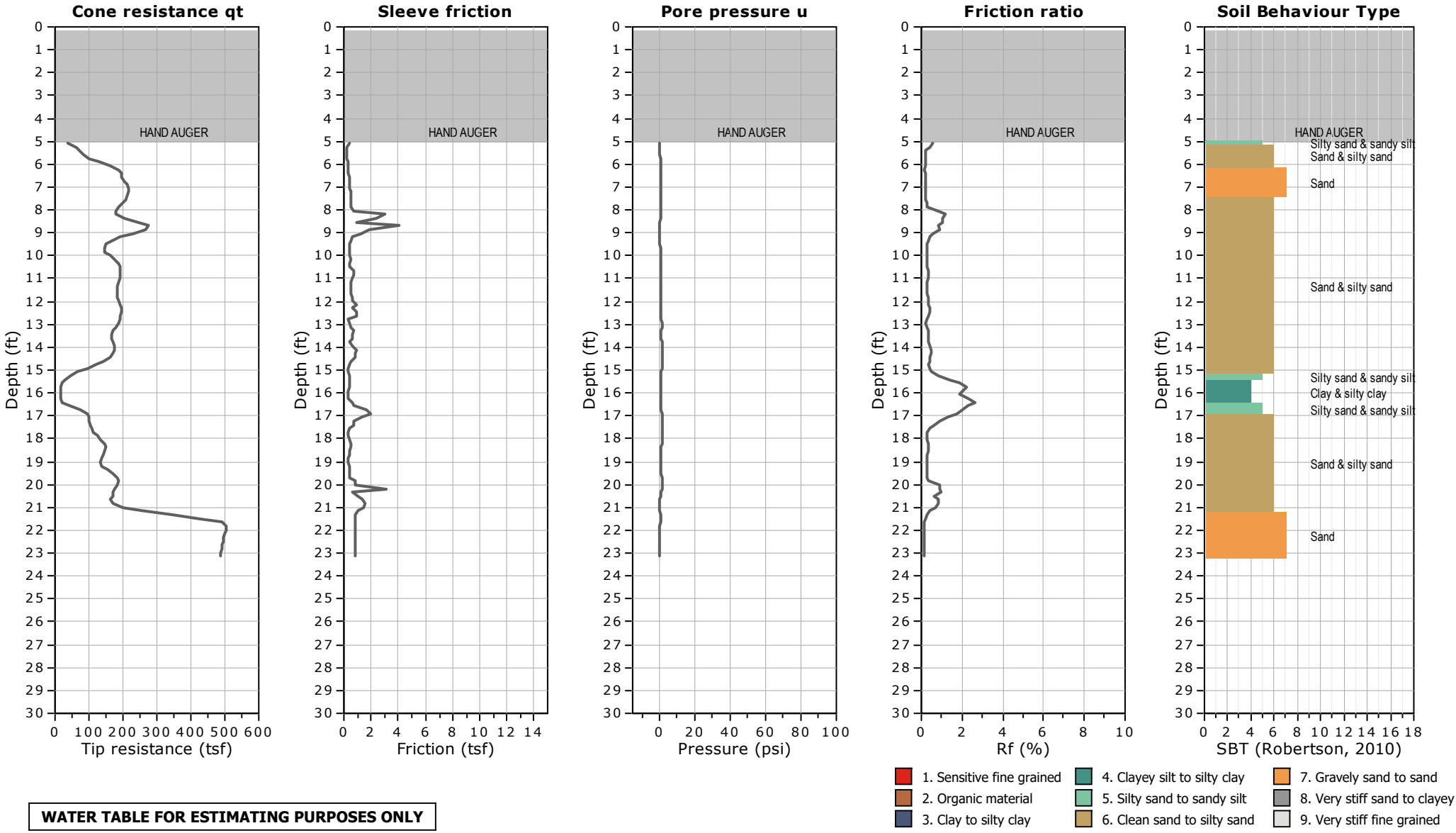


Gregg Drilling, LLC
www.greggdrilling.com

CPT: CPT-5

CLIENT: PETRA GEOSCIENCES
SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT
Total depth: 23.13 ft, Date: 1/2/2020



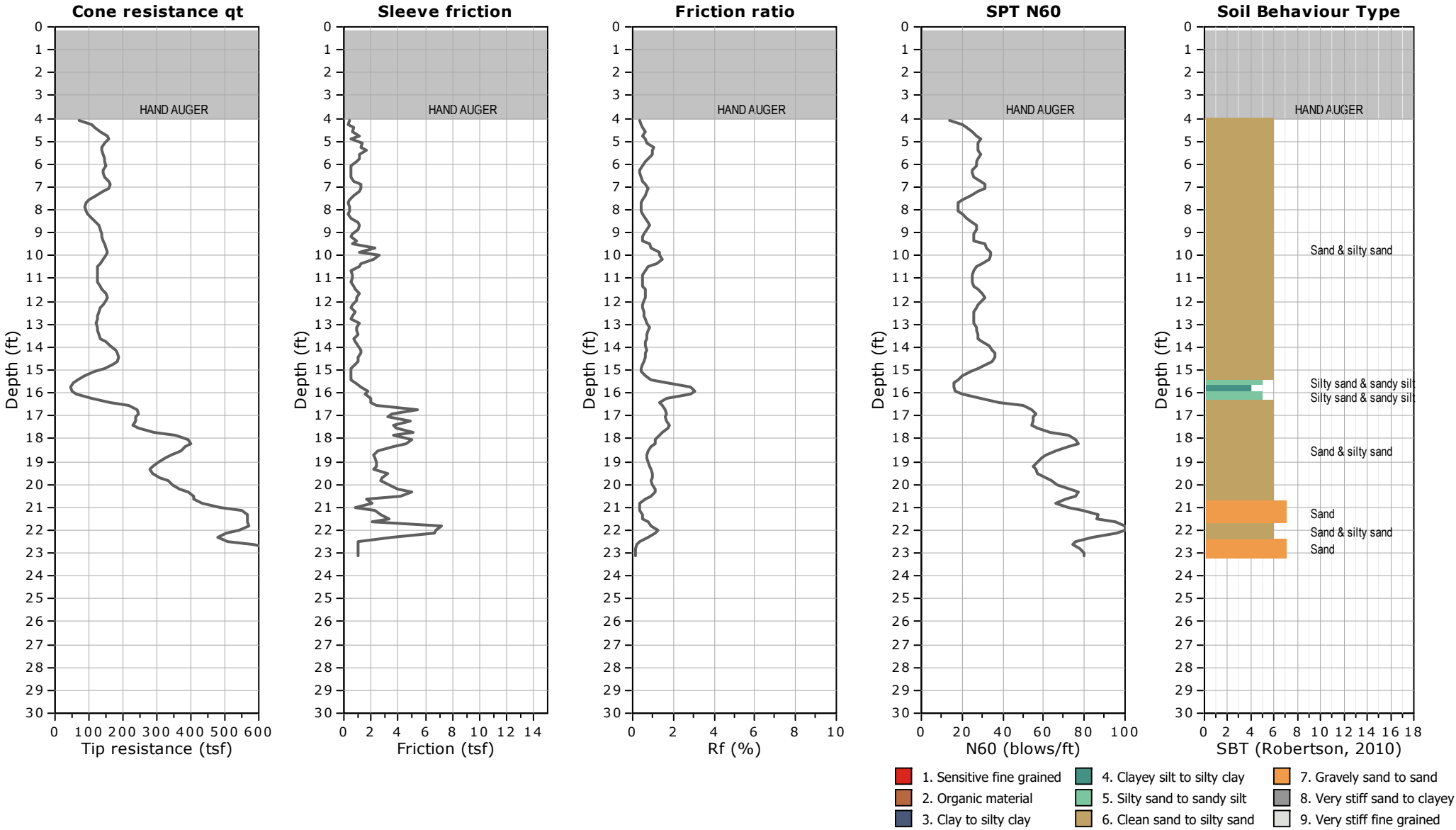
WATER TABLE FOR ESTIMATING PURPOSES ONLY

Gregg Drilling, LLC
www.greggdrilling.com

CPT: SCPT-2

CLIENT: PETRA GEOSCIENCES
SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT
Total depth: 23.13 ft, Date: 1/2/2020

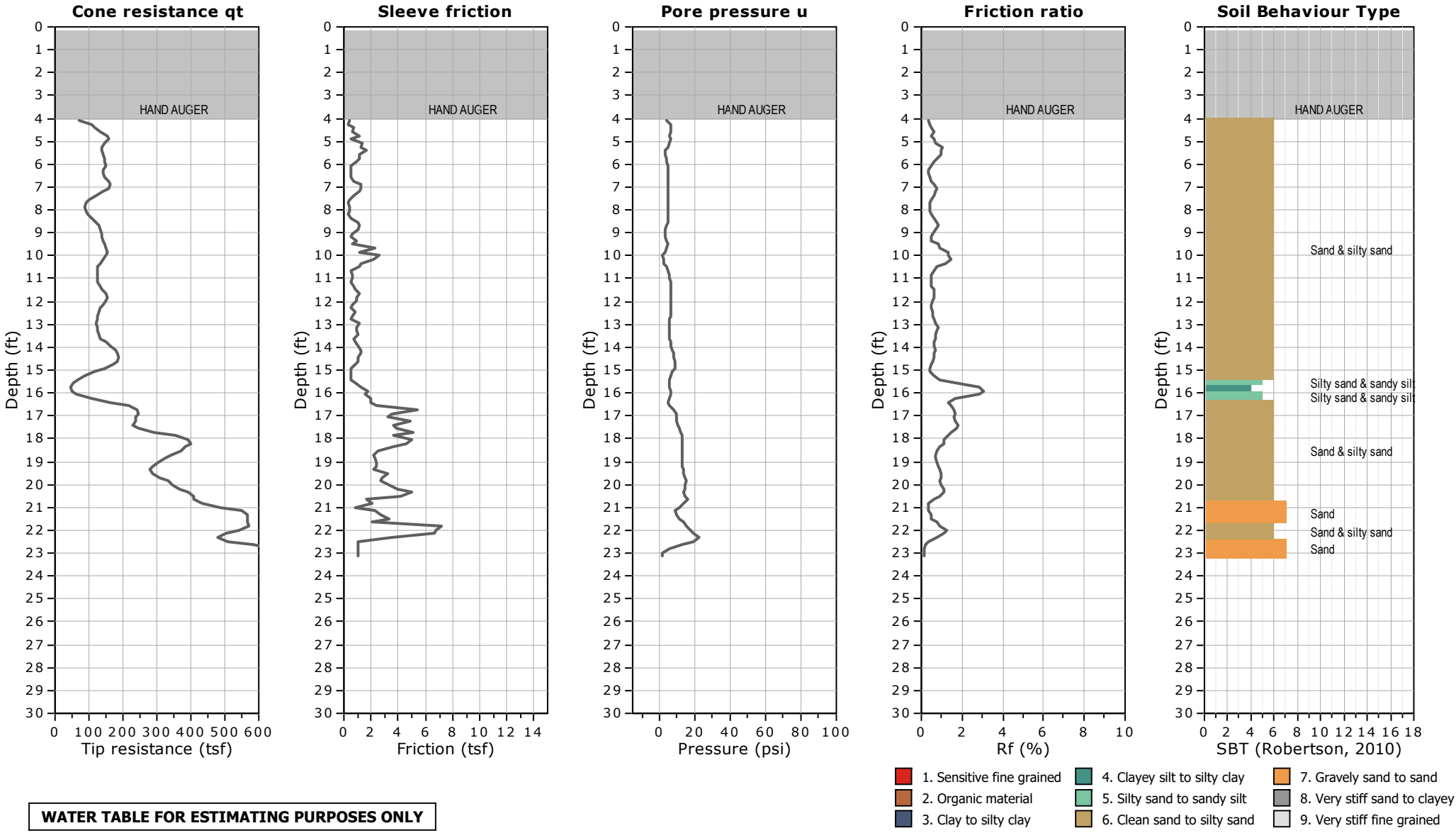


Gregg Drilling, LLC
www.greggdrilling.com

CPT: SCPT-2

CLIENT: PETRA GEOSCIENCES
SITE: CLOW VALVE, CORONA, CA

FIELD REP: KURT
Total depth: 23.13 ft, Date: 1/2/2020



WATER TABLE FOR ESTIMATING PURPOSES ONLY

FERO ENGINEERING
ENVIRONMENTAL ENGINEERING & CONSULTING

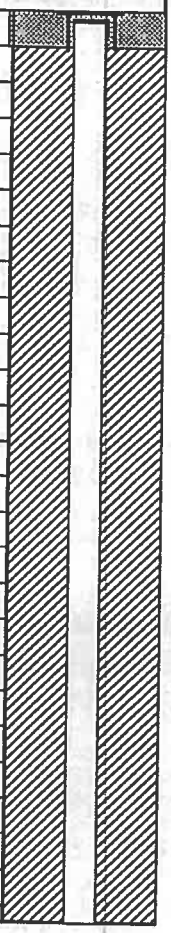
BORING LOG

PROJECT: Clow Valve Co.
JOB NO. 06-640
SITE: 1375 Magnolia Ave., Corona, Ca.
BORING AOC1-FB1 **SHEET** 1 of 3
DATE 9/21/06 **BY** J. Petersen
BORING LOCATION/CONDITIONS: see Figrue 1
SAMPLE METHOD Drive/ Undisturbed
OBSERVERS/SAMPLERS: JBP
DRILLERS: Layne Christensen Co.
EQUIPMENT: PID for H&S monitoring
EQUIPMENT: Percussion Rig with Split Spoon Sampler

Casing: 4" PVC flush thread w/ .02" slots
Vault: 12" traffic rated, water tight, bolt

- Concrete
- Cement Grout
- No. 3 Sand

DEPTH (FT.)	SAMPLE: BULK	SAMPLE: UNDISTURBED	SAMPLE: BLOWS/ FT	USCS CLASSIFICATION	MONITORING BACKGROUND/ SAMPLE	DESCRIPTION
					ppm	0-20' see B13
5'						
10'						
15'						
20'						
25'		X	50/60	SP	0	Tan fine to medium sand, very dense, slightly moist, no odor



FERO ENGINEERING
ENVIRONMENTAL ENGINEERING & CONSULTING

BORING LOG

PROJECT: Clow Valve Co.
JOB NO. 06-640
SITE: 1375 Magnolia Ave., Corona, Ca.
BORING AOC1-FB1 **SHEET** 2 of 3
DATE 9/21/06 **BY** J. Petersen
BORING LOCATION/CONDITIONS: See figure 1
SAMPLE METHOD Drive/ Undisturbed
OBSERVERS/SAMPLERS: JBP
DRILLERS: Layne Christensen Co.
EQUIPMENT: PID for H&S monitoring
EQUIPMENT: Percussion Rig with Split Spoon Sampler

Casing: 4" PVC flush thread w/ .02" slots
Vault: 12" traffic rated, water tight, bolt

- Concrete
- Cement Grout
- No. 3 Sand

DEPTH (FT.)	SAMPLE: BULK	SAMPLE: UNDISTURBED	SAMPLE: BLOWS/ FT	USCS CLASSIFICATION	MONITORING BACKGROUND/ SAMPLE	DESCRIPTION
					ppm	
30'		X	50	SP	0	No sample retained (rock in the shoe)
35'		X	35/55	SM	0	Medium brown silty fine to coarse sand with some gravel, very dense, slightly moist, no odor
40'		X	50/50	SP	0	Tan fine to medium sand with gravel, very dense, slightly moist, no odor
45'		X	50/60	SP		Tan fine to coarse sand, very dense, slightly moist, no odor
50'		X		SP		Light brown fine to coarse sand w/gravel, dense, saturated, no odor

FERO ENGINEERING
ENVIRONMENTAL ENGINEERING & CONSULTING

BORING LOG

PROJECT: Clow Valve Co. **JOB NO.** 06-640

SITE: 1375 Magnolia Ave., Corona, Ca. **BORING** AOC1-FB1 **SHEET** 3 of 3

DATE 9/21/06 **BY** J. Petersen

BORING LOCATION/CONDITIONS: see figure 1 **SAMPLE METHOD** Drive/ Undisturbed

OBSERVERS/SAMPLERS: JBP **DRILLERS:** Layne Christensen Co.

EQUIPMENT: PID for H&S monitoring **EQUIPMENT:** Percusion Rig with Split Spoon Sampler

Casing: 4" PVC flush thread w/ .02" slots
Vault: 12" traffic rated, water tight, bolt

- Concrete
- Cement Grout
- No. 3 Sand

DEPTH (FT.)	SAMPLE: BULK	SAMPLE: UNDISTURBED	SAMPLE: BLOWS/ FT	USCS CLASSIFICATION	MONITORING BACKGROUND/ SAMPLE	DESCRIPTION
					ppm	
55'		X		SP	0	Light brown fine to medium sand with some coarse sand, dense, saturated, no odor
60'		X		SP	0	Tan fine to coarse sand withe some gravel, dense, saturated, no odor
65'		X		SP	0	Tan fine to coarse sand with some gravel, dense, saturated, no odor
70'						
75'						

APPENDIX B

LABORATORY TEST PROCEDURES

LABORATORY DATA SUMMARY

LABORATORY TEST PROCEDURES

Soil Classification

Soils encountered within the exploration borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D 2488). The samples were re-examined in the laboratory and the classifications revised if appropriate.

In-Situ Moisture and Density

Moisture content and unit dry density of in-place soil were determined in representative strata and are depicted on the Exploration Logs, Appendix A.

Maximum Dry Density

Maximum dry density and optimum moisture content were determined for selected samples of soil in accordance with ASTM D 1557. Pertinent test values are given on Plate B-1.

Expansion Index

An expansion index test was performed on a selected sample of soil in accordance with ASTM D 4829. The expansion potential classification was determined from 2010 CBC Section 1802.3.2 on the basis of the expansion index value. The test result and expansion potentials are presented on Plate B-1.

Soil Corrosivity

Chemical analyses were performed on a selected sample of soil to determine concentrations of soluble sulfate and chloride, as well as pH and resistivity. These tests were performed in accordance with California Test Method Nos. 417 (sulfate), 422 (chloride) and 643 (pH and resistivity). Test results are included on Plate B-1.

Grain-Size Analysis

Grain-size analyses were performed on selected samples to verify visual classifications performed in the field. These tests were performed in accordance with ASTM C136 and C117. Test results are presented on Plate B-2.

Direct Shear

The Coulomb shear strength parameters, i.e., angle of internal friction and cohesion, were determined for a remolded sample of onsite soil. This test was performed in general accordance with the current version of Test Method ASTM D 3080. Three specimens were prepared for each test. The test specimens were inundated and then sheared under various normal loads at a constant strain rate of 0.005 inch per minute. The results of the direct shear test are graphically presented on Plate B-3.

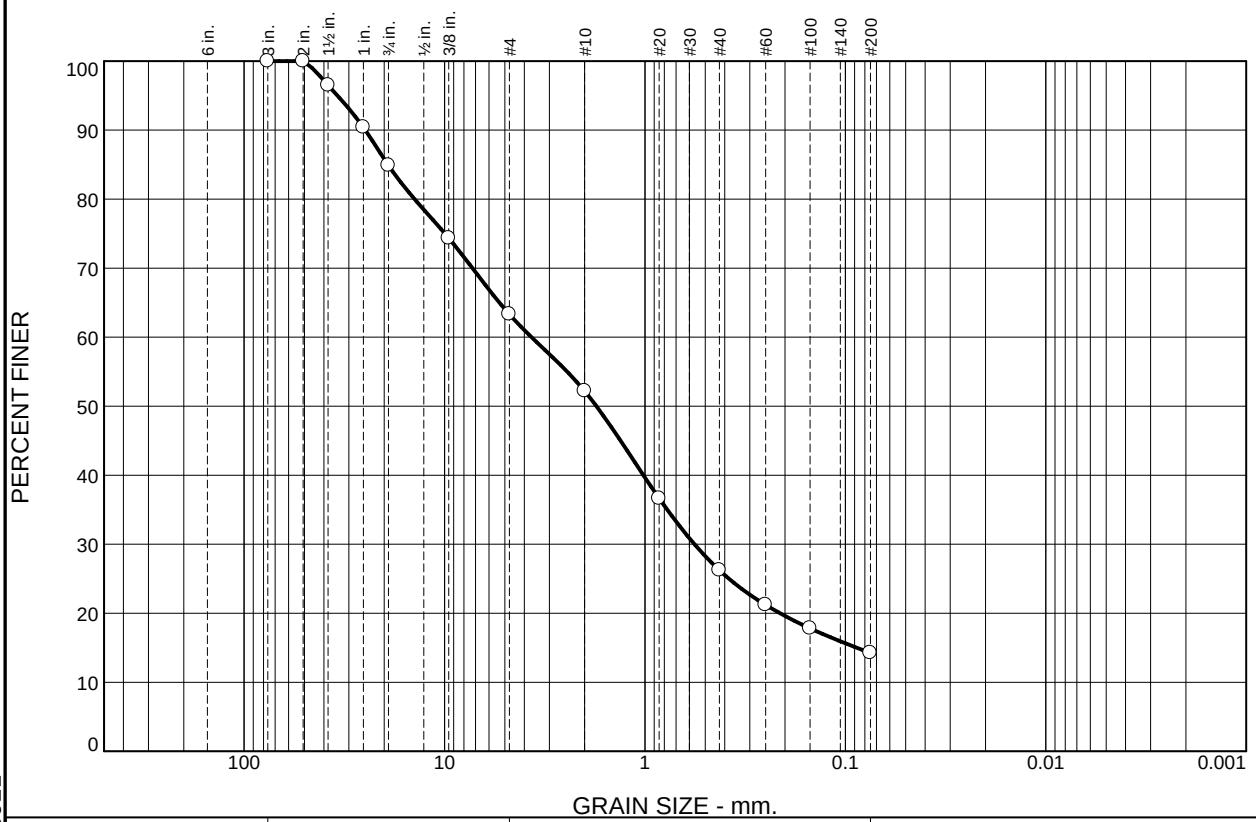
LABORATORY DATA SUMMARY													
Boring Number	**Sample Depth (ft)**	**Soil Description**	**Max. Dry Density [1] (pcf)**	**Optimum Moisture[1] (%)**	**Expansion Index[2]**	**USCS Soil Classification[3]**	**Atterberg Limits[4]**			**Sulfate Content[5] (%)**	**Chloride Content[6] (ppm)**	**pH[7]**	**Minimum Resistivity[7] (ohm-cm)**
							LL	**PL**	**PI**				
B-1	0-5	Sand, trace Silt (SP)	133.5	6.5	--	Non-Expansive	--	--	--	0.0006	99	8.7	15,000
B-3	0-5	Silty Sand (SM)	--	--	0	Non-Expansive	--	--	--	0.005	66	8.6	4,800

(--) Tests Not Performed

Test Procedures:

[1] Per ASTM Test Method D 1557
[2] Per ASTM Test Method D 4829
[3] Per ASTM Test Method D 2487
[4] Per ASTM Test Method D 4318
[5] Per Caltrans Test Method 417
[6] Per Caltrans Test Method 422
[7] Per Caltrans Test Method 643

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.1	21.6	11.1	26.0	11.9	14.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1 1/2	96.5		
1	90.4		
3/4	84.9		
.375	74.3		
#4	63.3		
#10	52.2		
#20	36.7		
#40	26.2		
#60	21.2		
#100	17.8		
#200	14.3		

* (no specification provided)

Material Description

Dark Gray, Silty fine to coarse Sand with fine to coarse Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 24.8455 D_{85}= 19.1685 D_{60}= 3.6820
D_{50}= 1.7456 D_{30}= 0.5659 D_{15}= 0.0876
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Source of Sample: B-3 **Depth:** 0-5

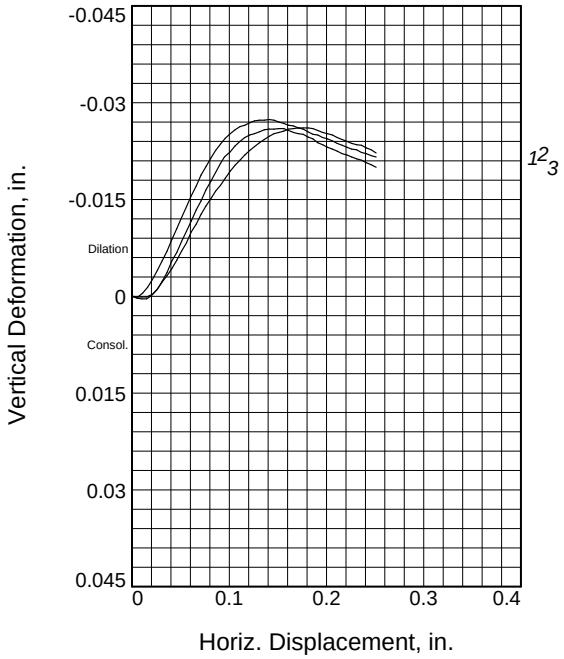
Date: 1-7-20

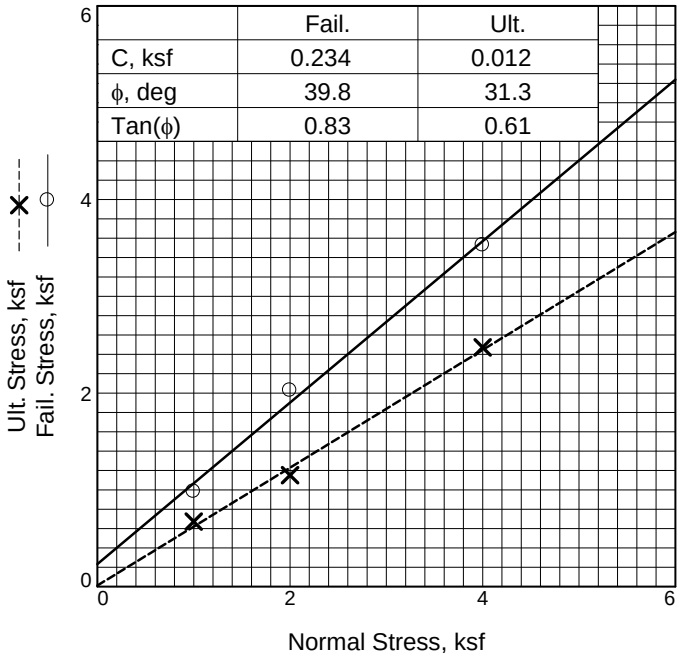
Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #: 714.549.8921

PETRA GEOSCIENCES INC.

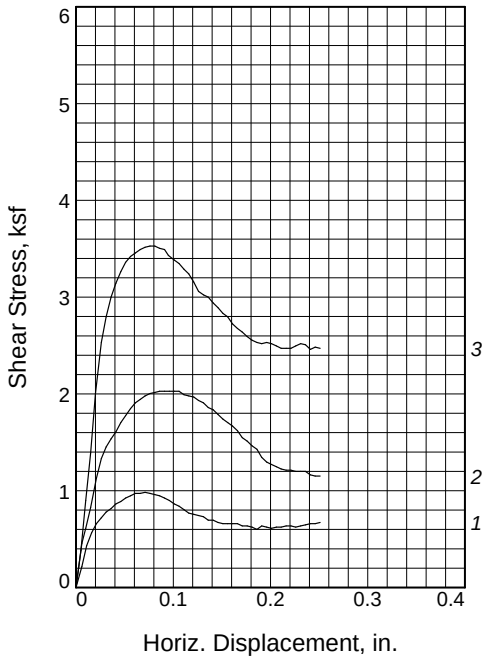
Client: Western RealCo
Project: 1375 Magnolia

Project No: 19-433 **Figure** B-2





	Fail.	Ult.
C, ksf	0.234	0.012
ϕ, deg	39.8	31.3
Tan(ϕ)	0.83	0.61



Sample No.		1	2	3
Initial	Water Content, %	8.0	8.0	8.0
	Dry Density, pcf	114.7	114.3	114.5
	Saturation, %	47.8	47.4	47.6
	Void Ratio	0.4429	0.4468	0.4449
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	13.5	14.2	13.5
	Dry Density, pcf	114.7	114.3	114.5
	Saturation, %	80.7	84.5	80.5
	Void Ratio	0.4429	0.4468	0.4449
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
Normal Stress, ksf		1.000	2.000	4.000
Fail. Stress, ksf		0.984	2.028	3.528
Displacement, in.		0.071	0.086	0.076
Ult. Stress, ksf		0.672	1.152	2.472
Displacement, in.		0.251	0.251	0.251
Strain rate, in./min.		0.010	0.010	0.010

Sample Type: Remolded to 90% RC
Description: Brown, Silty fine to coarse Sand

Assumed Specific Gravity= 2.65
Remarks:

Figure B-3

Client: Western RealCo

Project: 1375 Magnolia

Source of Sample: B-1 **Depth:** 0-5

Proj. No.: 19-433 **Date Sampled:** 1-3-20

PETRA GEOSCIENCES INC.

APPENDIX C

EARTHQUAKE-INDUCED SETTLEMENT ANALYSIS AND SEISMIC DESIGN PARAMETERS

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update) (v4.2.0)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.86988

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

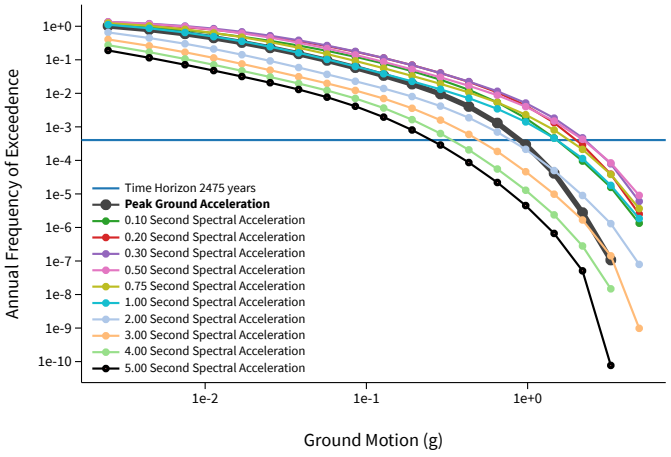
-117.537768

Site Class

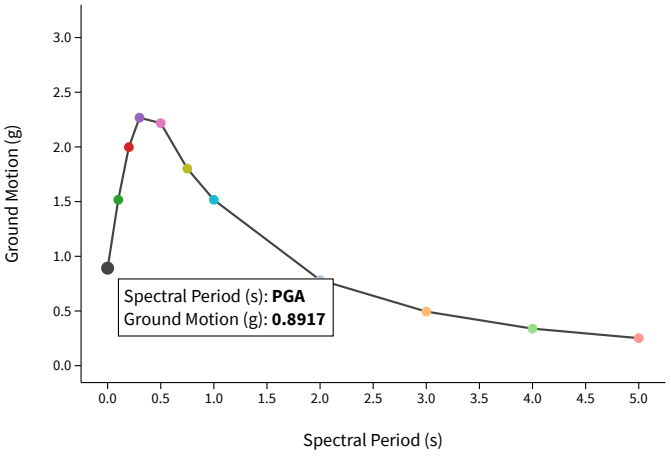
259 m/s (Site class D)

Hazard Curve

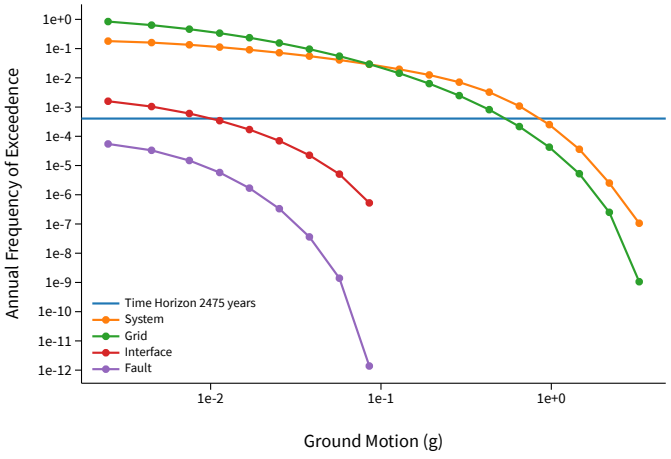
Hazard Curves



Uniform Hazard Response Spectrum



Component Curves for Peak Ground Acceleration

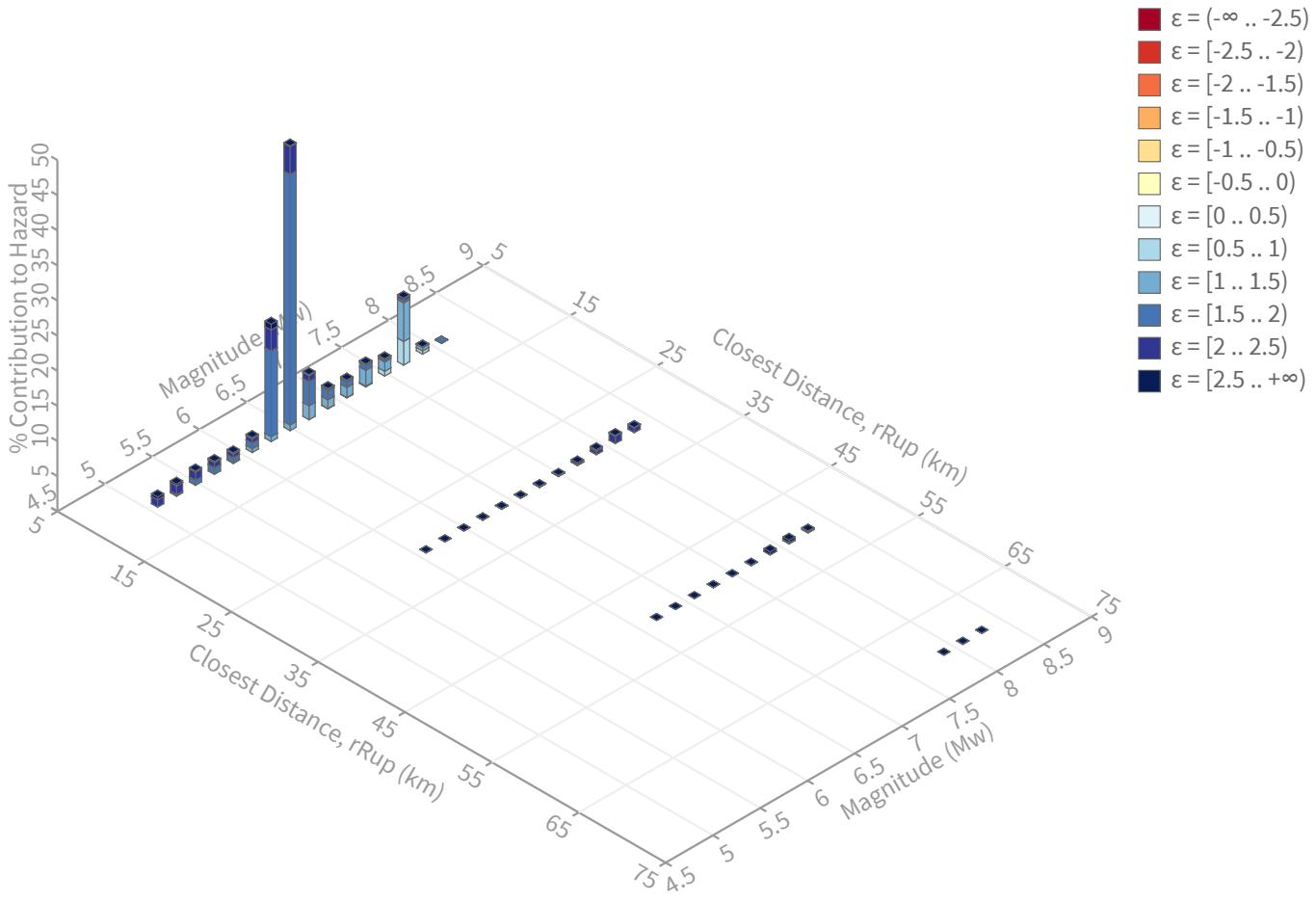


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.89168659 g

Recovered targets

Return period: 2970.0995 yrs
Exceedance rate: 0.00033668906 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.07 %

Mean (over all sources)

m: 6.64
r: 8.07 km
ε₀: 1.73 σ

Mode (largest m-r bin)

m: 6.47
r: 6.39 km
ε₀: 1.74 σ
Contribution: 40.5 %

Mode (largest m-r-ε₀ bin)

m: 6.47
r: 6.34 km
ε₀: 1.7 σ
Contribution: 35.66 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							43.64
Elsinore (Glen Ivy) rev [0]		6.30	6.71	1.62	117.563°W	33.819°N	202.01	35.62
Elsinore (Glen Ivy) rev [1]		7.99	6.53	1.90	117.531°W	33.799°N	175.38	1.90
Whittier alt 1 [0]		6.30	6.54	1.39	117.588°W	33.833°N	228.26	1.54
San Jacinto (San Bernardino) [4]		31.69	8.09	2.32	117.276°W	34.055°N	49.47	1.28
UC33brAvg_FM32	System							43.00
Elsinore (Glen Ivy) rev [0]		6.30	6.69	1.63	117.563°W	33.819°N	202.01	32.54
Chino alt 2 [3]		6.04	6.93	1.54	117.584°W	33.833°N	226.27	4.14
Elsinore (Glen Ivy) rev [1]		7.99	6.56	1.89	117.531°W	33.799°N	175.38	2.02
San Jacinto (San Bernardino) [4]		31.69	8.08	2.32	117.276°W	34.055°N	49.47	1.26
UC33brAvg_FM31 (opt)	Grid							6.77
PointSourceFinite: -117.538, 33.910		6.63	5.73	1.79	117.538°W	33.910°N	0.00	1.46
PointSourceFinite: -117.538, 33.910		6.63	5.73	1.79	117.538°W	33.910°N	0.00	1.46
UC33brAvg_FM32 (opt)	Grid							6.59
PointSourceFinite: -117.538, 33.910		6.63	5.74	1.78	117.538°W	33.910°N	0.00	1.43
PointSourceFinite: -117.538, 33.910		6.63	5.74	1.78	117.538°W	33.910°N	0.00	1.43

19-433 (1375 Magnolia Avenue, Corona, CA)

Latitude, Longitude: 33.86988, -117.537768

Date	1/7/2020, 8:51:00 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.872	MCE_R ground motion. (for 0.2 second period)
S_1	0.732	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.872	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.248	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.788	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.867	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	2.128	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.319	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.872	Factored deterministic acceleration value. (0.2 second)
S1RT	0.752	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.831	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.732	Factored deterministic acceleration value. (1.0 second)
PGAd	0.788	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.918	Mapped value of the risk coefficient at short periods
C_{R1}	0.905	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

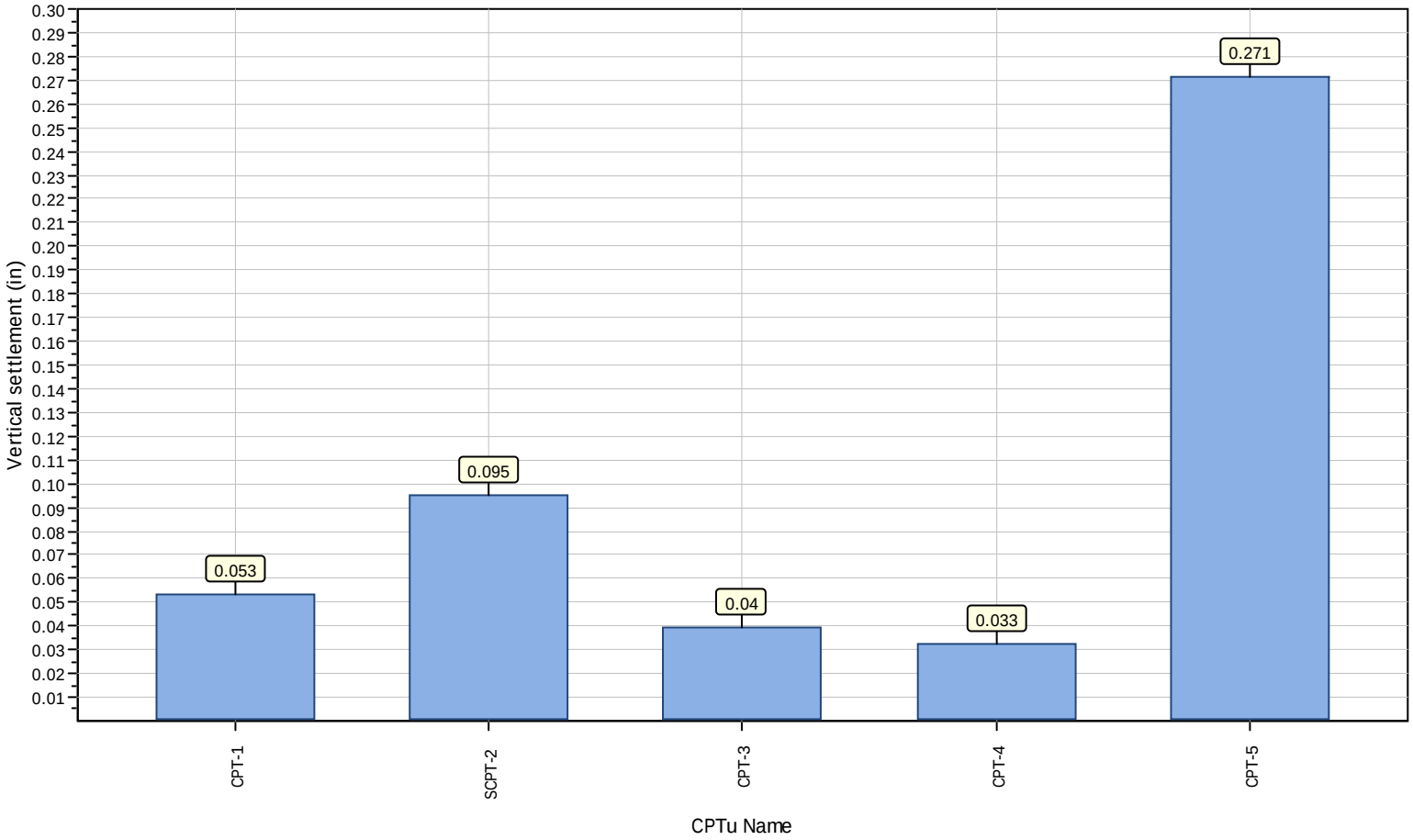
While the information presented on this website is believed to be correct, SEAOC /OSHPD and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in this web application should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. SEAOC / OSHPD do not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the seismic data provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the search results of this website.

Petra Geosciences, Inc.
3186 Airway Avenue, Suite K
Costa Mesa, CA 92626
www.petra-inc.com

Project title : 19-433, Western Realco

Location : 1375 Magnolia Avenue, Corona, CA

Overall vertical settlements report



Petra Geosciences, Inc.
3186 Airway Avenue, Suite K
Costa Mesa, CA 92626
www.petra-inc.com

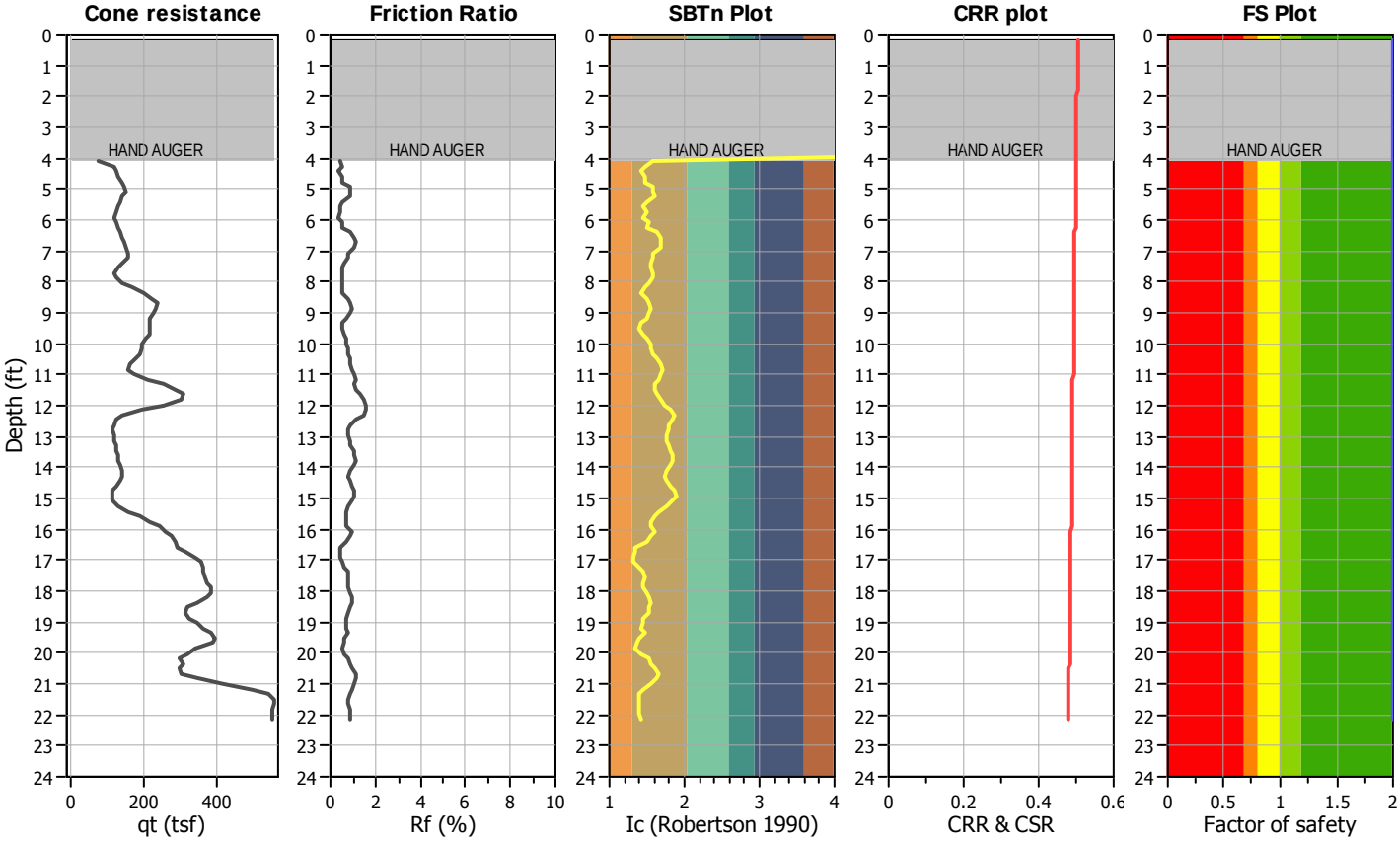
LIQUEFACTION ANALYSIS REPORT

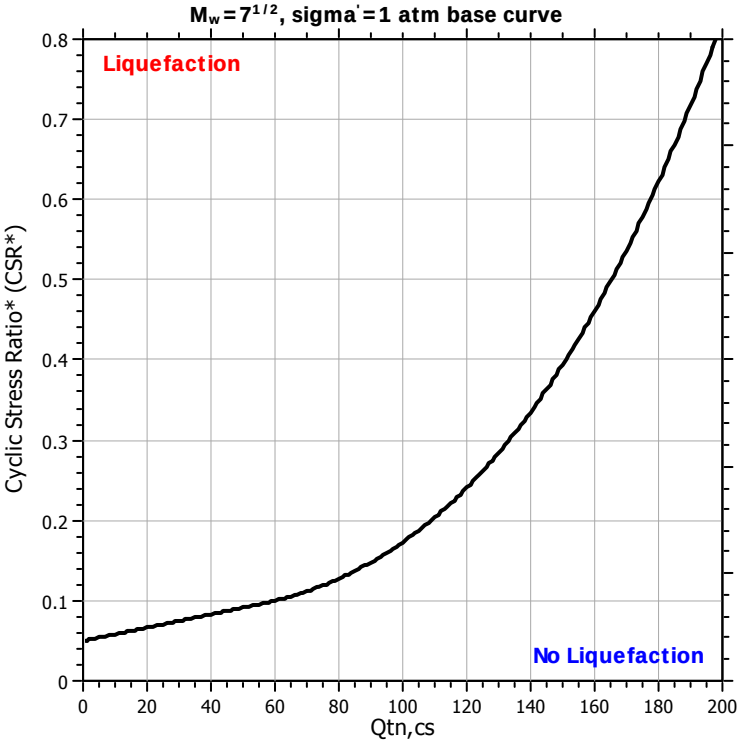
Project title : 19-433, Western Realco **Location : 1375 Magnolia Avenue, Corona, CA**

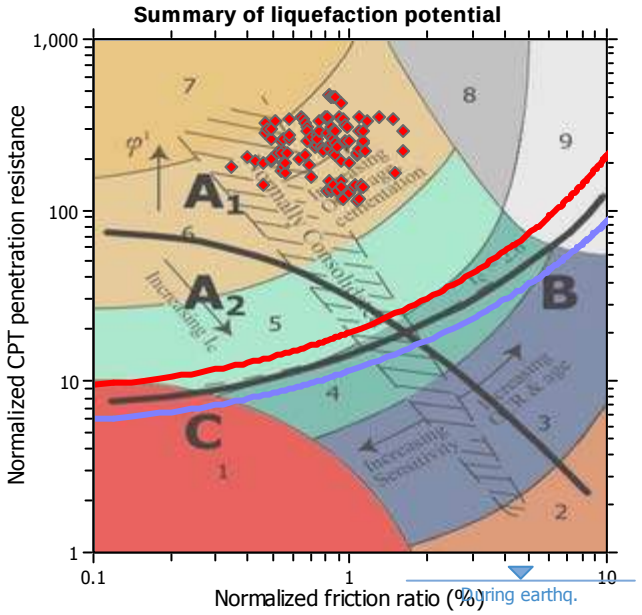
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	45.00 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:	6.47	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.87	Unit weight calculation:	Based on SBT	K_σ applied:	No		

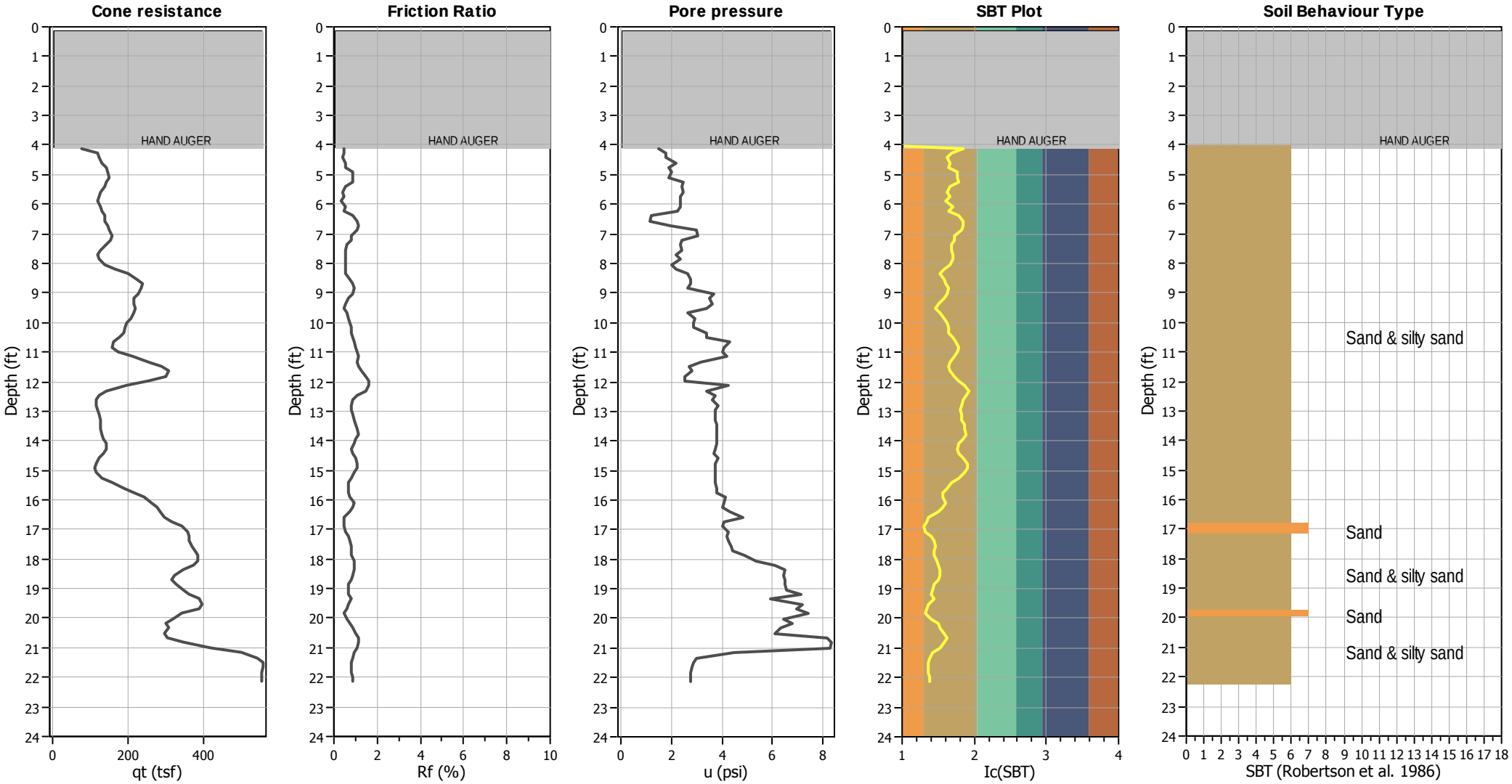






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



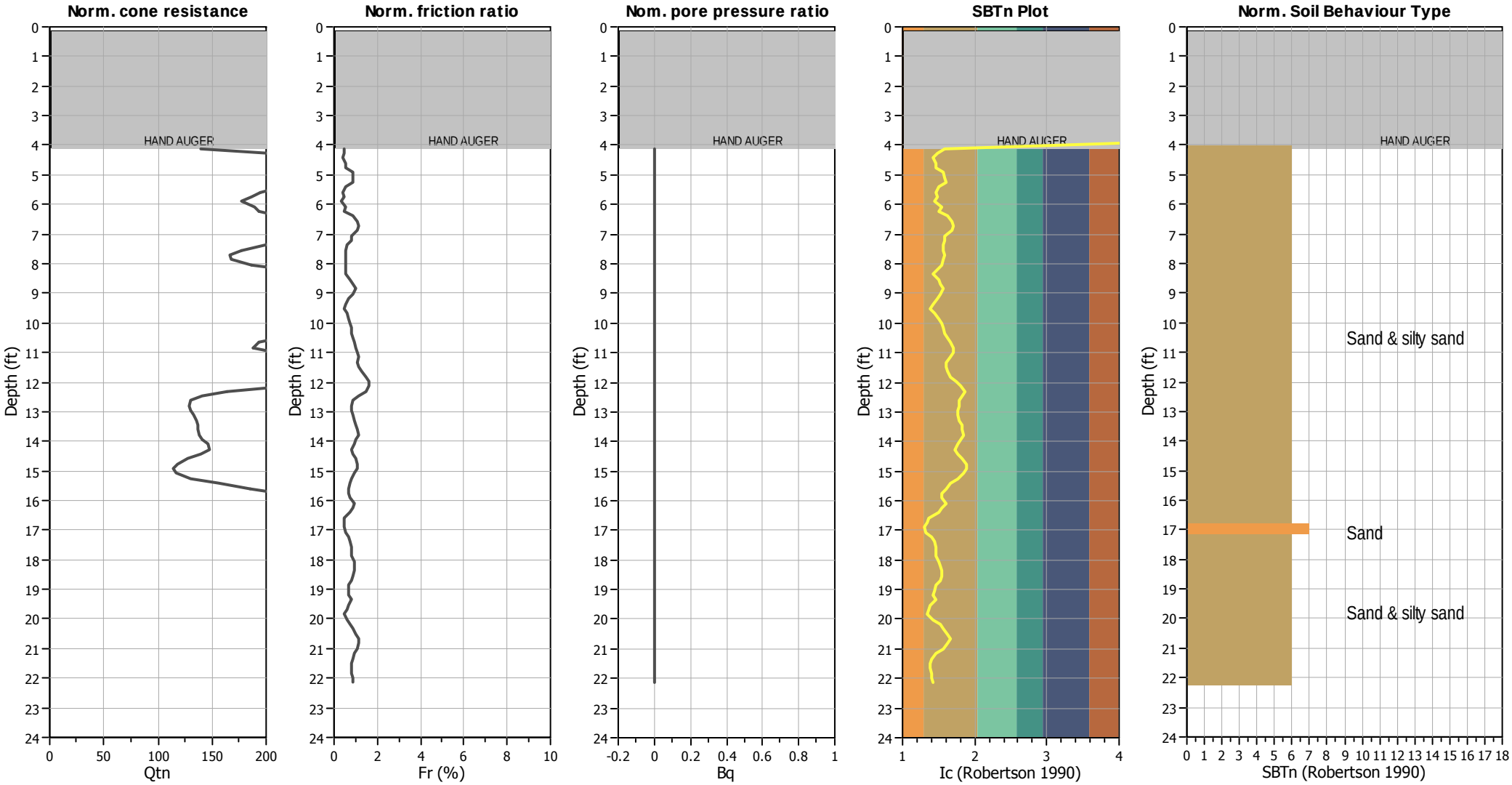
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 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

CPT basic interpretation plots (normalized)



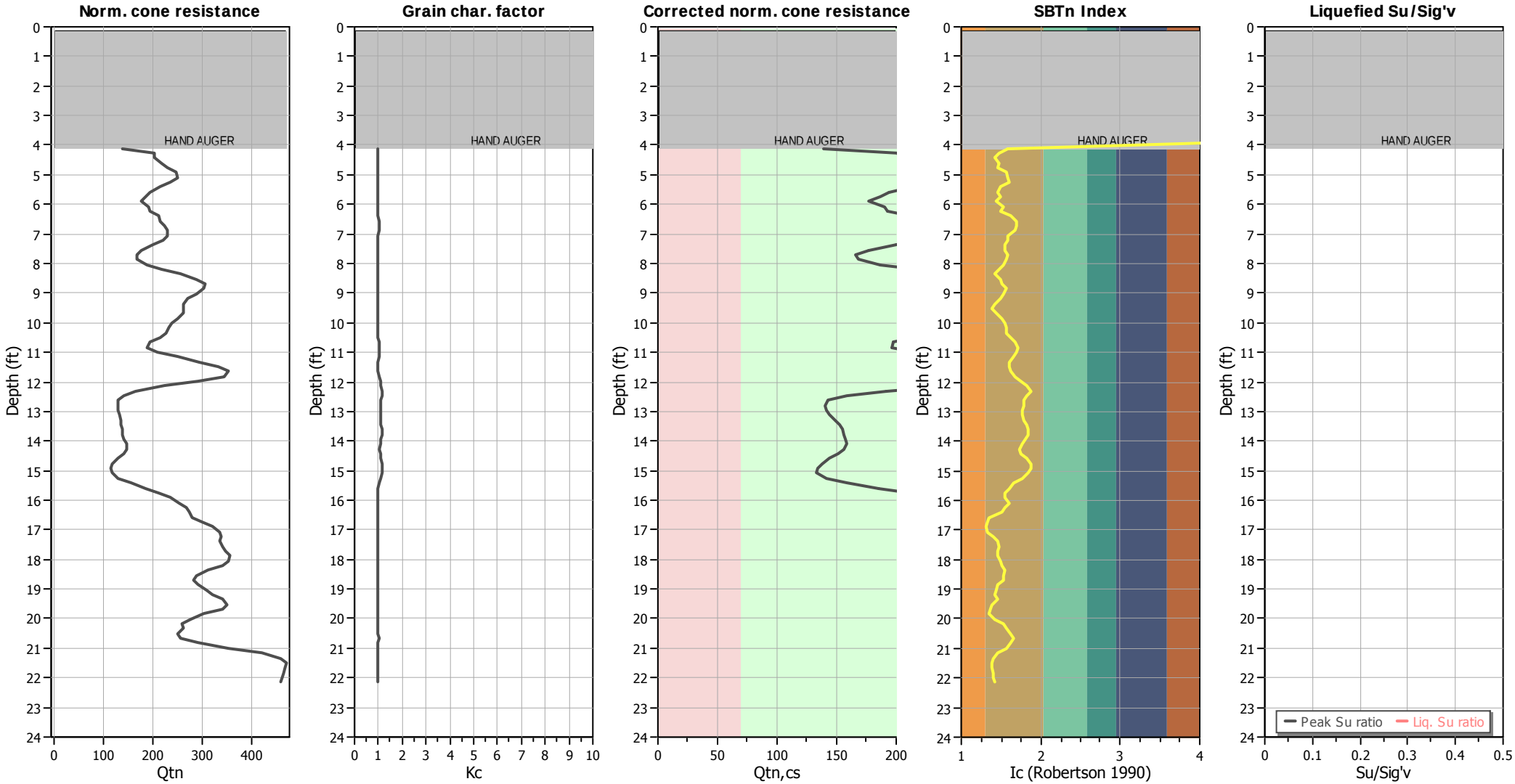
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn 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

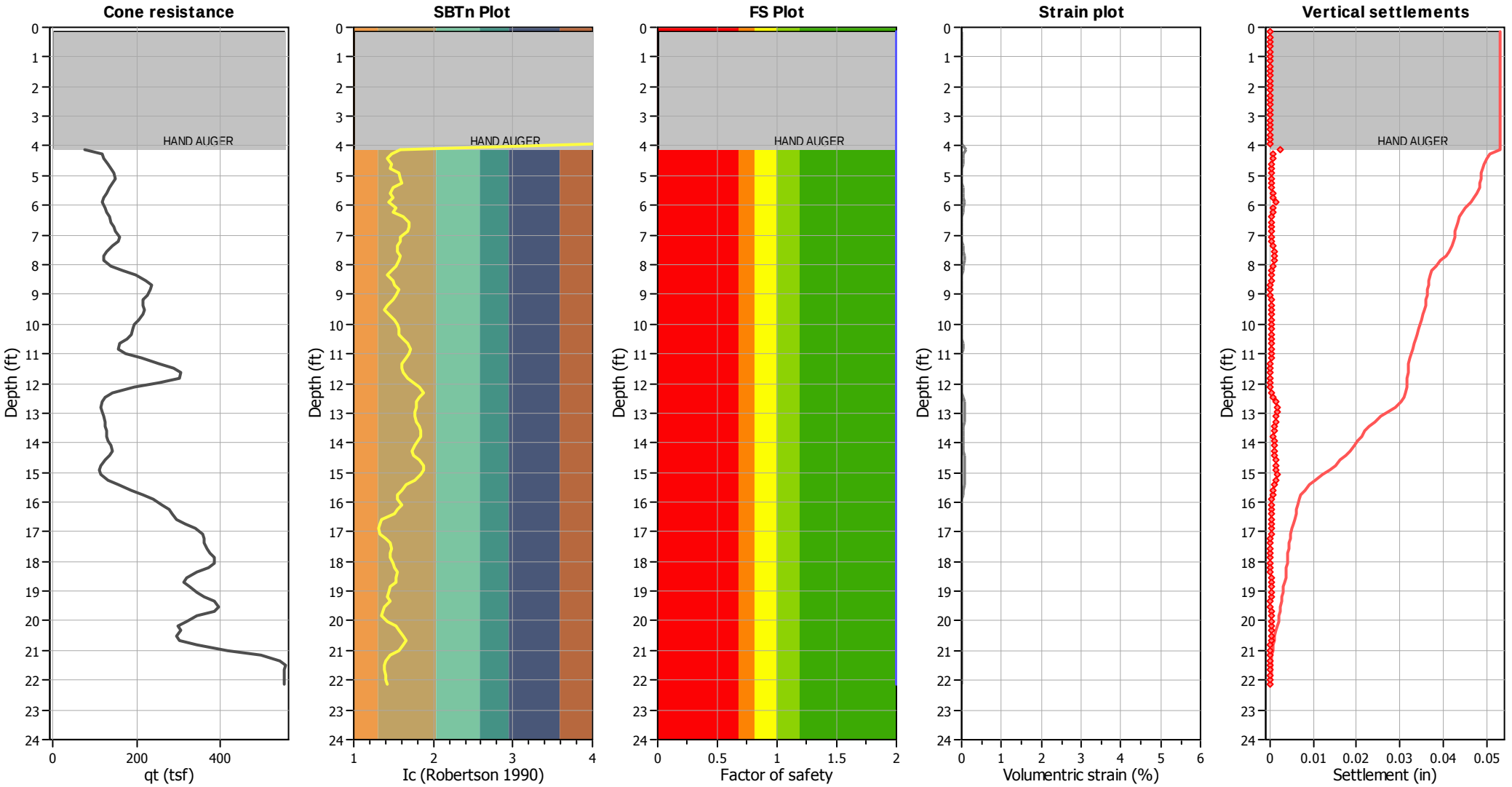
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.16	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.33	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.49	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.66	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.82	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.98	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.15	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.31	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.48	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.64	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.80	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.97	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.13	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.30	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.46	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.62	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.79	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.95	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.12	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.28	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.44	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.61	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.77	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.94	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.10	1.59	139.40	1.00	139.40	25	504	0.50	0.244	0.19	7.11	0.12	0.002
4.27	1.48	201.59	1.00	201.59	35	685	0.50	0.076	0.04	7.11	0.03	0.001
4.43	1.42	202.05	1.00	202.05	34	668	0.50	0.090	0.05	7.11	0.03	0.001
4.59	1.47	216.82	1.00	216.82	37	752	0.50	0.065	0.03	7.11	0.02	0.000
4.76	1.46	228.42	1.00	228.42	39	799	0.50	0.057	0.03	7.11	0.02	0.000
4.92	1.57	246.98	1.00	246.98	44	956	0.50	0.038	0.01	7.11	0.01	0.000
5.09	1.58	250.29	1.00	250.29	45	988	0.50	0.037	0.01	7.11	0.01	0.000
5.25	1.60	236.44	1.00	236.44	43	965	0.50	0.041	0.02	7.11	0.01	0.000
5.41	1.50	214.64	1.00	214.64	37	817	0.50	0.068	0.03	7.11	0.02	0.000
5.58	1.46	194.22	1.00	194.22	33	723	0.50	0.109	0.06	7.11	0.04	0.001
5.74	1.49	186.47	1.00	186.47	32	720	0.50	0.117	0.07	7.11	0.04	0.001
5.91	1.44	177.11	1.00	177.11	30	663	0.50	0.171	0.10	7.11	0.07	0.001
6.07	1.53	189.91	1.00	189.91	34	781	0.50	0.098	0.05	7.11	0.03	0.001
6.23	1.49	192.67	1.00	192.67	34	773	0.50	0.106	0.06	7.11	0.04	0.001
6.40	1.63	211.05	1.00	211.05	38	966	0.50	0.056	0.03	7.11	0.02	0.000
6.56	1.69	215.09	1.03	221.50	41	1050	0.50	0.047	0.02	7.11	0.01	0.000
6.73	1.70	223.70	1.04	231.71	43	1114	0.50	0.043	0.02	7.11	0.01	0.000
6.89	1.68	227.96	1.02	232.92	43	1129	0.50	0.043	0.02	7.11	0.01	0.000
7.05	1.59	230.39	1.00	230.39	41	1065	0.50	0.052	0.02	7.11	0.01	0.000
7.22	1.58	221.84	1.00	221.84	40	1033	0.50	0.058	0.03	7.11	0.02	0.000
7.38	1.55	199.71	1.00	199.71	35	913	0.50	0.086	0.04	7.11	0.03	0.001
7.55	1.56	177.09	1.00	177.09	31	818	0.50	0.130	0.08	7.11	0.05	0.001
7.71	1.58	166.41	1.00	166.41	30	793	0.50	0.153	0.09	7.11	0.06	0.001
7.87	1.57	168.41	1.00	168.41	30	802	0.50	0.152	0.09	7.11	0.06	0.001

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
8.04	1.53	187.01	1.00	187.01	33	871	0.50	0.119	0.06	7.11	0.04	0.001
8.20	1.48	217.93	1.00	217.93	38	969	0.50	0.087	0.04	7.11	0.02	0.000
8.37	1.43	254.44	1.00	254.44	43	1085	0.50	0.065	0.03	7.11	0.02	0.000
8.53	1.50	286.69	1.00	286.69	50	1319	0.49	0.042	0.01	7.11	0.01	0.000
8.69	1.51	304.58	1.00	304.58	53	1440	0.49	0.036	0.01	7.11	0.01	0.000
8.86	1.56	302.94	1.00	302.94	54	1515	0.49	0.034	0.01	7.11	0.01	0.000
9.02	1.53	288.47	1.00	288.47	51	1412	0.49	0.040	0.01	7.11	0.01	0.000
9.19	1.49	270.45	1.00	270.45	47	1277	0.49	0.051	0.02	7.11	0.01	0.000
9.35	1.42	262.62	1.00	262.62	45	1168	0.49	0.065	0.02	7.11	0.01	0.000
9.51	1.39	262.04	1.00	262.04	44	1135	0.49	0.073	0.03	7.11	0.02	0.000
9.68	1.44	261.29	1.00	261.29	45	1199	0.49	0.065	0.02	7.11	0.01	0.000
9.84	1.50	250.85	1.00	250.85	44	1240	0.49	0.061	0.02	7.11	0.01	0.000
10.01	1.55	238.76	1.00	238.76	42	1243	0.49	0.063	0.03	7.11	0.02	0.000
10.17	1.56	233.24	1.00	233.24	42	1249	0.49	0.064	0.03	7.11	0.02	0.000
10.33	1.58	227.02	1.00	227.02	41	1239	0.49	0.067	0.03	7.11	0.02	0.000
10.50	1.63	213.24	1.00	213.24	39	1238	0.49	0.069	0.03	7.11	0.02	0.000
10.66	1.67	193.37	1.02	197.03	36	1190	0.49	0.078	0.04	7.11	0.02	0.000
10.83	1.71	188.15	1.04	195.95	37	1210	0.49	0.077	0.04	7.11	0.02	0.000
10.99	1.70	208.04	1.04	215.44	40	1336	0.49	0.061	0.03	7.11	0.02	0.000
11.15	1.66	248.58	1.01	251.44	46	1548	0.49	0.045	0.02	7.11	0.01	0.000
11.32	1.61	293.28	1.00	293.28	53	1730	0.49	0.037	0.01	7.11	0.01	0.000
11.48	1.60	331.30	1.00	331.30	60	1954	0.49	0.030	0.01	7.11	0.00	0.000
11.65	1.62	351.27	1.00	351.27	64	2147	0.49	0.027	0.01	7.11	0.00	0.000
11.81	1.67	344.69	1.02	351.16	65	2241	0.49	0.025	0.01	7.11	0.00	0.000
11.98	1.74	290.22	1.07	309.98	59	2064	0.49	0.029	0.01	7.11	0.00	0.000
12.14	1.81	223.34	1.12	249.53	48	1732	0.49	0.041	0.01	7.11	0.01	0.000
12.30	1.88	163.72	1.17	191.05	38	1373	0.49	0.070	0.03	7.11	0.02	0.000
12.47	1.83	140.51	1.13	158.71	31	1127	0.49	0.124	0.07	7.11	0.04	0.001
12.63	1.79	130.38	1.10	143.22	28	1004	0.49	0.188	0.13	7.11	0.07	0.001
12.80	1.78	128.34	1.09	139.99	27	983	0.49	0.208	0.15	7.11	0.08	0.002
12.96	1.77	130.56	1.08	141.36	27	994	0.49	0.206	0.14	7.11	0.08	0.002
13.12	1.77	132.30	1.09	143.69	27	1020	0.49	0.192	0.13	7.11	0.07	0.001
13.29	1.79	135.43	1.10	148.48	29	1069	0.49	0.167	0.11	7.11	0.06	0.001
13.45	1.82	136.28	1.12	152.38	30	1122	0.49	0.145	0.09	7.11	0.05	0.001
13.62	1.83	136.99	1.13	155.10	30	1160	0.49	0.133	0.08	7.11	0.04	0.001
13.78	1.84	137.62	1.14	156.42	31	1182	0.49	0.129	0.08	7.11	0.04	0.001
13.94	1.81	141.41	1.11	157.36	31	1178	0.49	0.133	0.08	7.11	0.04	0.001
14.11	1.76	146.66	1.08	158.09	30	1161	0.49	0.143	0.09	7.11	0.05	0.001
14.27	1.73	147.05	1.06	155.75	29	1133	0.49	0.158	0.10	7.11	0.05	0.001
14.44	1.76	139.88	1.08	150.72	29	1120	0.49	0.168	0.11	7.11	0.06	0.001
14.60	1.83	127.93	1.13	144.16	28	1119	0.49	0.172	0.11	7.11	0.06	0.001
14.76	1.88	117.64	1.17	137.77	27	1106	0.49	0.184	0.13	7.11	0.07	0.001
14.93	1.89	113.57	1.18	133.65	27	1083	0.49	0.202	0.14	7.11	0.08	0.002
15.09	1.84	117.04	1.14	133.23	26	1063	0.49	0.221	0.16	7.11	0.09	0.002
15.26	1.77	130.68	1.08	141.41	27	1088	0.49	0.208	0.14	7.11	0.08	0.002
15.42	1.67	155.98	1.01	158.17	29	1156	0.49	0.172	0.11	7.11	0.06	0.001
15.58	1.60	184.81	1.00	184.81	33	1276	0.49	0.128	0.07	7.11	0.04	0.001
15.75	1.55	211.66	1.00	211.66	38	1377	0.49	0.105	0.05	7.11	0.03	0.001

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
15.91	1.55	234.37	1.00	234.37	42	1522	0.49	0.082	0.03	7.11	0.02	0.000
16.08	1.60	253.65	1.00	253.65	46	1783	0.49	0.058	0.02	7.11	0.01	0.000
16.24	1.55	268.32	1.00	268.32	48	1773	0.49	0.060	0.02	7.11	0.01	0.000
16.40	1.50	273.90	1.00	273.90	48	1716	0.49	0.065	0.02	7.11	0.01	0.000
16.57	1.36	280.34	1.00	280.34	47	1465	0.49	0.097	0.03	7.11	0.02	0.000
16.73	1.34	299.63	1.00	299.63	50	1539	0.49	0.087	0.03	7.11	0.01	0.000
16.90	1.31	321.67	1.00	321.67	53	1602	0.49	0.080	0.02	7.11	0.01	0.000
17.06	1.33	336.51	1.00	336.51	56	1715	0.49	0.069	0.02	7.11	0.01	0.000
17.22	1.40	337.88	1.00	337.88	57	1904	0.49	0.056	0.02	7.11	0.01	0.000
17.39	1.45	335.85	1.00	335.85	58	2022	0.49	0.051	0.01	7.11	0.01	0.000
17.55	1.47	342.05	1.00	342.05	59	2115	0.49	0.047	0.01	7.11	0.01	0.000
17.72	1.46	346.06	1.00	346.06	60	2122	0.48	0.047	0.01	7.11	0.01	0.000
17.88	1.46	354.40	1.00	354.40	61	2184	0.48	0.046	0.01	7.11	0.01	0.000
18.04	1.50	352.67	1.00	352.67	62	2298	0.48	0.042	0.01	7.11	0.01	0.000
18.21	1.51	340.31	1.00	340.31	60	2278	0.48	0.043	0.01	7.11	0.01	0.000
18.37	1.55	311.53	1.00	311.53	55	2181	0.48	0.047	0.01	7.11	0.01	0.000
18.54	1.54	289.10	1.00	289.10	51	2008	0.48	0.056	0.02	7.11	0.01	0.000
18.70	1.52	281.62	1.00	281.62	50	1929	0.48	0.062	0.02	7.11	0.01	0.000
18.86	1.46	291.40	1.00	291.40	50	1844	0.48	0.069	0.02	7.11	0.01	0.000
19.03	1.44	307.85	1.00	307.85	53	1912	0.48	0.065	0.02	7.11	0.01	0.000
19.19	1.42	321.73	1.00	321.73	55	1961	0.48	0.062	0.02	7.11	0.01	0.000
19.36	1.47	341.33	1.00	341.33	59	2212	0.48	0.050	0.01	7.11	0.01	0.000
19.52	1.38	349.16	1.00	349.16	59	2041	0.48	0.059	0.02	7.11	0.01	0.000
19.69	1.36	342.10	1.00	342.10	57	1935	0.48	0.067	0.02	7.11	0.01	0.000
19.85	1.34	301.64	1.00	301.64	50	1685	0.48	0.093	0.03	7.11	0.01	0.000
20.01	1.42	277.39	1.00	277.39	47	1727	0.48	0.088	0.03	7.11	0.01	0.000
20.18	1.52	257.84	1.00	257.84	45	1841	0.48	0.077	0.03	7.11	0.01	0.000
20.34	1.56	261.70	1.00	261.70	47	1974	0.48	0.067	0.02	7.11	0.01	0.000
20.51	1.62	251.19	1.00	251.19	46	2051	0.48	0.063	0.02	7.11	0.01	0.000
20.67	1.66	255.11	1.01	257.39	47	2210	0.48	0.055	0.02	7.11	0.01	0.000
20.83	1.62	289.90	1.00	289.90	53	2411	0.48	0.047	0.01	7.11	0.01	0.000
21.00	1.56	351.90	1.00	351.90	63	2693	0.48	0.039	0.01	7.11	0.00	0.000
21.16	1.46	421.60	1.00	421.60	73	2825	0.48	0.037	0.01	7.11	0.00	0.000
21.33	1.40	459.52	1.00	459.52	78	2877	0.48	0.036	0.01	7.11	0.00	0.000
21.49	1.39	470.25	1.00	470.25	79	2894	0.48	0.036	0.01	7.11	0.00	0.000
21.65	1.39	466.88	1.00	466.88	79	2892	0.48	0.037	0.01	7.11	0.00	0.000
21.82	1.40	463.78	1.00	463.78	78	2911	0.48	0.037	0.01	7.11	0.00	0.000
21.98	1.41	460.53	1.00	460.53	78	2932	0.48	0.037	0.01	7.11	0.00	0.000
22.15	1.41	457.82	1.00	457.82	78	2957	0.48	0.037	0.01	7.11	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.05

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

Petra Geosciences, Inc.
3186 Airway Avenue, Suite K
Costa Mesa, CA 92626
www.petra-inc.com

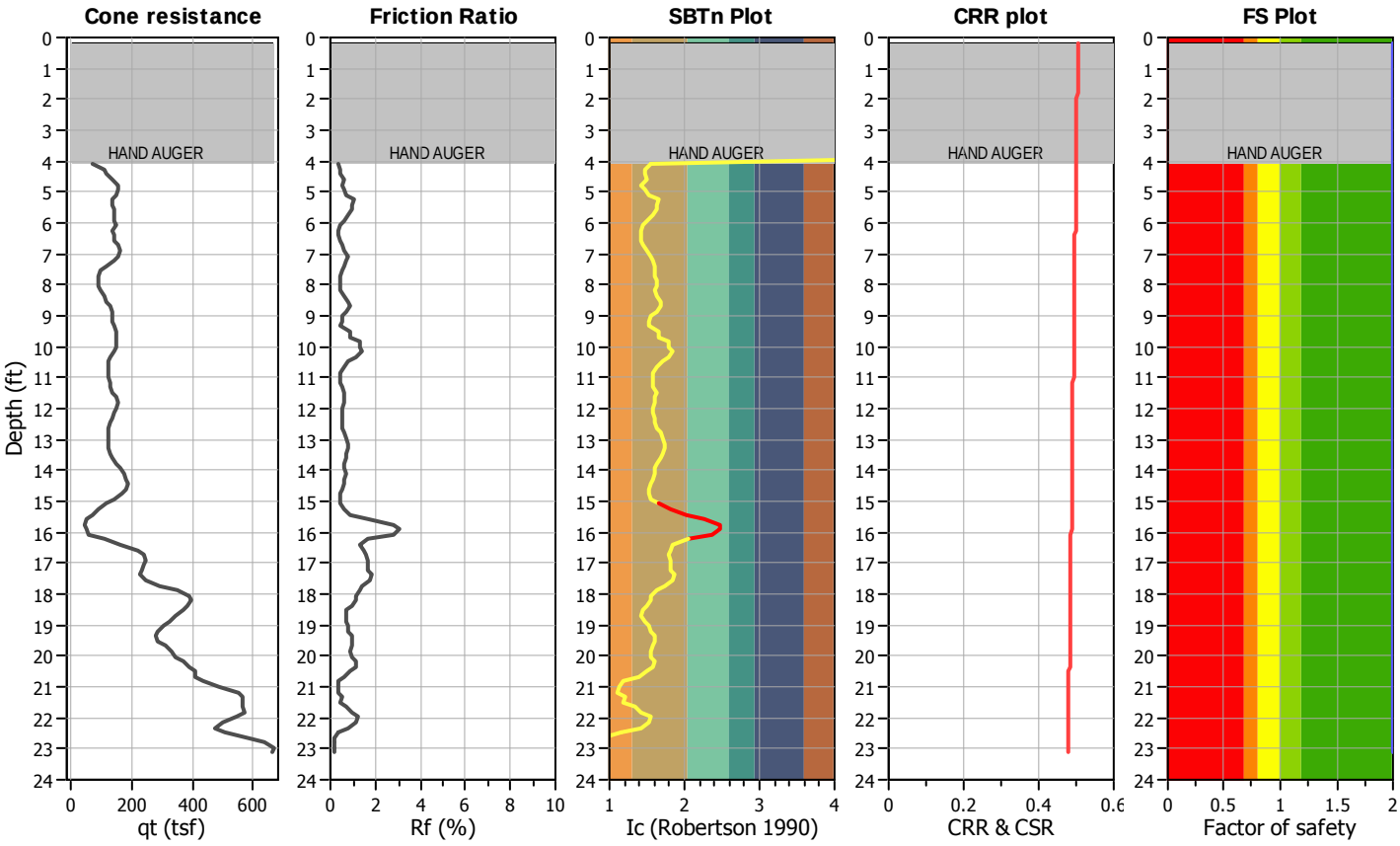
LIQUEFACTION ANALYSIS REPORT

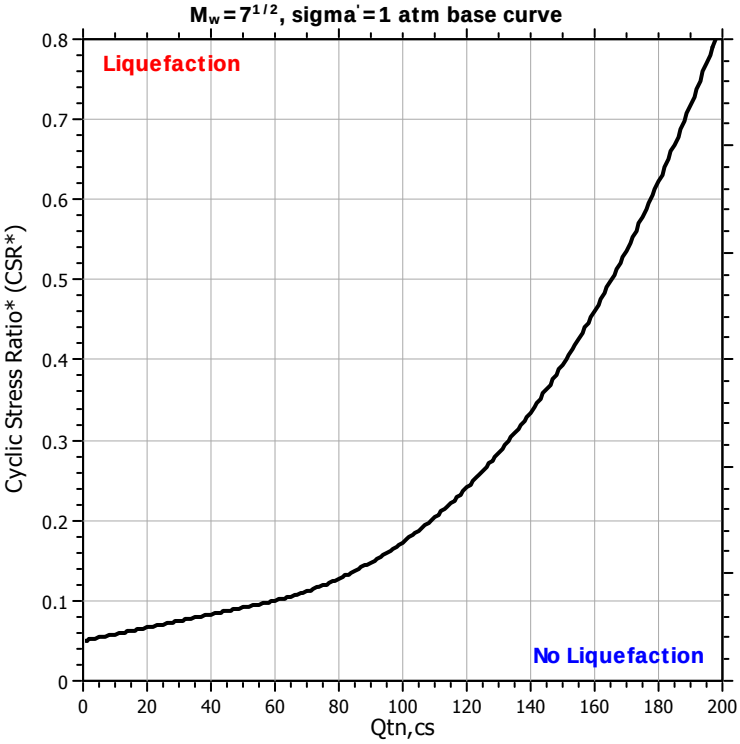
Project title : 19-433, Western Realco **Location : 1375 Magnolia Avenue, Corona, CA**

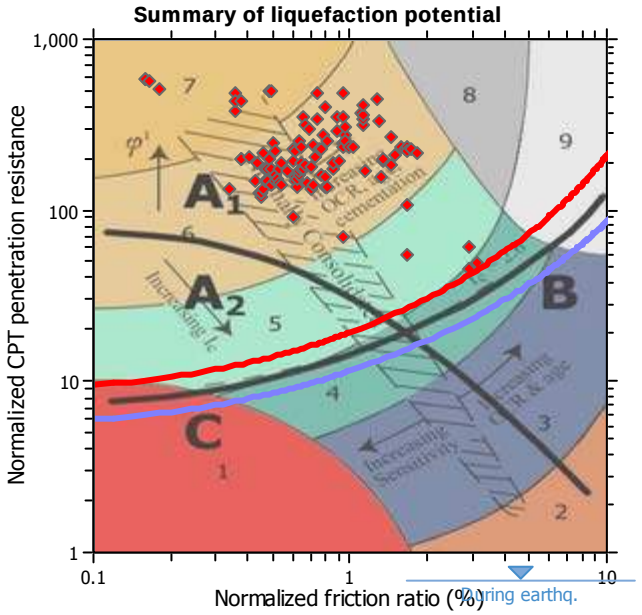
CPT file : SCPT-2

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	45.00 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:	6.47	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.87	Unit weight calculation:	Based on SBT	K_σ applied:	No		

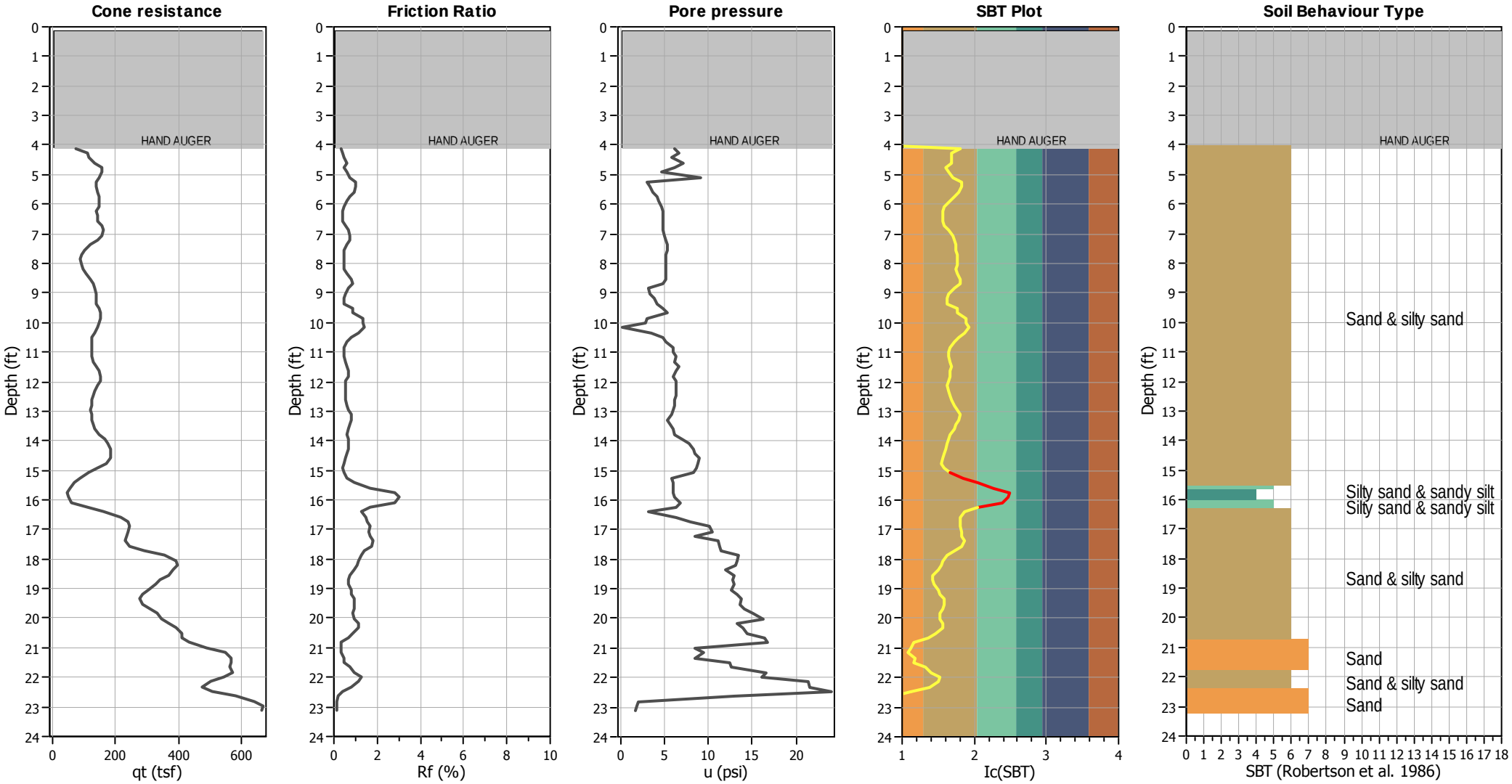






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



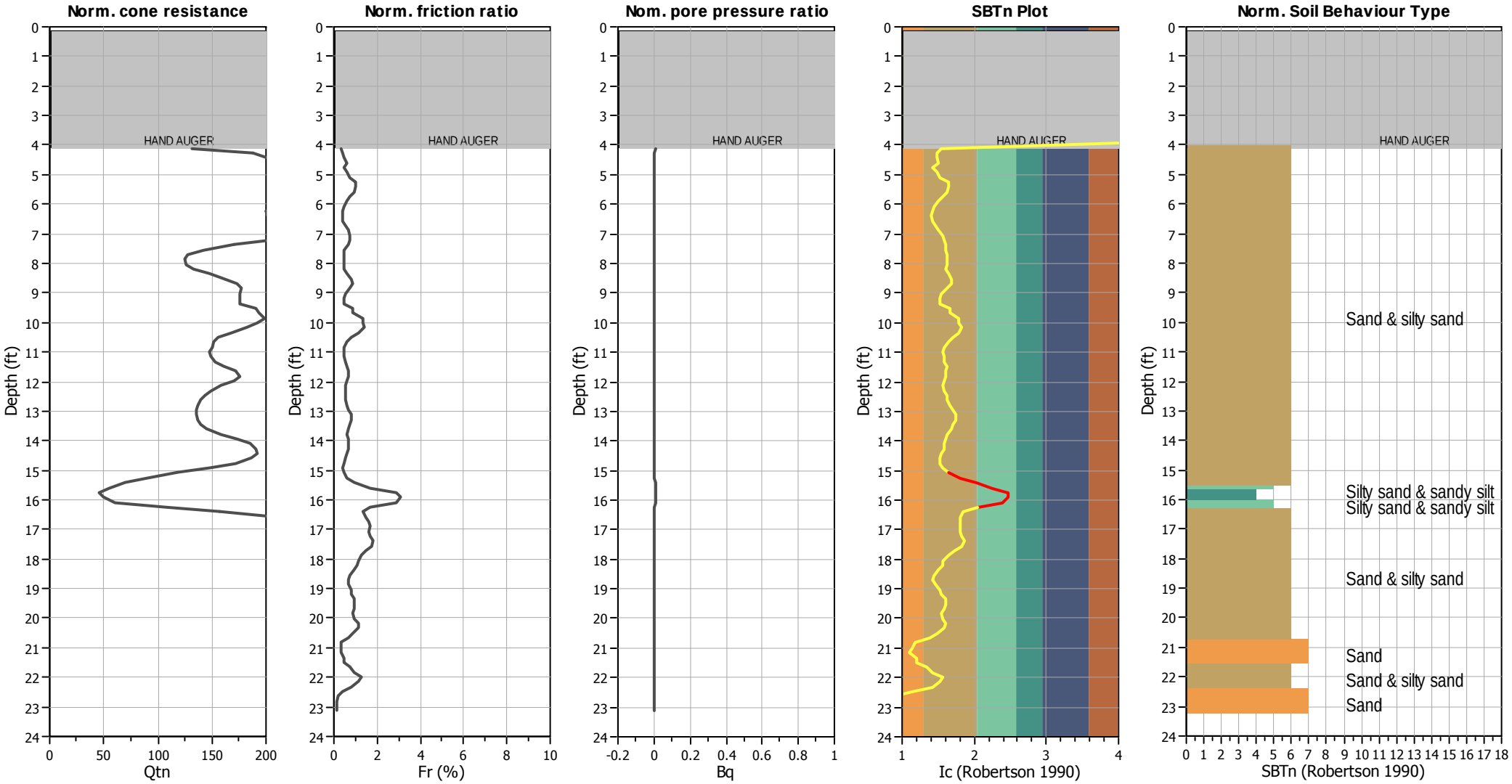
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 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

CPT basic interpretation plots (normalized)



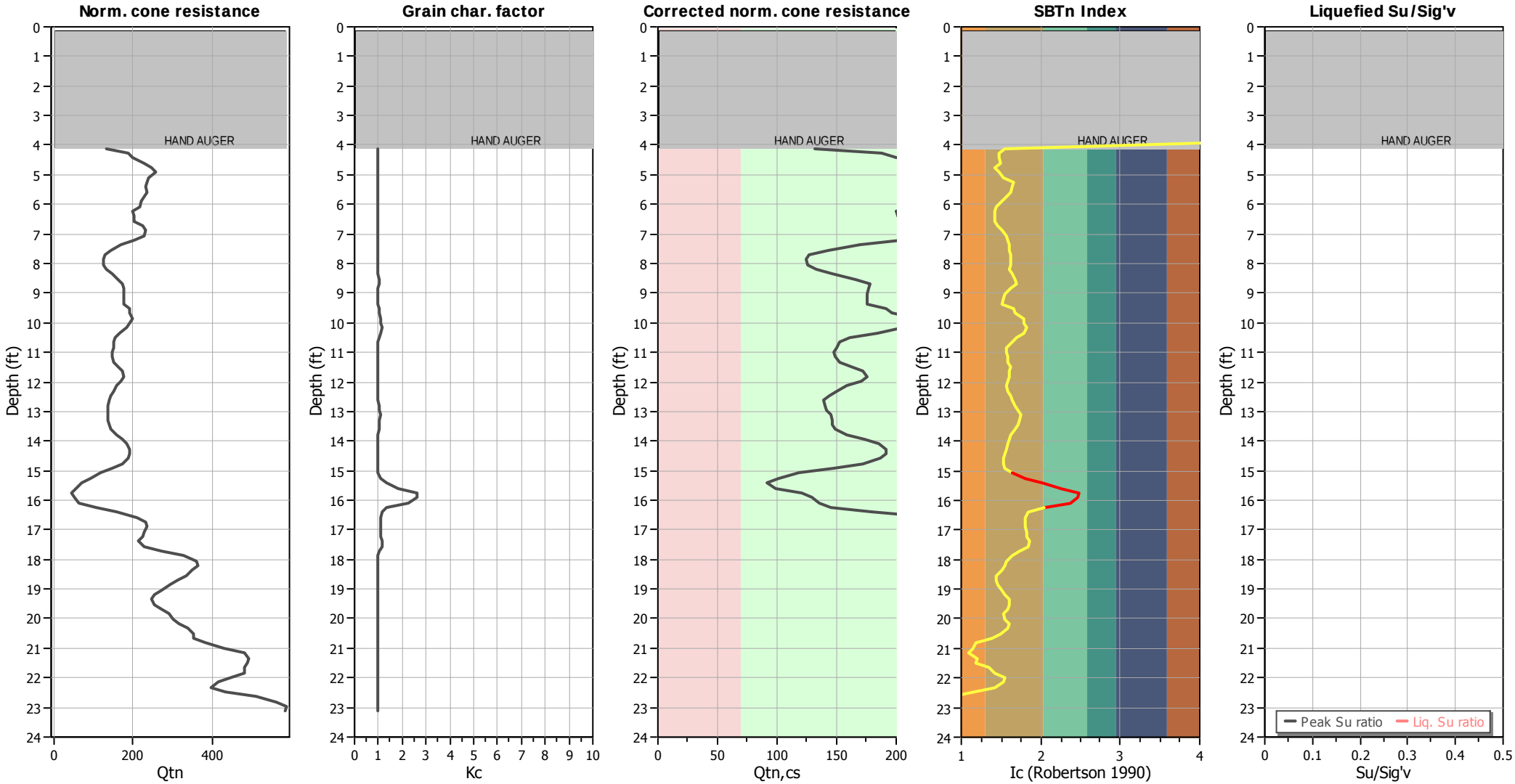
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn 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

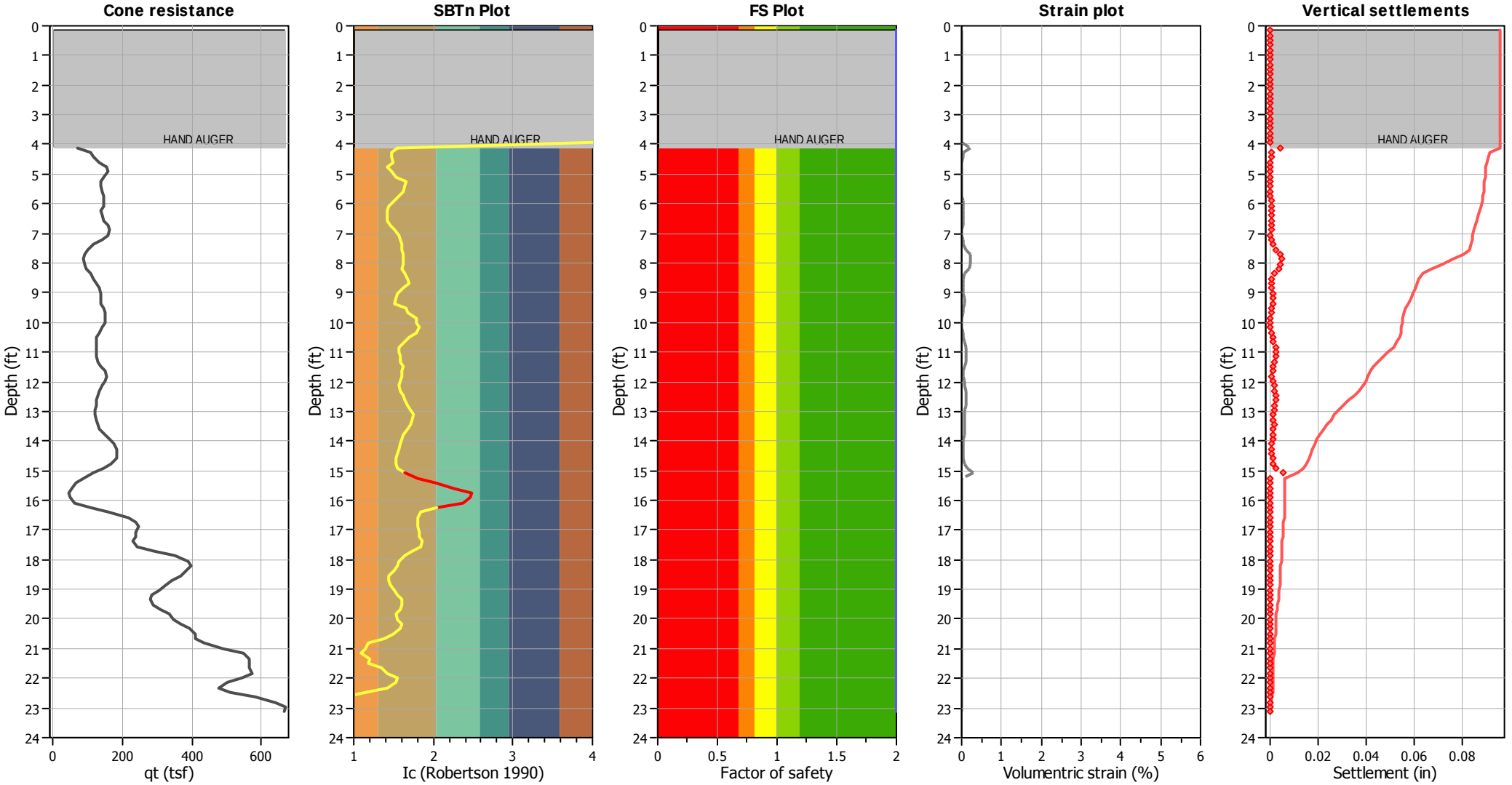
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.16	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.33	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.49	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.66	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.82	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.98	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.15	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.31	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.48	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.64	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.80	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.97	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.13	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.30	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.46	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.62	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.79	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.95	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.12	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.28	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.44	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.61	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.77	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.94	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.10	1.55	131.71	1.00	131.71	23	460	0.50	0.385	0.32	7.11	0.21	0.004
4.27	1.47	187.72	1.00	187.72	32	634	0.50	0.100	0.06	7.11	0.04	0.001
4.43	1.48	199.49	1.00	199.49	35	687	0.50	0.081	0.04	7.11	0.03	0.001
4.59	1.50	227.85	1.00	227.85	40	807	0.50	0.052	0.02	7.11	0.02	0.000
4.76	1.42	247.05	1.00	247.05	42	835	0.50	0.051	0.02	7.11	0.01	0.000
4.92	1.47	256.36	1.00	256.36	44	918	0.50	0.042	0.02	7.11	0.01	0.000
5.09	1.53	241.00	1.00	241.00	43	917	0.50	0.044	0.02	7.11	0.01	0.000
5.25	1.65	236.45	1.00	237.27	44	1003	0.50	0.037	0.01	7.11	0.01	0.000
5.41	1.64	232.64	1.00	232.18	42	996	0.50	0.040	0.02	7.11	0.01	0.000
5.58	1.62	235.32	1.00	235.32	43	1005	0.50	0.041	0.02	7.11	0.01	0.000
5.74	1.57	230.12	1.00	230.12	41	950	0.50	0.049	0.02	7.11	0.01	0.000
5.91	1.51	221.75	1.00	221.75	39	884	0.50	0.063	0.03	7.11	0.02	0.000
6.07	1.44	217.01	1.00	217.01	37	822	0.50	0.083	0.04	7.11	0.03	0.001
6.23	1.41	200.29	1.00	200.29	34	751	0.50	0.119	0.06	7.11	0.04	0.001
6.40	1.41	201.23	1.00	201.23	34	761	0.50	0.120	0.06	7.11	0.04	0.001
6.56	1.42	203.77	1.00	203.77	35	786	0.50	0.112	0.06	7.11	0.04	0.001
6.73	1.46	223.78	1.00	223.78	39	898	0.50	0.076	0.03	7.11	0.02	0.000
6.89	1.51	232.82	1.00	232.82	41	992	0.50	0.060	0.03	7.11	0.02	0.000
7.05	1.56	228.27	1.00	228.27	41	1031	0.50	0.056	0.02	7.11	0.02	0.000
7.22	1.59	204.26	1.00	204.26	37	952	0.50	0.073	0.04	7.11	0.02	0.000
7.38	1.61	169.98	1.00	169.98	31	817	0.50	0.125	0.07	7.11	0.05	0.001
7.55	1.60	142.27	1.00	142.27	26	688	0.50	0.259	0.19	7.11	0.12	0.002
7.71	1.62	127.22	1.00	127.22	23	628	0.50	0.419	0.35	7.11	0.22	0.004
7.87	1.63	124.57	1.00	124.57	23	629	0.50	0.436	0.37	7.11	0.23	0.005

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
8.04	1.62	125.55	1.00	125.55	23	636	0.50	0.434	0.37	7.11	0.23	0.004
8.20	1.61	132.93	1.00	132.93	24	669	0.50	0.357	0.29	7.11	0.18	0.003
8.37	1.64	147.04	1.00	146.87	27	774	0.50	0.198	0.14	7.11	0.09	0.002
8.53	1.68	162.72	1.02	166.44	31	894	0.49	0.121	0.07	7.11	0.04	0.001
8.69	1.69	172.82	1.03	177.74	33	967	0.49	0.097	0.05	7.11	0.03	0.001
8.86	1.62	177.27	1.00	177.27	32	940	0.49	0.110	0.06	7.11	0.04	0.001
9.02	1.54	175.94	1.00	175.94	31	869	0.49	0.150	0.09	7.11	0.05	0.001
9.19	1.53	175.46	1.00	175.46	31	860	0.49	0.161	0.10	7.11	0.06	0.001
9.35	1.52	175.57	1.00	175.57	31	856	0.49	0.171	0.10	7.11	0.06	0.001
9.51	1.66	190.11	1.01	191.84	35	1081	0.49	0.082	0.04	7.11	0.02	0.000
9.68	1.67	193.46	1.02	196.54	36	1121	0.49	0.076	0.04	7.11	0.02	0.000
9.84	1.79	198.67	1.10	218.05	42	1316	0.49	0.052	0.02	7.11	0.01	0.000
10.01	1.80	192.36	1.10	212.20	41	1297	0.49	0.056	0.02	7.11	0.01	0.000
10.17	1.83	182.78	1.13	206.65	40	1294	0.49	0.057	0.02	7.11	0.01	0.000
10.33	1.79	167.69	1.10	183.99	35	1142	0.49	0.082	0.04	7.11	0.02	0.000
10.50	1.70	155.13	1.04	161.11	30	972	0.49	0.139	0.08	7.11	0.05	0.001
10.66	1.64	152.29	1.00	152.29	28	899	0.49	0.190	0.13	7.11	0.07	0.001
10.83	1.57	150.03	1.00	150.03	27	832	0.49	0.266	0.19	7.11	0.11	0.002
10.99	1.57	148.05	1.00	148.05	26	827	0.49	0.284	0.20	7.11	0.12	0.002
11.15	1.58	148.33	1.00	148.33	27	837	0.49	0.278	0.20	7.11	0.11	0.002
11.32	1.59	152.86	1.00	152.86	27	879	0.49	0.235	0.16	7.11	0.09	0.002
11.48	1.62	161.66	1.00	161.66	29	971	0.49	0.166	0.10	7.11	0.06	0.001
11.65	1.61	172.01	1.00	172.01	31	1025	0.49	0.142	0.08	7.11	0.05	0.001
11.81	1.61	175.46	1.00	175.46	32	1052	0.49	0.134	0.08	7.11	0.04	0.001
11.98	1.58	170.41	1.00	170.41	31	995	0.49	0.167	0.10	7.11	0.06	0.001
12.14	1.57	158.98	1.00	158.98	28	928	0.49	0.222	0.15	7.11	0.08	0.002
12.30	1.59	149.59	1.00	149.59	27	901	0.49	0.257	0.18	7.11	0.10	0.002
12.47	1.62	143.78	1.00	143.78	26	894	0.49	0.272	0.20	7.11	0.11	0.002
12.63	1.63	139.30	1.00	139.30	25	889	0.49	0.288	0.22	7.11	0.12	0.002
12.80	1.67	137.33	1.02	139.99	26	922	0.49	0.255	0.19	7.11	0.10	0.002
12.96	1.71	134.91	1.05	141.13	26	954	0.49	0.229	0.16	7.11	0.09	0.002
13.12	1.75	135.94	1.07	145.55	28	1010	0.49	0.190	0.13	7.11	0.07	0.001
13.29	1.74	137.04	1.07	145.97	28	1015	0.49	0.192	0.13	7.11	0.07	0.001
13.45	1.71	140.05	1.04	146.12	27	1006	0.49	0.204	0.14	7.11	0.08	0.002
13.62	1.68	145.23	1.02	148.49	27	1013	0.49	0.204	0.14	7.11	0.08	0.002
13.78	1.62	158.25	1.00	158.25	29	1036	0.49	0.192	0.12	7.11	0.07	0.001
13.94	1.61	173.37	1.00	173.37	31	1130	0.49	0.146	0.09	7.11	0.05	0.001
14.11	1.59	185.72	1.00	185.72	33	1195	0.49	0.125	0.07	7.11	0.04	0.001
14.27	1.57	191.09	1.00	191.09	34	1208	0.49	0.124	0.07	7.11	0.04	0.001
14.44	1.55	192.02	1.00	192.02	34	1187	0.49	0.134	0.07	7.11	0.04	0.001
14.60	1.53	187.11	1.00	187.11	33	1132	0.49	0.159	0.09	7.11	0.05	0.001
14.76	1.53	172.15	1.00	172.15	30	1043	0.49	0.217	0.13	7.11	0.07	0.001
14.93	1.55	147.58	1.00	147.58	26	932	0.49	0.348	0.25	7.11	0.13	0.003
15.09	1.65	118.23	1.00	118.23	22	838	0.49	0.577	0.52	7.11	0.28	0.005
15.26	1.81	90.38	1.12	100.93	0	0	0.49	0.000	0.00	0.00	0.00	0.000
15.42	2.02	69.34	1.32	91.77	0	0	0.49	0.000	0.00	0.00	0.00	0.000
15.58	2.25	54.87	1.81	99.33	0	0	0.49	0.000	0.00	0.00	0.00	0.000
15.75	2.47	45.59	2.64	120.18	0	0	0.49	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
15.91	2.47	49.81	2.60	129.45	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.08	2.38	60.86	2.23	135.81	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.24	2.04	107.24	1.36	145.35	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.40	1.85	156.71	1.14	179.33	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.57	1.80	211.82	1.11	234.96	45	1918	0.49	0.051	0.02	7.11	0.01	0.000
16.73	1.80	231.71	1.10	256.04	49	2097	0.49	0.043	0.01	7.11	0.01	0.000
16.90	1.81	235.67	1.11	262.75	51	2182	0.49	0.041	0.01	7.11	0.01	0.000
17.06	1.82	227.42	1.12	254.25	49	2130	0.49	0.043	0.01	7.11	0.01	0.000
17.22	1.83	224.06	1.13	252.37	49	2142	0.49	0.044	0.01	7.11	0.01	0.000
17.39	1.87	215.30	1.16	249.42	49	2177	0.49	0.043	0.01	7.11	0.01	0.000
17.55	1.83	228.54	1.13	258.81	51	2234	0.49	0.042	0.01	7.11	0.01	0.000
17.72	1.73	271.14	1.06	286.24	54	2324	0.48	0.039	0.01	7.11	0.01	0.000
17.88	1.64	327.80	1.00	327.80	60	2527	0.48	0.035	0.01	7.11	0.00	0.000
18.04	1.57	361.27	1.00	361.27	64	2549	0.48	0.035	0.01	7.11	0.00	0.000
18.21	1.56	366.19	1.00	366.19	65	2563	0.48	0.035	0.01	7.11	0.00	0.000
18.37	1.51	351.04	1.00	351.04	61	2318	0.48	0.042	0.01	7.11	0.01	0.000
18.54	1.44	336.83	1.00	336.83	58	2059	0.48	0.052	0.01	7.11	0.01	0.000
18.70	1.43	311.73	1.00	311.73	53	1886	0.48	0.063	0.02	7.11	0.01	0.000
18.86	1.46	294.86	1.00	294.86	51	1859	0.48	0.066	0.02	7.11	0.01	0.000
19.03	1.52	272.94	1.00	272.94	48	1863	0.48	0.067	0.02	7.11	0.01	0.000
19.19	1.55	255.72	1.00	255.72	45	1832	0.48	0.070	0.03	7.11	0.01	0.000
19.36	1.61	247.11	1.00	247.11	45	1912	0.48	0.065	0.02	7.11	0.01	0.000
19.52	1.61	253.37	1.00	253.37	46	1970	0.48	0.062	0.02	7.11	0.01	0.000
19.69	1.58	271.91	1.00	271.91	49	2059	0.48	0.057	0.02	7.11	0.01	0.000
19.85	1.54	292.97	1.00	292.97	52	2104	0.48	0.056	0.02	7.11	0.01	0.000
20.01	1.56	303.39	1.00	303.39	54	2234	0.48	0.050	0.02	7.11	0.01	0.000
20.18	1.59	318.74	1.00	318.74	57	2485	0.48	0.042	0.01	7.11	0.01	0.000
20.34	1.58	339.50	1.00	339.50	61	2605	0.48	0.039	0.01	7.11	0.00	0.000
20.51	1.49	355.04	1.00	355.04	62	2425	0.48	0.045	0.01	7.11	0.01	0.000
20.67	1.39	355.14	1.00	355.14	60	2121	0.48	0.058	0.02	7.11	0.01	0.000
20.83	1.18	382.00	1.00	382.00	60	1729	0.48	0.092	0.02	7.11	0.01	0.000
21.00	1.14	430.15	1.00	430.15	67	1861	0.48	0.078	0.02	7.11	0.01	0.000
21.16	1.10	483.62	1.00	483.62	75	1989	0.48	0.069	0.01	7.11	0.01	0.000
21.33	1.20	492.20	1.00	492.20	78	2322	0.48	0.051	0.01	7.11	0.00	0.000
21.49	1.19	491.09	1.00	491.09	78	2300	0.48	0.053	0.01	7.11	0.00	0.000
21.65	1.35	481.60	1.00	481.60	80	2791	0.48	0.038	0.01	7.11	0.00	0.000
21.82	1.43	481.85	1.00	481.85	82	3136	0.48	0.032	0.01	7.11	0.00	0.000
21.98	1.55	450.66	1.00	450.66	80	3493	0.48	0.028	0.01	7.11	0.00	0.000
22.15	1.53	416.45	1.00	416.45	73	3144	0.48	0.033	0.01	7.11	0.00	0.000
22.31	1.42	397.73	1.00	397.73	68	2578	0.48	0.045	0.01	7.11	0.00	0.000
22.47	1.15	435.32	1.00	435.32	68	1958	0.48	0.078	0.02	7.11	0.01	0.000
22.64	0.90	511.41	1.00	511.41	75	1635	0.48	0.123	0.03	7.11	0.01	0.000
22.80	0.84	562.82	1.00	562.82	81	1674	0.48	0.117	0.02	7.11	0.01	0.000
22.97	0.82	589.85	1.00	589.85	84	1692	0.48	0.115	0.02	7.11	0.01	0.000
23.13	0.82	584.58	1.00	584.58	84	1692	0.48	0.116	0.02	7.11	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.10

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

Petra Geosciences, Inc.
3186 Airway Avenue, Suite K
Costa Mesa, CA 92626
www.petra-inc.com

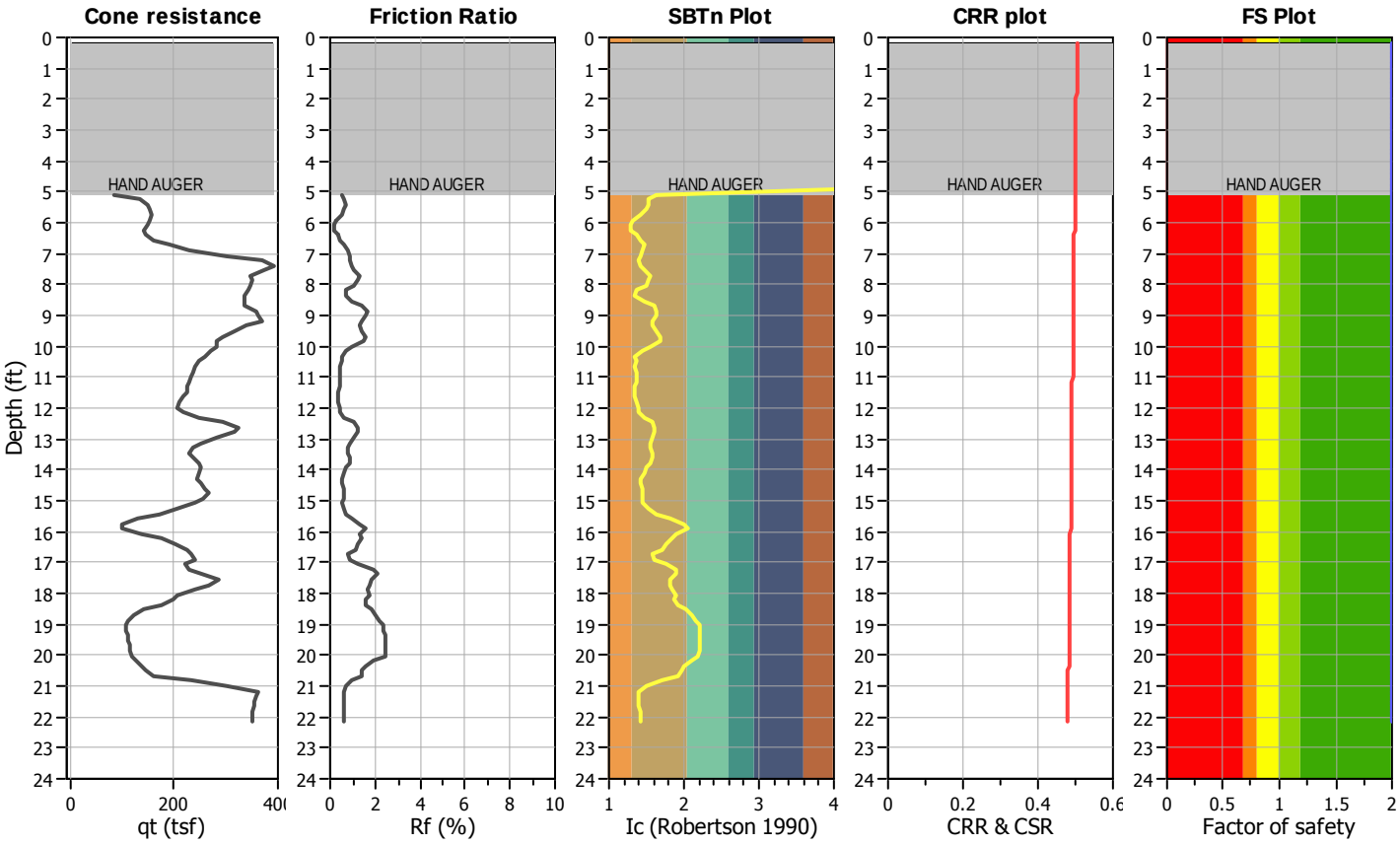
LIQUEFACTION ANALYSIS REPORT

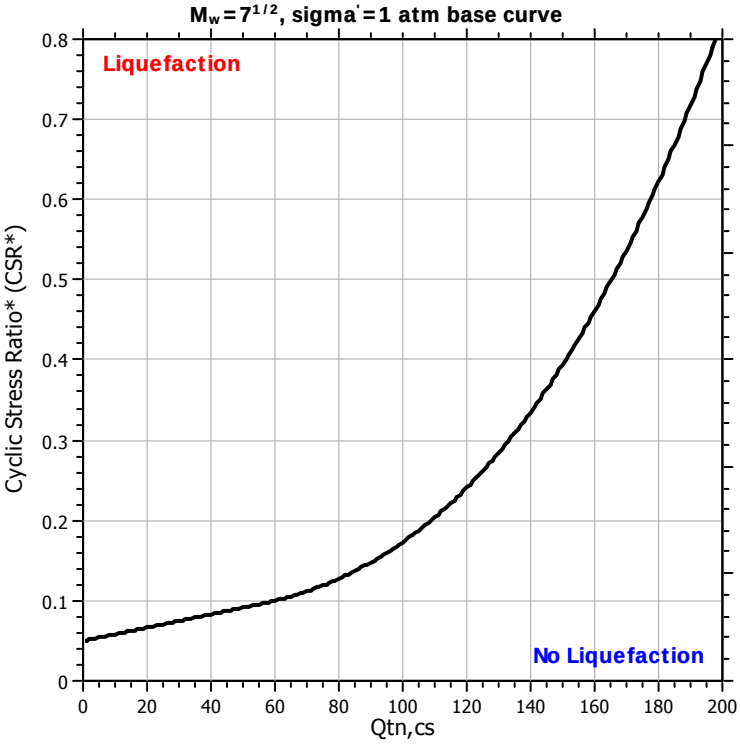
Project title : 19-433, Western Realco **Location : 1375 Magnolia Avenue, Corona, CA**

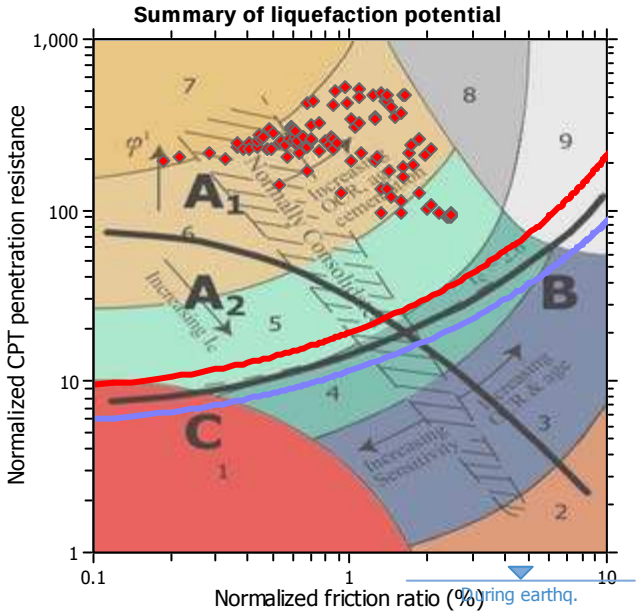
CPT file : CPT-3

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	45.00 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:	6.47	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.87	Unit weight calculation:	Based on SBT	K_σ applied:	No		

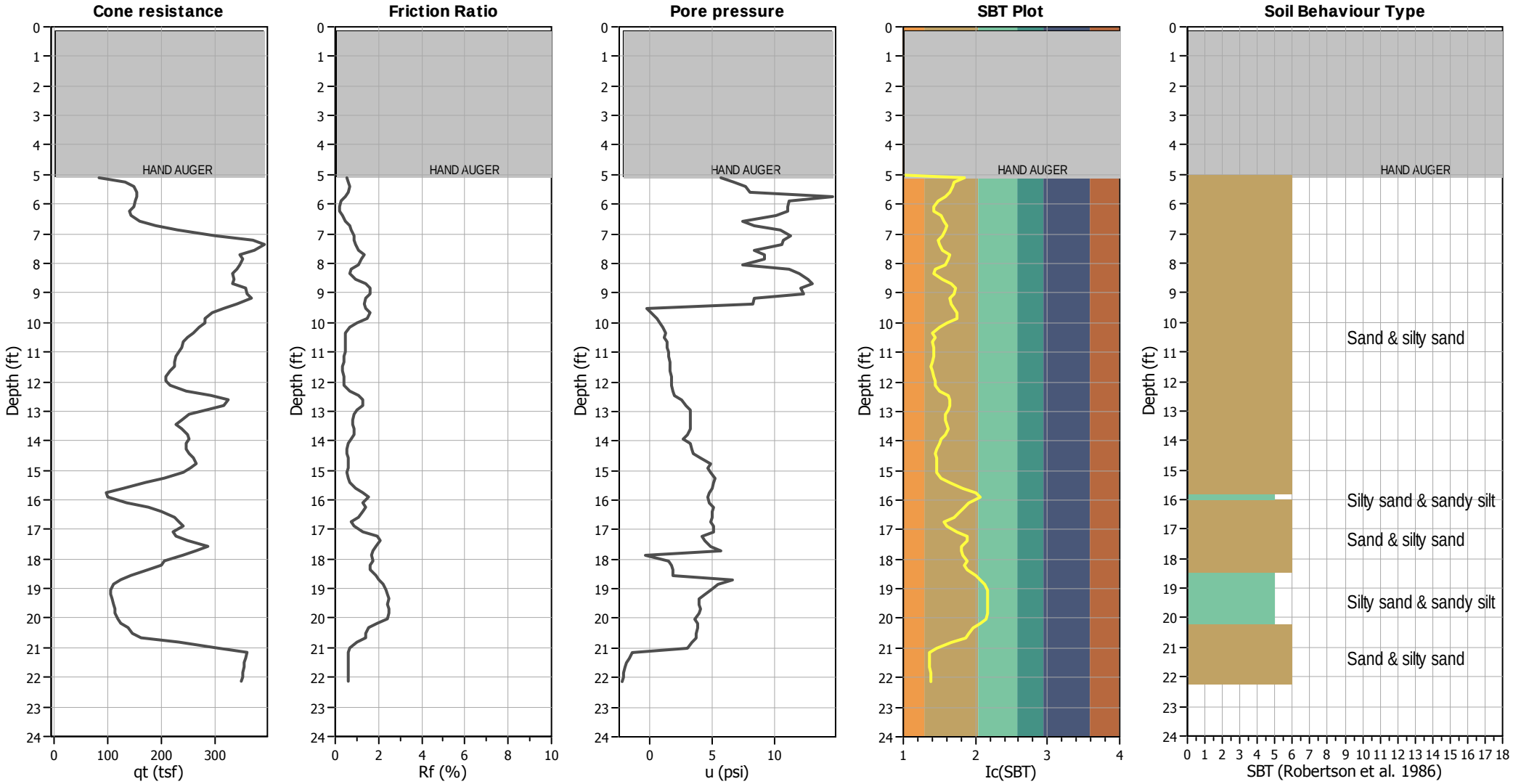






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



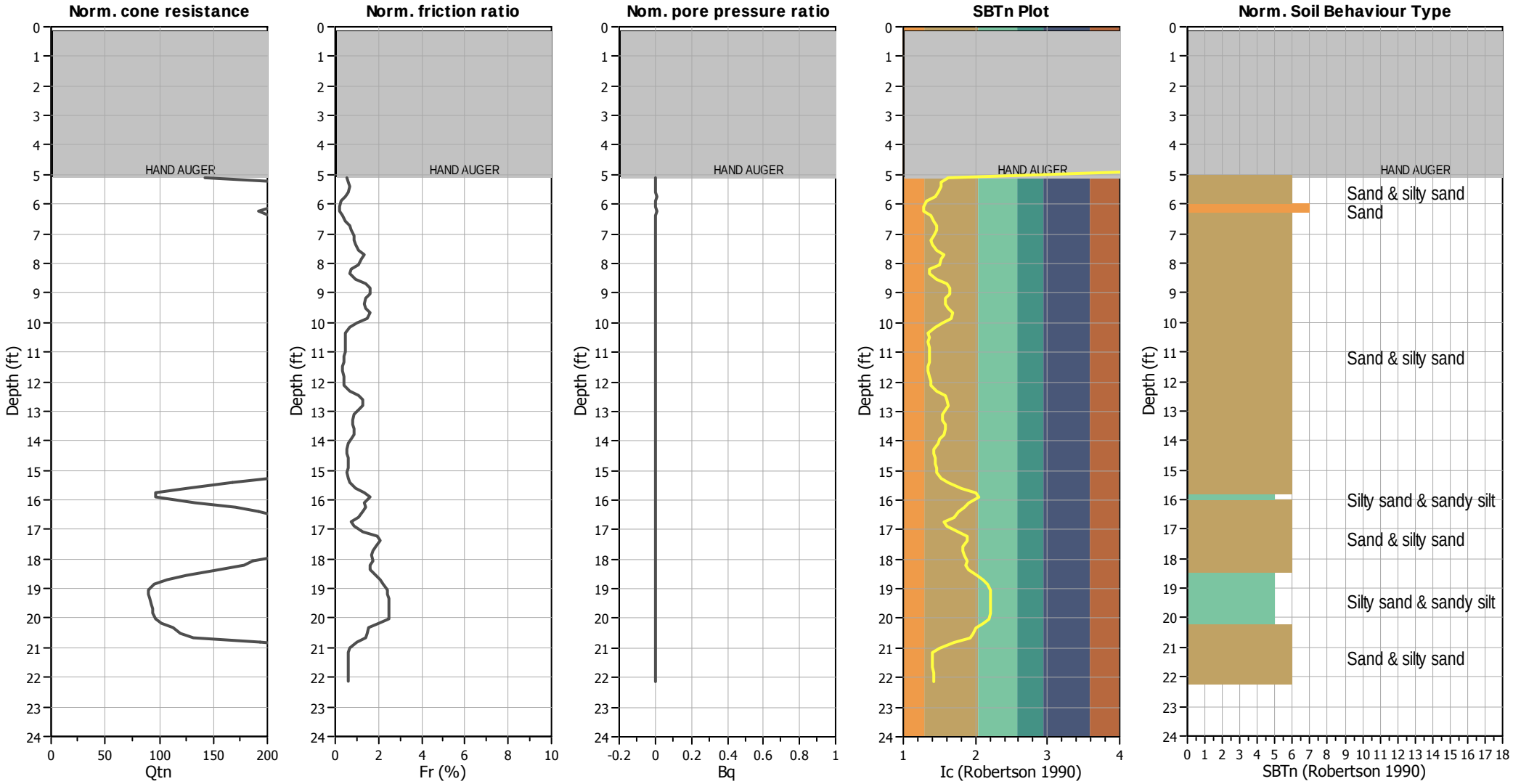
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 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

CPT basic interpretation plots (normalized)



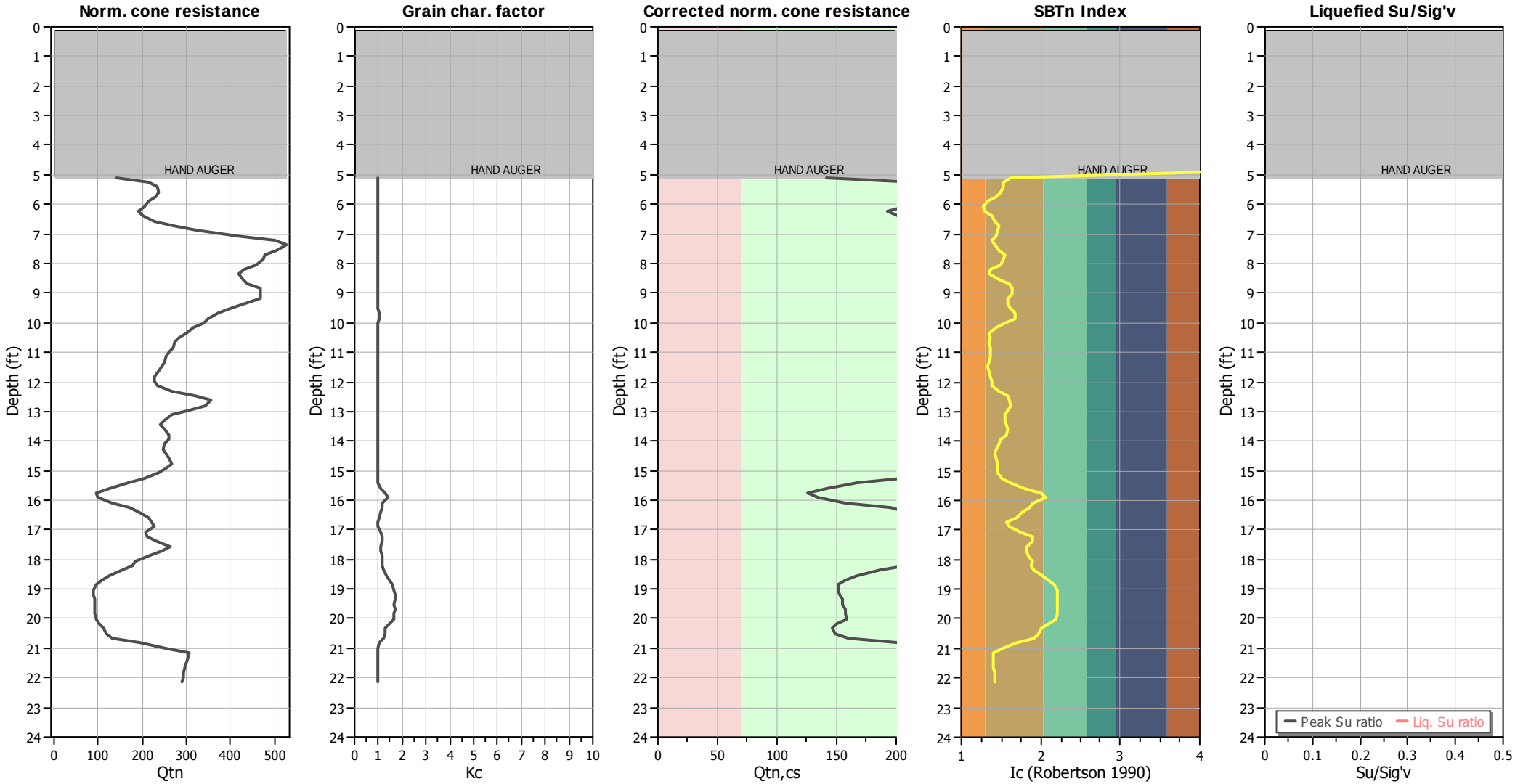
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn 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

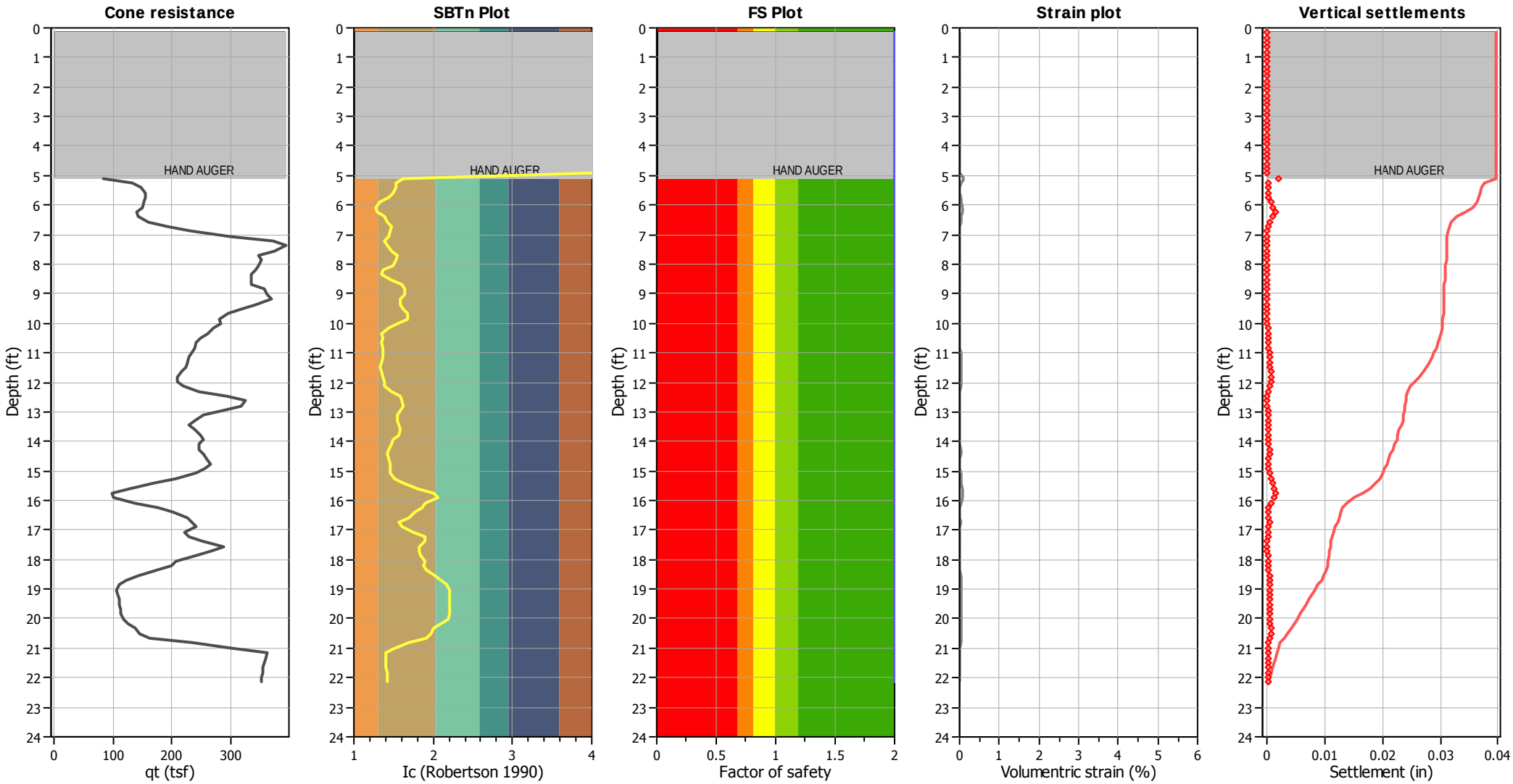
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.16	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.33	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.49	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.66	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.82	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.98	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.15	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.31	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.48	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.64	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.80	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.97	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.13	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.30	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.46	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.62	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.79	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.95	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.12	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.28	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.44	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.61	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.77	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.94	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.10	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.27	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.43	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.59	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.76	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.92	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
5.09	1.62	141.67	1.00	141.67	26	580	0.50	0.216	0.16	7.11	0.10	0.002
5.25	1.53	215.06	1.00	215.06	38	828	0.50	0.062	0.03	7.11	0.02	0.000
5.41	1.52	235.17	1.00	235.17	41	913	0.50	0.050	0.02	7.11	0.01	0.000
5.58	1.49	238.07	1.00	238.07	41	910	0.50	0.053	0.02	7.11	0.01	0.000
5.74	1.43	231.01	1.00	231.01	39	853	0.50	0.067	0.03	7.11	0.02	0.000
5.91	1.32	213.93	1.00	213.93	35	728	0.50	0.119	0.06	7.11	0.04	0.001
6.07	1.28	205.91	1.00	205.91	34	682	0.50	0.162	0.09	7.11	0.06	0.001
6.23	1.28	192.25	1.00	192.25	31	644	0.50	0.219	0.13	7.11	0.08	0.002
6.40	1.38	200.85	1.00	200.85	34	738	0.50	0.133	0.07	7.11	0.05	0.001
6.56	1.43	225.94	1.00	225.94	39	875	0.50	0.078	0.04	7.11	0.02	0.000
6.73	1.47	270.90	1.00	270.90	47	1096	0.50	0.044	0.02	7.11	0.01	0.000
6.89	1.46	323.32	1.00	323.32	56	1312	0.50	0.031	0.01	7.11	0.01	0.000
7.05	1.43	414.46	1.00	414.46	71	1659	0.50	0.021	0.00	7.11	0.00	0.000
7.22	1.39	500.35	1.00	500.35	84	1948	0.50	0.017	0.00	7.11	0.00	0.000
7.38	1.41	527.65	1.00	527.65	90	2114	0.50	0.015	0.00	7.11	0.00	0.000
7.55	1.47	505.97	1.00	505.97	87	2155	0.50	0.016	0.00	7.11	0.00	0.000
7.71	1.56	478.64	1.00	478.64	85	2244	0.50	0.015	0.00	7.11	0.00	0.000
7.87	1.53	476.42	1.00	476.42	84	2206	0.50	0.016	0.00	7.11	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
8.04	1.49	458.16	1.00	458.16	80	2062	0.50	0.018	0.00	7.11	0.00	0.000
8.20	1.36	433.15	1.00	433.15	72	1730	0.50	0.024	0.01	7.11	0.00	0.000
8.37	1.35	417.79	1.00	417.79	70	1666	0.50	0.027	0.01	7.11	0.00	0.000
8.53	1.47	428.69	1.00	428.69	74	1932	0.49	0.021	0.00	7.11	0.00	0.000
8.69	1.59	438.70	1.00	438.70	79	2266	0.49	0.017	0.00	7.11	0.00	0.000
8.86	1.64	469.09	1.00	468.21	86	2568	0.49	0.015	0.00	7.11	0.00	0.000
9.02	1.63	469.26	1.00	469.26	86	2573	0.49	0.015	0.00	7.11	0.00	0.000
9.19	1.58	467.81	1.00	467.81	84	2452	0.49	0.017	0.00	7.11	0.00	0.000
9.35	1.59	430.33	1.00	430.33	77	2297	0.49	0.019	0.00	7.11	0.00	0.000
9.51	1.63	399.35	1.00	399.35	73	2242	0.49	0.020	0.00	7.11	0.00	0.000
9.68	1.68	373.35	1.02	382.53	71	2230	0.49	0.020	0.00	7.11	0.00	0.000
9.84	1.67	350.59	1.02	357.10	66	2094	0.49	0.023	0.01	7.11	0.00	0.000
10.01	1.54	340.19	1.00	340.19	60	1785	0.49	0.030	0.01	7.11	0.00	0.000
10.17	1.44	317.08	1.00	317.08	54	1504	0.49	0.043	0.01	7.11	0.01	0.000
10.33	1.34	299.07	1.00	299.07	50	1287	0.49	0.063	0.02	7.11	0.01	0.000
10.50	1.37	284.04	1.00	284.04	48	1267	0.49	0.067	0.02	7.11	0.01	0.000
10.66	1.35	273.65	1.00	273.65	46	1197	0.49	0.080	0.03	7.11	0.02	0.000
10.83	1.37	268.86	1.00	268.86	45	1205	0.49	0.081	0.03	7.11	0.02	0.000
10.99	1.37	261.63	1.00	261.63	44	1182	0.49	0.088	0.03	7.11	0.02	0.000
11.15	1.37	254.20	1.00	254.20	43	1156	0.49	0.096	0.04	7.11	0.02	0.000
11.32	1.35	250.41	1.00	250.41	42	1126	0.49	0.106	0.04	7.11	0.03	0.001
11.48	1.33	245.67	1.00	245.67	41	1088	0.49	0.121	0.05	7.11	0.03	0.001
11.65	1.35	236.61	1.00	236.61	39	1068	0.49	0.132	0.06	7.11	0.03	0.001
11.81	1.37	228.43	1.00	228.43	38	1067	0.49	0.136	0.06	7.11	0.04	0.001
11.98	1.39	226.27	1.00	226.27	38	1082	0.49	0.134	0.06	7.11	0.04	0.001
12.14	1.39	235.54	1.00	235.54	40	1137	0.49	0.117	0.05	7.11	0.03	0.001
12.30	1.47	267.96	1.00	267.96	46	1421	0.49	0.065	0.02	7.11	0.01	0.000
12.47	1.58	321.30	1.00	321.30	58	1947	0.49	0.035	0.01	7.11	0.01	0.000
12.63	1.61	354.76	1.00	354.76	64	2234	0.49	0.028	0.01	7.11	0.00	0.000
12.80	1.62	342.97	1.00	342.97	62	2202	0.49	0.029	0.01	7.11	0.00	0.000
12.96	1.58	305.33	1.00	305.33	55	1891	0.49	0.039	0.01	7.11	0.01	0.000
13.12	1.55	268.12	1.00	268.12	48	1610	0.49	0.055	0.02	7.11	0.01	0.000
13.29	1.55	250.90	1.00	250.90	45	1516	0.49	0.064	0.02	7.11	0.01	0.000
13.45	1.57	240.10	1.00	240.10	43	1501	0.49	0.067	0.03	7.11	0.01	0.000
13.62	1.59	249.94	1.00	249.94	45	1596	0.49	0.059	0.02	7.11	0.01	0.000
13.78	1.56	259.13	1.00	259.13	46	1622	0.49	0.058	0.02	7.11	0.01	0.000
13.94	1.50	260.40	1.00	260.40	45	1521	0.49	0.068	0.03	7.11	0.01	0.000
14.11	1.47	251.49	1.00	251.49	44	1427	0.49	0.081	0.03	7.11	0.02	0.000
14.27	1.43	248.71	1.00	248.71	42	1348	0.49	0.096	0.04	7.11	0.02	0.000
14.44	1.43	254.29	1.00	254.29	43	1382	0.49	0.092	0.04	7.11	0.02	0.000
14.60	1.44	260.27	1.00	260.27	45	1443	0.49	0.084	0.03	7.11	0.02	0.000
14.76	1.45	265.71	1.00	265.71	46	1494	0.49	0.078	0.03	7.11	0.02	0.000
14.93	1.46	254.84	1.00	254.84	44	1454	0.49	0.085	0.03	7.11	0.02	0.000
15.09	1.46	237.84	1.00	237.84	41	1366	0.49	0.102	0.04	7.11	0.02	0.000
15.26	1.52	203.81	1.00	203.81	36	1265	0.49	0.131	0.06	7.11	0.03	0.001
15.42	1.63	167.63	1.00	167.63	31	1201	0.49	0.157	0.09	7.11	0.05	0.001
15.58	1.81	126.73	1.12	141.32	27	1142	0.49	0.190	0.13	7.11	0.07	0.001
15.75	2.00	96.71	1.30	125.55	26	1106	0.49	0.217	0.16	7.11	0.08	0.002

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
15.91	2.05	97.31	1.38	133.84	28	1198	0.49	0.168	0.11	7.11	0.06	0.001
16.08	1.90	132.36	1.19	157.30	32	1355	0.49	0.117	0.07	7.11	0.04	0.001
16.24	1.85	170.37	1.15	195.18	38	1652	0.49	0.071	0.03	7.11	0.02	0.000
16.40	1.77	192.10	1.09	209.14	40	1704	0.49	0.068	0.03	7.11	0.02	0.000
16.57	1.70	213.71	1.04	222.08	41	1740	0.49	0.066	0.03	7.11	0.01	0.000
16.73	1.57	220.33	1.00	220.33	39	1532	0.49	0.090	0.04	7.11	0.02	0.000
16.90	1.60	227.06	1.00	227.06	41	1647	0.49	0.077	0.03	7.11	0.02	0.000
17.06	1.76	206.39	1.08	222.04	42	1830	0.49	0.062	0.03	7.11	0.01	0.000
17.22	1.89	211.94	1.18	250.53	50	2249	0.49	0.042	0.01	7.11	0.01	0.000
17.39	1.90	230.62	1.18	273.22	55	2472	0.49	0.036	0.01	7.11	0.01	0.000
17.55	1.82	263.14	1.12	295.47	58	2583	0.49	0.034	0.01	7.11	0.00	0.000
17.72	1.82	242.69	1.12	271.35	53	2377	0.48	0.040	0.01	7.11	0.01	0.000
17.88	1.84	218.06	1.13	247.33	48	2207	0.48	0.046	0.02	7.11	0.01	0.000
18.04	1.89	186.02	1.18	219.99	44	2038	0.48	0.054	0.02	7.11	0.01	0.000
18.21	1.87	178.78	1.16	208.12	41	1919	0.48	0.062	0.03	7.11	0.01	0.000
18.37	1.91	155.54	1.20	187.14	38	1774	0.48	0.074	0.03	7.11	0.02	0.000
18.54	2.03	124.79	1.34	166.81	35	1657	0.48	0.088	0.04	7.11	0.02	0.000
18.70	2.10	107.19	1.46	156.72	34	1584	0.48	0.100	0.05	7.11	0.03	0.001
18.86	2.16	95.77	1.58	151.14	34	1536	0.48	0.110	0.06	7.11	0.03	0.001
19.03	2.20	90.25	1.67	150.75	34	1535	0.48	0.112	0.06	7.11	0.03	0.001
19.19	2.21	90.25	1.68	151.95	34	1556	0.48	0.110	0.06	7.11	0.03	0.001
19.36	2.21	91.80	1.69	155.10	35	1598	0.48	0.104	0.05	7.11	0.03	0.000
19.52	2.20	92.94	1.67	155.38	35	1613	0.48	0.103	0.05	7.11	0.03	0.000
19.69	2.21	93.32	1.68	156.76	35	1637	0.48	0.100	0.05	7.11	0.02	0.000
19.85	2.20	93.78	1.68	157.20	36	1653	0.48	0.099	0.05	7.11	0.02	0.000
20.01	2.19	96.55	1.64	158.59	36	1681	0.48	0.096	0.05	7.11	0.02	0.000
20.18	2.10	102.66	1.46	150.25	33	1605	0.48	0.110	0.06	7.11	0.03	0.001
20.34	2.00	112.54	1.30	146.84	31	1546	0.48	0.124	0.07	7.11	0.03	0.001
20.51	1.96	119.23	1.25	149.28	31	1555	0.48	0.123	0.07	7.11	0.03	0.001
20.67	1.92	132.17	1.21	159.69	32	1640	0.48	0.108	0.06	7.11	0.03	0.001
20.83	1.70	192.96	1.04	200.79	38	1798	0.48	0.087	0.04	7.11	0.02	0.000
21.00	1.51	254.86	1.00	254.86	45	1828	0.48	0.085	0.03	7.11	0.01	0.000
21.16	1.40	305.94	1.00	305.94	52	1893	0.48	0.079	0.03	7.11	0.01	0.000
21.33	1.40	302.74	1.00	302.74	51	1891	0.48	0.081	0.03	7.11	0.01	0.000
21.49	1.40	299.55	1.00	299.55	51	1889	0.48	0.082	0.03	7.11	0.01	0.000
21.65	1.41	296.83	1.00	296.83	50	1889	0.48	0.083	0.03	7.11	0.01	0.000
21.82	1.41	294.36	1.00	294.36	50	1896	0.48	0.083	0.03	7.11	0.01	0.000
21.98	1.42	292.16	1.00	292.16	50	1903	0.48	0.083	0.03	7.11	0.01	0.000
22.15	1.42	290.33	1.00	290.33	49	1911	0.48	0.083	0.03	7.11	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.04

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

Petra Geosciences, Inc.
3186 Airway Avenue, Suite K
Costa Mesa, CA 92626
www.petra-inc.com

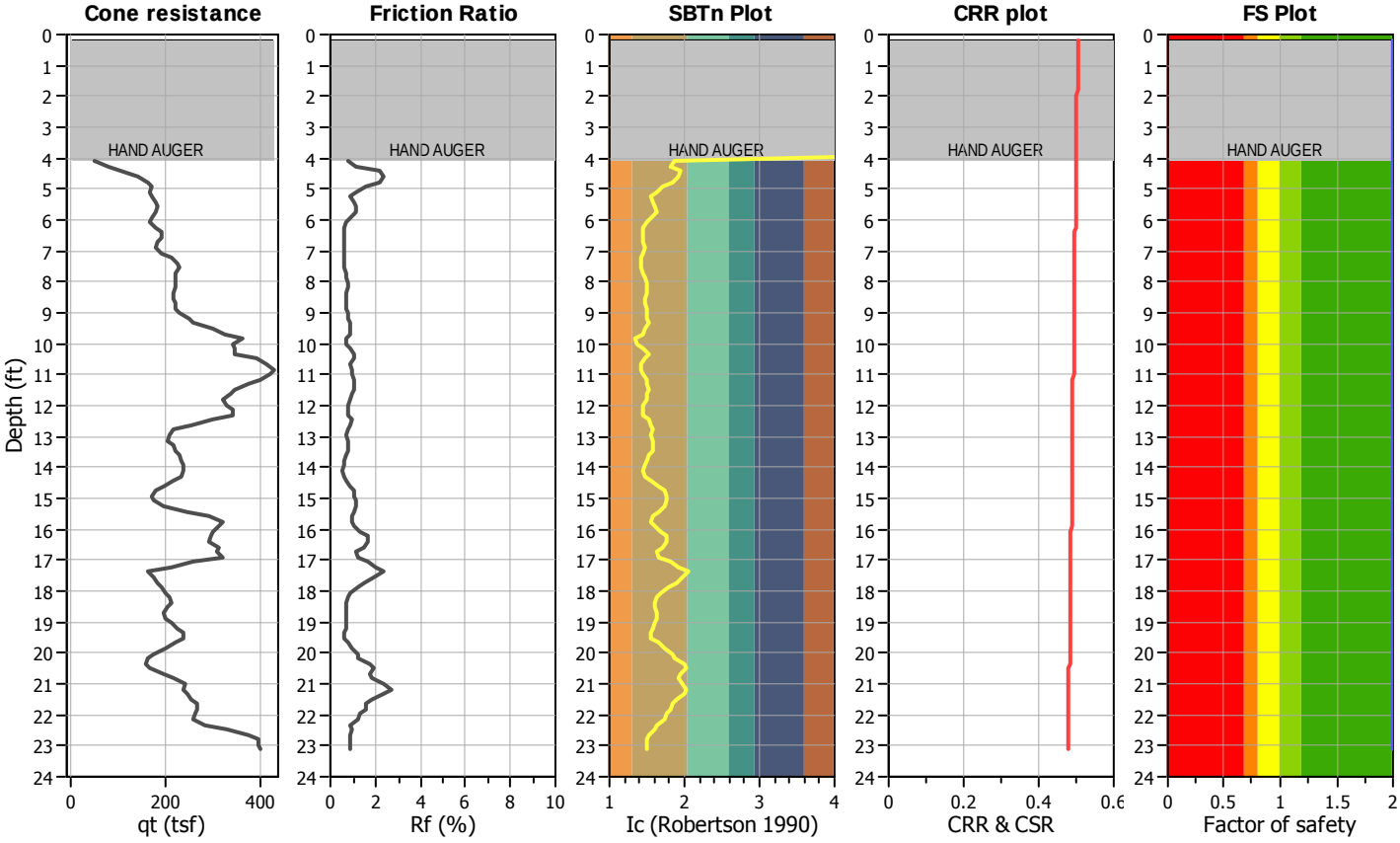
LIQUEFACTION ANALYSIS REPORT

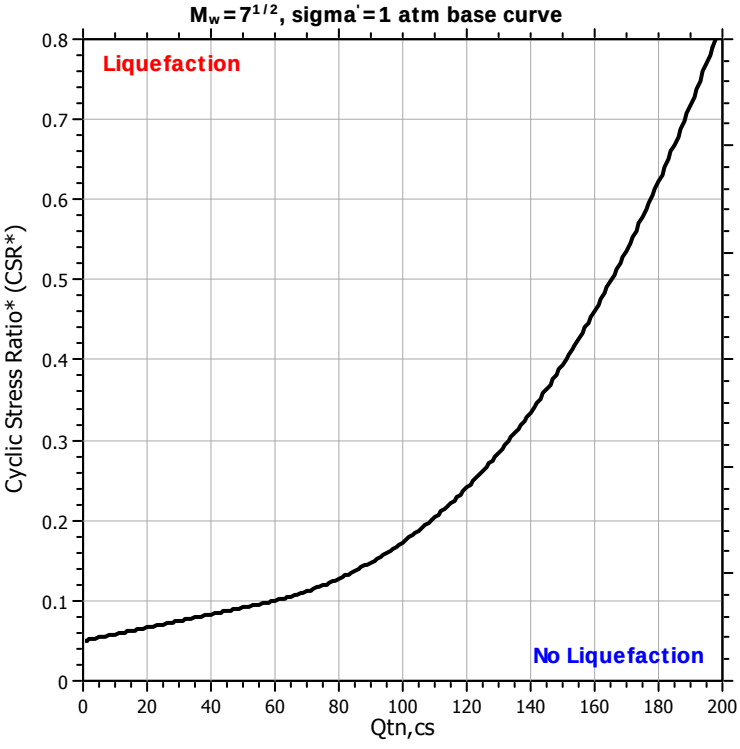
Project title : 19-433, Western Realco **Location : 1375 Magnolia Avenue, Corona, CA**

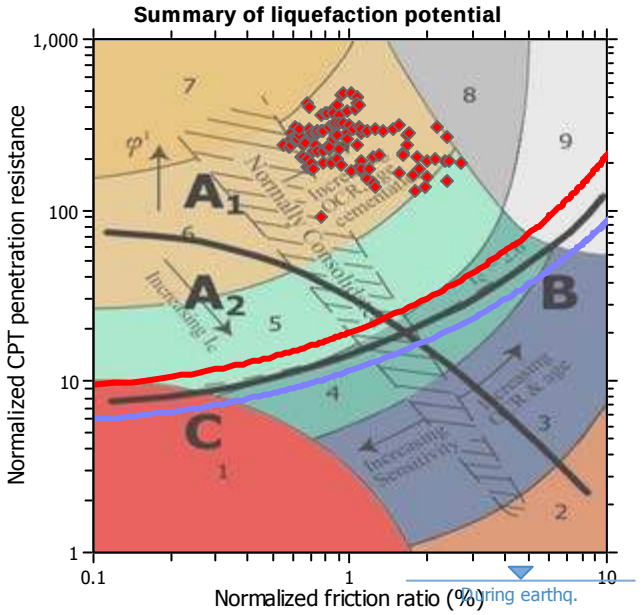
CPT file : CPT-4

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	45.00 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:	6.47	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.87	Unit weight calculation:	Based on SBT	K_σ applied:	No		

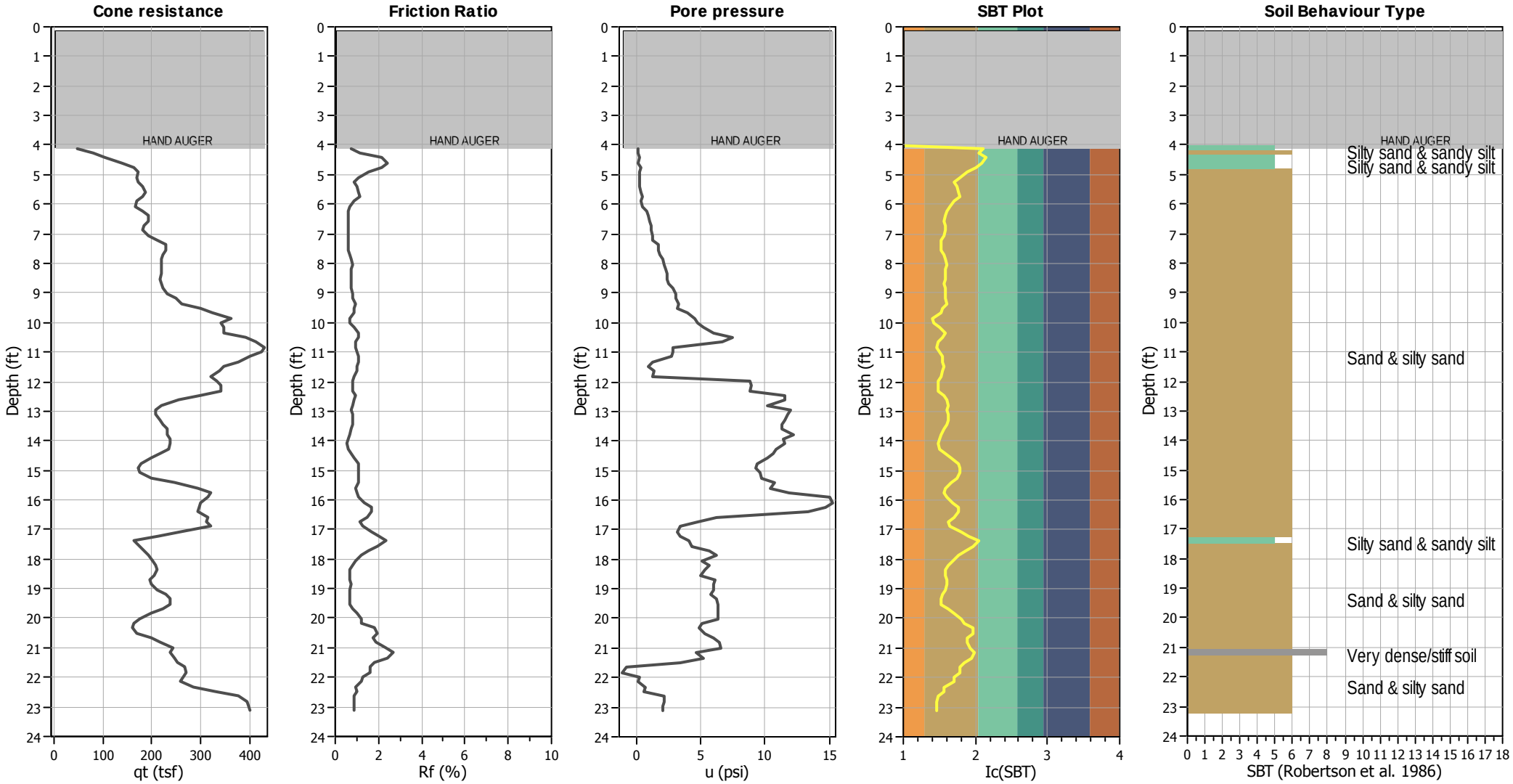






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



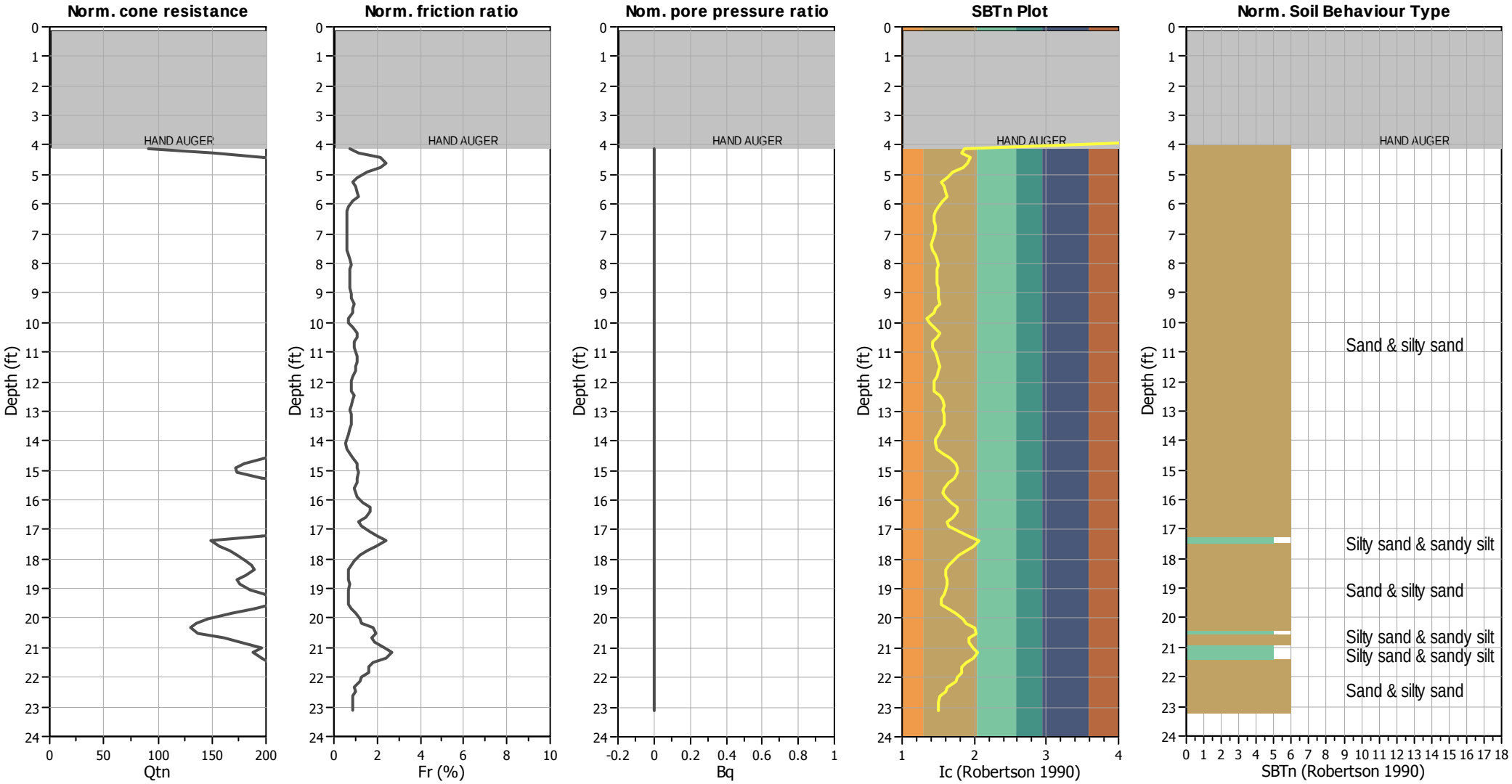
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 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

CPT basic interpretation plots (normalized)



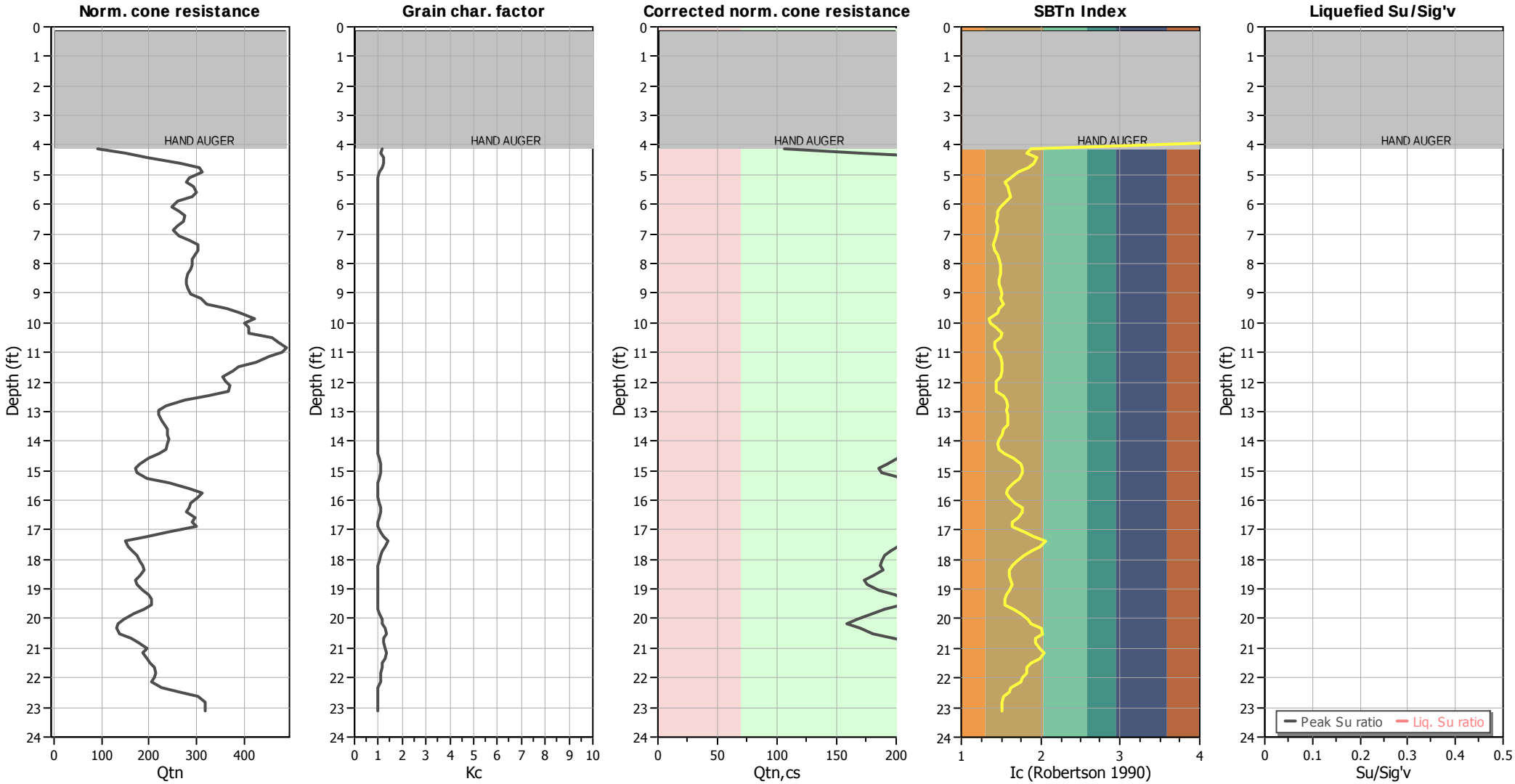
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn 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

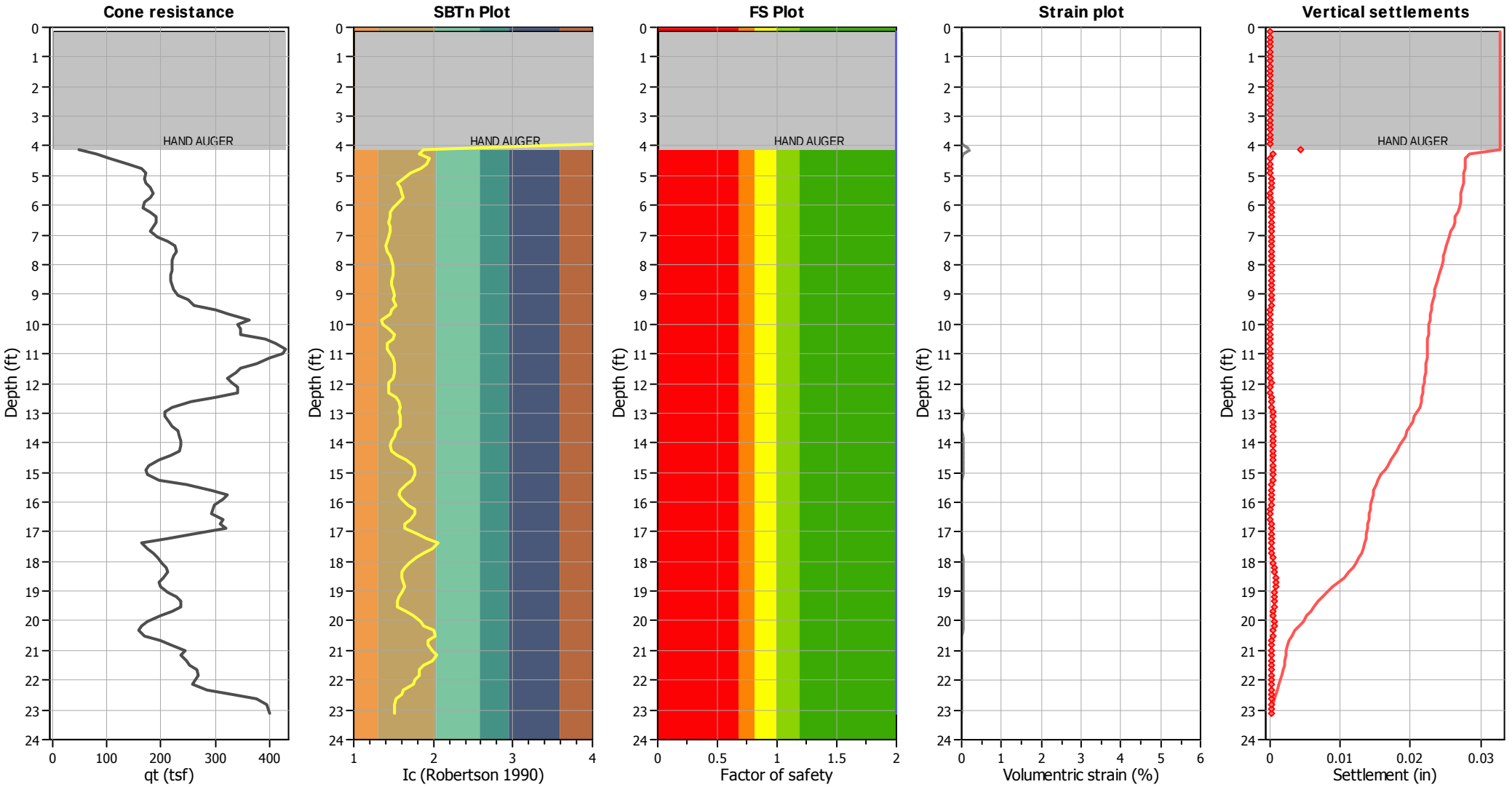
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.16	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.33	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.49	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.66	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.82	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.98	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.15	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.31	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.48	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.64	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.80	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.97	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.13	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.30	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.46	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.62	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.79	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.95	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.12	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.28	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.44	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.61	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.77	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.94	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.10	1.87	91.65	1.16	106.47	21	466	0.50	0.361	0.34	7.11	0.23	0.004
4.27	1.82	151.26	1.12	169.66	33	722	0.50	0.064	0.04	7.11	0.02	0.000
4.43	1.95	197.11	1.24	244.14	50	1107	0.50	0.024	0.01	7.11	0.01	0.000
4.59	1.91	265.17	1.20	318.13	64	1420	0.50	0.016	0.00	7.11	0.00	0.000
4.76	1.84	307.98	1.14	349.92	69	1505	0.50	0.015	0.00	7.11	0.00	0.000
4.92	1.71	313.20	1.05	327.64	61	1358	0.50	0.019	0.00	7.11	0.00	0.000
5.09	1.62	286.37	1.00	286.37	52	1174	0.50	0.026	0.01	7.11	0.01	0.000
5.25	1.55	277.86	1.00	277.86	49	1094	0.50	0.031	0.01	7.11	0.01	0.000
5.41	1.58	295.04	1.00	295.04	53	1211	0.50	0.027	0.01	7.11	0.01	0.000
5.58	1.61	300.90	1.00	300.90	54	1276	0.50	0.025	0.01	7.11	0.00	0.000
5.74	1.63	291.17	1.00	291.17	53	1277	0.50	0.026	0.01	7.11	0.01	0.000
5.91	1.56	261.82	1.00	261.82	47	1099	0.50	0.037	0.01	7.11	0.01	0.000
6.07	1.50	249.41	1.00	249.41	43	1001	0.50	0.049	0.02	7.11	0.01	0.000
6.23	1.46	262.78	1.00	262.78	45	1032	0.50	0.047	0.02	7.11	0.01	0.000
6.40	1.45	274.84	1.00	274.84	47	1084	0.50	0.043	0.02	7.11	0.01	0.000
6.56	1.44	271.28	1.00	271.28	47	1073	0.50	0.046	0.02	7.11	0.01	0.000
6.73	1.46	260.29	1.00	260.29	45	1052	0.50	0.051	0.02	7.11	0.01	0.000
6.89	1.47	252.39	1.00	252.39	44	1039	0.50	0.054	0.02	7.11	0.01	0.000
7.05	1.44	263.83	1.00	263.83	45	1075	0.50	0.052	0.02	7.11	0.01	0.000
7.22	1.42	284.49	1.00	284.49	48	1142	0.50	0.046	0.02	7.11	0.01	0.000
7.38	1.41	302.41	1.00	302.41	51	1214	0.50	0.042	0.01	7.11	0.01	0.000
7.55	1.42	301.90	1.00	301.90	51	1241	0.50	0.041	0.01	7.11	0.01	0.000
7.71	1.46	296.11	1.00	296.11	51	1266	0.50	0.041	0.01	7.11	0.01	0.000
7.87	1.48	291.85	1.00	291.85	51	1290	0.50	0.040	0.01	7.11	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
8.04	1.50	291.41	1.00	291.41	51	1320	0.50	0.040	0.01	7.11	0.01	0.000
8.20	1.49	286.87	1.00	286.87	50	1304	0.50	0.042	0.01	7.11	0.01	0.000
8.37	1.49	282.50	1.00	282.50	49	1293	0.50	0.044	0.01	7.11	0.01	0.000
8.53	1.48	277.54	1.00	277.54	48	1272	0.49	0.047	0.02	7.11	0.01	0.000
8.69	1.48	279.03	1.00	279.03	48	1288	0.49	0.047	0.02	7.11	0.01	0.000
8.86	1.49	281.58	1.00	281.58	49	1327	0.49	0.045	0.02	7.11	0.01	0.000
9.02	1.51	289.25	1.00	289.25	51	1391	0.49	0.042	0.01	7.11	0.01	0.000
9.19	1.50	310.20	1.00	310.20	54	1497	0.49	0.037	0.01	7.11	0.01	0.000
9.35	1.52	322.56	1.00	322.56	57	1602	0.49	0.034	0.01	7.11	0.01	0.000
9.51	1.47	365.74	1.00	365.74	63	1734	0.49	0.030	0.01	7.11	0.00	0.000
9.68	1.45	390.76	1.00	390.76	67	1828	0.49	0.028	0.01	7.11	0.00	0.000
9.84	1.35	423.96	1.00	423.96	71	1793	0.49	0.029	0.01	7.11	0.00	0.000
10.01	1.37	399.95	1.00	399.95	67	1750	0.49	0.031	0.01	7.11	0.00	0.000
10.17	1.45	409.74	1.00	409.74	70	1956	0.49	0.027	0.01	7.11	0.00	0.000
10.33	1.52	409.31	1.00	409.31	72	2123	0.49	0.024	0.01	7.11	0.00	0.000
10.50	1.49	458.69	1.00	458.69	80	2313	0.49	0.021	0.00	7.11	0.00	0.000
10.66	1.43	472.32	1.00	472.32	81	2249	0.49	0.023	0.00	7.11	0.00	0.000
10.83	1.42	490.35	1.00	490.35	84	2345	0.49	0.022	0.00	7.11	0.00	0.000
10.99	1.45	481.84	1.00	481.84	83	2398	0.49	0.021	0.00	7.11	0.00	0.000
11.15	1.49	454.10	1.00	454.10	79	2372	0.49	0.022	0.00	7.11	0.00	0.000
11.32	1.51	425.52	1.00	425.52	74	2277	0.49	0.024	0.00	7.11	0.00	0.000
11.48	1.52	390.72	1.00	390.72	69	2128	0.49	0.027	0.01	7.11	0.00	0.000
11.65	1.50	376.76	1.00	376.76	66	2037	0.49	0.030	0.01	7.11	0.00	0.000
11.81	1.49	355.91	1.00	355.91	62	1907	0.49	0.034	0.01	7.11	0.01	0.000
11.98	1.44	362.33	1.00	362.33	62	1836	0.49	0.037	0.01	7.11	0.01	0.000
12.14	1.44	370.29	1.00	370.29	63	1890	0.49	0.036	0.01	7.11	0.01	0.000
12.30	1.45	368.33	1.00	368.33	63	1912	0.49	0.036	0.01	7.11	0.01	0.000
12.47	1.53	325.88	1.00	325.88	57	1870	0.49	0.038	0.01	7.11	0.01	0.000
12.63	1.56	275.22	1.00	275.22	49	1646	0.49	0.050	0.02	7.11	0.01	0.000
12.80	1.58	235.52	1.00	235.52	42	1455	0.49	0.067	0.03	7.11	0.02	0.000
12.96	1.56	221.75	1.00	221.75	40	1353	0.49	0.082	0.04	7.11	0.02	0.000
13.12	1.58	219.31	1.00	219.31	39	1378	0.49	0.080	0.04	7.11	0.02	0.000
13.29	1.59	227.17	1.00	227.17	41	1444	0.49	0.073	0.03	7.11	0.02	0.000
13.45	1.58	232.21	1.00	232.21	42	1466	0.49	0.071	0.03	7.11	0.02	0.000
13.62	1.54	239.17	1.00	239.17	42	1446	0.49	0.075	0.03	7.11	0.02	0.000
13.78	1.51	239.97	1.00	239.97	42	1404	0.49	0.083	0.03	7.11	0.02	0.000
13.94	1.47	242.35	1.00	242.35	42	1370	0.49	0.090	0.04	7.11	0.02	0.000
14.11	1.45	240.13	1.00	240.13	41	1334	0.49	0.099	0.04	7.11	0.02	0.000
14.27	1.47	236.07	1.00	236.07	41	1352	0.49	0.097	0.04	7.11	0.02	0.000
14.44	1.56	220.23	1.00	220.23	39	1401	0.49	0.090	0.04	7.11	0.02	0.000
14.60	1.65	199.58	1.01	200.90	37	1437	0.49	0.086	0.04	7.11	0.02	0.000
14.76	1.75	180.24	1.07	192.62	37	1459	0.49	0.084	0.04	7.11	0.02	0.000
14.93	1.77	171.73	1.08	185.87	35	1433	0.49	0.090	0.05	7.11	0.02	0.000
15.09	1.76	173.78	1.08	187.95	36	1457	0.49	0.087	0.04	7.11	0.02	0.000
15.26	1.73	195.60	1.06	206.59	39	1576	0.49	0.073	0.03	7.11	0.02	0.000
15.42	1.65	242.21	1.00	243.31	45	1789	0.49	0.056	0.02	7.11	0.01	0.000
15.58	1.58	285.31	1.00	285.31	51	1932	0.49	0.049	0.02	7.11	0.01	0.000
15.75	1.56	311.90	1.00	311.90	56	2081	0.49	0.043	0.01	7.11	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
15.91	1.60	304.27	1.00	304.27	55	2141	0.49	0.042	0.01	7.11	0.01	0.000
16.08	1.68	287.61	1.03	295.12	55	2260	0.49	0.038	0.01	7.11	0.01	0.000
16.24	1.77	284.12	1.09	308.79	59	2512	0.49	0.033	0.01	7.11	0.00	0.000
16.40	1.77	277.99	1.09	302.08	58	2473	0.49	0.034	0.01	7.11	0.00	0.000
16.57	1.71	296.49	1.04	309.40	58	2449	0.49	0.035	0.01	7.11	0.01	0.000
16.73	1.63	291.52	1.00	291.52	53	2196	0.49	0.043	0.01	7.11	0.01	0.000
16.90	1.65	299.78	1.00	300.57	55	2322	0.49	0.039	0.01	7.11	0.01	0.000
17.06	1.81	240.00	1.11	267.20	52	2293	0.49	0.041	0.01	7.11	0.01	0.000
17.22	1.92	196.21	1.21	237.47	48	2179	0.49	0.045	0.02	7.11	0.01	0.000
17.39	2.06	148.98	1.39	206.39	44	1985	0.49	0.055	0.02	7.11	0.01	0.000
17.55	1.98	157.67	1.27	200.84	41	1908	0.49	0.060	0.02	7.11	0.01	0.000
17.72	1.88	166.78	1.17	195.52	39	1792	0.48	0.070	0.03	7.11	0.02	0.000
17.88	1.79	173.25	1.10	190.30	37	1659	0.48	0.084	0.04	7.11	0.02	0.000
18.04	1.70	181.68	1.03	187.95	35	1549	0.48	0.102	0.05	7.11	0.03	0.001
18.21	1.64	186.82	1.00	186.82	34	1488	0.48	0.115	0.06	7.11	0.03	0.001
18.37	1.60	188.69	1.00	188.69	34	1439	0.48	0.129	0.07	7.11	0.03	0.001
18.54	1.60	181.06	1.00	181.06	33	1392	0.48	0.144	0.08	7.11	0.04	0.001
18.70	1.63	172.71	1.00	172.71	31	1378	0.48	0.151	0.09	7.11	0.04	0.001
18.86	1.63	175.47	1.00	175.47	32	1410	0.48	0.143	0.08	7.11	0.04	0.001
19.03	1.60	185.57	1.00	185.57	34	1444	0.48	0.135	0.07	7.11	0.04	0.001
19.19	1.58	198.57	1.00	198.57	36	1495	0.48	0.124	0.06	7.11	0.03	0.001
19.36	1.55	206.46	1.00	206.46	37	1512	0.48	0.122	0.06	7.11	0.03	0.001
19.52	1.55	205.36	1.00	205.36	36	1506	0.48	0.125	0.06	7.11	0.03	0.001
19.69	1.65	189.82	1.00	190.63	35	1603	0.48	0.107	0.05	7.11	0.03	0.001
19.85	1.74	169.53	1.07	180.78	34	1623	0.48	0.105	0.06	7.11	0.03	0.001
20.01	1.85	145.64	1.14	166.71	33	1617	0.48	0.108	0.06	7.11	0.03	0.001
20.18	1.88	135.08	1.17	157.96	31	1568	0.48	0.119	0.07	7.11	0.03	0.001
20.34	2.00	130.31	1.30	169.80	35	1795	0.48	0.085	0.04	7.11	0.02	0.000
20.51	2.02	136.59	1.32	180.76	38	1932	0.48	0.073	0.03	7.11	0.02	0.000
20.67	1.94	161.19	1.22	197.24	40	2051	0.48	0.065	0.03	7.11	0.01	0.000
20.83	1.93	176.46	1.22	214.54	43	2235	0.48	0.056	0.02	7.11	0.01	0.000
21.00	1.98	195.44	1.27	248.98	51	2671	0.48	0.041	0.01	7.11	0.01	0.000
21.16	2.04	188.21	1.35	254.81	54	2804	0.48	0.038	0.01	7.11	0.01	0.000
21.33	1.99	195.67	1.29	252.08	52	2748	0.48	0.040	0.01	7.11	0.01	0.000
21.49	1.88	202.05	1.17	237.27	47	2466	0.48	0.049	0.02	7.11	0.01	0.000
21.65	1.83	212.61	1.13	240.03	47	2421	0.48	0.051	0.02	7.11	0.01	0.000
21.82	1.83	213.30	1.13	240.49	47	2435	0.48	0.051	0.02	7.11	0.01	0.000
21.98	1.76	210.55	1.08	226.99	43	2199	0.48	0.062	0.02	7.11	0.01	0.000
22.15	1.75	205.05	1.07	219.66	42	2122	0.48	0.068	0.03	7.11	0.01	0.000
22.31	1.62	227.88	1.00	227.88	41	1985	0.48	0.079	0.03	7.11	0.01	0.000
22.47	1.60	264.04	1.00	264.04	48	2249	0.48	0.061	0.02	7.11	0.01	0.000
22.64	1.53	302.84	1.00	302.84	53	2329	0.48	0.058	0.02	7.11	0.01	0.000
22.80	1.51	317.65	1.00	317.65	56	2386	0.48	0.056	0.02	7.11	0.01	0.000
22.97	1.51	317.98	1.00	317.98	56	2419	0.48	0.055	0.02	7.11	0.01	0.000
23.13	1.51	320.04	1.00	320.04	56	2441	0.48	0.055	0.02	7.11	0.01	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.03

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

Petra Geosciences, Inc.
3186 Airway Avenue, Suite K
Costa Mesa, CA 92626
www.petra-inc.com

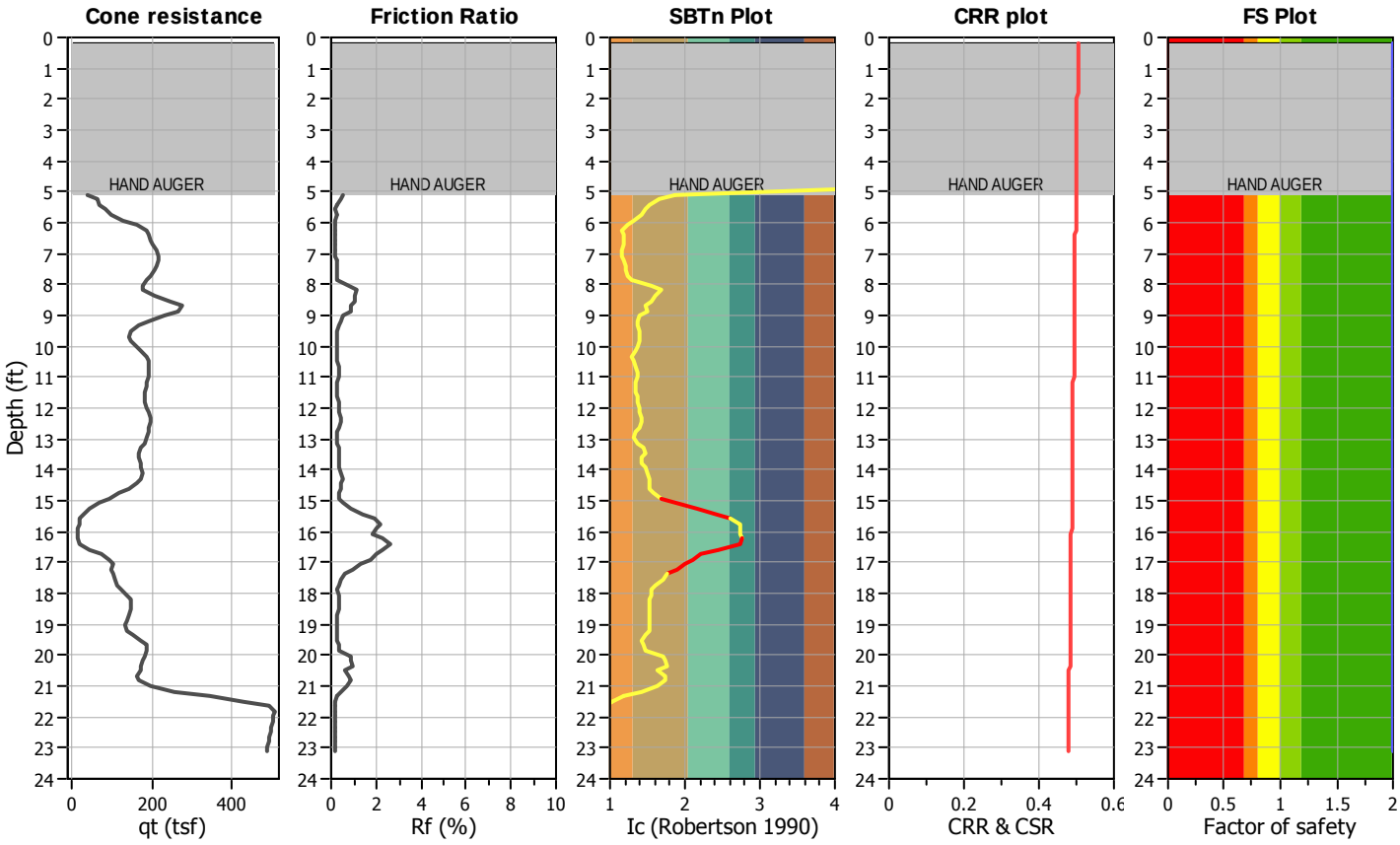
LIQUEFACTION ANALYSIS REPORT

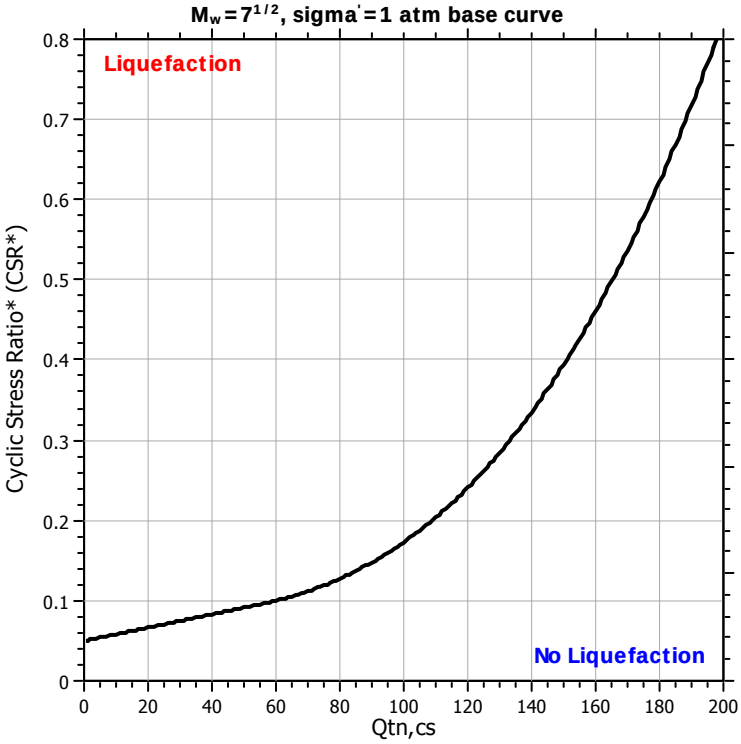
Project title : 19-433, Western Realco **Location : 1375 Magnolia Avenue, Corona, CA**

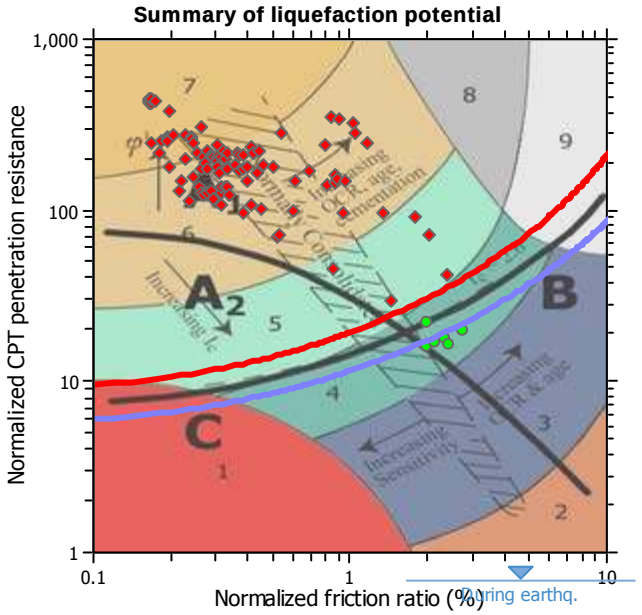
CPT file : CPT-5

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	45.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	45.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	6.47	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	N/A
Peak ground acceleration:	0.87	Unit weight calculation:	Based on SBT	K_σ applied:	No	MSF method:	Method based

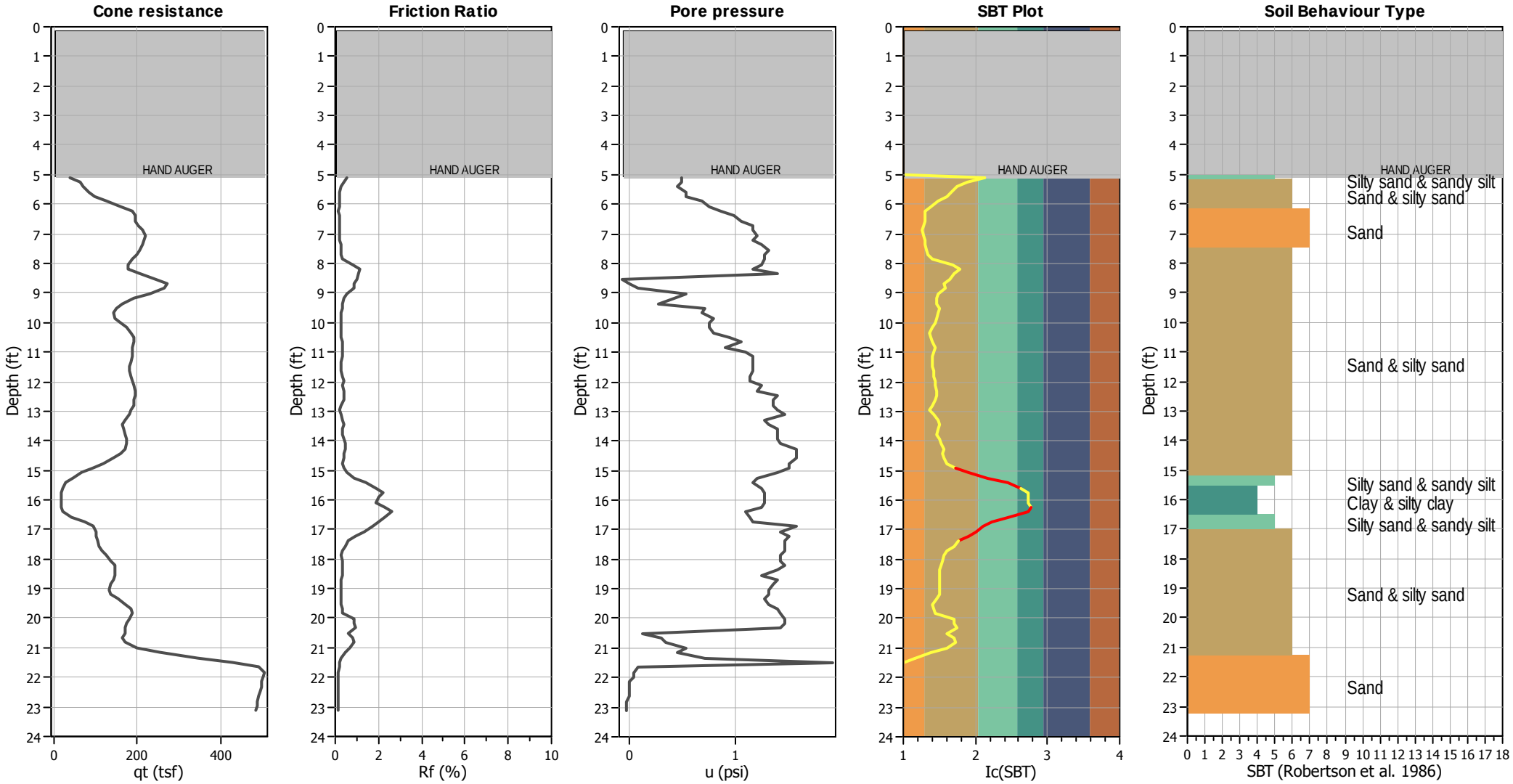






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



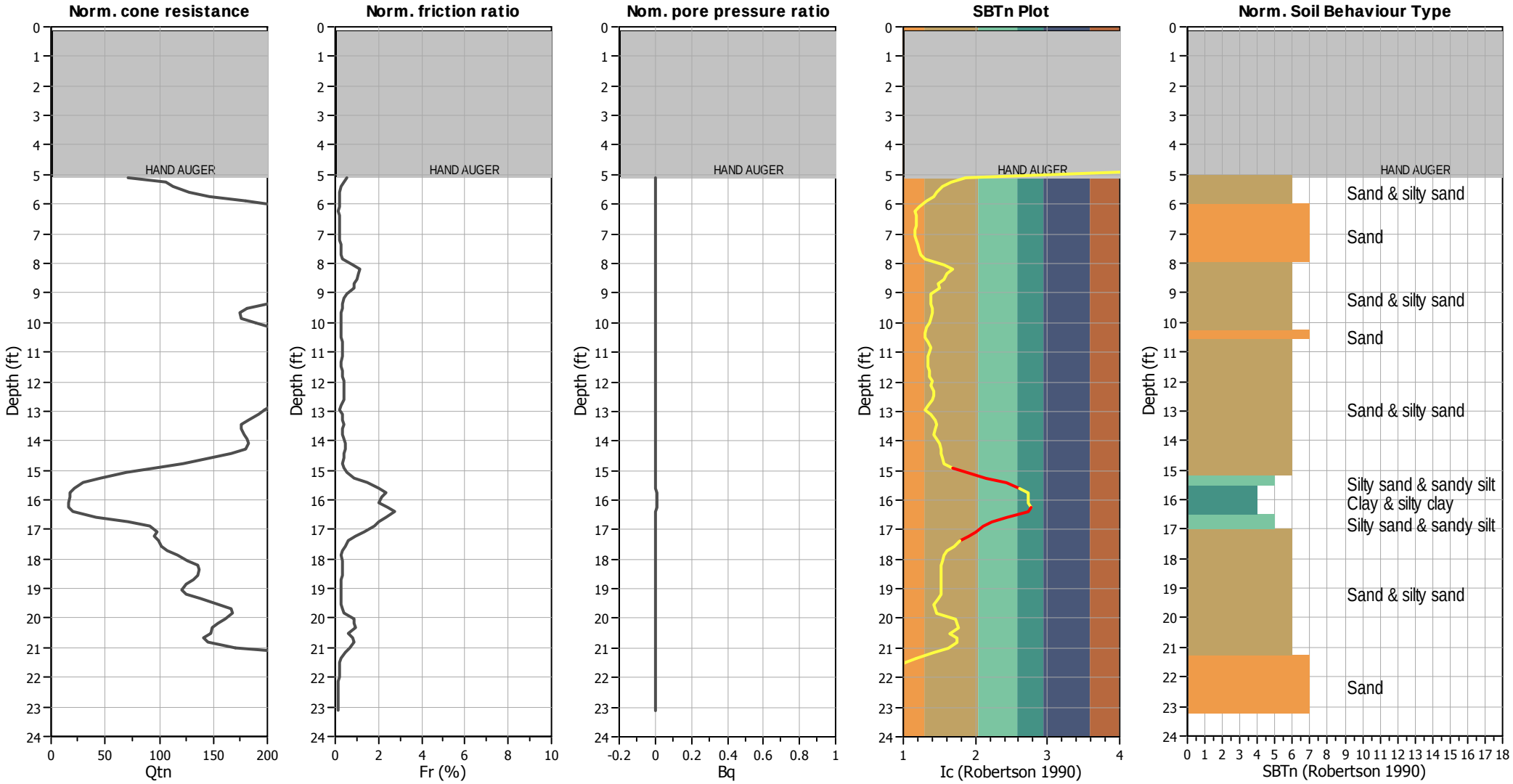
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 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

CPT basic interpretation plots (normalized)



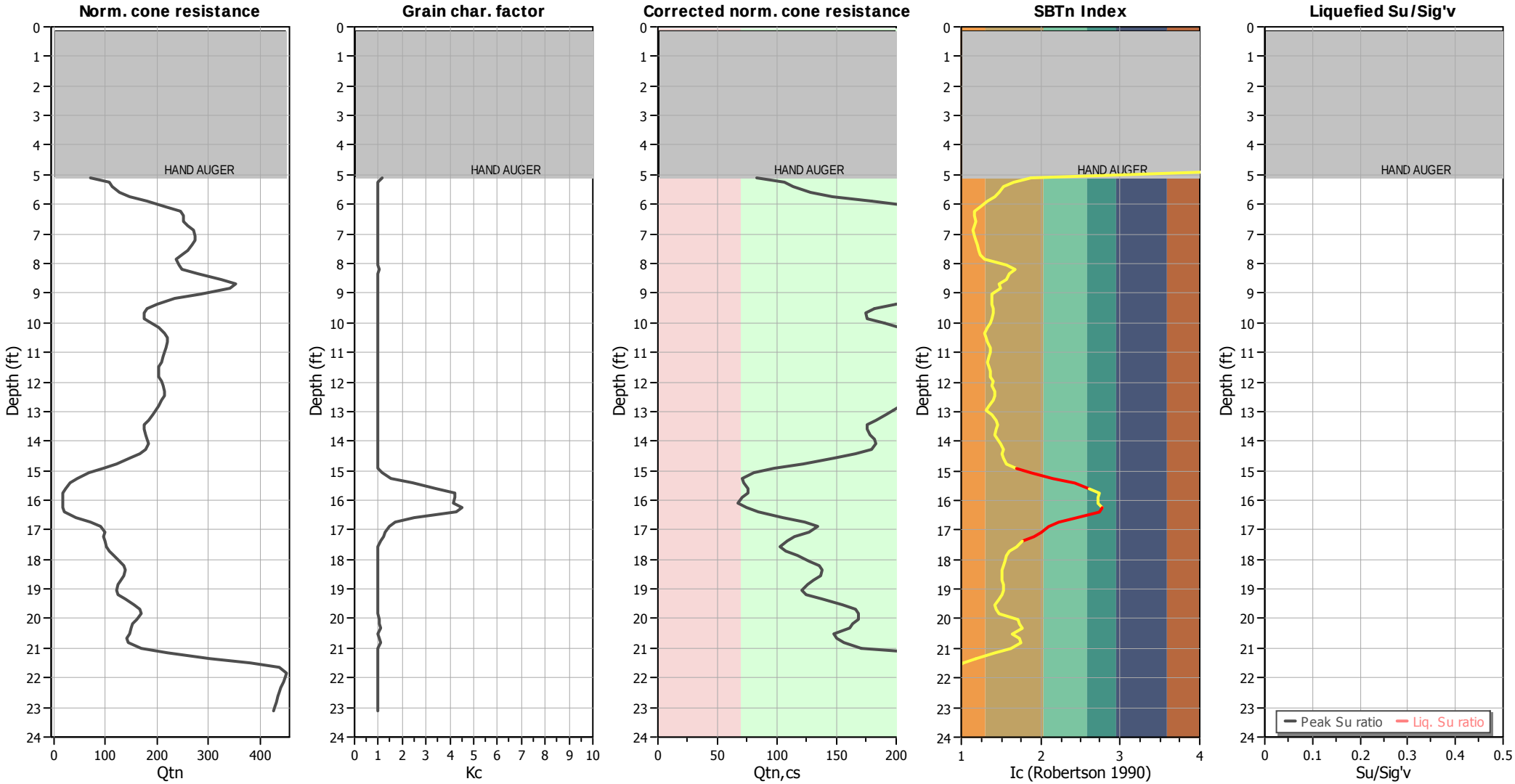
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn 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

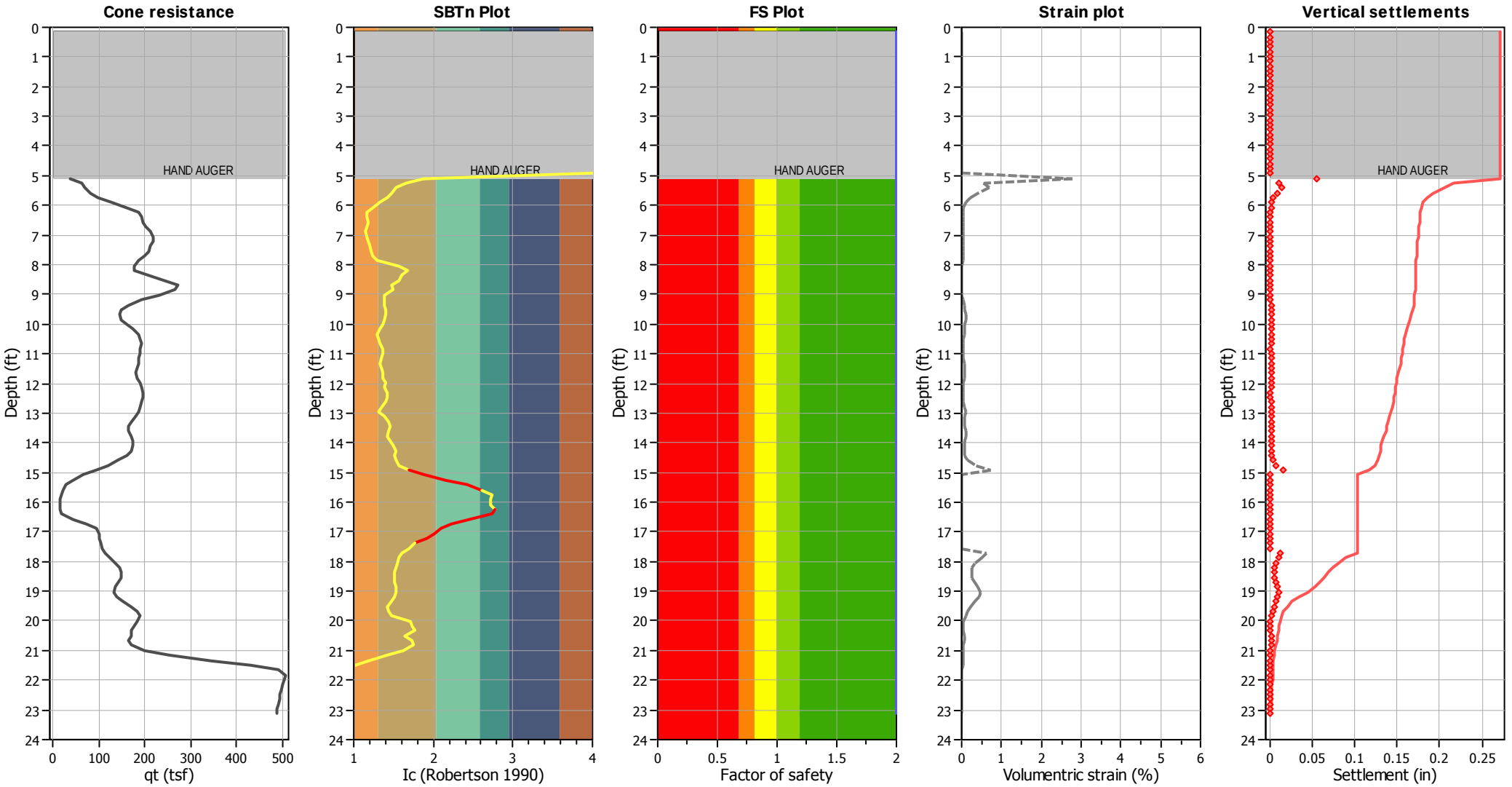
Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	45.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.47	Unit weight calculation:	Based on SBT	Clay like behavior applied:	All soils
Peak ground acceleration:	0.87	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	45.00 ft	Fill height:	N/A	Limit depth:	N/A

Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

:: Post-earthquake settlement of dry sands ::

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
0.16	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.33	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.49	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.66	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.82	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
0.98	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.15	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.31	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.48	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.64	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.80	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
1.97	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.13	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.30	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.46	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.62	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.79	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
2.95	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.12	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.28	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.44	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.61	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.77	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
3.94	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.10	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.27	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.43	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.59	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.76	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
4.92	4.06	-1.00	26.61	-26.61	0	0	0.50	0.000	0.00	0.00	0.00	0.000
5.09	1.87	71.08	1.16	82.69	16	362	0.50	3.356	4.26	7.11	2.78	0.055
5.25	1.67	106.44	1.00	106.44	20	457	0.50	0.800	0.82	7.11	0.53	0.010
5.41	1.54	113.08	1.00	113.08	20	443	0.50	1.052	1.05	7.11	0.68	0.013
5.58	1.47	127.96	1.00	127.96	22	481	0.50	0.699	0.62	7.11	0.40	0.008
5.74	1.42	146.50	1.00	146.50	25	533	0.50	0.428	0.33	7.11	0.21	0.004
5.91	1.32	179.87	1.00	179.87	30	607	0.50	0.243	0.15	7.11	0.10	0.002
6.07	1.23	217.79	1.00	217.79	35	687	0.50	0.153	0.08	7.11	0.05	0.001
6.23	1.17	246.18	1.00	246.18	39	740	0.50	0.122	0.05	7.11	0.04	0.001
6.40	1.17	252.42	1.00	252.42	40	770	0.50	0.111	0.05	7.11	0.03	0.001
6.56	1.18	252.83	1.00	252.83	40	783	0.50	0.110	0.05	7.11	0.03	0.001
6.73	1.17	259.22	1.00	259.22	41	801	0.50	0.106	0.05	7.11	0.03	0.001
6.89	1.16	270.06	1.00	270.06	42	828	0.50	0.100	0.04	7.11	0.03	0.001
7.05	1.16	275.27	1.00	275.27	43	854	0.50	0.094	0.04	7.11	0.02	0.000
7.22	1.18	273.63	1.00	273.63	43	873	0.50	0.092	0.04	7.11	0.02	0.000
7.38	1.20	268.50	1.00	268.50	43	876	0.50	0.094	0.04	7.11	0.02	0.000
7.55	1.21	260.81	1.00	260.81	42	867	0.50	0.102	0.04	7.11	0.03	0.001
7.71	1.24	249.55	1.00	249.55	40	853	0.50	0.113	0.05	7.11	0.03	0.001
7.87	1.30	238.11	1.00	238.11	39	870	0.50	0.110	0.05	7.11	0.03	0.001

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
8.04	1.56	242.41	1.00	242.41	43	1151	0.50	0.051	0.02	7.11	0.01	0.000
8.20	1.68	248.78	1.02	254.44	47	1333	0.50	0.038	0.01	7.11	0.01	0.000
8.37	1.61	279.63	1.00	279.63	51	1416	0.50	0.034	0.01	7.11	0.01	0.000
8.53	1.56	325.45	1.00	325.45	58	1582	0.49	0.029	0.01	7.11	0.00	0.000
8.69	1.47	351.92	1.00	351.92	61	1587	0.49	0.029	0.01	7.11	0.00	0.000
8.86	1.50	341.32	1.00	341.32	60	1599	0.49	0.030	0.01	7.11	0.00	0.000
9.02	1.39	285.23	1.00	285.23	48	1205	0.49	0.056	0.02	7.11	0.01	0.000
9.19	1.38	235.67	1.00	235.67	40	988	0.49	0.100	0.04	7.11	0.03	0.001
9.35	1.38	200.54	1.00	200.54	34	847	0.49	0.176	0.09	7.11	0.06	0.001
9.51	1.40	181.39	1.00	181.39	31	789	0.49	0.242	0.14	7.11	0.09	0.002
9.68	1.40	174.42	1.00	174.42	29	761	0.49	0.293	0.18	7.11	0.11	0.002
9.84	1.38	175.76	1.00	175.76	30	761	0.49	0.306	0.19	7.11	0.11	0.002
10.01	1.36	189.65	1.00	189.65	32	807	0.49	0.247	0.14	7.11	0.08	0.002
10.17	1.33	202.53	1.00	202.53	34	840	0.49	0.217	0.12	7.11	0.07	0.001
10.33	1.30	214.75	1.00	214.75	35	864	0.49	0.201	0.10	7.11	0.06	0.001
10.50	1.31	219.75	1.00	219.75	36	901	0.49	0.177	0.09	7.11	0.05	0.001
10.66	1.34	221.72	1.00	221.72	37	941	0.49	0.156	0.08	7.11	0.04	0.001
10.83	1.37	218.39	1.00	218.39	37	970	0.49	0.145	0.07	7.11	0.04	0.001
10.99	1.36	216.01	1.00	216.01	36	949	0.49	0.161	0.08	7.11	0.05	0.001
11.15	1.35	211.48	1.00	211.48	35	922	0.49	0.185	0.09	7.11	0.05	0.001
11.32	1.34	207.81	1.00	207.81	34	901	0.49	0.208	0.11	7.11	0.06	0.001
11.48	1.35	203.74	1.00	203.74	34	899	0.49	0.216	0.11	7.11	0.07	0.001
11.65	1.36	202.59	1.00	202.59	34	911	0.49	0.212	0.11	7.11	0.06	0.001
11.81	1.36	204.37	1.00	204.37	34	930	0.49	0.202	0.11	7.11	0.06	0.001
11.98	1.39	209.05	1.00	209.05	35	989	0.49	0.166	0.08	7.11	0.05	0.001
12.14	1.39	212.47	1.00	212.47	36	1003	0.49	0.162	0.08	7.11	0.05	0.001
12.30	1.41	215.05	1.00	215.05	37	1052	0.49	0.142	0.07	7.11	0.04	0.001
12.47	1.42	214.95	1.00	214.95	37	1059	0.49	0.142	0.07	7.11	0.04	0.001
12.63	1.40	208.90	1.00	208.90	35	1018	0.49	0.167	0.08	7.11	0.05	0.001
12.80	1.35	204.07	1.00	204.07	34	941	0.49	0.230	0.12	7.11	0.07	0.001
12.96	1.31	197.06	1.00	197.06	32	874	0.49	0.319	0.18	7.11	0.10	0.002
13.12	1.38	191.63	1.00	191.63	32	925	0.49	0.260	0.15	7.11	0.08	0.002
13.29	1.44	182.86	1.00	182.86	31	947	0.49	0.244	0.14	7.11	0.08	0.002
13.45	1.46	175.61	1.00	175.61	30	945	0.49	0.252	0.15	7.11	0.08	0.002
13.62	1.43	175.17	1.00	175.17	30	913	0.49	0.297	0.18	7.11	0.10	0.002
13.78	1.43	177.85	1.00	177.85	30	925	0.49	0.289	0.18	7.11	0.10	0.002
13.94	1.46	181.17	1.00	181.17	31	987	0.49	0.230	0.13	7.11	0.07	0.001
14.11	1.50	182.87	1.00	182.87	32	1043	0.49	0.192	0.11	7.11	0.06	0.001
14.27	1.52	179.29	1.00	179.29	32	1063	0.49	0.184	0.11	7.11	0.06	0.001
14.44	1.52	166.43	1.00	166.43	29	982	0.49	0.254	0.16	7.11	0.09	0.002
14.60	1.54	147.33	1.00	147.33	26	897	0.49	0.378	0.28	7.11	0.15	0.003
14.76	1.57	121.99	1.00	121.99	22	778	0.49	0.761	0.69	7.11	0.37	0.007
14.93	1.69	96.97	1.00	96.97	18	714	0.49	1.238	1.40	7.11	0.75	0.015
15.09	1.88	69.13	1.17	80.94	0	0	0.49	0.000	0.00	0.00	0.00	0.000
15.26	2.15	45.94	1.55	71.00	0	0	0.49	0.000	0.00	0.00	0.00	0.000
15.42	2.43	29.77	2.43	72.26	0	0	0.49	0.000	0.00	0.00	0.00	0.000
15.58	2.61	22.05	3.40	75.01	0	0	0.49	0.000	0.00	0.00	0.00	0.000
15.75	2.73	17.89	4.22	75.50	0	0	0.49	0.000	0.00	0.00	0.00	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)
15.91	2.73	16.90	4.19	70.87	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.08	2.72	16.14	4.18	67.40	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.24	2.77	16.47	4.51	74.24	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.40	2.74	19.64	4.27	83.78	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.57	2.44	42.13	2.48	104.39	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.73	2.22	71.52	1.72	123.10	0	0	0.49	0.000	0.00	0.00	0.00	0.000
16.90	2.11	91.63	1.47	134.37	0	0	0.49	0.000	0.00	0.00	0.00	0.000
17.06	2.00	97.57	1.30	127.26	0	0	0.49	0.000	0.00	0.00	0.00	0.000
17.22	1.91	95.76	1.19	114.38	0	0	0.49	0.000	0.00	0.00	0.00	0.000
17.39	1.78	99.92	1.09	108.84	0	0	0.49	0.000	0.00	0.00	0.00	0.000
17.55	1.70	102.16	1.00	102.16	0	0	0.49	0.000	0.00	0.00	0.00	0.000
17.72	1.61	107.27	1.00	107.27	19	780	0.48	1.204	1.25	7.11	0.62	0.012
17.88	1.56	116.51	1.00	116.51	21	804	0.48	1.047	1.00	7.11	0.50	0.010
18.04	1.55	126.25	1.00	126.25	22	856	0.48	0.779	0.68	7.11	0.34	0.007
18.21	1.53	135.07	1.00	135.07	24	904	0.48	0.612	0.50	7.11	0.25	0.005
18.37	1.52	137.22	1.00	137.22	24	909	0.48	0.607	0.49	7.11	0.24	0.005
18.54	1.52	136.11	1.00	136.11	24	902	0.48	0.644	0.52	7.11	0.26	0.005
18.70	1.51	131.02	1.00	131.02	23	868	0.48	0.796	0.67	7.11	0.33	0.006
18.86	1.53	125.18	1.00	125.18	22	845	0.48	0.929	0.83	7.11	0.40	0.008
19.03	1.53	121.31	1.00	121.31	21	825	0.48	1.075	0.99	7.11	0.48	0.009
19.19	1.52	124.62	1.00	124.62	22	839	0.48	1.006	0.90	7.11	0.44	0.009
19.36	1.47	137.76	1.00	137.76	24	880	0.48	0.806	0.65	7.11	0.31	0.006
19.52	1.42	154.45	1.00	154.45	26	924	0.48	0.650	0.47	7.11	0.22	0.004
19.69	1.44	166.00	1.00	166.00	28	1021	0.48	0.423	0.28	7.11	0.13	0.003
19.85	1.47	168.39	1.00	168.39	29	1087	0.48	0.333	0.21	7.11	0.10	0.002
20.01	1.72	160.66	1.05	168.80	32	1438	0.48	0.130	0.08	7.11	0.04	0.001
20.18	1.73	153.74	1.06	163.18	31	1412	0.48	0.140	0.08	7.11	0.04	0.001
20.34	1.77	148.63	1.08	161.13	31	1434	0.48	0.136	0.08	7.11	0.04	0.001
20.51	1.64	147.85	1.00	147.53	27	1214	0.48	0.236	0.16	7.11	0.08	0.002
20.67	1.74	140.94	1.06	149.84	28	1318	0.48	0.181	0.12	7.11	0.06	0.001
20.83	1.75	145.30	1.07	155.56	30	1386	0.48	0.157	0.10	7.11	0.05	0.001
21.00	1.63	170.40	1.00	170.40	31	1392	0.48	0.157	0.09	7.11	0.04	0.001
21.16	1.42	220.88	1.00	220.88	38	1375	0.48	0.166	0.08	7.11	0.04	0.001
21.33	1.18	303.61	1.00	303.61	48	1370	0.48	0.170	0.06	7.11	0.03	0.001
21.49	1.03	382.39	1.00	382.39	58	1413	0.48	0.157	0.04	7.11	0.02	0.000
21.65	0.95	438.63	1.00	438.63	65	1462	0.48	0.144	0.03	7.11	0.02	0.000
21.82	0.93	452.01	1.00	452.01	67	1472	0.48	0.143	0.03	7.11	0.02	0.000
21.98	0.93	448.12	1.00	448.12	66	1469	0.48	0.146	0.03	7.11	0.02	0.000
22.15	0.93	445.09	1.00	445.09	66	1463	0.48	0.149	0.04	7.11	0.02	0.000
22.31	0.93	441.43	1.00	441.43	65	1458	0.48	0.153	0.04	7.11	0.02	0.000
22.47	0.94	437.59	1.00	437.59	65	1454	0.48	0.156	0.04	7.11	0.02	0.000
22.64	0.94	434.29	1.00	434.29	64	1450	0.48	0.160	0.04	7.11	0.02	0.000
22.80	0.94	431.28	1.00	431.28	64	1450	0.48	0.162	0.04	7.11	0.02	0.000
22.97	0.95	428.38	1.00	428.38	63	1452	0.48	0.164	0.04	7.11	0.02	0.000
23.13	0.95	426.36	1.00	426.36	63	1455	0.48	0.165	0.04	7.11	0.02	0.000

:: Post-earthquake settlement of dry sands :: (continued)

Depth (ft)	Ic	Q_{tn}	Kc	$Q_{tn,cs}$	$N_{1,60}$ (blows)	G_{max} (tsf)	CSR	Shear, γ (%)	$e_{vol(15)}$ (%)	N_c	e_v (%)	Settle. (in)

Total estimated settlement: 0.27

Abbreviations

Q_{tn}: Equivalent clean sand normalized cone resistance
K_c: Fines correction factor
$Q_{tn,cs}$: Post-liquefaction volumentric strain
G_{max}: Small strain shear modulus
CSR: Soil cyclic stress ratio
γ: Cyclic shear strain
$e_{vol(15)}$: Volumetric strain after 15 cycles
N_c: Equivalent number of cycles
e_v: Volumetric strain
Settle.: Calculated settlement

APPENDIX D

STANDARD GRADING SPECIFICATIONS

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for projects on which Petra Geosciences, Inc. (Petra) is the geotechnical consultant. No deviation from these specifications will be allowed, except where specifically superseded in the preliminary geology and soils report, or in other written communication signed by the Soils Engineer and Engineering Geologist of record (Geotechnical Consultant).

I. GENERAL

A. The Geotechnical Consultant is the Owner's or Builder's representative on the project. For the purpose of these specifications, participation by the Geotechnical Consultant includes that observation performed by any person or persons employed by, and responsible to, the licensed Soils Engineer and Engineering Geologist signing the soils report.

B. The contractor should prepare and submit to the Owner and Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" and the estimated quantities of daily earthwork to be performed prior to the commencement of grading. This work plan should be reviewed by the Geotechnical Consultant to schedule personnel to perform the appropriate level of observation, mapping, and compaction testing as necessary.

C. All clearing, site preparation, or earthwork performed on the project shall be conducted by the Contractor in accordance with the recommendations presented in the geotechnical report and under the observation of the Geotechnical Consultant.

D. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Geotechnical Consultant and to place, spread, mix, water, and compact the fill in accordance with the specifications of the Geotechnical Consultant. The Contractor shall also remove all material considered unsatisfactory by the Geotechnical Consultant.

E. It is the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction to project specifications. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement, and time of year.

F. After completion of grading a report will be submitted by the Geotechnical Consultant.

II. SITE PREPARATION

A. Clearing and Grubbing

1. All vegetation such as trees, brush, grass, roots, and deleterious material shall be disposed of offsite. This removal shall be concluded prior to placing fill.

2. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines, etc., are to be removed or treated in a manner prescribed by the Geotechnical Consultant.

III. FILL AREA PREPARATION

A. Remedial Removals/Overexcavations

1. Remedial removals, as well as overexcavation for remedial purposes, shall be evaluated by the Geotechnical Consultant. Remedial removal depths presented in the geotechnical report and shown on the geotechnical plans are estimates only. The actual extent of removal should be determined by the Geotechnical Consultant based on the conditions exposed during grading. All soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as determined by the Geotechnical Consultant.

2. Soil, alluvium, or bedrock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed from the site. Any material incorporated as a part of a compacted fill must be approved by the Geotechnical Consultant.

3. Should potentially hazardous materials be encountered, the Contractor should stop work in the affected area. An environmental consultant specializing in hazardous materials should be notified immediately for evaluation and handling of these materials prior to continuing work in the affected area.

B. Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide sufficient survey control for determining locations and elevations of processed areas, keys, and benches.

C. Processing

After the ground surface to receive fill has been declared satisfactory for support of fill by the Geotechnical Consultant, it shall be scarified to a minimum depth of 6 inches and until the ground surface is uniform and free from ruts, hollows, hummocks, or other uneven features which may prevent uniform compaction.

The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted to a minimum relative compaction of 90 percent.

D. Subdrains

Subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, and/or with the recommendations of the Geotechnical Consultant. (Typical Canyon Subdrain details are given on Plate SG-1).

E. Cut/Fill & Deep Fill/Shallow Fill Transitions

In order to provide uniform bearing conditions in cut/fill and deep fill/shallow fill transition lots, the cut and shallow fill portions of the lot should be overexcavated to the depths and the horizontal limits discussed in the approved geotechnical report and replaced with compacted fill. (Typical details are given on Plate SG-7.)

STANDARD GRADING SPECIFICATIONS

IV. COMPACTED FILL MATERIAL

A. General

Materials excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Geotechnical Consultant. Material to be used for fill shall be essentially free of organic material and other deleterious substances. Roots, tree branches, and other matter missed during clearing shall be removed from the fill as recommended by the Geotechnical Consultant. Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

B. Oversize Materials

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches in diameter, shall be taken offsite or placed in accordance with the recommendations of the Geotechnical Consultant in areas designated as suitable for rock disposal (Typical details for Rock Disposal are given on Plate SG-4).

Rock fragments less than 12 inches in diameter may be utilized in the fill provided, they are not nested or placed in concentrated pockets; they are surrounded by compacted fine grained soil material and the distribution of rocks is approved by the Geotechnical Consultant.

C. Laboratory Testing

Representative samples of materials to be utilized as compacted fill shall be analyzed by the laboratory of the Geotechnical Consultant to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Geotechnical Consultant as soon as possible.

D. Import

If importing of fill material is required for grading, proposed import material should meet the requirements of the previous section. The import source shall be given to the Geotechnical Consultant at least 2 working days prior to importing so that appropriate tests can be performed and its suitability determined.

V. FILL PLACEMENT AND COMPACTION

A. Fill Layers

Material used in the compacting process shall be evenly spread, watered, processed, and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Consultant.

B. Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly above optimum moisture content.

C. Compaction

Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency. (In general, ASTM D 1557-02, will be used.)

If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soils condition, the area to received fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soils report.

D. Failing Areas

If the moisture content or relative density varies from that required by the Geotechnical Consultant, the Contractor shall rework the fill until it is approved by the Geotechnical Consultant.

E. Benching

All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of 5 horizontal to 1 vertical, in accordance with the recommendations of the Geotechnical Consultant.

VI. SLOPES

A. Fill Slopes

The contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses, and stabilization fills. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure that produces the required compaction.

B. Side Hill Fills

The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the soils report. (See detail on Plate SG-5.)

C. Fill-Over-Cut Slopes

Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials, and the transition shall be stripped of all soils prior to placing fill. (see detail on Plate SG-6).

D. Landscaping

All fill slopes should be planted or protected from erosion by other methods specified in the soils report.

E. Cut Slopes

1. The Geotechnical Consultant should observe all cut slopes at vertical intervals not exceeding 10 feet.

2. 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 evaluated by the Geotechnical Consultant, and recommendations shall be made to treat these problems (Typical details for stabilization of a portion of a cut slope are given in Plates SG-2 and SG-3.).

3. Cut slopes that face in the same direction as the prevailing drainage shall be protected from slope wash by a non-erodible interceptor swale placed at the top of the slope.

4. Unless otherwise specified in the soils and geological report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

5. Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Geotechnical Consultant.

VII. GRADING OBSERVATION

A. General

All cleanouts, processed ground to receive fill, key excavations, subdrains, and rock disposals must be observed and approved by the Geotechnical Consultant prior to placing any fill. It shall be the Contractor's responsibility to notify the Geotechnical Consultant when such areas are ready.

B. Compaction Testing

Observation of the fill placement shall be provided by the Geotechnical Consultant during the progress of grading. Location and frequency of tests shall be at the Consultants discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations may be selected to verify adequacy of compaction levels in areas that are judged to be susceptible to inadequate compaction.

C. Frequency of Compaction Testing

In general, density tests should be made at intervals not exceeding 2 feet of fill height or every 1000 cubic yards of fill placed. This criteria will vary depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction is being achieved.

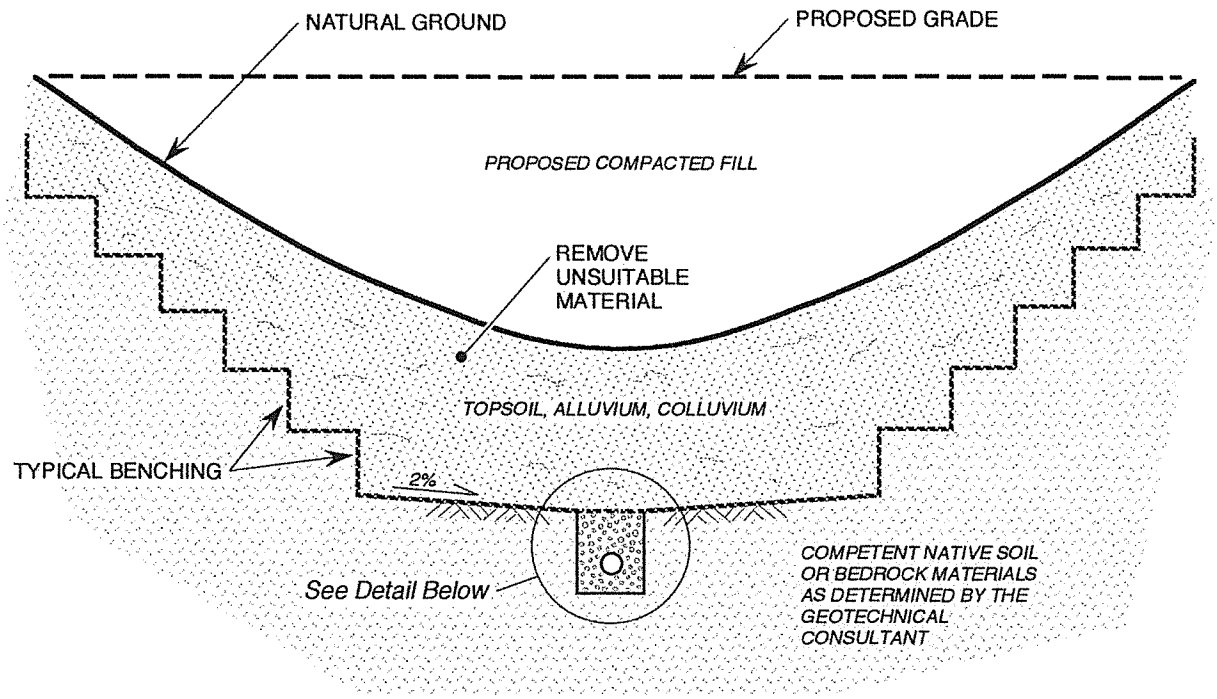
VIII. CONSTRUCTION CONSIDERATIONS

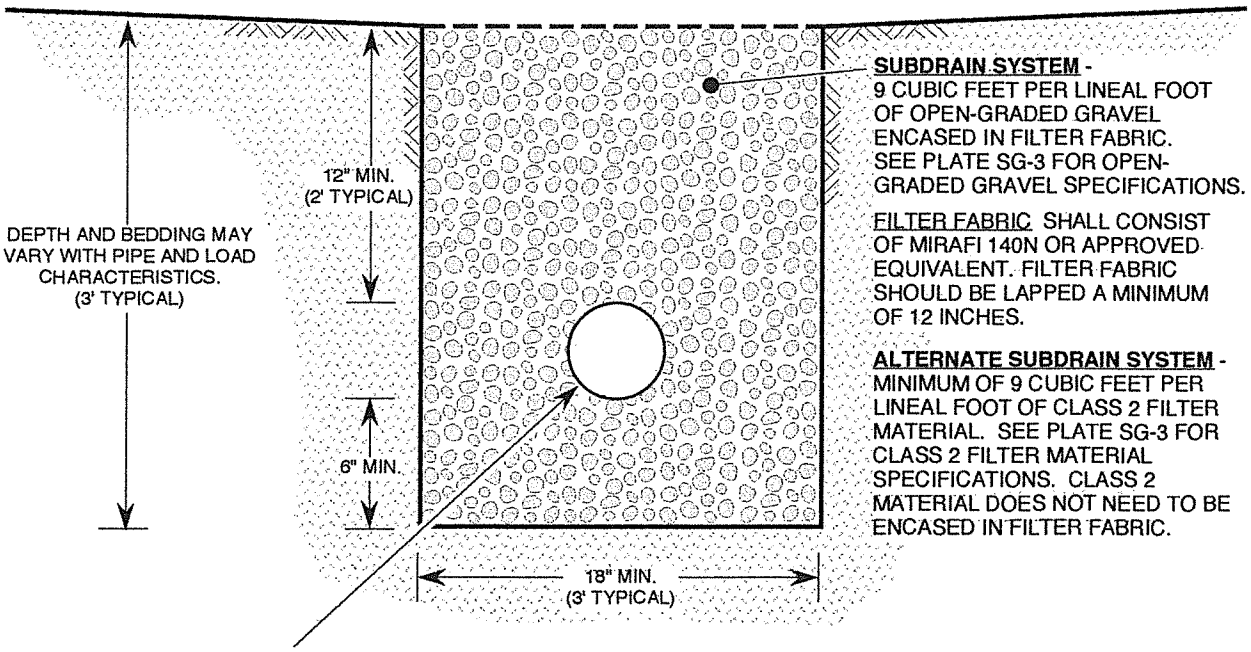
A. Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

B. Upon completion of grading and termination of observations by the Geotechnical Consultant, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Geotechnical Consultant.

C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of permanent nature on or adjacent to the property.

S:\!BOILERS-WORK\REPORT INSERTS\STANDARD GRADING SPECS





SUBDRAIN SYSTEM - 9 CUBIC FEET PER LINEAL FOOT OF OPEN-GRADED GRAVEL ENCASED IN FILTER FABRIC. SEE PLATE SG-3 FOR OPEN-GRADED GRAVEL SPECIFICATIONS.

FILTER FABRIC SHALL CONSIST OF MIRAFI 140N OR APPROVED EQUIVALENT. FILTER FABRIC SHOULD BE LAPPED A MINIMUM OF 12 INCHES.

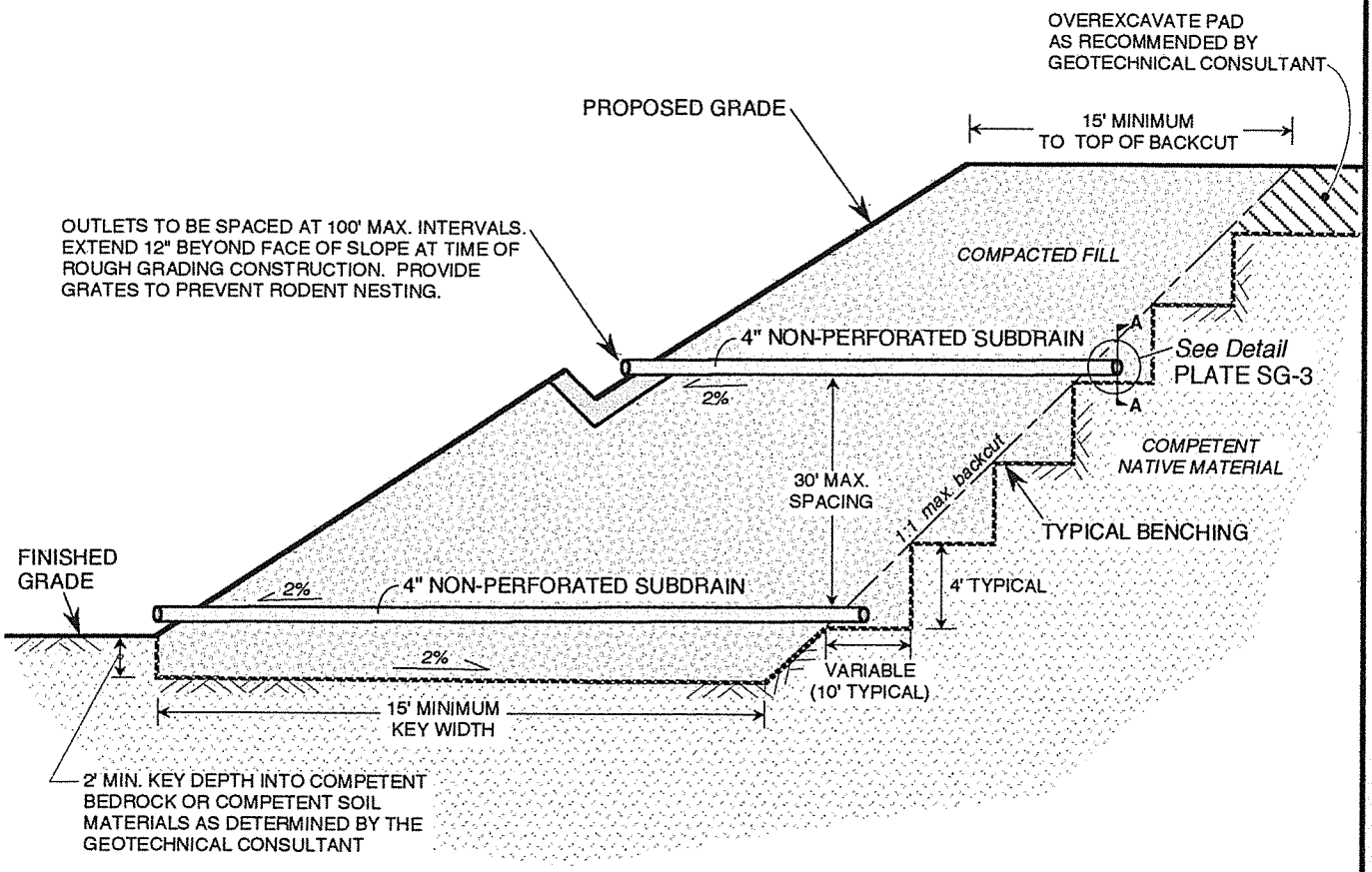
ALTERNATE SUBDRAIN SYSTEM - MINIMUM OF 9 CUBIC FEET PER LINEAL FOOT OF CLASS 2 FILTER MATERIAL. SEE PLATE SG-3 FOR CLASS 2 FILTER MATERIAL SPECIFICATIONS. CLASS 2 MATERIAL DOES NOT NEED TO BE ENCASED IN FILTER FABRIC.

MINIMUM 6-INCH DIAMETER PVC SCHEDULE 40, OR ABS SDR-35 WITH A MINIMUM OF EIGHT 1/4-INCH DIAMETER PERFORATIONS PER LINEAL FOOT IN BOTTOM HALF OF PIPE. PIPE TO BE LAID WITH PERFORATIONS FACING DOWN.

NOTES:

1. FOR CONTINUOUS RUNS IN EXCESS OF 500 FEET USE 8-INCH DIAMETER PIPE.
2. FINAL 20 FEET OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL.

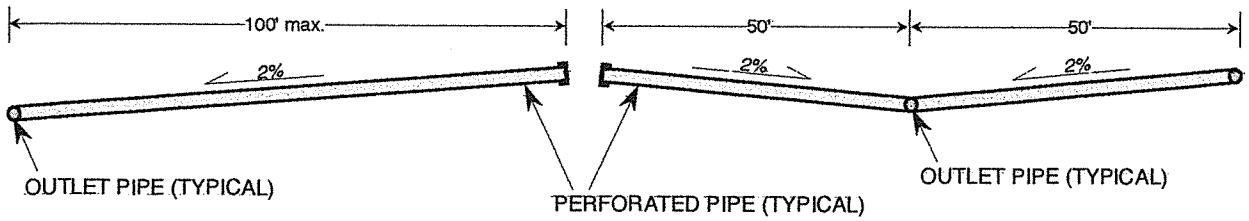
PETRA	CANYON SUBDRAIN DETAIL	PLATE SG-1



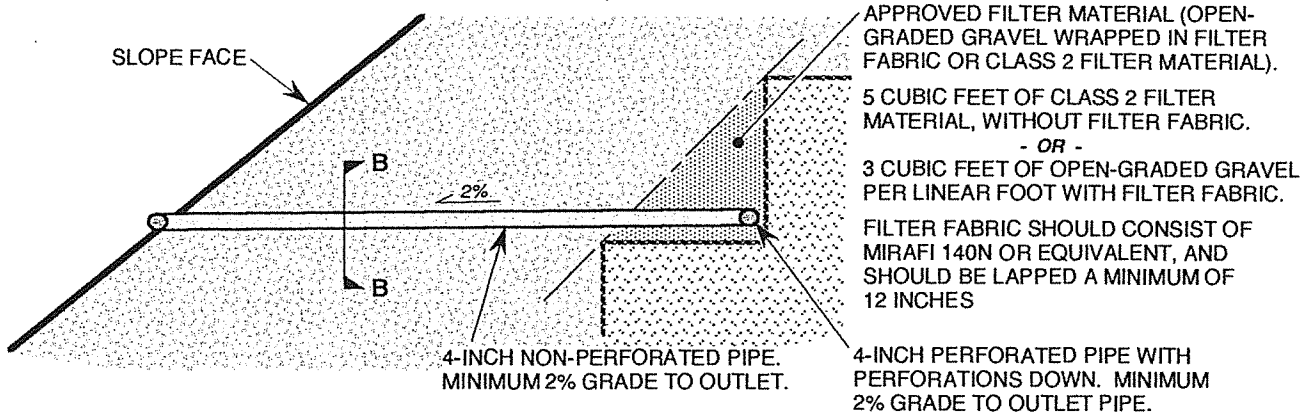
NOTES:

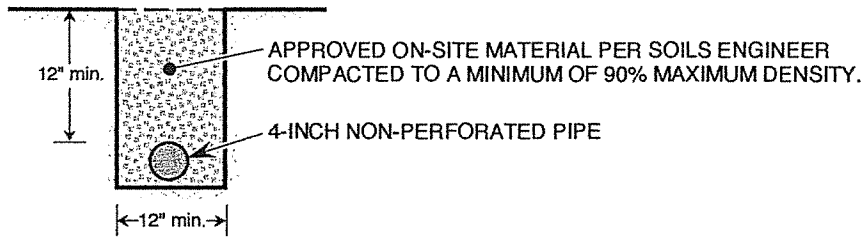
1. 30' MAXIMUM VERTICAL SPACING BETWEEN SUBDRAIN SYSTEMS.
2. 100' MAXIMUM HORIZONTAL DISTANCE BETWEEN NON-PERFORATED OUTLET PIPES. *(See Below)*
3. MINIMUM GRADIENT OF 2% FOR ALL PERFORATED AND NON-PERFORATED PIPE.

SECTION A-A (PERFORATED PIPE PROFILE)



PETRA	BUTTRESS OR STABILIZATION FILL DETAIL	PLATE SG-2





SECTION B-B (OUTLET PIPE)

PIPE SPECIFICATIONS:

1. 4-INCH MINIMUM DIAMETER, PVC SCHEDULE 40 OR ABS SDR-35.
2. FOR PERFORATED PIPE, MINIMUM 8 PERFORATIONS PER FOOT ON BOTTOM HALF OF PIPE.

FILTER MATERIAL/FABRIC SPECIFICATIONS:

OPEN-GRADED GRAVEL ENCASED IN FILTER FABRIC.
(MIRAFI 140N OR EQUIVALENT)

OPEN-GRADED GRAVEL

SIEVE SIZE	PERCENT PASSING
1 1/2-INCH	88 - 100
1-INCH	5 - 40
3/4-INCH	0 - 17
3/8-INCH	0 - 7
No. 200	0 - 3

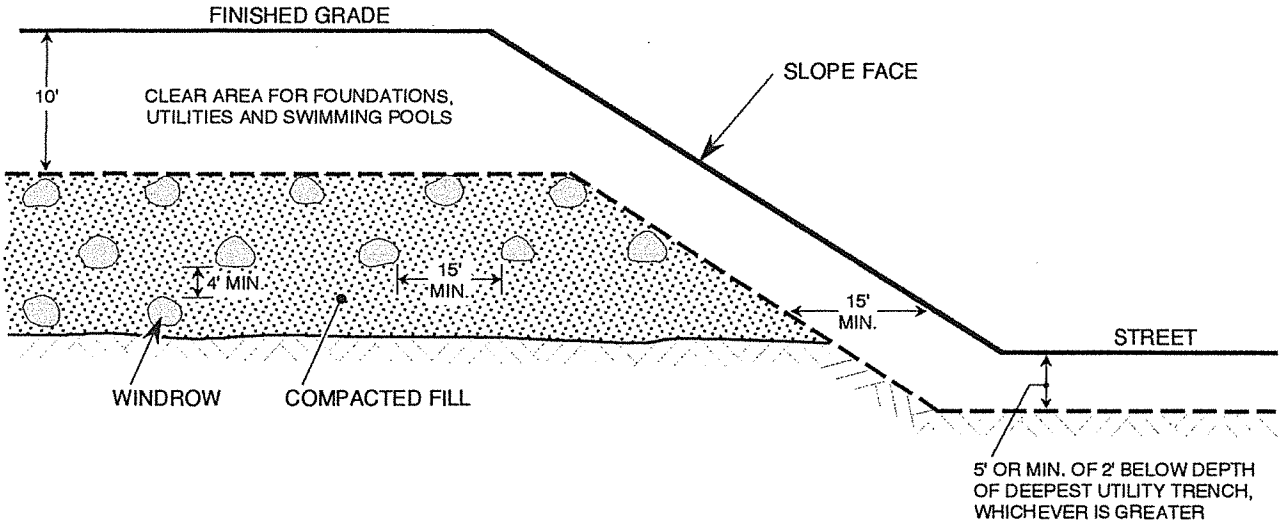
ALTERNATE:

CLASS 2 PERMEABLE FILTER MATERIAL PER CALTRANS STANDARD SPECIFICATION 68-1.025.

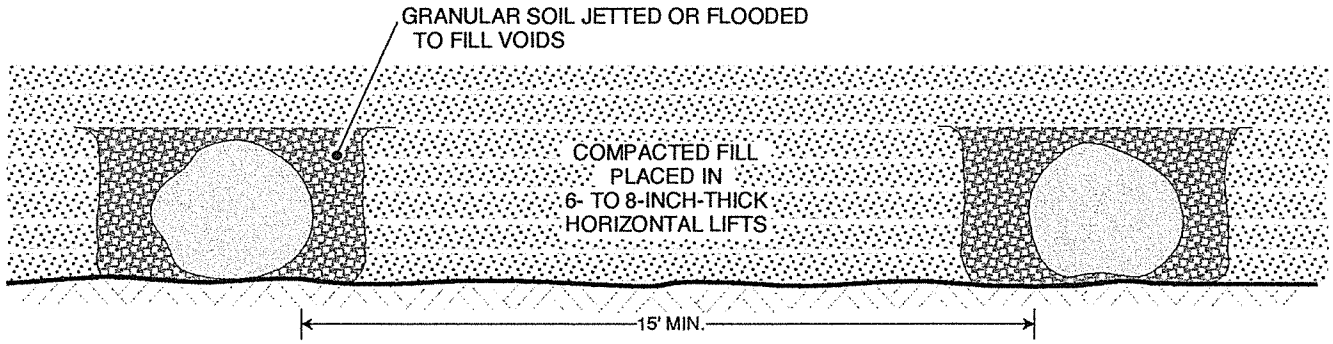
CLASS 2 FILTER MATERIAL

SIEVE SIZE	PERCENT PASSING
1-INCH	100
3/4-INCH	90 - 100
3/8-INCH	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. -30	5 - 15
No. -50	0 - 7
No. 200	0 - 3

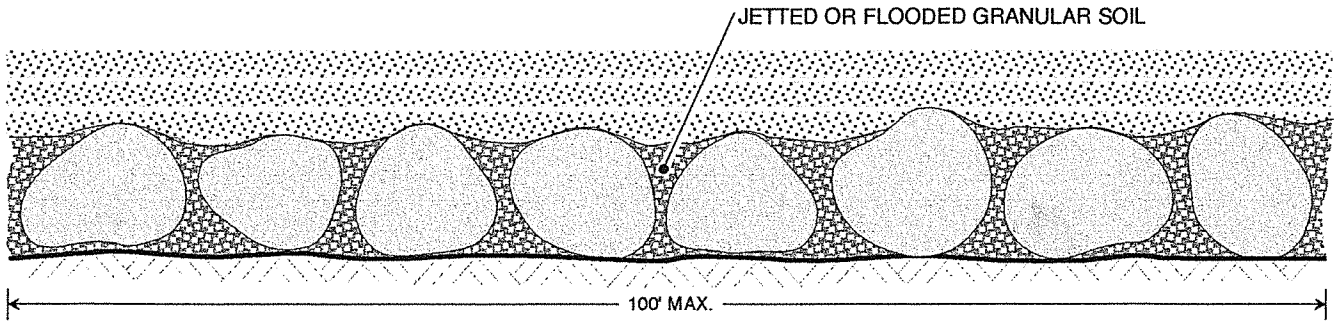
PETRA	BUTTRESS OR STABILIZATION FILL SUBDRAIN	PLATE SG-3



TYPICAL WINDROW DETAIL (END VIEW)

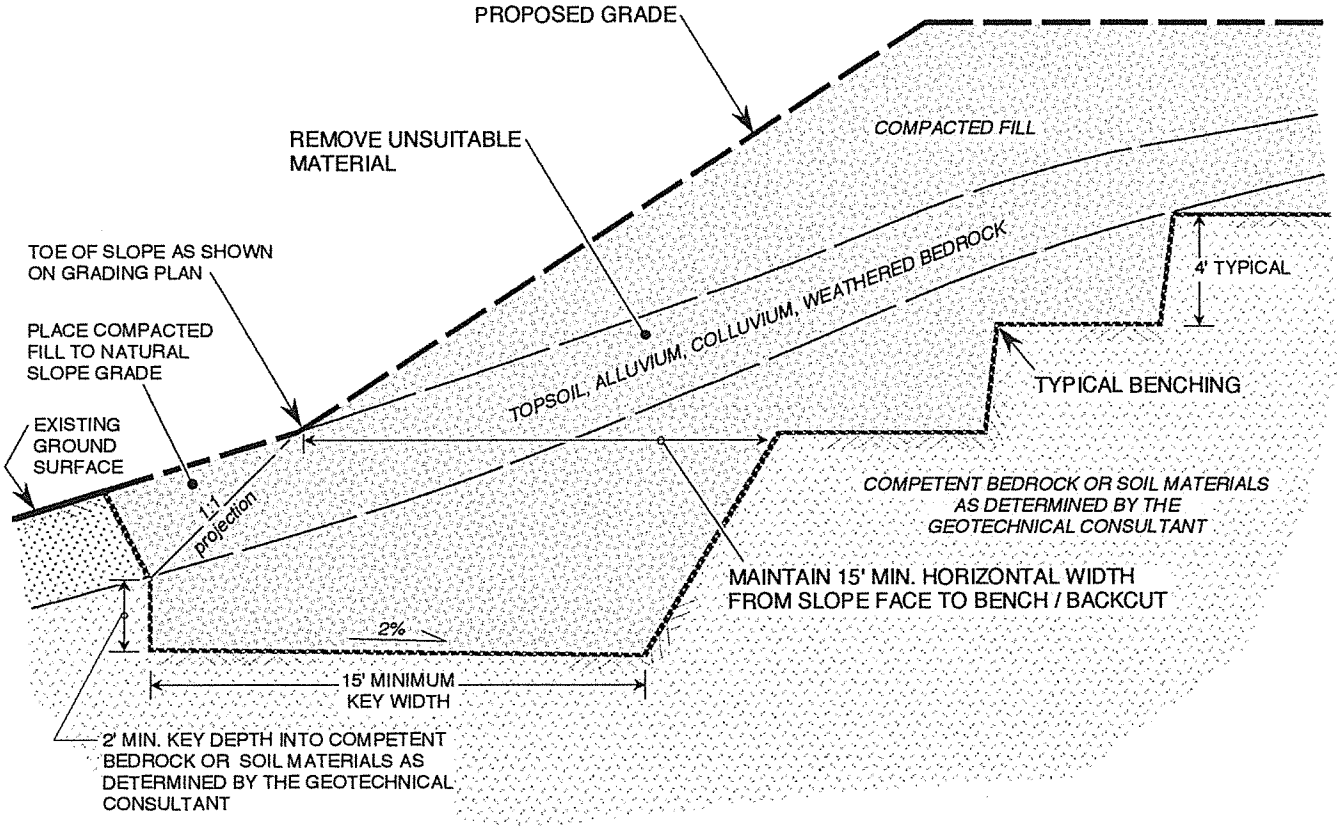


TYPICAL WINDROW DETAIL (PROFILE VIEW)



NOTE: OVERSIZE ROCK IS DEFINED AS CLASTS HAVING A MAXIMUM DIMENSION OF 12" OR LARGER

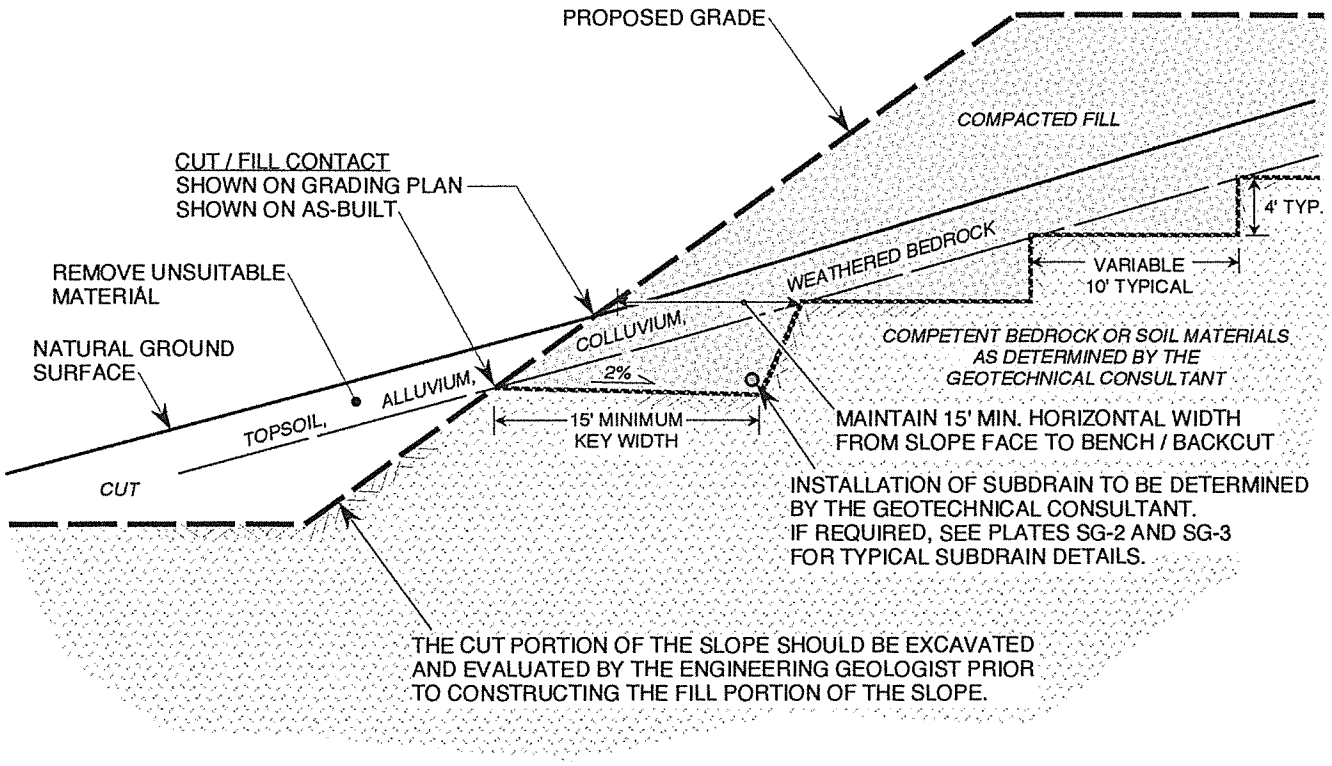
PETRA	TYPICAL ROCK DISPOSAL DETAIL	PLATE SG-4



NOTES:

1. WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS, BENCHING IS NOT NECESSARY; HOWEVER, FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.
2. SOILS ENGINEER TO DETERMINE IF SUBDRAIN IS REQUIRED.

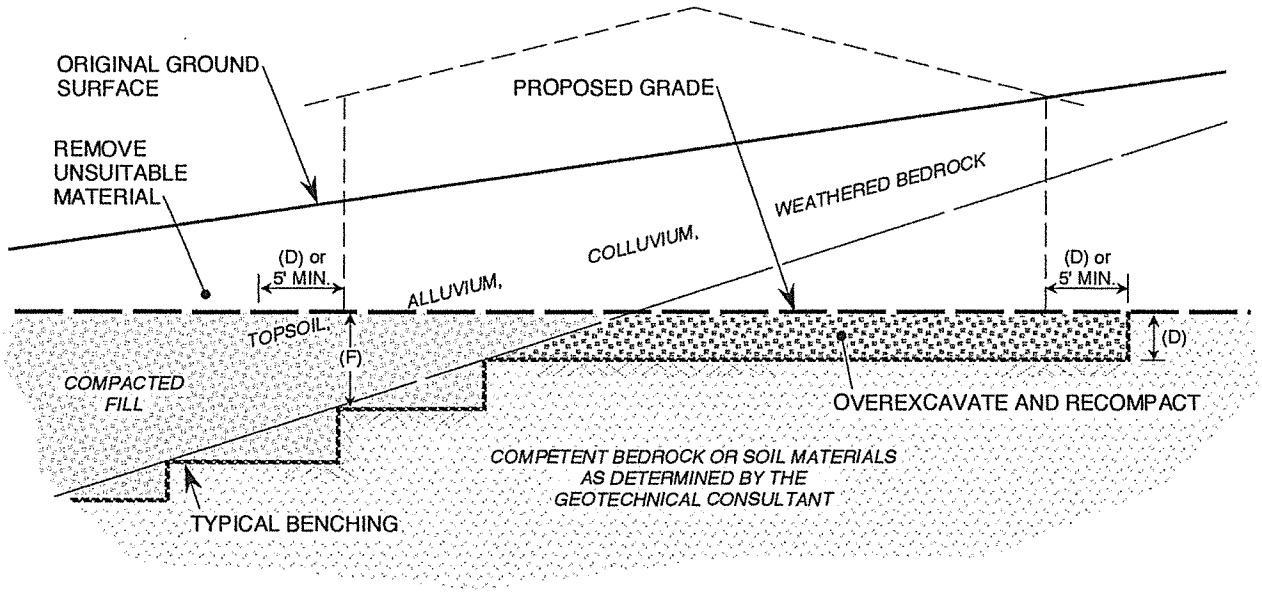
PETRA	FILL SLOPE ABOVE NATURAL SLOPE	PLATE SG-5



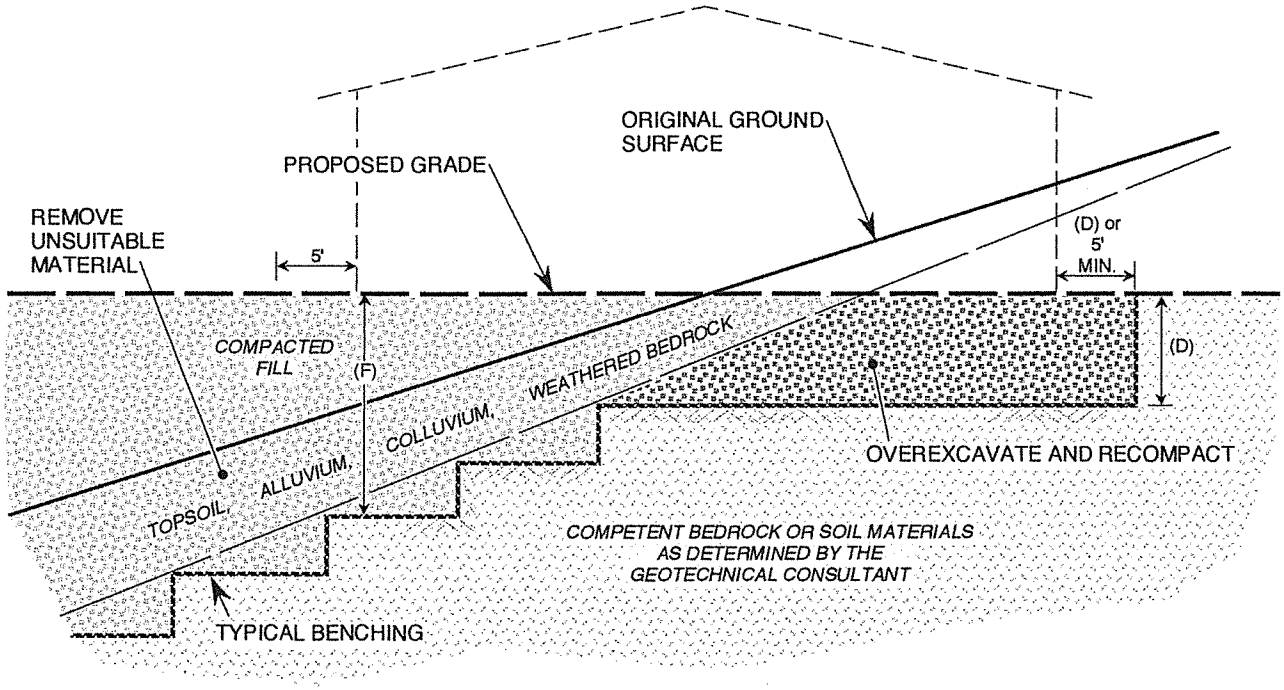
PETRA	FILL SLOPE ABOVE CUT SLOPE	PLATE SG-6

CUT LOT

UNSUITABLE MATERIAL EXPOSED IN PORTION OF CUT PAD

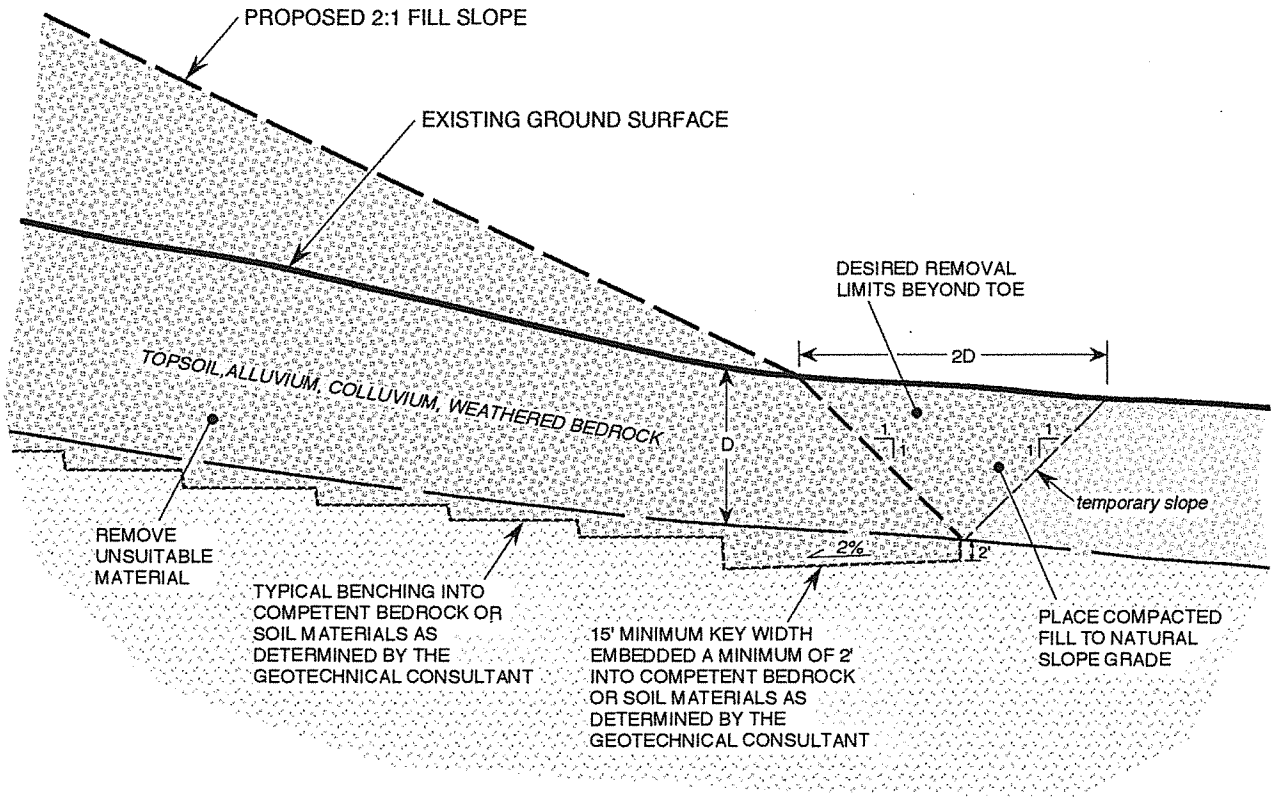


CUT-FILL TRANSITION LOT



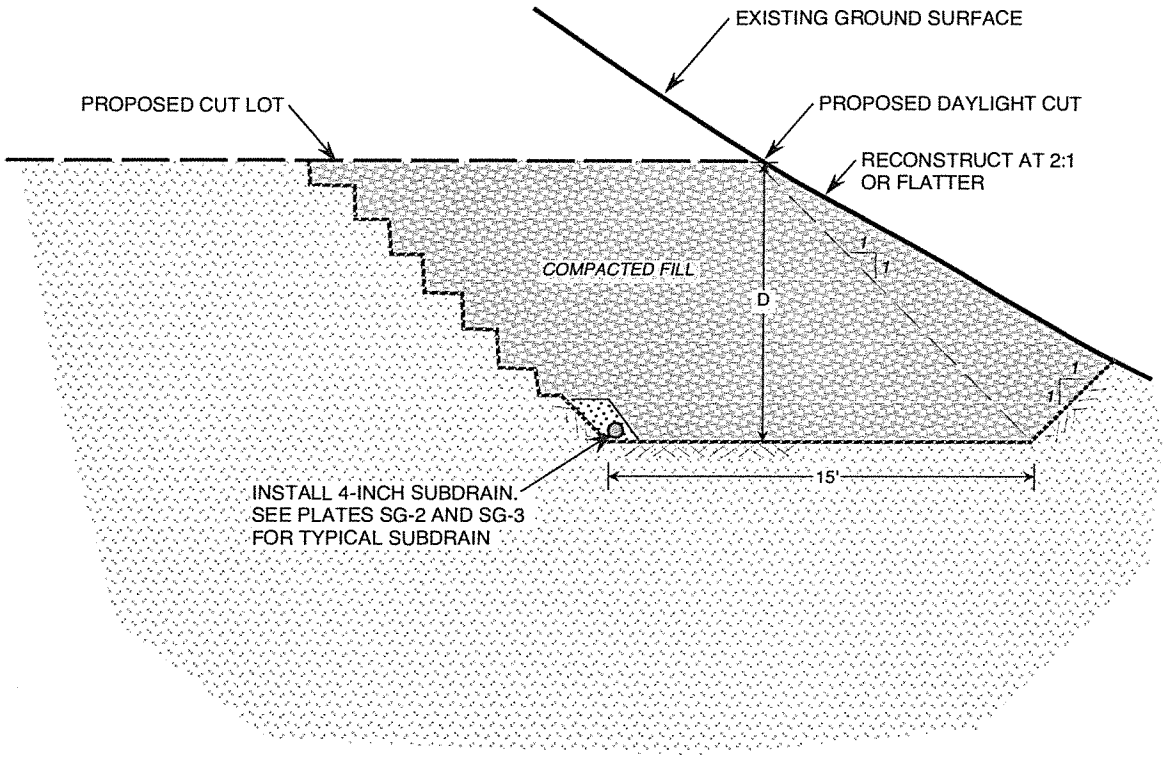
MAXIMUM FILL THICKNESS (F)	DEPTH OF OVEREXCAVATION (D)
FOOTING DEPTH TO 3 FEET	EQUAL DEPTH
3 TO 6 FEET	3 FEET
GREATER THAN 6 FEET	1/2 THE THICKNESS OF DEEPEST FILL PLACED WITHIN THE "FILL" PORTION (F) TO 15 FEET MAXIMUM

PETRA	CUT LOTS AND CUT-FILL TRANSITION LOTS	PLATE SG-7



D = RECOMMENDED DEPTH OF REMOVAL PER GEOTECHNICAL REPORT

PETRA	TYPICAL REMOVALS BEYOND TOE OF PROPOSED FILL SLOPE	PLATE SG-8



NOTE:

1. "D" SHALL BE 10 FEET MINIMUM OR AS DETERMINED BY SOILS ENGINEER.

PETRA	SHEAR KEY ON DAYLIGHT CUT LOTS	PLATE SG-9

Appendix

C

EXISTING CONDITION HYDROLOGY RATIONAL METHOD & KEY MAP

EX. R/W

ELEV. 634.8 (304)
Q_{10} = 17.19 cfs
Q_{100} =27.06 cfs

EX. 24" RCP
RCFC SD OUTLET

EX. 24" RCP
RCFC SD OUTLET

ELEV. 639.9 (203)
INV. 634.9
Q_{10} = 15.52 cfs
Q_{100} =24.44 cfs

ELEV. 640.0 (102)
Q_{10} = 5.98 cfs
Q_{100} =9.32 cfs

EX. 24"
RCP RCFC
SD OUTLET

TEMESCAL WASH

B2
4.60

C3
3.79

A1
3.10

Lp=698'

L=615'

L=822'

EL CAMINO AVENUE

ELEV. 641.9 (202)
INV. 637.9
Q_{10} = 6.99 cfs
Q_{100} =10.91 cfs

C2
3.22

L=259'

ELEV. 643.4 (201)

ELEV. 647.1 (401)

L=402'

D1
0.58

ELEV. 642.4 (303)
Q_{10} = 9.16 cfs
Q_{100} =12.79 cfs

B1
3.27

EX. CAP AREA
BOUNDARY

EX. CB LP

ELEV. 644.5 (402)
Q_{10} = 1.15 cfs
Q_{100} =1.79 cfs

L=378'

HP

MAGNOLIA AVENUE

EX. 30" SD PER LINE A-3
DWG 03-081S SHEET 18 OF 20

ELEV. 647.0 (302)
Q_{10} = 0.96 cfs
Q_{100} =1.50 cfs

L=160'

EX. R/W

EXISTING R/W 40'

EXISTING R/W 104'

64'

C1
0.38

ELEV. 645.1 (301)

SHERBORN STREET

LEGEND

- MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED BOUNDARY
- A / 6.98 — SUBAREA DESIGNATION / SUBAREA ACREAGE
- ZZZ — ELEVATION @ NODE
- XX — NODAL POINT REFERENCE
- Q_{10} OR Q_{100} — 10 OR 100 YEAR PEAK DISCHARGE

60' 0 60' 120' 180'
SCALE IN FEET

FIGURE 2

EXISTING CONDITION
HYDROLOGY KEY MAP
FOR
MAGNOLIA AVENUE
BUSINESS CENTER
COUNTY OF RIVERSIDE

HYD:	CS	KWC ENGINEERS
DRAFT:	CS	CIVIL ENGINEERING, PLANNING AND CONSTRUCTION MANAGEMENT
CHECK:	NN	1880 CHAPTON AVENUE, SUITE 100 CORONA, CA. 92881-AUTOR 909-734-2130

SHEET 1 of 1

R:\19\1995\PRELIM\REPORTS\HYDRO\1995 Exist. Hydro Key Map.dwg (9/19/2023 5:25 PM) Plotted by: Connie Phan

10 YEAR EXISTING CONDITION

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 04/11/22 File:1995E10A.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING CONDITION HYDROLOGY AREA A
RCFC&WCD 10 YR STORM EVENT
BY CS

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 615.000(Ft.)
Top (of initial area) elevation = 647.000(Ft.)
Bottom (of initial area) elevation = 640.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.01138 s(percent)= 1.14
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.581 min.
Rainfall intensity = 2.268(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.850
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 5.975(CFS)
Total initial stream area = 3.100(Ac.)
Pervious area fraction = 0.100
End of computations, total study area = 3.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 04/11/22 File:1995E10B.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING CONDITION HYDROLOGY AREA B
RCC&WCD 10 YR STORM EVENT
BY CS

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++
Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 259.000(Ft.)
Top (of initial area) elevation = 643.400(Ft.)
Bottom (of initial area) elevation = 641.900(Ft.)
Difference in elevation = 1.500(Ft.)
Slope = 0.00579 s(percent)= 0.58
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.760 min.
Rainfall intensity = 2.509(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.852
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 6.992(CFS)
Total initial stream area = 3.270(Ac.)
Pervious area fraction = 0.100

++
Process from Point/Station 202.000 to Point/Station 203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
Upstream point/station elevation =   637.900(Ft.)
Downstream point/station elevation =   634.900(Ft.)
Pipe length  =   698.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.992(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     6.992(CFS)
Normal flow depth in pipe =   15.00(In.)
Flow top width inside pipe =   13.42(In.)
Critical Depth =   12.28(In.)
Pipe flow velocity =      4.44(Ft/s)
Travel time through pipe =    2.62 min.
Time of concentration (TC) =    10.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.849
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.38 min.
Rainfall intensity =      2.182(In/Hr) for a    10.0 year storm
Subarea runoff =      8.523(CFS) for      4.600(Ac.)
Total runoff =     15.515(CFS)        Total area =       7.870(Ac.)
End of computations, total study area =            7.87 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/19/23 File:1995E10C.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING CONDITION HYDROLOGY AREA C
RCFC&WCD 10 YR STORM EVENT
CY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 301.000 to Point/Station 302.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 160.000(Ft.)
Top (of initial area) elevation = 645.100(Ft.)
Bottom (of initial area) elevation = 647.000(Ft.)
Difference in elevation = 1.900(Ft.)
Slope = 0.01187 s(percent)= 1.19
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.544 min.
Rainfall intensity = 2.948(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.856
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 0.959(CFS)
Total initial stream area = 0.380(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 302.000 to Point/Station 303.000
**** SUBAREA FLOW ADDITION ****

```
COMMERCIAL subarea type
Runoff Coefficient = 0.856
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     5.54 min.
Rainfall intensity =      2.948(In/Hr) for a    10.0 year storm
Subarea runoff =      8.202(CFS) for      3.250(Ac.)
Total runoff =      9.161(CFS)        Total area =       3.630(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   642.400(Ft.)
Downstream point elevation =   634.800(Ft.)
Channel length thru subarea  =   822.000(Ft.)
Channel base width     =    3.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     13.227(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =     13.227(CFS)
Depth of flow =   0.627(Ft.), Average velocity =   5.812(Ft/s)
Channel flow top width =    4.255(Ft.)
Flow Velocity =    5.81(Ft/s)
Travel time  =    2.36 min.
Time of concentration =    7.90 min.

Sub-Channel No. 1 Critical depth =      0.773(Ft.)
  '     '       '     Critical flow top width =      4.547(Ft.)
  '     '       '     Critical flow velocity=    4.532(Ft/s)
  '     '       '     Critical flow area =      2.919(Sq.Ft)

 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.852
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.487(In/Hr) for a    10.0 year storm
Subarea runoff =      8.033(CFS) for      3.790(Ac.)
Total runoff =     17.193(CFS)        Total area =       7.420(Ac.)
Depth of flow =   0.731(Ft.), Average velocity =   6.303(Ft/s)

Sub-Channel No. 1 Critical depth =      0.906(Ft.)
  '     '       '     Critical flow top width =      4.813(Ft.)
  '     '       '     Critical flow velocity=    4.857(Ft/s)
  '     '       '     Critical flow area =      3.540(Sq.Ft)

End of computations, total study area =            7.42 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/19/23 File:1995E10D.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING OFFSITE CONDITION HYDROLOGY AREA D
RCFC&WCD 10 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 402.000(Ft.)
Top (of initial area) elevation = 647.100(Ft.)
Bottom (of initial area) elevation = 644.500(Ft.)
Difference in elevation = 2.600(Ft.)
Slope = 0.00647 s(percent)= 0.65
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.050 min.
Rainfall intensity = 2.330(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.851
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 1.150(CFS)
Total initial stream area = 0.580(Ac.)
Pervious area fraction = 0.100
End of computations, total study area = 0.58 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

100 YEAR EXISTING CONDITION

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 04/11/22 File:1995E100A.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING CONDITION HYDROLOGY AREA A
RCFC&WCD 100 YR STORM EVENT
BY CS

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 615.000(Ft.)
Top (of initial area) elevation = 647.000(Ft.)
Bottom (of initial area) elevation = 640.000(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.01138 s(percent)= 1.14
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.581 min.
Rainfall intensity = 3.498(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.860
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 9.322(CFS)
Total initial stream area = 3.100(Ac.)
Pervious area fraction = 0.100
End of computations, total study area = 3.10 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 04/11/22 File:1995E100B.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING CONDITION HYDROLOGY AREA B
RCC&WCD 100 YR STORM EVENT
BY CS

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++
Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 259.000(Ft.)
Top (of initial area) elevation = 643.400(Ft.)
Bottom (of initial area) elevation = 641.900(Ft.)
Difference in elevation = 1.500(Ft.)
Slope = 0.00579 s(percent)= 0.58
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 7.760 min.
Rainfall intensity = 3.870(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.862
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 10.909(CFS)
Total initial stream area = 3.270(Ac.)
Pervious area fraction = 0.100

++
Process from Point/Station 202.000 to Point/Station 203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
Upstream point/station elevation =   637.900(Ft.)
Downstream point/station elevation =   634.900(Ft.)
Pipe length  =   698.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.909(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    10.909(CFS)
Normal flow depth in pipe =   15.30(In.)
Flow top width inside pipe =   23.07(In.)
Critical Depth =   14.19(In.)
Pipe flow velocity =      5.16(Ft/s)
Travel time through pipe =    2.25 min.
Time of concentration (TC) =    10.01 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.859
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.01 min.
Rainfall intensity =      3.424(In/Hr) for a   100.0 year storm
Subarea runoff =     13.535(CFS) for      4.600(Ac.)
Total runoff =     24.444(CFS)        Total area =       7.870(Ac.)
End of computations, total study area =            7.87 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/19/23 File:1995E100C.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING CONDITION HYDROLOGY AREA C
RCFC&WCD 100 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 301.000 to Point/Station 302.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 160.000(Ft.)
Top (of initial area) elevation = 645.100(Ft.)
Bottom (of initial area) elevation = 647.000(Ft.)
Difference in elevation = 1.900(Ft.)
Slope = 0.01187 s(percent)= 1.19
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.544 min.
Rainfall intensity = 4.548(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.865
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 1.496(CFS)
Total initial stream area = 0.380(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 302.000 to Point/Station 303.000
**** SUBAREA FLOW ADDITION ****

```
COMMERCIAL subarea type
Runoff Coefficient = 0.865
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     5.54 min.
Rainfall intensity =      4.548(In/Hr) for a   100.0 year storm
Subarea runoff =     12.793(CFS) for      3.250(Ac.)
Total runoff =     14.289(CFS)        Total area =       3.630(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   642.400(Ft.)
Downstream point elevation =   634.800(Ft.)
Channel length thru subarea  =   822.000(Ft.)
Channel base width     =    3.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     20.711(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =     20.711(CFS)
Depth of flow =   0.814(Ft.), Average velocity =   6.668(Ft/s)
Channel flow top width =    4.629(Ft.)
Flow Velocity =    6.67(Ft/s)
Travel time  =    2.05 min.
Time of concentration =    7.60 min.

Sub-Channel No. 1 Critical depth =      1.016(Ft.)
  '     '       '     Critical flow top width =      5.031(Ft.)
  '     '       '     Critical flow velocity=    5.078(Ft/s)
  '     '       '     Critical flow area =      4.078(Sq.Ft)

 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.862
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      3.910(In/Hr) for a   100.0 year storm
Subarea runoff =     12.775(CFS) for      3.790(Ac.)
Total runoff =     27.064(CFS)        Total area =       7.420(Ac.)
Depth of flow =   0.949(Ft.), Average velocity =   7.218(Ft/s)

Sub-Channel No. 1 Critical depth =      1.188(Ft.)
  '     '       '     Critical flow top width =      5.375(Ft.)
  '     '       '     Critical flow velocity=    5.442(Ft/s)
  '     '       '     Critical flow area =      4.973(Sq.Ft)

End of computations, total study area =            7.42 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/19/23 File:1995E100D.out

MAGNOLIA AVE BUSINESS CENTER
EXISTING OFFSITE CONDITION HYDROLOGY AREA D
RCFC&WCD 100 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

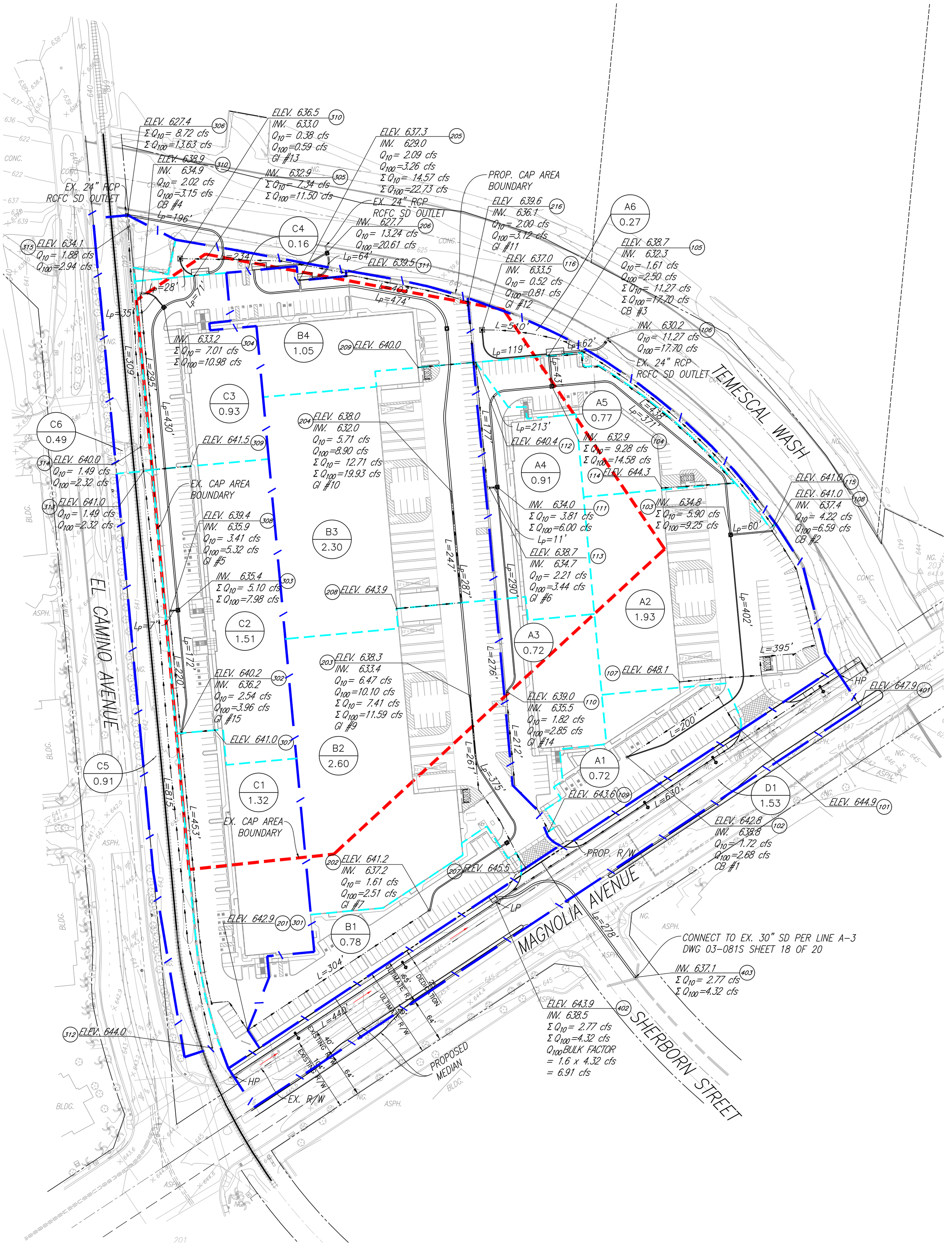
Initial area flow distance = 402.000(Ft.)
Top (of initial area) elevation = 647.100(Ft.)
Bottom (of initial area) elevation = 644.500(Ft.)
Difference in elevation = 2.600(Ft.)
Slope = 0.00647 s(percent)= 0.65
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.050 min.
Rainfall intensity = 3.595(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.860
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 1.794(CFS)
Total initial stream area = 0.580(Ac.)
Pervious area fraction = 0.100
End of computations, total study area = 0.58 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

Appendix

D

PROPOSED CONDITION HYDROLOGY RATIONAL METHOD & KEY MAP



LEGEND

- MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED BOUNDARY
- A / 6.98 — SUBAREA DESIGNATION / SUBAREA ACREAGE
- ZZZ / XX — ELEVATION @ NODE / NODAL POINT REFERENCE
- Q_{10} OR Q_{100} — 10 OR 100 YEAR PEAK DISCHARGE
- ΣQ_{10} OR ΣQ_{100} — 10 OR 100 YEAR CONFLUENCE DISCHARGE

60' 0 60' 120' 180'

SCALE IN FEET

FIGURE 3

PROPOSED CONDITION HYDROLOGY KEY MAP
FOR
MAGNOLIA AVENUE BUSINESS CENTER
COUNTY OF RIVERSIDE

HYD:	CS	KWC ENGINEERS
DRAFT:	CS	CIVIL ENGINEERING, PLANNING AND CONSTRUCTION MANAGEMENT
CHECK:	NN	1880 CHAPTON AVENUE, SUITE 100 CORONA, CA. 92881-(619) 734-2130

SHEET 1 of 1

\\KWC-FS\Jd31\19\1995\PRELIM\REPORTS\HYDRO\1995 Prop. Hydro Key Map.dwg (10/12/2023 2:39 PM) Plotted by: Connie Phan

10 YEAR PROPOSED CONDITION

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/18/23 File:1995D10A.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED CONDITION HYDROLOGY AREA A
RCFC&WCD 10 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 200.000(Ft.)
Top (of initial area) elevation = 644.900(Ft.)
Bottom (of initial area) elevation = 642.800(Ft.)
Difference in elevation = 2.100(Ft.)
Slope = 0.01050 s(percent)= 1.05
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.213 min.
Rainfall intensity = 2.792(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.855
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 1.718(CFS)
Total initial stream area = 0.720(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 102.000 to Point/Station 103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
_____________________________________________________________________________
Upstream point/station elevation =   638.800(Ft.)
Downstream point/station elevation =   634.800(Ft.)
Pipe length  =   402.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.718(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     1.718(CFS)
Normal flow depth in pipe =    5.88(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =    6.68(In.)
Pipe flow velocity =      4.49(Ft/s)
Travel time through pipe =    1.49 min.
Time of concentration (TC) =     7.71 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.720(Ac.)
Runoff from this stream =      1.718(CFS)
Time of concentration =    7.71 min.
Rainfall intensity =     2.517(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
Initial area flow distance =   395.000(Ft.)
Top (of initial area) elevation =   648.100(Ft.)
Bottom (of initial area) elevation =   641.400(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.01696  s(percent)=       1.70
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.411 min.
Rainfall intensity =      2.565(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.853
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      4.222(CFS)
Total initial stream area =        1.930(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   637.400(Ft.)
Downstream point/station elevation =   634.800(Ft.)
Pipe length  =    60.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.222(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.222(CFS)
Normal flow depth in pipe =    6.49(In.)
Flow top width inside pipe =   11.96(In.)
Critical Depth =   10.40(In.)
Pipe flow velocity =      9.75(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     7.51 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.930(Ac.)
Runoff from this stream =      4.222(CFS)
Time of concentration =    7.51 min.
Rainfall intensity =     2.548(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.718      7.71               2.517
2        4.222      7.51               2.548
Largest stream flow has longer or shorter time of concentration
Qp =      4.222 + sum of
          Qa          Tb/Ta
           1.718 *    0.975 =      1.675
Qp =      5.897

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.718       4.222
Area of streams before confluence:
        0.720        1.930


Results of confluence:
Total flow rate =      5.897(CFS)
Time of concentration =     7.513 min.
Effective stream area after confluence  =      2.650(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   634.800(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =   371.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.897(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.897(CFS)
Normal flow depth in pipe =   12.00(In.)
Flow top width inside pipe =   16.97(In.)
Critical Depth =   11.25(In.)
Pipe flow velocity =      4.71(Ft/s)
Travel time through pipe =    1.31 min.
Time of concentration (TC) =     8.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.650(Ac.)
Runoff from this stream =      5.897(CFS)
Time of concentration =    8.83 min.
Rainfall intensity =     2.359(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
```

```
Initial area flow distance =   212.000(Ft.)
Top (of initial area) elevation =   643.600(Ft.)
Bottom (of initial area) elevation =   639.000(Ft.)
Difference in elevation =     4.600(Ft.)
Slope =    0.02170  s(percent)=       2.17
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.500 min.
Rainfall intensity =      2.960(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.856
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.824(CFS)
Total initial stream area =        0.720(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   635.500(Ft.)
Downstream point/station elevation =   634.000(Ft.)
Pipe length  =   290.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.824(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     1.824(CFS)
Normal flow depth in pipe =    7.48(In.)
Flow top width inside pipe =   11.63(In.)
Critical Depth =    6.90(In.)
Pipe flow velocity =      3.54(Ft/s)
Travel time through pipe =    1.36 min.
Time of concentration (TC) =     6.86 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.720(Ac.)
Runoff from this stream =      1.824(CFS)
Time of concentration =    6.86 min.
Rainfall intensity =     2.661(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   177.000(Ft.)
Top (of initial area) elevation =   640.400(Ft.)
Bottom (of initial area) elevation =   638.700(Ft.)
Difference in elevation =     1.700(Ft.)
Slope =    0.00960  s(percent)=       0.96
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.023 min.
Rainfall intensity =      2.834(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.855
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
```

```
Initial subarea runoff =      2.205(CFS)
Total initial stream area =        0.910(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   634.700(Ft.)
Downstream point/station elevation =   634.000(Ft.)
Pipe length  =    11.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.205(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.205(CFS)
Normal flow depth in pipe =    4.65(In.)
Flow top width inside pipe =    9.00(In.)
Critical Depth =    7.99(In.)
Pipe flow velocity =      9.58(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     6.04 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.910(Ac.)
Runoff from this stream =      2.205(CFS)
Time of concentration =    6.04 min.
Rainfall intensity =     2.829(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1        1.824      6.86                2.661
2        2.205      6.04                2.829
Largest stream flow has longer or shorter time of concentration
Qp =      2.205 + sum of
          Qa          Tb/Ta
           1.824 *    0.880 =      1.606
Qp =      3.810

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.824       2.205
Area of streams before confluence:
        0.720        0.910
Results of confluence:
Total flow rate =      3.810(CFS)
Time of concentration =     6.042 min.
Effective stream area after confluence =      1.630(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   634.000(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =   213.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.810(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.810(CFS)
Normal flow depth in pipe =   10.34(In.)
Flow top width inside pipe =   13.89(In.)
Critical Depth =    9.47(In.)
Pipe flow velocity =      4.22(Ft/s)
```

```
Travel time through pipe =    0.84 min.
Time of concentration (TC) =     6.88 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.630(Ac.)
Runoff from this stream =      3.810(CFS)
Time of concentration =    6.88 min.
Rainfall intensity =     2.658(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.897      8.83               2.359
2        3.810      6.88               2.658
Largest stream flow has longer time of concentration
Qp =      5.897 + sum of
          Qb         Ia/Ib
           3.810 *    0.887 =      3.382
Qp =      9.278

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.897       3.810
Area of streams before confluence:
        2.650        1.630


Results of confluence:
Total flow rate =      9.278(CFS)
Time of concentration =     8.827 min.
Effective stream area after confluence  =      4.280(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   632.900(Ft.)
Downstream point/station elevation =   632.300(Ft.)
Pipe length  =    43.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.278(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     9.278(CFS)
Normal flow depth in pipe =   11.60(In.)
Flow top width inside pipe =   17.23(In.)
Critical Depth =   14.13(In.)
Pipe flow velocity =      7.70(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     8.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.280(Ac.)
Runoff from this stream =      9.278(CFS)
Time of concentration =    8.92 min.
Rainfall intensity =     2.347(In/Hr)
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   438.000(Ft.)
Top (of initial area) elevation =   644.300(Ft.)
Bottom (of initial area) elevation =   638.700(Ft.)
Difference in elevation =     5.600(Ft.)
Slope =    0.01279  s(percent)=       1.28
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.173 min.
Rainfall intensity =      2.447(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.852
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.605(CFS)
Total initial stream area =        0.770(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.770(Ac.)
Runoff from this stream =      1.605(CFS)
Time of concentration =    8.17 min.
Rainfall intensity =     2.447(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      116.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   510.000(Ft.)
Top (of initial area) elevation =   641.000(Ft.)
Bottom (of initial area) elevation =   637.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00784  s(percent)=       0.78
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.577 min.
Rainfall intensity =      2.268(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.850
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.521(CFS)
Total initial stream area =        0.270(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   633.500(Ft.)
Downstream point/station elevation =   632.300(Ft.)
Pipe length  =   119.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     0.521(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.521(CFS)
Normal flow depth in pipe =    4.55(In.)
Flow top width inside pipe =    5.14(In.)
Critical Depth =    4.41(In.)
Pipe flow velocity =      3.26(Ft/s)
Travel time through pipe =    0.61 min.
Time of concentration (TC) =    10.19 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.270(Ac.)
Runoff from this stream =      0.521(CFS)
Time of concentration =   10.19 min.
Rainfall intensity =     2.202(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        9.278      8.92               2.347
2        1.605      8.17               2.447
3        0.521     10.19               2.202
Largest stream flow has longer or shorter time of concentration
Qp =      9.278 + sum of
          Qb         Ia/Ib
           1.605 *    0.959 =      1.539
          Qa          Tb/Ta
           0.521 *    0.876 =      0.456
Qp =     11.273

Total of 3 main streams to confluence:
Flow rates before confluence point:
       9.278       1.605       0.521
Area of streams before confluence:
        4.280        0.770        0.270


Results of confluence:
Total flow rate =     11.273(CFS)
Time of concentration =     8.920 min.
Effective stream area after confluence  =      5.320(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   632.300(Ft.)
Downstream point/station elevation =   630.200(Ft.)
Pipe length  =    62.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.273(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    11.273(CFS)
Normal flow depth in pipe =   11.65(In.)
Flow top width inside pipe =   12.50(In.)
Critical depth could not be calculated.
Pipe flow velocity =     11.02(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     9.01 min.
End of computations, total study area =            5.32 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

```
Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/18/23 File:1995D10B.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED CONDITION HYDROLOGY AREA B
RCC&WCD 10 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 304.000(Ft.)
Top (of initial area) elevation = 642.900(Ft.)
Bottom (of initial area) elevation = 641.200(Ft.)
Difference in elevation = 1.700(Ft.)
Slope = 0.00559 s(percent)= 0.56
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.332 min.
Rainfall intensity = 2.425(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.852
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 1.610(CFS)
Total initial stream area = 0.780(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 202.000 to Point/Station 203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
Upstream point/station elevation =   637.200(Ft.)
Downstream point/station elevation =   633.400(Ft.)
Pipe length  =   375.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.610(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.610(CFS)
Normal flow depth in pipe =    7.13(In.)
Flow top width inside pipe =    7.31(In.)
Critical Depth =    7.00(In.)
Pipe flow velocity =      4.29(Ft/s)
Travel time through pipe =    1.46 min.
Time of concentration (TC) =     9.79 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.780(Ac.)
Runoff from this stream =      1.610(CFS)
Time of concentration =    9.79 min.
Rainfall intensity =     2.244(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      203.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   261.000(Ft.)
Top (of initial area) elevation =   645.500(Ft.)
Bottom (of initial area) elevation =   638.300(Ft.)
Difference in elevation =     7.200(Ft.)
Slope =    0.02759  s(percent)=       2.76
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.697 min.
Rainfall intensity =      2.910(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.856
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      6.474(CFS)
Total initial stream area =        2.600(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.600(Ac.)
Runoff from this stream =      6.474(CFS)
Time of concentration =    5.70 min.
Rainfall intensity =     2.910(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        1.610      9.79               2.244
2        6.474      5.70               2.910
```

```
Largest stream flow has longer or shorter time of concentration
Qp =      6.474 + sum of
          Qa          Tb/Ta
           1.610 *    0.582 =      0.937
Qp =      7.412

Total of 2 main streams to confluence:
Flow rates before confluence point:
       1.610       6.474
Area of streams before confluence:
        0.780        2.600


Results of confluence:
Total flow rate =      7.412(CFS)
Time of concentration =     5.697 min.
Effective stream area after confluence  =      3.380(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   633.400(Ft.)
Downstream point/station elevation =   632.000(Ft.)
Pipe length  =   287.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.412(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.412(CFS)
Normal flow depth in pipe =   14.93(In.)
Flow top width inside pipe =   13.54(In.)
Critical Depth =   12.66(In.)
Pipe flow velocity =      4.73(Ft/s)
Travel time through pipe =    1.01 min.
Time of concentration (TC) =     6.71 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      204.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.380(Ac.)
Runoff from this stream =      7.412(CFS)
Time of concentration =    6.71 min.
Rainfall intensity =     2.691(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      204.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Initial area flow distance =   247.000(Ft.)
Top (of initial area) elevation =   643.900(Ft.)
Bottom (of initial area) elevation =   638.000(Ft.)
Difference in elevation =     5.900(Ft.)
Slope =    0.02389  s(percent)=       2.39
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.735 min.
Rainfall intensity =      2.901(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.856
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      5.708(CFS)
```

```
Total initial stream area =        2.300(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      204.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.300(Ac.)
Runoff from this stream =      5.708(CFS)
Time of concentration =    5.74 min.
Rainfall intensity =     2.901(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        7.412      6.71               2.691
2        5.708      5.74               2.901
Largest stream flow has longer time of concentration
Qp =      7.412 + sum of
          Qb         Ia/Ib
           5.708 *    0.928 =      5.295
Qp =     12.706

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.412       5.708
Area of streams before confluence:
        3.380        2.300


Results of confluence:
Total flow rate =     12.706(CFS)
Time of concentration =     6.708 min.
Effective stream area after confluence  =      5.680(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   632.000(Ft.)
Downstream point/station elevation =   629.000(Ft.)
Pipe length  =   474.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.706(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    12.706(CFS)
Normal flow depth in pipe =   17.37(In.)
Flow top width inside pipe =   15.89(In.)
Critical Depth =   15.93(In.)
Pipe flow velocity =      5.97(Ft/s)
Travel time through pipe =    1.32 min.
Time of concentration (TC) =     8.03 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      5.680(Ac.)
Runoff from this stream =     12.706(CFS)
Time of concentration =    8.03 min.
Rainfall intensity =     2.468(In/Hr)
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      209.000 to Point/Station      205.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   403.000(Ft.)
Top (of initial area) elevation =   640.000(Ft.)
Bottom (of initial area) elevation =   637.300(Ft.)
Difference in elevation =     2.700(Ft.)
Slope =    0.00670  s(percent)=       0.67
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.996 min.
Rainfall intensity =      2.337(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.851
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.088(CFS)
Total initial stream area =        1.050(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.050(Ac.)
Runoff from this stream =      2.088(CFS)
Time of concentration =    9.00 min.
Rainfall intensity =     2.337(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       12.706      8.03               2.468
2        2.088      9.00               2.337
Largest stream flow has longer or shorter time of concentration
Qp =     12.706 + sum of
          Qa          Tb/Ta
           2.088 *    0.893 =      1.864
Qp =     14.570

Total of 2 main streams to confluence:
Flow rates before confluence point:
      12.706       2.088
Area of streams before confluence:
        5.680        1.050


Results of confluence:
Total flow rate =     14.570(CFS)
Time of concentration =     8.031 min.
Effective stream area after confluence  =      6.730(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   629.000(Ft.)
Downstream point/station elevation =   627.700(Ft.)
Pipe length  =    64.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.570(CFS)
```

```
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    14.570(CFS)
Normal flow depth in pipe =   14.34(In.)
Flow top width inside pipe =   14.48(In.)
Critical Depth =   16.75(In.)
Pipe flow velocity =      9.65(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =     8.14 min.
End of computations, total study area =            6.73 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/18/23 File:1995D10C.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED CONDITION HYDROLOGY AREA C
RCFC&WCD 10 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++
Process from Point/Station 301.000 to Point/Station 302.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 453.000(Ft.)
Top (of initial area) elevation = 642.900(Ft.)
Bottom (of initial area) elevation = 640.200(Ft.)
Difference in elevation = 2.700(Ft.)
Slope = 0.00596 s(percent)= 0.60
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.650 min.
Rainfall intensity = 2.260(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.850
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 2.535(CFS)
Total initial stream area = 1.320(Ac.)
Pervious area fraction = 0.100

++
Process from Point/Station 302.000 to Point/Station 303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
_____________________________________________________________________________
Upstream point/station elevation =   636.200(Ft.)
Downstream point/station elevation =   635.400(Ft.)
Pipe length  =   172.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.535(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.535(CFS)
Normal flow depth in pipe =    8.16(In.)
Flow top width inside pipe =   14.94(In.)
Critical Depth =    7.65(In.)
Pipe flow velocity =      3.71(Ft/s)
Travel time through pipe =    0.77 min.
Time of concentration (TC) =    10.42 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.320(Ac.)
Runoff from this stream =      2.535(CFS)
Time of concentration =   10.42 min.
Rainfall intensity =     2.178(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      307.000 to Point/Station      308.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
Initial area flow distance =   220.000(Ft.)
Top (of initial area) elevation =   641.000(Ft.)
Bottom (of initial area) elevation =   639.400(Ft.)
Difference in elevation =     1.600(Ft.)
Slope =    0.00727  s(percent)=       0.73
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.946 min.
Rainfall intensity =      2.646(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.853
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.410(CFS)
Total initial stream area =        1.510(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      308.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   635.900(Ft.)
Downstream point/station elevation =   635.400(Ft.)
Pipe length  =     7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.410(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.410(CFS)
Normal flow depth in pipe =    5.93(In.)
Flow top width inside pipe =    8.53(In.)
Critical depth could not be calculated.
Pipe flow velocity =     11.04(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     6.96 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.510(Ac.)
Runoff from this stream =      3.410(CFS)
Time of concentration =    6.96 min.
Rainfall intensity =     2.644(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.535     10.42               2.178
2        3.410      6.96               2.644
Largest stream flow has longer or shorter time of concentration
Qp =      3.410 + sum of
          Qa          Tb/Ta
           2.535 *    0.668 =      1.692
Qp =      5.103

Total of 2 main streams to confluence:
Flow rates before confluence point:
       2.535       3.410
Area of streams before confluence:
        1.320        1.510


Results of confluence:
Total flow rate =      5.103(CFS)
Time of concentration =     6.957 min.
Effective stream area after confluence  =      2.830(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   635.400(Ft.)
Downstream point/station elevation =   633.200(Ft.)
Pipe length  =   430.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.103(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.103(CFS)
Normal flow depth in pipe =   10.88(In.)
Flow top width inside pipe =   17.61(In.)
Critical Depth =   10.43(In.)
Pipe flow velocity =      4.57(Ft/s)
Travel time through pipe =    1.57 min.
Time of concentration (TC) =     8.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      304.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.830(Ac.)
Runoff from this stream =      5.103(CFS)
Time of concentration =    8.52 min.
Rainfall intensity =     2.398(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      309.000 to Point/Station      310.000
**** INITIAL AREA EVALUATION ****
```

```
Initial area flow distance =   295.000(Ft.)
Top (of initial area) elevation =   641.500(Ft.)
Bottom (of initial area) elevation =   638.900(Ft.)
Difference in elevation =     2.600(Ft.)
Slope =    0.00881  s(percent)=       0.88
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.517 min.
Rainfall intensity =      2.548(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.853
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.020(CFS)
Total initial stream area =        0.930(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      304.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   634.900(Ft.)
Downstream point/station elevation =   633.200(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.020(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.020(CFS)
Normal flow depth in pipe =    4.79(In.)
Flow top width inside pipe =    8.98(In.)
Critical Depth =    7.74(In.)
Pipe flow velocity =      8.47(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     7.59 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      304.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.930(Ac.)
Runoff from this stream =      2.020(CFS)
Time of concentration =    7.59 min.
Rainfall intensity =     2.537(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.103      8.52               2.398
2        2.020      7.59               2.537
Largest stream flow has longer time of concentration
Qp =      5.103 + sum of
          Qb         Ia/Ib
           2.020 *    0.945 =      1.910
Qp =      7.013

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.103       2.020
Area of streams before confluence:
        2.830        0.930
```

```
Results of confluence:
Total flow rate =      7.013(CFS)
Time of concentration =     8.525 min.
Effective stream area after confluence  =      3.760(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      305.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   633.200(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =    71.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.013(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     7.013(CFS)
Normal flow depth in pipe =   12.70(In.)
Flow top width inside pipe =   20.53(In.)
Critical Depth =   11.75(In.)
Pipe flow velocity =      4.60(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =     8.78 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      305.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.760(Ac.)
Runoff from this stream =      7.013(CFS)
Time of concentration =    8.78 min.
Rainfall intensity =     2.364(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      311.000 to Point/Station      310.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   234.000(Ft.)
Top (of initial area) elevation =   639.500(Ft.)
Bottom (of initial area) elevation =   636.500(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.01282  s(percent)=       1.28
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.357 min.
Rainfall intensity =      2.761(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.854
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.377(CFS)
Total initial stream area =        0.160(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      305.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   633.000(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.377(CFS)
Nearest computed pipe diameter  =      9.00(In.)
```

```
Calculated individual pipe flow  =     0.377(CFS)
Normal flow depth in pipe =    3.86(In.)
Flow top width inside pipe =    8.91(In.)
Critical Depth =    3.30(In.)
Pipe flow velocity =      2.09(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     6.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      305.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.160(Ac.)
Runoff from this stream =      0.377(CFS)
Time of concentration =    6.58 min.
Rainfall intensity =     2.716(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        7.013      8.78               2.364
2        0.377      6.58               2.716
Largest stream flow has longer time of concentration
Qp =      7.013 + sum of
          Qb         Ia/Ib
           0.377 *    0.871 =      0.329
Qp =      7.341

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.013       0.377
Area of streams before confluence:
        3.760        0.160


Results of confluence:
Total flow rate =      7.341(CFS)
Time of concentration =     8.782 min.
Effective stream area after confluence  =      3.920(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   632.900(Ft.)
Downstream point/station elevation =   627.400(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.341(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.341(CFS)
Normal flow depth in pipe =    9.06(In.)
Flow top width inside pipe =   14.67(In.)
Critical Depth =   12.97(In.)
Pipe flow velocity =      9.48(Ft/s)
Travel time through pipe =    0.34 min.
Time of concentration (TC) =     9.13 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.920(Ac.)
```

```
Runoff from this stream =      7.341(CFS)
Time of concentration =    9.13 min.
Rainfall intensity =     2.321(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      312.000 to Point/Station      313.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   815.000(Ft.)
Top (of initial area) elevation =   644.000(Ft.)
Bottom (of initial area) elevation =   641.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00368  s(percent)=       0.37
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.440 min.
Rainfall intensity =      1.928(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.846
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.485(CFS)
Total initial stream area =        0.910(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      313.000 to Point/Station      314.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   641.000(Ft.)
Downstream point/station elevation =   640.000(Ft.)
Pipe length  =    34.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.485(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.485(CFS)
Normal flow depth in pipe =    4.62(In.)
Flow top width inside pipe =    9.00(In.)
Critical Depth =    6.73(In.)
Pipe flow velocity =      6.50(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    13.53 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      314.000 to Point/Station      315.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   640.000(Ft.)
Downstream point elevation =   634.100(Ft.)
Channel length thru subarea  =   309.000(Ft.)
Channel base width     =    3.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      1.884(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =      1.884(CFS)
Depth of flow =   0.158(Ft.), Average velocity =   3.775(Ft/s)
Channel flow top width =    3.316(Ft.)
Flow Velocity =    3.77(Ft/s)
Travel time  =    1.36 min.
Time of concentration =   14.89 min.

Sub-Channel No. 1 Critical depth =      0.225(Ft.)
  '     '       '     Critical flow top width =      3.449(Ft.)
```

```
  '     '       '     Critical flow velocity=    2.602(Ft/s)
  '     '       '     Critical flow area =      0.724(Sq.Ft)

 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.845
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      1.835(In/Hr) for a    10.0 year storm
Subarea runoff =      0.760(CFS) for      0.490(Ac.)
Total runoff =      2.245(CFS)        Total area =       1.400(Ac.)
Depth of flow =   0.176(Ft.), Average velocity =   4.026(Ft/s)

Sub-Channel No. 1 Critical depth =      0.252(Ft.)
  '     '       '     Critical flow top width =      3.504(Ft.)
  '     '       '     Critical flow velocity=    2.740(Ft/s)
  '     '       '     Critical flow area =      0.819(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      315.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
____________________________________________________________________________
Upstream point/station elevation =   634.100(Ft.)
Downstream point/station elevation =   627.400(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.245(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     2.245(CFS)
Normal flow depth in pipe =    3.48(In.)
Flow top width inside pipe =    5.92(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.02(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    14.91 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
____________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.400(Ac.)
Runoff from this stream =      2.245(CFS)
Time of concentration =   14.91 min.
Rainfall intensity =     1.834(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        7.341      9.13               2.321
2        2.245     14.91               1.834
Largest stream flow has longer or shorter time of concentration
Qp =      7.341 + sum of
          Qa          Tb/Ta
           2.245 *    0.612 =      1.374
Qp =      8.716

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.341       2.245
Area of streams before confluence:
        3.920        1.400
```

Results of confluence:
Total flow rate = 8.716(CFS)
Time of concentration = 9.127 min.
Effective stream area after confluence = 5.320(Ac.)
End of computations, total study area = 5.32 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/19/23 File:1995D10D.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED OFFSITE CONDITION HYDROLOGY AREA D
RCFC&WCD 10 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.940(In/Hr)
Slope of intensity duration curve = 0.4800

++
Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 630.000(Ft.)
Top (of initial area) elevation = 647.900(Ft.)
Bottom (of initial area) elevation = 643.900(Ft.)
Difference in elevation = 4.000(Ft.)
Slope = 0.00635 s(percent)= 0.63
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.872 min.
Rainfall intensity = 2.134(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.849
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 2.771(CFS)
Total initial stream area = 1.530(Ac.)
Pervious area fraction = 0.100

++
Process from Point/Station 402.000 to Point/Station 403.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
Upstream point/station elevation =   638.500(Ft.)
Downstream point/station elevation =   637.100(Ft.)
Pipe length  =   278.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.771(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.771(CFS)
Normal flow depth in pipe =    8.41(In.)
Flow top width inside pipe =   14.89(In.)
Critical Depth =    8.02(In.)
Pipe flow velocity =      3.91(Ft/s)
Travel time through pipe =    1.18 min.
Time of concentration (TC) =    12.06 min.
End of computations, total study area =            1.53 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

100 YEAR PROPOSED CONDITION

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/18/23 File:1995D100A.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED CONDITION HYDROLOGY AREA A
RCFC&WCD 100 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 101.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 200.000(Ft.)
Top (of initial area) elevation = 644.900(Ft.)
Bottom (of initial area) elevation = 642.800(Ft.)
Difference in elevation = 2.100(Ft.)
Slope = 0.01050 s(percent)= 1.05
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.213 min.
Rainfall intensity = 4.306(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.864
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 2.680(CFS)
Total initial stream area = 0.720(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 102.000 to Point/Station 103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
Upstream point/station elevation =   638.800(Ft.)
Downstream point/station elevation =   634.800(Ft.)
Pipe length  =   402.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.680(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.680(CFS)
Normal flow depth in pipe =    7.78(In.)
Flow top width inside pipe =   11.46(In.)
Critical Depth =    8.42(In.)
Pipe flow velocity =      4.97(Ft/s)
Travel time through pipe =    1.35 min.
Time of concentration (TC) =     7.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.720(Ac.)
Runoff from this stream =      2.680(CFS)
Time of concentration =    7.56 min.
Rainfall intensity =     3.919(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   395.000(Ft.)
Top (of initial area) elevation =   648.100(Ft.)
Bottom (of initial area) elevation =   641.400(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.01696  s(percent)=       1.70
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.411 min.
Rainfall intensity =      3.957(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.862
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      6.586(CFS)
Total initial stream area =        1.930(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   637.400(Ft.)
Downstream point/station elevation =   634.800(Ft.)
Pipe length  =    60.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.586(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     6.586(CFS)
Normal flow depth in pipe =    8.80(In.)
Flow top width inside pipe =   10.61(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.67(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     7.50 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.930(Ac.)
Runoff from this stream =      6.586(CFS)
Time of concentration =    7.50 min.
Rainfall intensity =     3.933(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.680      7.56               3.919
2        6.586      7.50               3.933
Largest stream flow has longer or shorter time of concentration
Qp =      6.586 + sum of
          Qa          Tb/Ta
           2.680 *    0.993 =      2.660
Qp =      9.246

Total of 2 main streams to confluence:
Flow rates before confluence point:
       2.680       6.586
Area of streams before confluence:
        0.720        1.930


Results of confluence:
Total flow rate =      9.246(CFS)
Time of concentration =     7.505 min.
Effective stream area after confluence  =      2.650(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   634.800(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =   371.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.246(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     9.246(CFS)
Normal flow depth in pipe =   14.41(In.)
Flow top width inside pipe =   19.49(In.)
Critical Depth =   13.57(In.)
Pipe flow velocity =      5.26(Ft/s)
Travel time through pipe =    1.18 min.
Time of concentration (TC) =     8.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.650(Ac.)
Runoff from this stream =      9.246(CFS)
Time of concentration =    8.68 min.
Rainfall intensity =     3.667(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
```

```
Initial area flow distance =   212.000(Ft.)
Top (of initial area) elevation =   643.600(Ft.)
Bottom (of initial area) elevation =   639.000(Ft.)
Difference in elevation =     4.600(Ft.)
Slope =    0.02170  s(percent)=       2.17
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.500 min.
Rainfall intensity =      4.566(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.866
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.845(CFS)
Total initial stream area =        0.720(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   635.500(Ft.)
Downstream point/station elevation =   634.000(Ft.)
Pipe length  =   290.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.845(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     2.845(CFS)
Normal flow depth in pipe =    8.48(In.)
Flow top width inside pipe =   14.87(In.)
Critical Depth =    8.12(In.)
Pipe flow velocity =      3.98(Ft/s)
Travel time through pipe =    1.22 min.
Time of concentration (TC) =     6.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      0.720(Ac.)
Runoff from this stream =      2.845(CFS)
Time of concentration =    6.72 min.
Rainfall intensity =     4.148(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   177.000(Ft.)
Top (of initial area) elevation =   640.400(Ft.)
Bottom (of initial area) elevation =   638.700(Ft.)
Difference in elevation =     1.700(Ft.)
Slope =    0.00960  s(percent)=       0.96
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.023 min.
Rainfall intensity =      4.371(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.865
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
```

```
Initial subarea runoff =      3.439(CFS)
Total initial stream area =        0.910(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   634.700(Ft.)
Downstream point/station elevation =   634.000(Ft.)
Pipe length  =    11.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.439(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.439(CFS)
Normal flow depth in pipe =    6.22(In.)
Flow top width inside pipe =    8.31(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.55(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =     6.04 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.910(Ac.)
Runoff from this stream =      3.439(CFS)
Time of concentration =    6.04 min.
Rainfall intensity =     4.365(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1        2.845      6.72                4.148
2        3.439      6.04                4.365
Largest stream flow has longer or shorter time of concentration
Qp =      3.439 + sum of
          Qa          Tb/Ta
           2.845 *    0.899 =      2.559
Qp =      5.998

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.845       3.439
Area of streams before confluence:
        0.720        0.910
Results of confluence:
Total flow rate =      5.998(CFS)
Time of concentration =     6.040 min.
Effective stream area after confluence =      1.630(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   634.000(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =   213.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.998(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.998(CFS)
Normal flow depth in pipe =   12.12(In.)
Flow top width inside pipe =   16.89(In.)
Critical Depth =   11.35(In.)
Pipe flow velocity =      4.74(Ft/s)
```

```
Travel time through pipe =    0.75 min.
Time of concentration (TC) =     6.79 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.630(Ac.)
Runoff from this stream =      5.998(CFS)
Time of concentration =    6.79 min.
Rainfall intensity =     4.127(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        9.246      8.68               3.667
2        5.998      6.79               4.127
Largest stream flow has longer time of concentration
Qp =      9.246 + sum of
          Qb         Ia/Ib
           5.998 *    0.889 =      5.331
Qp =     14.577

Total of 2 main streams to confluence:
Flow rates before confluence point:
       9.246       5.998
Area of streams before confluence:
        2.650        1.630


Results of confluence:
Total flow rate =     14.577(CFS)
Time of concentration =     8.681 min.
Effective stream area after confluence  =      4.280(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   632.900(Ft.)
Downstream point/station elevation =   632.300(Ft.)
Pipe length  =    43.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.577(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    14.577(CFS)
Normal flow depth in pipe =   13.93(In.)
Flow top width inside pipe =   19.85(In.)
Critical Depth =   17.00(In.)
Pipe flow velocity =      8.60(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =     8.76 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.280(Ac.)
Runoff from this stream =     14.577(CFS)
Time of concentration =    8.76 min.
Rainfall intensity =     3.651(In/Hr)
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   438.000(Ft.)
Top (of initial area) elevation =   644.300(Ft.)
Bottom (of initial area) elevation =   638.700(Ft.)
Difference in elevation =     5.600(Ft.)
Slope =    0.01279  s(percent)=       1.28
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.173 min.
Rainfall intensity =      3.775(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.861
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.504(CFS)
Total initial stream area =        0.770(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.770(Ac.)
Runoff from this stream =      2.504(CFS)
Time of concentration =    8.17 min.
Rainfall intensity =     3.775(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      116.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   510.000(Ft.)
Top (of initial area) elevation =   641.000(Ft.)
Bottom (of initial area) elevation =   637.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00784  s(percent)=       0.78
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.577 min.
Rainfall intensity =      3.498(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.860
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.812(CFS)
Total initial stream area =        0.270(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   633.500(Ft.)
Downstream point/station elevation =   632.300(Ft.)
Pipe length  =   119.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     0.812(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.812(CFS)
Normal flow depth in pipe =    4.44(In.)
Flow top width inside pipe =    9.00(In.)
Critical Depth =    4.94(In.)
Pipe flow velocity =      3.74(Ft/s)
Travel time through pipe =    0.53 min.
Time of concentration (TC) =    10.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.270(Ac.)
Runoff from this stream =      0.812(CFS)
Time of concentration =   10.11 min.
Rainfall intensity =     3.409(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       14.577      8.76               3.651
2        2.504      8.17               3.775
3        0.812     10.11               3.409
Largest stream flow has longer or shorter time of concentration
Qp =     14.577 + sum of
          Qb         Ia/Ib
           2.504 *    0.967 =      2.421
          Qa          Tb/Ta
           0.812 *    0.867 =      0.704
Qp =     17.702

Total of 3 main streams to confluence:
Flow rates before confluence point:
      14.577       2.504       0.812
Area of streams before confluence:
        4.280        0.770        0.270


Results of confluence:
Total flow rate =     17.702(CFS)
Time of concentration =     8.764 min.
Effective stream area after confluence  =      5.320(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   632.300(Ft.)
Downstream point/station elevation =   630.200(Ft.)
Pipe length  =    62.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.702(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    17.702(CFS)
Normal flow depth in pipe =   13.55(In.)
Flow top width inside pipe =   15.53(In.)
Critical depth could not be calculated.
Pipe flow velocity =     12.41(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =     8.85 min.
End of computations, total study area =            5.32 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

```
Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  32.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/18/23 File:1995D100B.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED CONDITION HYDROLOGY AREA B
RCC&WCD 100 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 201.000 to Point/Station 202.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 304.000(Ft.)
Top (of initial area) elevation = 642.900(Ft.)
Bottom (of initial area) elevation = 641.200(Ft.)
Difference in elevation = 1.700(Ft.)
Slope = 0.00559 s(percent)= 0.56
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.332 min.
Rainfall intensity = 3.740(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.861
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 2.513(CFS)
Total initial stream area = 0.780(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 202.000 to Point/Station 203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
Upstream point/station elevation =   637.200(Ft.)
Downstream point/station elevation =   633.400(Ft.)
Pipe length  =   375.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.513(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.513(CFS)
Normal flow depth in pipe =    7.41(In.)
Flow top width inside pipe =   11.67(In.)
Critical Depth =    8.15(In.)
Pipe flow velocity =      4.94(Ft/s)
Travel time through pipe =    1.26 min.
Time of concentration (TC) =     9.60 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.780(Ac.)
Runoff from this stream =      2.513(CFS)
Time of concentration =    9.60 min.
Rainfall intensity =     3.495(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      203.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   261.000(Ft.)
Top (of initial area) elevation =   645.500(Ft.)
Bottom (of initial area) elevation =   638.300(Ft.)
Difference in elevation =     7.200(Ft.)
Slope =    0.02759  s(percent)=       2.76
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.697 min.
Rainfall intensity =      4.489(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.865
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     10.098(CFS)
Total initial stream area =        2.600(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.600(Ac.)
Runoff from this stream =     10.098(CFS)
Time of concentration =    5.70 min.
Rainfall intensity =     4.489(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.513      9.60               3.495
2       10.098      5.70               4.489
```

```
Largest stream flow has longer or shorter time of concentration
Qp =     10.098 + sum of
          Qa          Tb/Ta
           2.513 *    0.594 =      1.492
Qp =     11.590

Total of 2 main streams to confluence:
Flow rates before confluence point:
       2.513      10.098
Area of streams before confluence:
        0.780        2.600


Results of confluence:
Total flow rate =     11.590(CFS)
Time of concentration =     5.697 min.
Effective stream area after confluence  =      3.380(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   633.400(Ft.)
Downstream point/station elevation =   632.000(Ft.)
Pipe length  =   287.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.590(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    11.590(CFS)
Normal flow depth in pipe =   15.28(In.)
Flow top width inside pipe =   23.09(In.)
Critical Depth =   14.66(In.)
Pipe flow velocity =      5.50(Ft/s)
Travel time through pipe =    0.87 min.
Time of concentration (TC) =     6.57 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      204.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.380(Ac.)
Runoff from this stream =     11.590(CFS)
Time of concentration =    6.57 min.
Rainfall intensity =     4.193(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      204.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   247.000(Ft.)
Top (of initial area) elevation =   643.900(Ft.)
Bottom (of initial area) elevation =   638.000(Ft.)
Difference in elevation =     5.900(Ft.)
Slope =    0.02389  s(percent)=       2.39
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.735 min.
Rainfall intensity =      4.475(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.865
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      8.904(CFS)
```

```
Total initial stream area =        2.300(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      204.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      2.300(Ac.)
Runoff from this stream =      8.904(CFS)
Time of concentration =    5.74 min.
Rainfall intensity =     4.475(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       11.590      6.57               4.193
2        8.904      5.74               4.475
Largest stream flow has longer time of concentration
Qp =     11.590 + sum of
          Qb         Ia/Ib
           8.904 *    0.937 =      8.343
Qp =     19.933

Total of 2 main streams to confluence:
Flow rates before confluence point:
      11.590       8.904
Area of streams before confluence:
        3.380        2.300


Results of confluence:
Total flow rate =     19.933(CFS)
Time of concentration =     6.567 min.
Effective stream area after confluence  =      5.680(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      205.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   632.000(Ft.)
Downstream point/station elevation =   629.000(Ft.)
Pipe length  =   474.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.933(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    19.933(CFS)
Normal flow depth in pipe =   18.42(In.)
Flow top width inside pipe =   25.14(In.)
Critical Depth =   18.75(In.)
Pipe flow velocity =      6.90(Ft/s)
Travel time through pipe =    1.15 min.
Time of concentration (TC) =     7.71 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      5.680(Ac.)
Runoff from this stream =     19.933(CFS)
Time of concentration =    7.71 min.
Rainfall intensity =     3.882(In/Hr)
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      209.000 to Point/Station      205.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   403.000(Ft.)
Top (of initial area) elevation =   640.000(Ft.)
Bottom (of initial area) elevation =   637.300(Ft.)
Difference in elevation =     2.700(Ft.)
Slope =    0.00670  s(percent)=       0.67
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.996 min.
Rainfall intensity =      3.605(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.860
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.257(CFS)
Total initial stream area =        1.050(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      205.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.050(Ac.)
Runoff from this stream =      3.257(CFS)
Time of concentration =    9.00 min.
Rainfall intensity =     3.605(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       19.933      7.71               3.882
2        3.257      9.00               3.605
Largest stream flow has longer or shorter time of concentration
Qp =     19.933 + sum of
          Qa          Tb/Ta
           3.257 *    0.857 =      2.792
Qp =     22.726

Total of 2 main streams to confluence:
Flow rates before confluence point:
      19.933       3.257
Area of streams before confluence:
        5.680        1.050


Results of confluence:
Total flow rate =     22.726(CFS)
Time of concentration =     7.712 min.
Effective stream area after confluence  =      6.730(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      206.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   629.000(Ft.)
Downstream point/station elevation =   627.700(Ft.)
Pipe length  =    64.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.726(CFS)
```

Nearest computed pipe diameter = 21.00(In.)
Calculated individual pipe flow = 22.726(CFS)
Normal flow depth in pipe = 17.34(In.)
Flow top width inside pipe = 15.93(In.)
Critical Depth = 19.80(In.)
Pipe flow velocity = 10.70(Ft/s)
Travel time through pipe = 0.10 min.
Time of concentration (TC) = 7.81 min.
End of computations, total study area = 6.73 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/18/23 File:1995D100C.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED CONDITION HYDROLOGY AREA C
RCFC&WCD 100 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 301.000 to Point/Station 302.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 453.000(Ft.)
Top (of initial area) elevation = 642.900(Ft.)
Bottom (of initial area) elevation = 640.200(Ft.)
Difference in elevation = 2.700(Ft.)
Slope = 0.00596 s(percent)= 0.60
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.650 min.
Rainfall intensity = 3.486(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.860
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 3.956(CFS)
Total initial stream area = 1.320(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 302.000 to Point/Station 303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

```
Upstream point/station elevation =   636.200(Ft.)
Downstream point/station elevation =   635.400(Ft.)
Pipe length  =   172.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.956(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.956(CFS)
Normal flow depth in pipe =   11.11(In.)
Flow top width inside pipe =   13.15(In.)
Critical Depth =    9.66(In.)
Pipe flow velocity =      4.06(Ft/s)
Travel time through pipe =    0.71 min.
Time of concentration (TC) =    10.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.320(Ac.)
Runoff from this stream =      3.956(CFS)
Time of concentration =   10.36 min.
Rainfall intensity =     3.370(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      307.000 to Point/Station      308.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   220.000(Ft.)
Top (of initial area) elevation =   641.000(Ft.)
Bottom (of initial area) elevation =   639.400(Ft.)
Difference in elevation =     1.600(Ft.)
Slope =    0.00727  s(percent)=       0.73
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.946 min.
Rainfall intensity =      4.082(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.863
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      5.320(CFS)
Total initial stream area =        1.510(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      308.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   635.900(Ft.)
Downstream point/station elevation =   635.400(Ft.)
Pipe length  =     7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.320(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.320(CFS)
Normal flow depth in pipe =    6.41(In.)
Flow top width inside pipe =   11.97(In.)
Critical Depth =   11.18(In.)
Pipe flow velocity =     12.46(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     6.96 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.510(Ac.)
Runoff from this stream =      5.320(CFS)
Time of concentration =    6.96 min.
Rainfall intensity =     4.079(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        3.956     10.36               3.370
2        5.320      6.96               4.079
Largest stream flow has longer or shorter time of concentration
Qp =      5.320 + sum of
          Qa          Tb/Ta
           3.956 *    0.672 =      2.657
Qp =      7.977

Total of 2 main streams to confluence:
Flow rates before confluence point:
       3.956       5.320
Area of streams before confluence:
        1.320        1.510


Results of confluence:
Total flow rate =      7.977(CFS)
Time of concentration =     6.956 min.
Effective stream area after confluence  =      2.830(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   635.400(Ft.)
Downstream point/station elevation =   633.200(Ft.)
Pipe length  =   430.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.977(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     7.977(CFS)
Normal flow depth in pipe =   13.00(In.)
Flow top width inside pipe =   20.40(In.)
Critical Depth =   12.57(In.)
Pipe flow velocity =      5.10(Ft/s)
Travel time through pipe =    1.40 min.
Time of concentration (TC) =     8.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      304.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      2.830(Ac.)
Runoff from this stream =      7.977(CFS)
Time of concentration =    8.36 min.
Rainfall intensity =     3.734(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      309.000 to Point/Station      310.000
**** INITIAL AREA EVALUATION ****
```

```
Initial area flow distance =   295.000(Ft.)
Top (of initial area) elevation =   641.500(Ft.)
Bottom (of initial area) elevation =   638.900(Ft.)
Difference in elevation =     2.600(Ft.)
Slope =    0.00881  s(percent)=       0.88
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.517 min.
Rainfall intensity =      3.930(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.862
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.152(CFS)
Total initial stream area =        0.930(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      304.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   634.900(Ft.)
Downstream point/station elevation =   633.200(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.152(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.152(CFS)
Normal flow depth in pipe =    6.46(In.)
Flow top width inside pipe =    8.10(In.)
Critical depth could not be calculated.
Pipe flow velocity =      9.29(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =     7.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      304.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.930(Ac.)
Runoff from this stream =      3.152(CFS)
Time of concentration =    7.58 min.
Rainfall intensity =     3.914(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        7.977      8.36               3.734
2        3.152      7.58               3.914
Largest stream flow has longer time of concentration
Qp =      7.977 + sum of
          Qb         Ia/Ib
           3.152 *    0.954 =      3.007
Qp =     10.983

Total of 2 main streams to confluence:
Flow rates before confluence point:
       7.977       3.152
Area of streams before confluence:
        2.830        0.930
```

```
Results of confluence:
Total flow rate =     10.983(CFS)
Time of concentration =     8.360 min.
Effective stream area after confluence  =      3.760(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      305.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   633.200(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =    71.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.983(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    10.983(CFS)
Normal flow depth in pipe =   18.90(In.)
Flow top width inside pipe =   12.60(In.)
Critical Depth =   14.81(In.)
Pipe flow velocity =      4.81(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     8.61 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      305.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.760(Ac.)
Runoff from this stream =     10.983(CFS)
Time of concentration =    8.61 min.
Rainfall intensity =     3.683(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      311.000 to Point/Station      310.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   234.000(Ft.)
Top (of initial area) elevation =   639.500(Ft.)
Bottom (of initial area) elevation =   636.500(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.01282  s(percent)=       1.28
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.357 min.
Rainfall intensity =      4.259(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.864
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.589(CFS)
Total initial stream area =        0.160(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      310.000 to Point/Station      305.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   633.000(Ft.)
Downstream point/station elevation =   632.900(Ft.)
Pipe length  =    28.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.589(CFS)
Nearest computed pipe diameter  =      9.00(In.)
```

```
Calculated individual pipe flow  =     0.589(CFS)
Normal flow depth in pipe =    5.00(In.)
Flow top width inside pipe =    8.94(In.)
Critical Depth =    4.17(In.)
Pipe flow velocity =      2.34(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     6.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      305.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.160(Ac.)
Runoff from this stream =      0.589(CFS)
Time of concentration =    6.56 min.
Rainfall intensity =     4.196(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       10.983      8.61               3.683
2        0.589      6.56               4.196
Largest stream flow has longer time of concentration
Qp =     10.983 + sum of
          Qb         Ia/Ib
           0.589 *    0.878 =      0.517
Qp =     11.500

Total of 2 main streams to confluence:
Flow rates before confluence point:
      10.983       0.589
Area of streams before confluence:
        3.760        0.160


Results of confluence:
Total flow rate =     11.500(CFS)
Time of concentration =     8.605 min.
Effective stream area after confluence  =      3.920(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   632.900(Ft.)
Downstream point/station elevation =   627.400(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.500(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    11.500(CFS)
Normal flow depth in pipe =   10.61(In.)
Flow top width inside pipe =   17.71(In.)
Critical Depth =   15.51(In.)
Pipe flow velocity =     10.61(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =     8.91 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.920(Ac.)
```

```
Runoff from this stream =     11.500(CFS)
Time of concentration =    8.91 min.
Rainfall intensity =     3.621(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      312.000 to Point/Station      313.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =   815.000(Ft.)
Top (of initial area) elevation =   644.000(Ft.)
Bottom (of initial area) elevation =   641.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00368  s(percent)=       0.37
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.440 min.
Rainfall intensity =      2.973(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.856
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.316(CFS)
Total initial stream area =        0.910(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      313.000 to Point/Station      314.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   641.000(Ft.)
Downstream point/station elevation =   640.000(Ft.)
Pipe length  =    34.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.316(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     2.316(CFS)
Normal flow depth in pipe =    6.18(In.)
Flow top width inside pipe =    8.35(In.)
Critical Depth =    8.13(In.)
Pipe flow velocity =      7.16(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    13.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      314.000 to Point/Station      315.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   640.000(Ft.)
Downstream point elevation =   634.100(Ft.)
Channel length thru subarea  =   309.000(Ft.)
Channel base width     =    3.000(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      2.940(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =      2.940(CFS)
Depth of flow =   0.206(Ft.), Average velocity =   4.440(Ft/s)
Channel flow top width =    3.413(Ft.)
Flow Velocity =    4.44(Ft/s)
Travel time  =    1.16 min.
Time of concentration =   14.68 min.

Sub-Channel No. 1 Critical depth =      0.301(Ft.)
  '     '       '     Critical flow top width =      3.602(Ft.)
```

```
  '     '       '     Critical flow velocity=    2.961(Ft/s)
  '     '       '     Critical flow area =      0.993(Sq.Ft)

 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.855
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.850(In/Hr) for a   100.0 year storm
Subarea runoff =      1.194(CFS) for      0.490(Ac.)
Total runoff =      3.511(CFS)        Total area =       1.400(Ac.)
Depth of flow =   0.230(Ft.), Average velocity =   4.732(Ft/s)

Sub-Channel No. 1 Critical depth =      0.336(Ft.)
  '     '       '     Critical flow top width =      3.672(Ft.)
  '     '       '     Critical flow velocity=    3.133(Ft/s)
  '     '       '     Critical flow area =      1.121(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      315.000 to Point/Station      306.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   634.100(Ft.)
Downstream point/station elevation =   627.400(Ft.)
Pipe length  =    17.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.511(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     3.511(CFS)
Normal flow depth in pipe =    4.90(In.)
Flow top width inside pipe =    4.65(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.45(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    14.69 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      306.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.400(Ac.)
Runoff from this stream =      3.511(CFS)
Time of concentration =   14.69 min.
Rainfall intensity =     2.849(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       11.500      8.91               3.621
2        3.511     14.69               2.849
Largest stream flow has longer or shorter time of concentration
Qp =     11.500 + sum of
          Qa          Tb/Ta
           3.511 *    0.607 =      2.130
Qp =     13.630

Total of 2 main streams to confluence:
Flow rates before confluence point:
      11.500       3.511
Area of streams before confluence:
        3.920        1.400
```

Results of confluence:
Total flow rate = 13.630(CFS)
Time of concentration = 8.913 min.
Effective stream area after confluence = 5.320(Ac.)
End of computations, total study area = 5.32 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/19/23 File:1995D100D.out

MAGNOLIA AVE BUSINESS CENTER
PROPOSED OFFSITE CONDITION HYDROLOGY AREA D
RCFC&WCD 100 YR STORM EVENT
BY CP

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Program License Serial Number 6062

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 401.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 630.000(Ft.)
Top (of initial area) elevation = 647.900(Ft.)
Bottom (of initial area) elevation = 643.900(Ft.)
Difference in elevation = 4.000(Ft.)
Slope = 0.00635 s(percent)= 0.63
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.872 min.
Rainfall intensity = 3.292(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.858
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 4.323(CFS)
Total initial stream area = 1.530(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 402.000 to Point/Station 403.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 638.500(Ft.)
Downstream point/station elevation = 637.100(Ft.)
Pipe length = 278.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 4.323(CFS)
Nearest computed pipe diameter = 15.00(In.)
Calculated individual pipe flow = 4.323(CFS)
Normal flow depth in pipe = 11.60(In.)
Flow top width inside pipe = 12.56(In.)
Critical Depth = 10.11(In.)
Pipe flow velocity = 4.25(Ft/s)
Travel time through pipe = 1.09 min.
Time of concentration (TC) = 11.96 min.
End of computations, total study area = 1.53 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number = 32.0

Appendix

E

FEMA FLOOD INSURANCE RATE MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1994 or later.

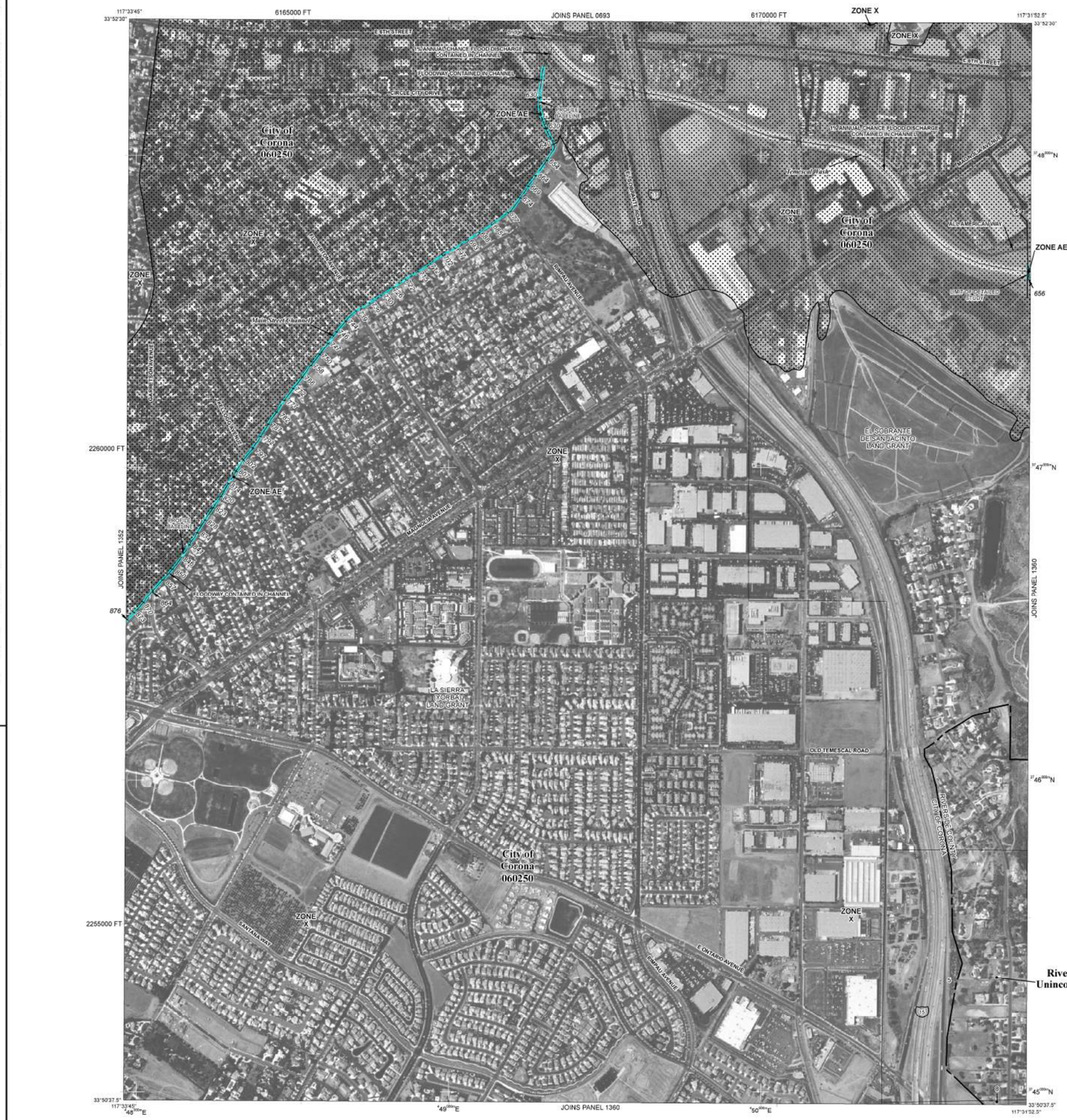
This map may reflect more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 7°76'000"N — 1000-meter Universal Transverse Mercator grid values, zone 11N
- 600000 FT — 5000-foot grid ticks: California State Plane coordinate system, zone VI (FIPSZONE 0406), Lambert Conformal Conic projection
- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- ● M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
August 28, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 1356G

FIRM

FLOOD INSURANCE RATE MAP

RIVERSIDE COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 1356 OF 3805
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
CORONA, CITY OF	060250	1356	G
RIVERSIDE COUNTY	060245	1356	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

NATIONAL FLOOD INSURANCE PROGRAM

MAP NUMBER
06065C1356G

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency

Appendix

F

DRAINAGE FACILITY CALCULATIONS

Worksheet for SD Outlet A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.43600	ft/ft
Diameter	2.00	ft
Discharge	17.60	ft³/s

Results

Normal Depth	0.46	ft
Flow Area	0.55	ft²
Wetted Perimeter	2.01	ft
Hydraulic Radius	0.27	ft
Top Width	1.69	ft
Critical Depth	1.51	ft
Percent Full	23.2	%
Critical Slope	0.00715	ft/ft
Velocity	31.89	ft/s
Velocity Head	15.81	ft
Specific Energy	16.27	ft
Froude Number	9.83	
Maximum Discharge	160.68	ft³/s
Discharge Full	149.37	ft³/s
Slope Full	0.00605	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	23.18	%
Downstream Velocity	Infinity	ft/s

Worksheet for SD Outlet A

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.46	ft
Critical Depth	1.51	ft
Channel Slope	0.43600	ft/ft
Critical Slope	0.00715	ft/ft

Cross Section for SD Outlet A

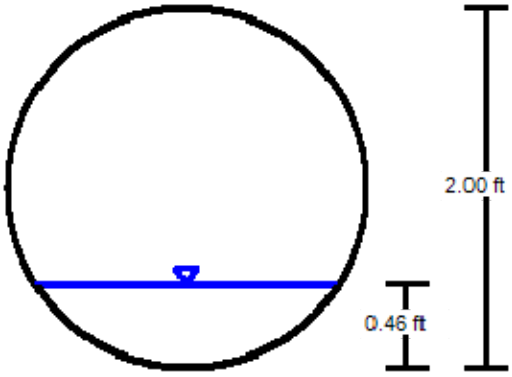
Project Description

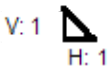
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.43600	ft/ft
Normal Depth	0.46	ft
Diameter	2.00	ft
Discharge	17.60	ft³/s

Cross Section Image





Worksheet for SD Outlet B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.42600	ft/ft
Diameter	2.00	ft
Discharge	20.55	ft^3/s

Results

Normal Depth	0.50	ft
Flow Area	0.62	ft^2
Wetted Perimeter	2.10	ft
Hydraulic Radius	0.30	ft
Top Width	1.74	ft
Critical Depth	1.63	ft
Percent Full	25.2	%
Critical Slope	0.00838	ft/ft
Velocity	33.08	ft/s
Velocity Head	17.01	ft
Specific Energy	17.51	ft
Froude Number	9.75	
Maximum Discharge	158.82	ft^3/s
Discharge Full	147.65	ft^3/s
Slope Full	0.00825	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	25.20	%
Downstream Velocity	Infinity	ft/s

Worksheet for SD Outlet B

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	1.63	ft
Channel Slope	0.42600	ft/ft
Critical Slope	0.00838	ft/ft

Cross Section for SD Outlet B

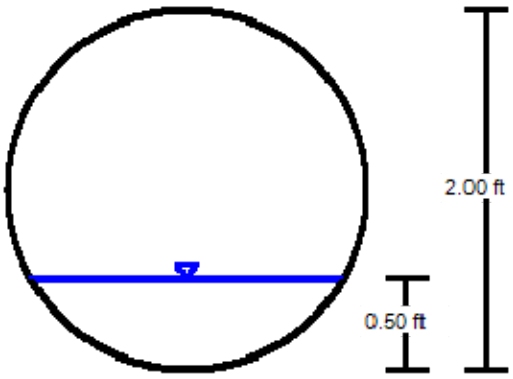
Project Description

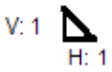
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.42600	ft/ft
Normal Depth	0.50	ft
Diameter	2.00	ft
Discharge	20.55	ft³/s

Cross Section Image





Worksheet for SD Outlet C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.41000	ft/ft
Diameter	2.00	ft
Discharge	10.75	ft³/s

Results

Normal Depth	0.37	ft
Flow Area	0.40	ft²
Wetted Perimeter	1.78	ft
Hydraulic Radius	0.22	ft
Top Width	1.55	ft
Critical Depth	1.18	ft
Percent Full	18.4	%
Critical Slope	0.00533	ft/ft
Velocity	27.01	ft/s
Velocity Head	11.34	ft
Specific Energy	11.71	ft
Froude Number	9.40	
Maximum Discharge	155.81	ft³/s
Discharge Full	144.85	ft³/s
Slope Full	0.00226	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	18.44	%
Downstream Velocity	Infinity	ft/s

Worksheet for SD Outlet C

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.37	ft
Critical Depth	1.18	ft
Channel Slope	0.41000	ft/ft
Critical Slope	0.00533	ft/ft

Cross Section for SD Outlet C

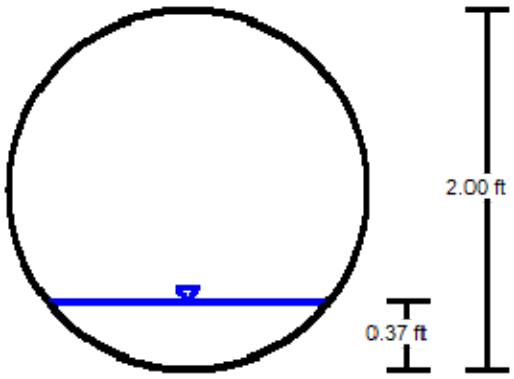
Project Description

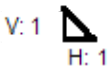
Friction Method	Manning Formula
Solve For	Normal Depth

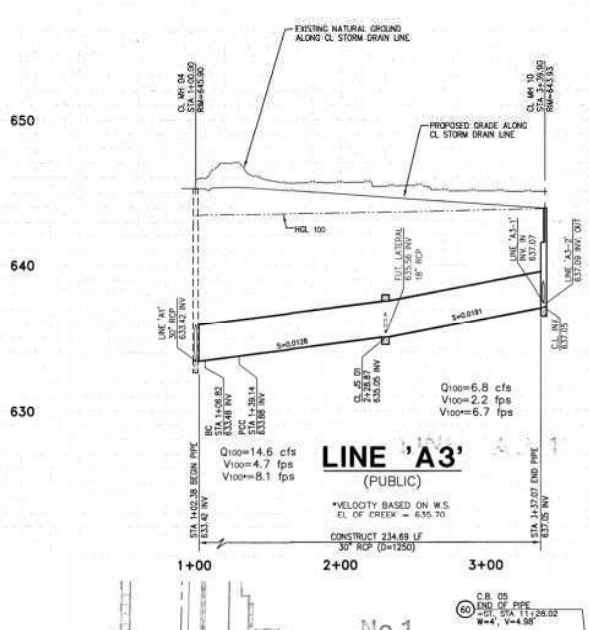
Input Data

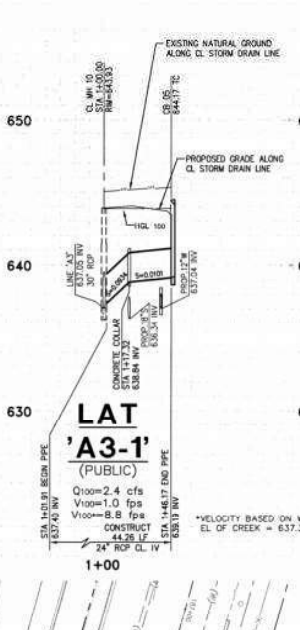
Roughness Coefficient	0.013	
Channel Slope	0.41000	ft/ft
Normal Depth	0.37	ft
Diameter	2.00	ft
Discharge	10.75	ft³/s

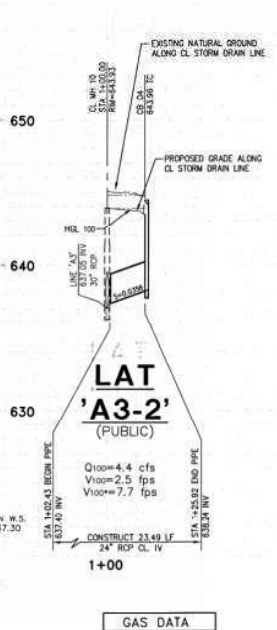
Cross Section Image

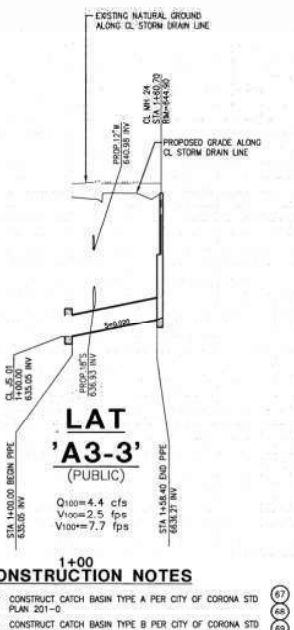




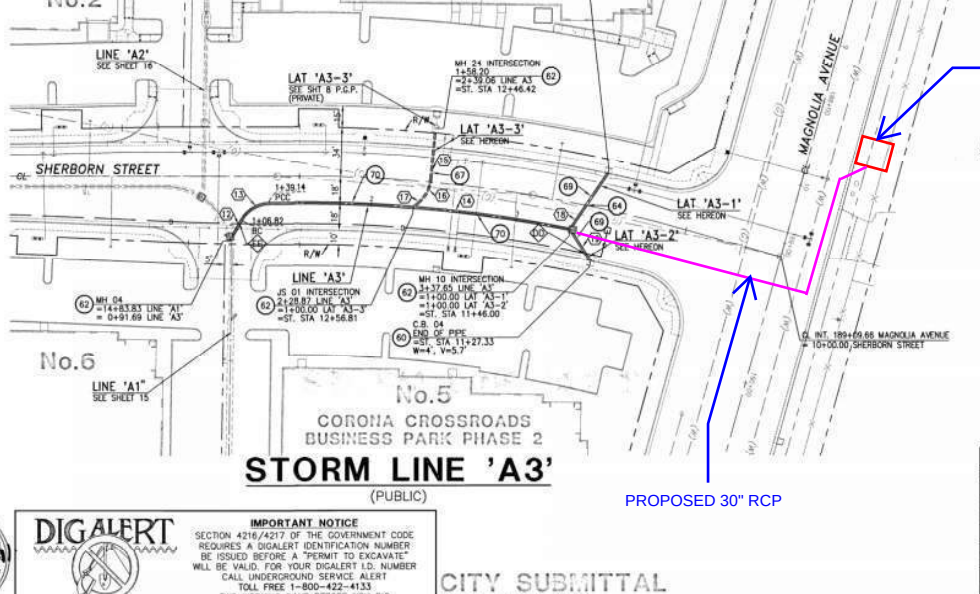








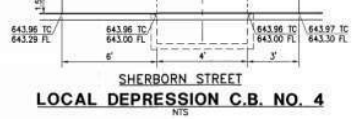
PROFILE SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'



STORM LINE 'A3'
(PUBLIC)

GAS DATA	
(No)	INVERT (PIPE)
DD	637.76 (24"SD)
EE	633.48 (30"SD)

LOCAL DEPRESSION C.B. NO. 5
NTS



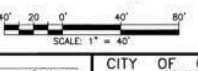
LOCAL DEPRESSION C.B. NO. 4
NTS

CONSTRUCTION NOTES

(60) CONSTRUCT CATCH BASIN TYPE A PER CITY OF CORONA STD PLAN 201-0
(61) CONSTRUCT CATCH BASIN TYPE B PER CITY OF CORONA STD PLAN 202-0
(62) CONSTRUCT STORM DRAIN MANHOLE PER CITY OF CORONA STD PLAN 207-0
(63) CONSTRUCT JUNCTION STRUCTURE PER CITY OF CORONA STD PLAN 208-1
(64) CONSTRUCT CONCRETE COLLAR CITY OF CORONA STD PLAN 209-0
(65) CONSTRUCT 10" PVC (SCHD 40)
(66) CONSTRUCT 12" PVC (SCHD 40)
(67) CONSTRUCT 15" RCP (CL. IV)
(68) CONSTRUCT 18" RCP (CL. IV)
(69) CONSTRUCT 24" RCP (CL. IV)
(70) CONSTRUCT 30" RCP (D-LOAD PER PLAN)
(71) CONSTRUCT 36" RCP (D-LOAD PER PLAN)
(72) CONSTRUCT 36" x 36" GRATE INLET (QUICKSET DB-3636 OR EQUAL)
(73) CONSTRUCT 24" x 24" GRATE INLET (QUICKSET DB-2424 OR EQUAL)
(74) CONSTRUCT 18" x 18" GRATE INLET (QUICKSET DB-1818 OR EQUAL)
(75) CONSTRUCT 12" x 12" GRATE INLET (QUICKSET DB-1212 OR EQUAL)
(76) CONSTRUCT TRENCH DRAIN PER DETAIL 1 ON SHEET 3
(77) CONSTRUCT BRICK & MORTAR PLUG
(78) CONSTRUCT 9"X9" GRATE INLET (NDS ATRIUM GRATE AND SPIGOT ADAPTER OR EQUAL)
(79) CONSTRUCT 4" P.V.C. (SCH. 40) WITH 4", 22.5 ELBOWS
(80) CONSTRUCT 48" RCP (D-LOAD PER PLAN)
(81) CONSTRUCT MANHOLE PIPE TO PIPE PER A.P.W.A STD. PLAN 322-1.
(82) CONSTRUCT TRANSITION STRUCTURE PER RIVERSIDE CO. F.C. STD. TS 303
(83) CONSTRUCT 42" RCP (D-LOAD PER PLAN)

CURVE / LINE DATA				
(No)	DELTA/BEARING	RADIUS	LENGTH	TANGENT
12	N70°58'06"E	–	15.13	–
13	58°34'12"	22.50	23.00	12.62
14	12°32'09"	967.00	211.57	106.21
15	N46°00'44"E	–	43.93	–
16	44°23'39"	22.50	17.43	9.18
17	N89°35'37"W	–	5.43	–
18	N75°22'20"E	–	46.17	–
19	N07°56'16"E	–	25.92	–

* TOTAL LENGTH



IMPORTANT NOTICE
SECTION 4216/4217 OF THE GOVERNMENT CODE REQUIRES A DIGALERT IDENTIFICATION NUMBER BE ISSUED BEFORE A "PERMIT TO EXCAVATE" WILL BE VALID. FOR YOUR DIGALERT I.D. NUMBER CALL UNDERGROUND SERVICE ALERT TOLL FREE 1-800-422-4133 TWO WORKING DAYS BEFORE YOU DIG

CITY SUBMITTAL
SEPTEMBER 18, 2003

HUITT-ZOLLARS Inc.
Huitt-Zollars, Inc.
200 Exchange, Suite 200
Irvine, California 92602-1309
Phone (714) 734-5100 Fax (714) 734-5155

Designed by	Drawn by	Checked by
D.M.A.	L.B.A.	D.M.A.

PLANS PREPARED UNDER SUPERVISION OF:
Date 9-19-03 R.C.E. No. 60816

Reference Plans for these Improvements

BENCH MARK: SEE TITLE SHEET
Scale: AS SHOWN

Engineering
Plng
Utility

Approved by: JOSEPH N. UCATA
Date 10/14/03
R.C.E. No. 60816 Expiration 12/31/2004

CITY OF CORONA
STORM DRAIN PLAN & PROFILE
LINE 'A3' (PUBLIC SYSTEM) PM 31869
STA. 0+91.69 THRU STA. 3+37.65

Drawing No. 03-0815
Sh 18 of 20

Magnolia CB Curb Inlet In Sag

Project Description

Solve For	Spread

Input Data

Discharge		6.91	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.08	ft/ft
Road Cross Slope		0.04	ft/ft
Curb Opening Length		5.00	ft
Opening Height		0.96	ft
Curb Throat Type	Horizontal		
Local Depression		3.50	in
Local Depression Width		5.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	8.96	ft
Depth	0.45	ft
Gutter Depression	0.09	ft
Total Depression	0.38	ft

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIER/PIP	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4	1		2.500														
CD	2	4	1		1.500														
CD	3	4	1		2.500														
CD	4	4	1		2.000														

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -
Magnolia Avenue Storm Drain Connection

HEADING LINE NO 2 IS -
Sherborn Connection

HEADING LINE NO 3 IS -
LINE "A-3"

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	102.380	633.420	1	643.500

ELEMENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	106.820	633.480	1	.013	.000	.000	.000	0

ELEMENT NO 3 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	139.140	633.880	1	.013	22.500	82.302	.000	0

ELEMENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	226.870	635.000	1	.013	967.018	5.198	.000	0

ELEMENT NO 5 IS A JUNCTION * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	227.000	635.050	1	2	0	.013	7.800	.000	635.560	.000	-45.000	.000

RADIUS	ANGLE
.000	.008

ELEMENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	337.070	637.050	1	.013	966.965	6.522	.000	0

ELEMENT NO 7 IS A JUNCTION * * * * * *

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	341.740	637.100	3	4	4	.013	2.400	4.400	637.400	637.400	-45.000	45.000

RADIUS	ANGLE
.000	.000

ELEMENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	485.310	637.820	3	.013	.000	.000	.000	0

ELEMENT NO 9 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	553.640	638.160	3	.013	45.000	-87.000	.000	0

ELEMENT NO 10 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	568.400	638.230	3	.013	.000	.000	.000	0

W S P G W

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 11 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	591.960	638.350	3	.013	44.999	29.998	.000	0

ELEMENT NO 12 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	604.900	638.415	3	.013	.000	.000	.000	0

ELEMENT NO 13 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	604.900	638.415	3	638.415

Program Package Serial Number: 1873

WATER SURFACE PROFILE LISTING Date:10-12-2023 Time: 1:13: 8

Magnolia Avenue Storm Drain Connection
Sherborn Connection
LINE "A-3"

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
102.380	633.420	10.080	643.500	21.51	4.38	.30	643.80	.00	1.58	.00	2.500	.000	.00	1 .0
4.440	.0135					.0028	.01	10.08	.00	1.18	.013	.00	.00	PIPE
106.820	633.480	10.032	643.512	21.51	4.38	.30	643.81	.00	1.58	.00	2.500	.000	.00	1 .0
32.320	.0124					.0028	.09	.00	.00	1.21	.013	.00	.00	PIPE
139.140	633.880	9.778	643.658	21.51	4.38	.30	643.96	.00	1.58	.00	2.500	.000	.00	1 .0
87.730	.0128					.0028	.24	.00	.00	1.20	.013	.00	.00	PIPE
226.870	635.000	8.914	643.914	21.51	4.38	.30	644.21	.00	1.58	.00	2.500	.000	.00	1 .0
JUNCT STR	.3845					.0019	.00	.00	.00		.013	.00	.00	PIPE
227.000	635.050	9.064	644.114	13.71	2.79	.12	644.24	.00	1.25	.00	2.500	.000	.00	1 .0
110.070	.0182					.0011	.12	.00	.00	.85	.013	.00	.00	PIPE
337.070	637.050	7.194	644.244	13.71	2.79	.12	644.36	.00	1.25	.00	2.500	.000	.00	1 .0
JUNCT STR	.0107					.0007	.00	7.19	.00		.013	.00	.00	PIPE
341.740	637.100	7.292	644.392	6.91	1.41	.03	644.42	.00	.87	.00	2.500	.000	.00	1 .0
143.570	.0050					.0003	.04	7.29	.00	.83	.013	.00	.00	PIPE
485.310	637.820	6.612	644.432	6.91	1.41	.03	644.46	.00	.87	.00	2.500	.000	.00	1 .0
68.330	.0050					.0003	.02	.00	.00	.83	.013	.00	.00	PIPE
553.640	638.160	6.298	644.458	6.91	1.41	.03	644.49	.00	.87	.00	2.500	.000	.00	1 .0
14.760	.0047					.0003	.00	6.30	.00	.84	.013	.00	.00	PIPE

Program Package Serial Number: 1873

WATER SURFACE PROFILE LISTING Date:10-12-2023 Time: 1:13: 8

Magnolia Avenue Storm Drain Connection
Sherborn Connection
LINE "A-3"

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
568.400	638.230	6.232	644.462	6.91	1.41	.03	644.49	.00	.87	.00	2.500	.000	.00	1 .0
23.560	.0051					.0003	.01	.00	.00	.83	.013	.00	.00	PIPE
591.960	638.350	6.122	644.472	6.91	1.41	.03	644.50	.00	.87	.00	2.500	.000	.00	1 .0
12.940	.0050					.0003	.00	6.12	.00	.83	.013	.00	.00	PIPE
604.900	638.415	6.061	644.476	6.91	1.41	.03	644.51	.00	.87	.00	2.500	.000	.00	1 .0

10 Year Street Capacity Calculation

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.20000	ft/ft
Discharge	2.77	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.91
0+12	0.67
0+12	0.00
0+14	0.15
0+14	0.18
0+58	2.02

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.91)	(0+58, 2.02)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.22	ft
Elevation Range	0.00 to 2.02 ft	
Flow Area	0.30	ft²
Wetted Perimeter	3.13	ft
Hydraulic Radius	0.10	ft
Top Width	2.88	ft
Normal Depth	0.22	ft

10 Year Street Capacity Calculation

Results

Critical Depth		0.40	ft
Critical Slope		0.00644	ft/ft
Velocity		9.26	ft/s
Velocity Head		1.33	ft
Specific Energy		1.55	ft
Froude Number		5.06	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	

GVF Output Data

Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		0.22	ft
Critical Depth		0.40	ft
Channel Slope		0.20000	ft/ft
Critical Slope		0.00644	ft/ft

Street Section

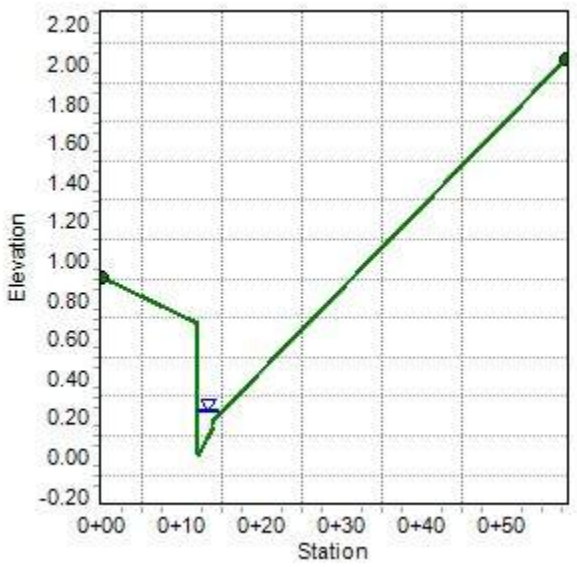
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.20000	ft/ft
Normal Depth	0.22	ft
Discharge	2.77	ft³/s

Cross Section Image



100 Year Street Capacity Calculation

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.20000	ft/ft
Discharge	4.32	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.91
0+12	0.67
0+12	0.00
0+14	0.15
0+14	0.18
0+58	2.02

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.91)	(0+58, 2.02)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.26	ft
Elevation Range	0.00 to 2.02 ft	
Flow Area	0.44	ft²
Wetted Perimeter	4.15	ft
Hydraulic Radius	0.11	ft
Top Width	3.86	ft
Normal Depth	0.26	ft

100 Year Street Capacity Calculation

Results

Critical Depth		0.46	ft
Critical Slope		0.00607	ft/ft
Velocity		9.88	ft/s
Velocity Head		1.52	ft
Specific Energy		1.77	ft
Froude Number		5.17	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth		0.00	ft
Length		0.00	ft
Number Of Steps		0	

GVF Output Data

Upstream Depth		0.00	ft
Profile Description			
Profile Headloss		0.00	ft
Downstream Velocity		Infinity	ft/s
Upstream Velocity		Infinity	ft/s
Normal Depth		0.26	ft
Critical Depth		0.46	ft
Channel Slope		0.20000	ft/ft
Critical Slope		0.00607	ft/ft

100 year street section

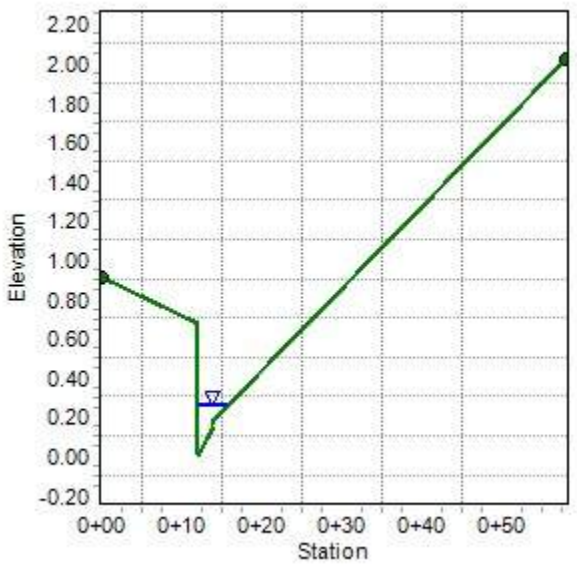
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.20000	ft/ft
Normal Depth	0.26	ft
Discharge	4.32	ft³/s

Cross Section Image



Appendix

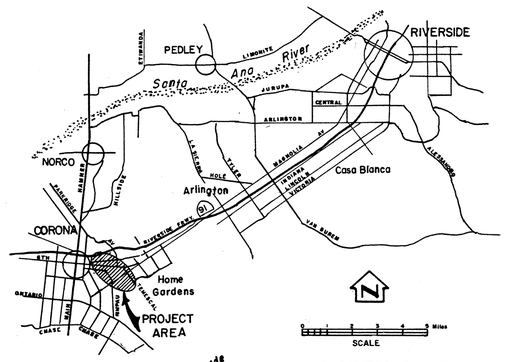
G

REFERENCE PLANS

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
08	RIV	15	40.9	11	85

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Approved December 3, 1984



VICINITY MAP

GENERAL NOTES

1. ALL STATIONING REFERS TO CENTERLINE OF IMPROVEMENT.
2. ALL ELEVATIONS ARE IN FEET, BASED ON U.S.C. & G.S. DATA.
3. ALL CHANNEL & LEVEE REFERENCES & CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM. ALL STREET REFERENCES & CROSS SECTIONS ARE TAKEN LOOKING UPSTATION. MAPPING IS BASED ON PHOTOS DATED NOV. 5, 1982.
4. STANDARD DRAWINGS CALLED FOR ON THE PLAN & PROFILE SHALL CONFORM TO R.C.F.C. & W.C.D. OR CITY OF CORONA STANDARD DRAWINGS OR CALIF. DEPT. OF TRANS. STD. PLANS DATED JULY, 1984.
5. ELEVATIONS & LOCATIONS OF UTILITIES ARE SHOWN APPROXIMATELY ON PLANS. 48 HRS. BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT 1-800-422-4133, ALL UTILITIES SHALL BE PROTECTED IN PLACE EXCEPT AS NOTED ON PLANS & SPECIFICATIONS.
6. FOR COMPLETE RIGHT OF WAY & TEMPORARY EASEMENTS, REFER TO R.C.F.C. & W.C.D. DRAWING No. 2-200, SHEETS 1 TO 7.
7. ALL SURFACING, CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS, FENCES & OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED SHALL BE CONSTRUCTED AT THE SAME ELEVATION & LOCATION AS THE EXISTING IMPROVEMENTS, UNLESS OTHERWISE NOTED.
8. ALL OPENINGS RESULTING FROM CUTTING OR PARTIAL REMOVAL OF EXISTING CULVERTS, PIPES OR SIMILAR STRUCTURES TO BE ABANDONED SHALL BE SEALED, BOTH ENDS, WITH 6" OF CLASS "B" CONCRETE.

INDEX

	SHEET NO.
TITLE SHEET	1
PLAN & PROFILE STA. 129+00± TO STA. 203+60±	2-9
RIGHT LEVEE	10
CAJALCO LEVEE	11
CAJALCO STREET	12
TYPICAL SECTIONS & DETAILS	13-15
RIGHT LEVEE TYPICAL SECTIONS	16
SIXTH STREET BRIDGE MODIFICATION PLAN	17
BRIDGE PIER EXTENSIONS AT SIXTH STREET BRIDGE	18
BRIDGE PIER EXTENSIONS AT EL SOBRANTE ROAD BRIDGE	19
CHANNEL ENTRANCE DETAILS	20-21
SIDE INLET PROFILES & DETAILS	22-27
J.S. No. 1 & PIPE TO CHANNEL JUNCTION DETAIL	28
PAYLINES & MISC. DETAILS	29
RETAINING WALL DETAILS	30-31
8" SEWER LINE RELOCATION AT SIXTH STREET	32
6" WATER LINE RELOCATION AT SIXTH STREET	33
8" SEWER LINE RELOCATION AT COMPTON AVENUE	34
10" WATER LINE RELOCATION AT COMPTON AVENUE	35
10" WATER LINE RELOCATION AT MAGNOLIA AVENUE	36
CAJALCO STREET DETOUR	37

R.C.F.C. & W.C.D. STANDARD DRAWINGS

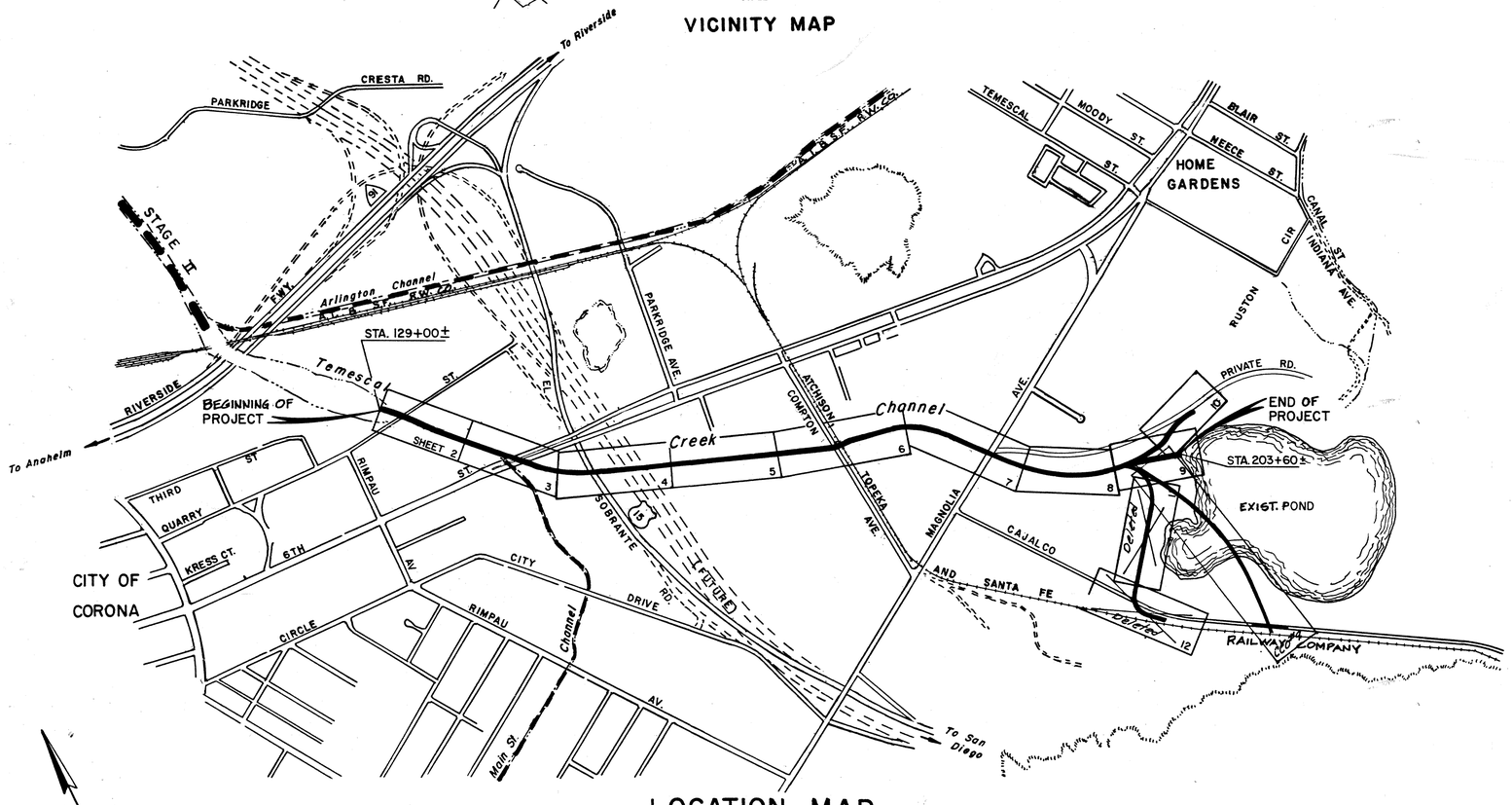
CB 110	CONCRETE DROP INLET AND	
JS 229	JUNCTION STRUCTURE No. 4	38
M 801	CHAIN LINK FENCE DETAILS	39
M 814	ABBREVIATIONS AND SYMBOLS	40
M 803	CONC. COLLAR FOR PIPE 12" THROUGH 66" AND	
M 816	CONCRETE BULKHEAD	41

CITY OF CORONA STANDARD PLANS

301	REINFORCED PRECAST MANHOLE	42
413	1" VACUUM AND AIR RELEASE VALVE AND	
415	4" BLOW-OFF ASSEMBLY	43

SUMMARY OF EARTHWORK QUANTITY ESTIMATES:

CHANNEL EXCAVATION	310,888 C.Y.
COMPACTED FILL	35,618 C.Y.
LEVEE EMBANKMENT	28,637 C.Y.
EMBANKMENT (ROADWAY)	1,830 C.Y.
STRUCTURE BACKFILL (CHANNEL)	11,970 C.Y.
BACKFILL (ROCK SLOPE PROTECTION)	8,700 C.Y.
MISC. CUT	8,211 C.Y.
MISC. FILL	52,503 C.Y.



LOCATION MAP

600' 0 600'

AS BUILT
CORRECTIONS BY J.E.Clemens
DATE 11/15/87

COUNTY OF RIVERSIDE, CALIFORNIA ROAD DEPARTMENT APPROVED by: ROAD COMMISSIONER RIVERSIDE COUNTY, CALIF. R.C.E. 14365 Date: 6-26-84	STATE OF CALIFORNIA BUSINESS AND TRANSPORTATION AGENCY DEPARTMENT OF TRANSPORTATION	CITY OF CORONA APPROVED 6/25/84 Date by George Thacker R.C.E. 21267 Director of Utilities APPROVED 6-22-84 Date by Joseph P. Paloma R.C.E. 25267 City Engineer	P8/234961 REVISIONS REF. DESCRIPTION APPR DATE	RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT DESIGNED BY: KONG DRAWN BY: K.R.B. 4 ERS DATE DRAWN: DEC. 1982 CHECKED BY: K.J.P. RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757 DATE: 6/21/84 APPROVED BY: CHIEF ENGINEER R.E. NO. 12400 DATE: 6-21-84	TEMESCAL CREEK CHANNEL STAGE III TITLE SHEET	PROJECT NO. 2-0-050 DRAWING NO. 2-195 SHEET NO. 1 OF 43

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
08	Riv	15	40.9	16	85

Approved December 3, 1984

Ep- 1-0-001356-3343
Time Warner Cable
INSTall, Operate and Maintain a 4" diameter Steel Casing on the El Camino Avenue Bridge over Temescal Channel at Station 169+94.98 in Accordance with Sheets 1 and 2 of the Time Warner Cable Fiber Optic Conduit Installation plans Prepared by K & B Engineering

The Fiber Optic Conduit will be installed on both Sides of the Bridge Underground in El Camino Avenue Street right of way.

ACCESS ROAD PROFILE
(12) LEFT ACCESS ROAD
(18) RIGHT ACCESS ROAD

PROFILE

PROPOSED 36"Ø REP LATERAL

EXISTING CHANNEL WALL

EXIST. 24" RCP TO BE REMOVED

HYDRAULIC DATA
Q = 24,000 C.F.S.
V = 27 F.P.S.

WARNING !!! THE G4 IS A HIGH PRESSURE GAS LINE EXTREMA CAUTION SHOULD BE EXERCISED WHEN WORKING IN THIS AREA. NOTIFY THE SO CALIF GAS CO. AT 714-781-6115 48 HRS IN ADVANCE OF ANY WORK. ALSO SEE NOTE (13)

NOTES (CONT.)
(13) THE 4" HIGH PRESSURE GAS LINE WILL BE RELOCATED BY OTHERS IN THE COMMON TRENCH (TO BE EXCAVATED BY THE CONTRACTOR) DURING THE RELOCATION OF THE WATER & SEWER LINES. THE CONTRACTOR SHALL COORDINATE THE RELOCATION WORK WITH SO. CALIF. GAS CO. AS DIRECTED BY THE ENGINEER.
(14) AFTER COMPLETION OF UTILITY RELOCATIONS, REMOVE INTERFERING PORTIONS OF ABANDONED LINES AND PLUG.
(15) SEE SHEET 29 OF 43 FOR DRIVEWAY DETAILS.
(16) CONSTRUCT 6' TEMPORARY CHAIN LINK FENCE.
(17) LINE TO BE ABANDONED BY OTHERS.
(18) PROVIDE CONTINUOUS ACCESS FOR PROPERTY OWNER ON A.C. IN ICE.
(19) INSTALL DROP STEPS EA. SIDE STA. 171+00 PER DETAIL SHEET NO. 29 OF 43.

NOTES:
(1) CONSTRUCT 6' CHAIN LINK FENCE PER R.C.F.C. STD. M801.
(2) INSTALL 12' DOUBLE DRIVE GATE PER R.C.F.C. STD. M801.
(3) SEE SHEET 35 OF 43 FOR WATER AND SHEET 34 OF 43 FOR SEWER RELOCATION PLANS.
(4) P.P. 209102-40 & PP 197822B-40 TO BE PROTECTED IN PLACE. PP 177019G-45, P.P. 209522-55S & PP 209788-55 TO BE RELOCATED BY OTHERS.
(5) MOBILE HOMES TO BE RELOCATED BY OTHERS. PROTECT EX. SEPTIC TANK. REMOVE EX. CONC. AS DIRECTED BY THE ENGINEER.
(6) REMOVE EXISTING FENCE AS DIRECTED BY THE ENGINEER.
(7) REMOVE AND REPLACE EXISTING FENCES WITHIN TCE.
(8) PROTECT EXISTING CHAIN LINK FENCE.
(9) SEE ROADWAY PLANS FOR A.T. & S.F. RW CO. & COMPTON AVE. BRIDGES & IMPROVEMENTS.
(10) SEE SHTS 25 TO 27 OF 43 FOR SIDE INLET PROFILE AND DETAILS.
(11) PROTECT EXISTING BUILDING.
(12) PROTECT EXISTING PAVEMENT.

EP# 2-0-0050/0278-2611
April 10, 2003
City of Corona, Public Works Department

Ex 14"Ø RCP LATERAL TO BE REMOVED & REPLACE WITH 36"Ø RCP LATERAL (SEE DETAIL ON SHT.)

PLAN

Ep# 2-0-0050-2683
October 6, 2003
South California Edison

AS BUILT
CORRECTIONS BY
DATE

BENCH MARK
COMP. AVE 4-A-74
STD. DISK IN I.P. AND CONC. STAMPED "B.M. COMP. 4-A-74" 51' LT. STA. 32+28 ℄ COMPTON AVE. BUR. 0.06' EL. = 635.29

P8/234961 REVISIONS

REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: KONG
DRAWN BY: D.L.P.
DATE DRAWN: 8-83
CHECKED BY: F.S.P.

RECOMMENDED FOR APPROVAL BY: DESIGN ENGINEER R.E. NO. 16757 DATE: 6/21/84

APPROVED BY: Kenneth L. Edwards CHIEF ENGINEER R.E. NO. 12400 DATE: 6-21-84

TEMESCAL CREEK CHANNEL STAGE III

STA. 165+00 TO STA. 177+00

PROJECT NO. 2-0-050
DRAWING NO. 2-195
SHEET NO. 6 OF 43

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
08	Riv	15	40.9	17	85

Approved December 3 1984

177 178 179 180 181 182 183 184 185 186 187 188

G45 G40 G35 G30 G25 G20

ACCESS ROAD PROFILE
(A) LEFT ACCESS ROAD
(B) RIGHT ACCESS ROAD

MATCH LINE
STA. 177+00
STA. 178+00 ℄ SIDE INLET LT. ℄ ST.
STA. 182+50
STA. 183+30 ℄ MAGNOLIA AVE.
STA. 184+00 ℄ RT. SIDE INLET
STA. 185+00 ℄ LT. SIDE INLET
STA. 186+00
STA. 187+30
MATCH LINE
STA. 188+00

(A) = 175'±
(B) = 210'±
(A) = 200'±
100'±
G447±
G447.0±
G446.5±
G446.5±
S=0.025±
S=0.027±
S=0.02±
S=0.01±
G444.53
TOP OF CHANNEL
WATER SURFACE
G442.05
M.I.D.
EX. PROFILE & IMP.
15'
G427.61 24"x76" R.C.P. EACH SIDE
PROFILE GRADE & IMP.
S=0.0032
G425.29
629.53 30" X 238' R.C.P.
629.83 30" X 240' ECP & 24"x 69' ECP
630.39 30" X 16' R.C.P.
45 R.C.P.
S=0.0036
S=0.015
630.07
G424.3
G427.85 GR. CHANGE
G429.34 GR. CHANGE
W.I.D.

HYDRAULIC DATA
Q = 24,000 C.F.S.
V = 29 F.P.S.

PROFILE

City of Corona Water & Power
E.P. 2-0-0050-2492
March 9, 2006
Instl. 4 Manhole Electrical Vaults

EP# 2-0-0050-2492
OCTOBER 22, 2008
CORONA CANYONS LLC

INVESTMENT BUILDING GROUP CONSTRUCTED A 54" ℄ RCP STORM DRAIN @ STA. 185+30 PER E.P. NO. 2-0-0050-2492

PROPOSED 20' ACCESS ROAD

CITY OF CORONA CONST A TRAFFIC LIGHT POLE, TRAFFIC LOOP DETECTORS, ASSOC. WIRING & IMPROVEMENTS W/IN S. ROW PER ENC. PERMIT #2-0-050-2015

℄ IMP CURVE DATA
Δ = 48°46'26"
R = 1250.00'
T = 580.68'
L = 1064.08'
B.C. = 185+09.90
E.C. = 195+73.98

STA. 36+00 ℄ A.C. D/W

PRIVATE ROAD

MONT. GATE

55'±VAR.

R/W

TCE

EX. A.C.

GRADE TO DRAIN

CREEK CHANNEL

℄ IMP CURVE DATA
Δ = 40°44'41"
R = 900.00'
T = 417.24'
L = 781.39'
B.C. = 174+72.05
E.C. = 182+53.43

LEFT ACCESS ROAD

RIGHT ACCESS ROAD

APPROX. GRADING LIMIT

GRADE TO EX. FENCE LINE (PROTECT EX. FENCE)

STA. 33+70 ℄ A.C. D/W

STA. 33+05 ℄ A.C. D/W

STA. 182+56.11 ℄ IMP. = STA. 3+53.48 ℄ MAGNOLIA AVE.

PARKING

W.I.D.

W.S.E.L.(100) 642.5

STA. 187+00+

STA. 180+00

70'

130'

12'

100'

AS BUILT

PLAN

50' 0 50'

NOTES:

1. CONSTRUCT 6' CHAIN LINK FENCE PER R.C.F.C. STD. M801.
2. REMOVE EXISTING FENCE WITHIN R/W.
3. INSTALL 14' DOUBLE DRIVE GATE PER R.C.F.C. STD. M801.
4. SEE ROADWAY PLANS FOR MAGNOLIA AVE. BRIDGE AND IMPROVEMENTS
5. EXISTING TANK TO BE RELOCATED BY OTHERS PRIOR TO CONSTRUCTION.
6. THE CONTRACTOR SHALL REMOVE ALL EXISTING ROCK SLOPE PROTECTION OR REMOVE THE UPPER PORTION & COVER THE LOWER PORTION WITH MIN. 5' OF MISC. FILL.
7. PROTECT IN PLACE P.P. 208805.50, P.P. 209101.40, P.P. 209031.40 & P.P. G937.59 H. TO BE RELOCATED BY OTHERS P.P. 137903.50 & P.P. 932803 H.
8. SEE SHEET 36 OF 43 FOR 10" WATER LINE RELOCATION PLAN
9. SEE SHEET 27 OF 43 FOR SIDE INLET PROFILE & DETAILS.
10. FILL HOLES TO MATCH ADJACENT GROUND.
11. REMOVE AND RECONSTRUCT EXISTING FENCE WITHIN TCE.
12. PROTECT EXISTING PAVEMENT.
13. PROVIDE CONTINUOUS ACCESS FOR PARKING AT SALVAGE YARD AND RELOCATE EXIST. FENCE TO R/W LINE.
14. SEE ROADWAY PLANS FOR SIDE INLET PROFILE AND DETAILS.
15. PROVIDE CONTINUOUS ACCESS FOR PROPERTY OWNER ON A.C. IN TCE.
16. REMOVE EXISTING PIPE GATES & REINSTALL AT STA. 185+85 RT.
17. INSTALL DROP STEPS EA. SIDE STA. 185+50 PER DETAIL SHEET 29 OF 43.

BENCH MARK
MAGNOLIA AVE. 4-A-74
STD. DISK IN I.P. AND CONC. STAMPED "BM. MAG. 4-A-74" 43' RT. STA. 33+50 ℄ MAGNOLIA AVE. BURIED 0.6' EL. = 645.48.

REF.	DESCRIPTION	APPR.	DATE
	P8/234961 REVISIONS		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

NO CORRECTIONS THIS SHEET

DESIGNED BY: KONG
DRAWN BY: D.L.P.
DATE DRAWN: 8-83
CHECKED BY: F.S.P.

RECOMMENDED FOR APPROVAL BY:
DESIGN ENGINEER R.E. NO. 16757
DATE: 6/21/84

APPROVED BY:
CHIEF ENGINEER R.E. NO. 12400
DATE: 6-21-84

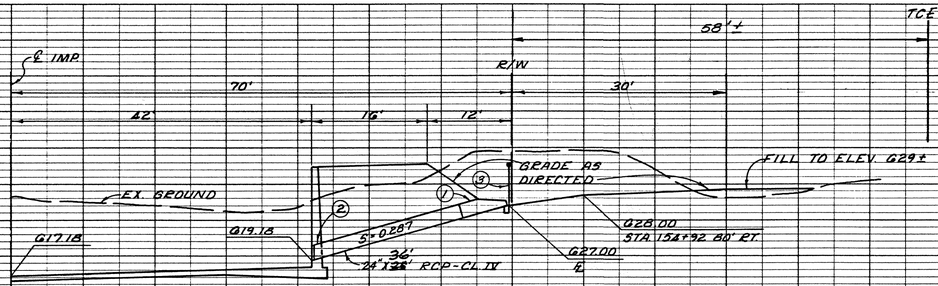
TEMESCAL CREEK CHANNEL STAGE III

STA. 177+00 TO STA. 188+00

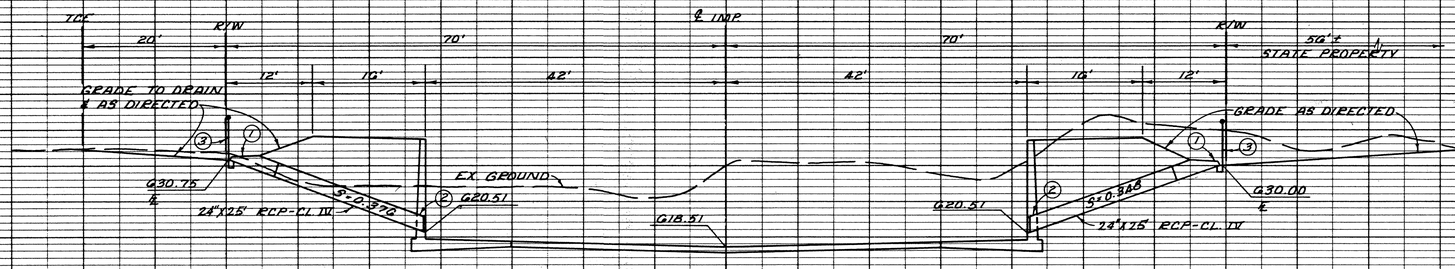
PROJECT NO. 2-0-050
DRAWING NO. 2-195
SHEET NO. 7 OF 43

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
08	Riv	15	40.9	35	85

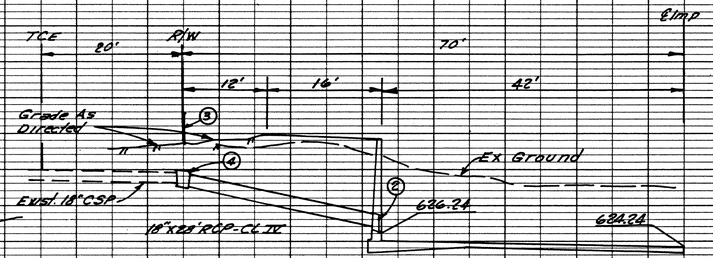
Approved December 3, 1984



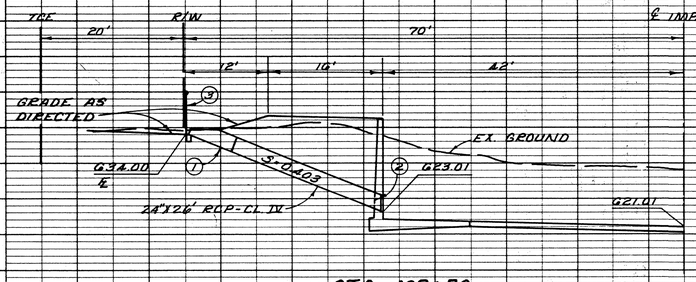
STA. 154+92
PLAN VIEW SHEET NO. 4 OF 43



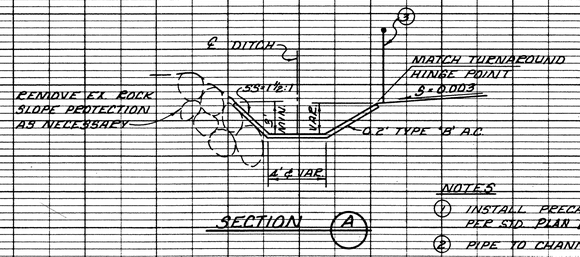
STA 159+35
PLAN VIEW SHEET NO. 5 OF 43



Sta. 173+71
PLAN VIEW Sheet No 6 of 43

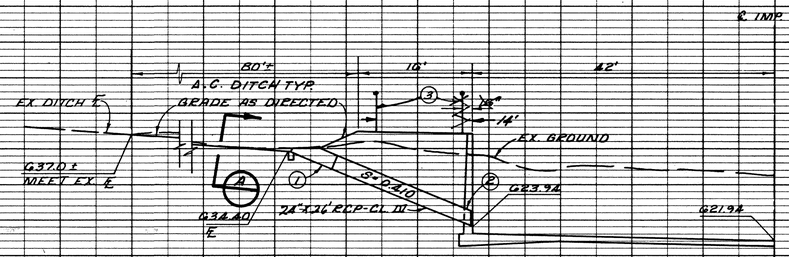


STA. 167+70
PLAN VIEW SHEET NO. 6 OF 43



NOTES

1. INSTALL PRECAST CONC. FLARED END SECTION PER STD. PLAN D-94
2. PIPE TO CHANNEL JUNCTION PER DETAIL SHEET 28 OF 43
3. CONSTRUCT 6' CHAIN LINK FENCE PER R.C.F.C. STD. M801.
4. Construct conc Collar Per R.C.F.C. Std. M803



STA. 170+81
PLAN VIEW SHEET NO. 6 OF 43

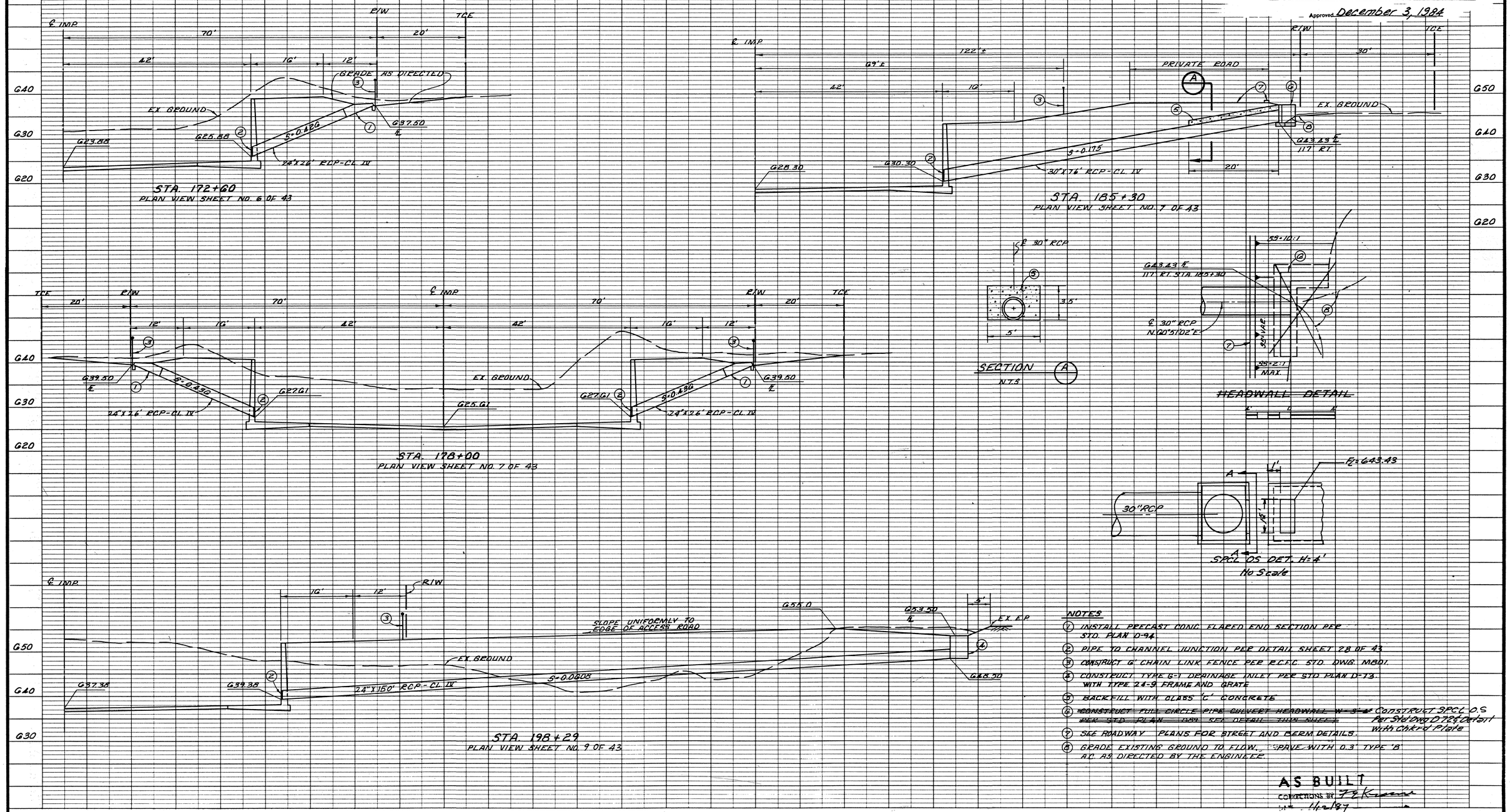
AS BUILT
CORRECTIONS BY
DATE 1/12/87

10' 0 10'

BENCH MARK	P8/234961 REVISIONS				RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		TEMESCAL CREEK CHANNEL STAGE III	PROJECT NO. 2-0-050
					DESIGNED BY: S.E.S.	RECOMMENDED FOR APPROVAL BY:	APPROVED BY:	DRAWING NO. 2-195
					DRAWN BY: D.L.P.	DESIGN ENGINEER R.E. NO. 16757	CHIEF ENGINEER R.E. NO. 12400	
					DATE DRAWN: 1-84	DATE: 6/21/84	DATE: 6-21-84	SHEET NO. 25 OF 43
	REF.	DESCRIPTION	APPR.	DATE	CHECKED BY: F.U.P.		SIDE INLET PROFILES AND DETAILS	

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL
08	RIV	15	40.9	37	85

Approved December 3, 1984



NOTES

1. INSTALL PRECAST CONC. FLARED END SECTION PER STD. PLAN D-94.
2. PIPE TO CHANNEL JUNCTION PER DETAIL SHEET 28 OF 43.
3. CONSTRUCT 6' CHAIN LINK FENCE PER R.C.F.C. STD. DWG. M801.
4. CONSTRUCT TYPE G-1 DRAINAGE INLET PER STD PLAN D-73. WITH TYPE 24-9 FRAME AND GRATE
5. BACKFILL WITH CLASS 'C' CONCRETE
6. ~~CONSTRUCT FULL CIRCLE PIPE CULVERT HEADWALL W=3'-4" PER STD. PLAN D89 SEE DETAIL THIS SHEET~~ CONSTRUCT SPCL O.S Per Std Dwg D72 & Detail With Chkrd Plate
7. SEE ROADWAY PLANS FOR STREET AND BERM DETAILS.
8. GRADE EXISTING GROUND TO FLOW. PAVE WITH 0.3' TYPE 'B' A.C. AS DIRECTED BY THE ENGINEER.

AS BUILT
CORRECTIONS BY F.E. Kissane
1/12/87

10' 0 10'

BENCH MARK	P8/234961	REVISIONS		
	REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

DESIGNED BY: S.E.S. KONG
DRAWN BY: D.L.P.
DATE DRAWN: 1-84
CHECKED BY: F.J.P.

RECOMMENDED FOR APPROVAL BY: Neil L. Matthews
DESIGN ENGINEER R.E. NO. 16757
DATE: 6/21/84

APPROVED BY: Kenneth F. Edwards
CHIEF ENGINEER R.E. NO. 12400
DATE: 6-21-84

TEMESCAL CREEK CHANNEL STAGE III

SIDE INLET PROFILES AND DETAILS

PROJECT NO. 2-0-050
DRAWING NO. 2-195
SHEET NO. 27 OF 43

PUBLIC IMPROVEMENT PLANS

FOR

CORONA CROSSROADS BUSINESS PARK
P.M. NO. 31369

(SOUTHERLY PORTION OF PROJECT)

GENERAL NOTES FOR PUBLIC IMPROVEMENT PLANS:

1. ALL WORK AND MATERIALS SHALL COMPLY WITH THE SPECIFICATIONS AND STANDARD PLANS OF THE CITY OF CORONA PUBLIC WORKS AND UTILITIES DEPARTMENT, AND THE LATEST EDITION OF THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION. THESE DRAWINGS AND THE DATA HEREIN ARE MADE PART OF THE SPECIFICATIONS.
2. PRIOR TO ANY CONSTRUCTION WORK, THE CONTRACTOR SHALL OBTAIN A CITY BUSINESS LICENSE, A PUBLIC WORKS CONSTRUCTION PERMIT, AND A UTILITY SERVICES CONSTRUCTION PERMIT.
3. INSPECTION TO BE CALLED FOR THROUGH THE CITY OF CORONA: 736-3511, 24 HOURS PRIOR TO STARTING WORK.
4. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT (1-800-422-4133) TWO FULL WORKING DAYS (48 HOURS MINIMUM) IN ADVANCE OF ANY CONSTRUCTION ACTIVITIES, AND OBTAIN AN IDENTIFICATION NUMBER PRIOR TO PERMIT ISSUANCE, INCLUDING PAVEMENT REMOVAL, EXCAVATION AND A. C. OVERLAY, WHICH COULD AFFECT ANY UNDERGROUND UTILITY.
5. THE CONTRACTOR SHALL NOTIFY ALL AFFECTED UTILITY COMPANIES AT LEAST TWO FULL WORKING DAYS (48 HOURS MINIMUM) PRIOR TO BEGINNING ANY CONSTRUCTION IN THE VICINITY OF THEIR FACILITIES.
6. THE CONTRACTOR SHALL EXCAVATE INSPECTION HOLES ("POT HOLES") AND DETERMINE THE LOCATION AND DEPTH OF ALL UNDERGROUND STRUCTURES AND UTILITIES THAT ARE IN THE VICINITY OF AND/OR MAY BE AFFECTED BY THE PROPOSED IMPROVEMENT WORK PRIOR TO ANY CONSTRUCTION WORK WHICH COULD DAMAGE OR CONFLICT WITH SAID STRUCTURES AND/OR UTILITIES.
7. ALL MATERIALS AND METHODS TO BE SUBJECT TO THE APPROVAL OF THE CITY ENGINEER AND DIRECTOR OF UTILITY SERVICES.
8. REPAIR OR REPLACE ANY EXISTING DAMAGED OR ALTERED EXISTING IMPROVEMENTS WITHIN PUBLIC RIGHT OF WAY AS DIRECTED BY THE CITY ENGINEER.
9. IF ANY EXISTING UTILITIES OR ANY OTHER FACILITIES CONFLICT WITH THE PROPOSED IMPROVEMENTS, WORK SHALL STOP AND THE ENGINEER NOTIFIED IMMEDIATELY.
10. ALL SURVEY MONUMENTS SHALL BE PROTECTED AND PERPETUATED IN PLACE. ANY DISTURBED OR COVERED MONUMENTS SHALL BE RESET BY A REGISTERED CIVIL ENGINEER OR A LICENSED LAND SURVEYOR AT THE DIRECTION OF THE CITY ENGINEER.
11. CITY APPROVAL OF PLANS DOES NOT RELIEVE THE DEVELOPER FROM RESPONSIBILITY FOR THE CORRECTION OF ERROR AND OMISSION DISCOVERED DURING CONSTRUCTION. UPON REQUEST, THE REQUIRED PLAN REVISIONS SHALL BE PROMPTLY SUBMITTED TO THE CITY ENGINEER FOR APPROVAL.
12. AS-BUILT ORIGINAL PLANS TO BE FURNISHED TO THE CITY OF CORONA AFTER COMPLETION OF CONSTRUCTION.

STREETS

1. ACTUAL THICKNESS OF BASE MATERIAL TO BE DETERMINED BY SOIL TEST AND RECOMMENDED BY SOILS ENGINEER. R-VALUES, SAND EQUIVALENTS AND STRUCTURAL SECTION OF STREETS SHALL BE SUBMITTED TO THE CITY OF CORONA FOR APPROVAL UPON COMPLETION OF ROUGH GRADING.
2. THE CONTRACTOR SHALL NOT ORDER OR PLACE ANY PORTLAND CEMENT CONCRETE OR ASPHALT CONCRETE PAVING UNTIL THE FORMS AND SUBGRADE AND/OR AGGREGATE BASE HAVE BEEN INSPECTED AND APPROVED BY THE CITY ENGINEER.
3. DRIVEWAY LOCATIONS SHALL BE DETERMINED IN THE FIELD AT THE TIME OF BUILDING CONSTRUCTION, UNLESS LOCATIONS ARE SHOWN ON THIS PLAN.
4. ALL NEW OR EXISTING MANHOLES SHALL BE ADJUSTED TO GRADE IN ACCORDANCE WITH STANDARD PLAN 111-0.
5. THE FINAL OR SURFACE LAYER OF ASPHALT CONCRETE SHALL NOT BE PLACED UNTIL ALL ON-SITE IMPROVEMENTS HAVE BEEN COMPLETED, INCLUDING ALL GRADING AND UNTIL ALL UNACCEPTABLE CONCRETE WORK HAS BEEN REMOVED AND REPLACED UNLESS APPROVED OTHERWISE BY THE ENGINEER.

TRAFFIC

1. CONTRACTOR IS TO PROVIDE TRAFFIC CONTROL PER "MATCH MANUAL" AND THE CITY ENGINEER'S DIRECTION IN THE FIELD. ACCESS TO ADJACENT PROPERTIES AND BUSINESSES IS TO BE MAINTAINED AT ALL TIMES.
2. ALL PERMANENT TRAFFIC CONTROL SIGNS AND DEVICES SHALL BE LOCATED IN THE FIELD BY THE TRAFFIC ENGINEER PRIOR TO FINAL CONSTRUCTION OF IMPROVEMENTS.
3. CONTRACTOR TO REMOVE AND/OR INSTALL PAVEMENT MARKINGS AND STRIPING AS REQUIRED BY THE ENGINEER IN THE FIELD.

STREET LIGHTS

1. SPLICING OF STREET LIGHT CONDUCTOR ONLY PERMITTED IN PULL BOXES

UTILITIES

1. PRIOR TO TAKING ANY WATER FROM A CITY FIRE HYDRANT, THE CONTRACTOR SHALL MAKE ARRANGEMENTS WITH THE CORONA UTILITIES SERVICES DEPARTMENT TO OBTAIN A FIRE HYDRANT WATER METER TO BE USED AT APPROVED LOCATIONS ONLY.
2. CONTRACTOR SHALL NOT OPERATE ANY MAIN LINE WATER VALVE **UNDER NO CIRCUMSTANCES.**
3. ALL CONNECTIONS TO EXISTING WATER MAINS SHALL BE DONE BY THE CONTRACTOR UNDER THE SUPERVISION OF THE DIRECTOR OF UTILITY SERVICES. CONNECTIONS SHALL BE MADE AFTER 9:00 A.M.
4. ALL ON-SITE AND OFF-SITE WATER VALVES SHALL BE SET TO GRADE BY THE CONTRACTOR.
5. WATER METER BOXES SHALL BE CONSIDERED TO BE PART OF THE WATER SERVICE AND SHALL BE BROUGHT TO GRADE AND LEVELED BEFORE THE CITY WILL INSTALL ANY WATER METERS. NO. 5 METER BOX FOR 1" WATER SERVICES AND NO. 8 FOR 2" WATER SERVICES.
6. WATER SERVICES TO BE MINIMUM OF 10' HORIZONTAL DISTANCE FROM SEWER LATERAL.
7. A CONTINUOUS DETECTION WIRE (#12 COPPER INSULATED) SHALL BE PLACED DIRECTLY OVER AND TIED TO ALL NON-METALLIC PIPE AND CARRIED TO AND ATTACHED ON INSIDE OF VALVE BOX 6" BELOW CAP.
8. A COPPER WATER SERVICE, SIZE AS NOTED ON THE PLANS, TO BE PROVIDED TO EACH LOT.
9. THE CONTRACTOR SHALL KEEP A STRICT RECORD OF THE LOCATION OF THE WYES, TREES AND SEWER LATERAL STUBS. SUCH RECORDS SHALL BE THE PROPERTY OF THE CITY OF CORONA UPON COMPLETION OF THE CONTRACT. STRICT ADHERENCE TO THE REQUIREMENTS OF THIS PARAGRAPH SHALL BE IMPOSED.
10. A V.C.P. SEWER LATERAL, SIZE AS NOTED ON THE PLANS, SHALL BE CONSTRUCTED TO EACH LOT. CONTRACTOR SHALL MARK A CHISELED "L" ON CURB AT LATERAL LOCATION.
11. ALL FIRE HYDRANTS WHICH HAVE NOT BEEN ACCEPTED FOR SERVICE SHALL BE COVERED WITH A SACKINDICATING THAT THE HYDRANTS ARE NOT IN SERVICE. ALL FIRE HYDRANTS SHALL BE SUPPLIED WITH 1-$\frac{1}{4}$" OPERATING NUTS.
12. THE CONTRACTOR SHALL KEEP A STRICT RECORD OF THE LOCATION OF THE WYES TEES, AND SEWER LATERAL STUBS. SUCH RECORDS SHALL BE PROPERTY OF THE CITY OF CORONA UPON COMPLETION OF THE CONTRACT. STRICT ADHERENCE TO THE REQUIREMENTS OF THE PARAGRAPH SHALL BE IMPOSED.
13. A SEWER LATERAL, SIZE AND MATERIAL AS NOTED ON THE PLANS, SHALL BE CONSTRUCTED TO EACH LOT. CONTRACTOR SHALL MARK A CHISLEDED "L" ON CURB AT LATERAL LOCATION AND STREET.

EXCAVATION

1. ALL TRENCH BEDDING AND BACKFILL SHALL DONE IN ACCORDANCE WITH STANDARD PLAN 108, AND SHALL BE CONTINUOUSLY INSPECTED, TESTED AND CERTIFIED BY A SOILS ENGINEER.
2. ALL SEWERLINE TRENCH BEDDINGS AND BACKFILL SHALL BE DONE IN ACCORDANCE WITH THE APPLICABLE SECTIONS OF STANDARD PLANS 108-0 AND 108-1 EXCEPT THAT EXCAVATED MATERIALS CONSIDERED AS SUITABLE FOR BACKFILL BY THE SOILS ENGINEER AND APPROVED BY THE CITY ENGINEER MAY BE USED FOR BACKFILL. IN ADDITION, ALL TRENCH BEDDING AND BACKFILL SHALL BE CONTINUOUSLY INSPECTED, TESTED, AND CERTIFIED BY A SOILS ENGINEER. CERTIFICATION SHALL BE ON A CITY "SUPERVISED TRENCH BEDDING AND BACKFILL INSPECTION CERTIFICATE." FIELD DENSITY TESTS SHALL BE MADE AT A FREQUENCY DETERMINED BY THE CITY, THE SOILS ENGINEER SHALL SUBMIT A CERTIFIED REPORT TO THE CITY ENGINEER SUMMARIZING ALL TESTS TAKEN, INCLUDING DATES AND LOCATIONS.
3. TRENCHES SHALL HAVE SHAPED BEDDING.
4. DURING THE WORKING DAY TRENCHES MAY BE LEFT OPEN ACROSS ONLY ONE ACCESS STREET AT A TIME. NO TRENCH MAY BE LEFT OPEN OVERNIGHT UNLESS AUTHORIZED IN WRITING BY THE CITY.
5. CARE SHOULD BE TAKEN TO PREVENT GRADED DITCHES AND SWALES FROM UNDERMINING STREET IMPROVEMENTS. UPON INSPECTION OF THE SITES, THE CITY ENGINEER MAY REQUIRE TEMPORARY GUNITE SWALES, ENTERING OR LEAVING IMPROVEMENTS.
6. ALL UTILITIES SHALL BE INSTALLED, TESTED, AND APPROVED PRIOR TO STREET PAVING.

NOTICE TO CONTRACTOR

ALL UNDERGROUND UTILITIES OR STRUCTURES REPORTED BY THE OWNER OR OTHERS, AND THOSE SHOWN ON THE RECORDS EXAMINED, ARE INDICATED WITH THEIR APPROXIMATE LOCATION AND EXTENT. THE CONTRACTOR, BY ACCEPTING A CONTRACT TO BUILD IN ACCORDANCE WITH THESE PLANS OR PROCEEDING WITH THE IMPROVEMENTS PURSUANT THERETO, AGREES TO ASSUME LIABILITY AND TO HOLD THE OWNER AND THE CIVIL ENGINEER HARMLESS FOR ANY DAMAGES RESULTING FROM THE EXISTENCE OF UNDERGROUND UTILITIES OR STRUCTURES NOT REPORTED TO THE UNDERSIGNED, NOT INDICATED ON THE PUBLIC RECORDS EXAMINED, LOCATED AT VARIANCE WITH THOSE REPORTED OR SHOWN ON RECORDS EXAMINED. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO VERIFY THE LOCATION OF AND TOPROTECT THE UTILITIES OR STRUCTURES SHOWN AND ANY OTHER UTILITIES OR STRUCTURES FOUND AT THE SITE. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE OWNERS OF THE UTILITIES OR STRUCTURES CONCERNED BEFORE STARTING WORK.

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THIS PLAN ARE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN AND ANY OTHER LINES OR STRUCTURES NOT SHOWN ON THESE PLANS.

ALL CONTRACTORS AND SUBCONTRACTORS PERFORMING WORK SHOWN ON OR RELATED TO THESE PLANS SHALL CONDUCT THEIR OPERATIONS SO THAT ALL EMPLOYEES ARE PROVIDED A SAFE PLACE TO WORK AND THE PUBLIC IS PROTECTED. ALL CONTRACTORS AND SUBCONTRACTORS SHALL COMPLY WITH THE "OCCUPATIONAL SAFETY AND HEALTH REGULATION" OF THE U.S. DEPARTMENT OF LABOR, AND WITH THE STATE OF CALIFORNIA DEPARTMENT OF INDUSTRIAL RELATIONS' "CONSTRUCTION SAFETY ORDERS."

THE CIVIL ENGINEER SHALL NOT BE RESPONSIBLE IN ANY WAY FOR THE CONTRACTORS' AND SUBCONTRACTORS' COMPLIANCE WITH THE "OCCUPATIONAL SAFETY AND HEALTH REGULATIONS" OF THE U.S. DEPARTMENT OF LABOR OR WITH THE STATE OF CALIFORNIA DEPARTMENT OF INDUSTRIAL RELATIONS' "CONSTRUCTION SAFETY ORDERS."

CONTRACTOR FURTHER AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER, ARCHITECT AND THE CIVIL ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER, ARCHITECT OR THE CIVIL ENGINEER.

THE ESTIMATED QUANTITIES HEREON ARE ONLY FOR THE PURPOSE OF OBTAINING THE NECESSARY PERMITS, AND HUITT-ZOLLARS DOES NOT GUARANTEE THE ACCURACY OF THE ESTIMATED QUANTITIES. THE CONTRACTOR SHALL PERFORM HIS OWN QUANTITY TAKEOFF BEFORE SUBMITTING A BID FOR ANY PORTION OF THE IMPROVEMENTS COVERED BY THESE PLANS.

ALL GRADING, EXCAVATION, REMOVAL AND RECOMPACTION SHALL BE IN ACCORDANCE WITH SOIL REPORT. THE PRELIMINARY REPORT AND ALL SUBSEQUENT REPORTS AS APPROVED BY THE CITY OF CORONA ARE CONSIDERED A PART OF GRADING PLAN.

UNAUTHORIZED CHANGES & USES CAUTION:
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES LINES AND STRUCTURES WHETHER SHOWN OR NOT SHOWN ON THIS PLAN, AND SHALL BE RESPONSIBLE FROM PROTECTING FROM DAMAGE.

ALL CONTRACTORS AND SUBCONTRACTORS PERFORMING WORK SHOWN ON OR RELATED TO THESE PLANS SHALL CONDUCT THEIR OPERATIONS SO THAT ALL EMPLOYEES ARE PROVIDED A SAFE PLACE TO WORK AND THE PUBLIC IS PROTECTED. ALL CONTRACTORS AND SUBCONTRACTORS SHALL COMPLY WITH THE "OCCUPATIONAL SAFETY AND HEALTH REGULATION" OF THE U.S. DEPARTMENT OF LABOR, AND WITH THE STATE OF CALIFORNIA DEPARTMENT OF INDUSTRIAL RELATIONS, "CONSTRUCTION SAFETY ORDERS". THE CIVIL ENGINEER SHALL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S AND SUBCONTRACTORS' COMPLIANCE WITH THE FEDERAL AND STATE REGULATIONS.

THE CONTRACTOR SHALL BE RESPONSIBLE TO REPORT DISCREPANCIES IN PLANS AND/OR FIELD CONDITIONS IMMEDIATELY TO THE CIVIL ENGINEER FOR RESOLUTION PRIOR TO CONSTRUCTION, AND SHALL BE RESPONSIBLE FOR DISCREPANCIES NOT SO REPORTED AND RESOLVED.

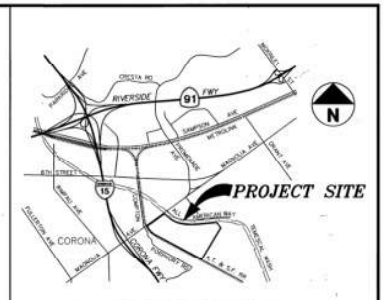
THE CONTRACTOR IS REQUIRED TO COMPLY WITH ALL THE PROVISIONS AND REQUIREMENTS OF TITLE 7 OF THE CALIFORNIA CIVIL CODE.

LEGEND

- PROJECT SITE BOUNDARY
- CENTERLINE
- CATCH BASIN
- STORM DRAIN MANHOLE
- SEWER MANHOLE
- SEWER CLEANOUT
- FIRE HYDRANT
- WATER VALVES
- DETECTOR CHECK VALVE
- WATER METER
- EXISTING WATER (W)
- EXISTING SEWER (S)
- EXISTING STORM DRAIN
- OVERHEAD ELECTRIC (OHE)
- EXISTING GAS LINE (G)
- TELEPHONE LINE (T)

SHEET INDEX

NO	DESCRIPTION	
1	TITLE SHEET	
2	CONSTRUCTION NOTES, QUANTITIES & DETAILS	
3	PAVING PLAN	MAGNOLIA PAVING PLAN
4	PLAN & PROFILE	MAGNOLIA 183+53.31 - 191+00.00
5	PLAN & PROFILE	MAGNOLIA 191+00.00 - 193+35.67
6	PLAN & PROFILE	SHERBORN 10+86.85 - 19+00.00
7	PLAN & PROFILE	SHERBORN 19+00.00 - 25+50.00
8	PLAN & PROFILE	SHERBORN 25+50.00 - 32+21.89
9	SEWER/ WATER	STA 11+42.61 - STA 19+00.00
10	SEWER/ WATER	SHERBORN STREET
11	SEWER/ WATER	SHERBORN STREET
12	SEWER/ WATER	ON SITE (PHASE I)
13	SEWER/ WATER	ON SITE (PHASE I)
14	SEWER/ WATER	ON SITE (FUTURE PHASES)
15	STORM DRAIN	LINE "A1"
16	STORM DRAIN	LINE "A2"
17	STORM DRAIN	LINE "A2-1"
18	STORM DRAIN	LINE "A3"
19	STORM DRAIN	LINE "B1"
20	STORM DRAIN	LINE "B2"



LOCATION MAP
NOT TO SCALE

ENGINEER:

HUITT-ZOLLARS, INC.
430 EXCHANGE, SUITE 200
IRVINE, CALIFORNIA 92602
(714) 734-5100

OWNER/DEVELOPER:

BIRTCHER COMMERCIAL DEVELOPMENT
27611 LA PAZ ROAD
LAGUNA NIGUEL, CALIFORNIA 92607
(949) 643-7418

UTILITIES:

ELECTRIC	SO. CAL. EDISON CO.
GAS	SO. CAL. GAS CO.
WATER	CITY OF CORONA
SEWER	CITY OF CORONA
TELEPHONE	PACIFIC BELL TEL. CO.

TELEPHONE NUMBERS:

EMERGENCY:

CORONA POLICE DEPARTMENT	911 OR 909 736-2333
CORONA FIRE DEPARTMENT	911 OR 909 736-2222
GOODHEW AMBULANCE	909 736-6666
CORONA REGIONAL MEDICAL CENTER 800 S. MAIN ST.	909 737-4343

UTILITIES:

UNDERGROUND SERVICE ALERT	800 422-4133
CITY OF CORONA UTILITY SERVICE	909 736-2263
CONTINENTAL (CABLE T.V.)	909 371-2811
SOUTHERN CALIFORNIA GAS (DISTRIBUTION)	800 624-2497
SOUTHERN CALIFORNIA EDISON	909 930-8412
PACIFIC BELL (ENGINEERING)	909 811-2130
PACIFIC BELL (REPAIRS)	611
AMERICAN TELEPHONE & TELEGRAPH COMPANY	909 381-7380

OTHERS:

CORONA PUBLIC WORKS DEPARTMENT	909 736-2259
STREET SWEEPING	800 222-5637
WESTERN WASTE	909 737-0343
CORONA DIAL-A-RIDE	909 734-1017
CORONA-NORCO UNIFIED SCHOOL DISTRICT	909 736-3340
SCHOOL DISTRICT TRANSPORTATION MANAGER	909 736-3305
U.S. POSTAL SERVICE	909 737-0451
RIVERSIDE TRANSIT AGENCY	909 684-0850
CORONA POLICE DEPARTMENT (FOR NOTIFICATIONS)	909 736-2330
CORONA FIRE DEPARTMENT (FOR NOTIFICATIONS)	909 736-2221

DECLARATION OF ENGINEER RECORD

I HEREBY DECLARE THAT THE DESIGN OF THE IMPROVEMENTS SHOWN ON THESE PLANS COMPLIES WITH ALL PROFESSIONAL ENGINEERING STANDARDS AND PRACTICES. AS THE ENGINEER OF RECORD FOR THE PLANS, I ASSUME FULL RESPONSIBILITY FOR THE DESIGN OF THE IMPROVEMENTS. WITH RESPECT TO THE PLAN CHECK PERFORMED BY THE CITY OF CORONA, I UNDERSTAND AND ACKNOWLEDGE THE FOLLOWING: (1) THE PLAN CHECK IS A REVIEW FOR THE LIMITED PURPOSE OF ENSURING THE PLANS COMPLY WITH THE CITY'S STANDARDS, PROCEDURES, POLICIES, AND ORDINANCES, (2) THE PLAN CHECK IS NOT A DETERMINATION OF THE TECHNICAL ADEQUACY OF THE DESIGN OF THE IMPROVEMENTS, AND (3) THE PLAN CHECK DOES NOT RELIEVE ME OF MY LEGAL AND PROFESSIONAL RESPONSIBILITY FOR THE DESIGN OF THE IMPROVEMENTS. AS THE ENGINEER OF RECORD, I AGREE TO DEFEND, INDEMNIFY, AND HOLD HARMLESS THE CITY, ITS ELECTED OFFICIALS, EMPLOYEES, AND AGENTS FROM ANY AND ALL ACTUAL OR ALLEGED CLAIMS, DEMANDS, CAUSES OF ACTION, LIABILITY, LOSS, DAMAGE, OR INJURY TO PROPERTY OR PERSONS, INCLUDING WRONGFUL DEATH, WHETHER IMPOSED BY A COURT OF LAW OR BY ADMINISTRATIVE ACTION OF ANY FEDERAL, STATE, OR LOCAL GOVERNMENTAL AGENCY, ARISING OUT OF OR INCIDENT TO ANY NEGLIGENT ACTS, OMISSIONS, OR ERRORS BY THE ENGINEER OF RECORD, ITS EMPLOYEES, -CONSULTANTS, OR AGENTS.

DUREY ATASI
PRINT NAME

43122 — LICENSE NUMBER
9-15-04 — DATE

SIGNATURE OF ENGINEER OF RECORD

DIGALERT

IMPORTANT NOTICE
SECTION 4216/4217 OF THE GOVERNMENT CODE REQUIRES A DIGALERT IDENTIFICATION NUMBER BE ISSUED BEFORE A "PERMIT TO EXCAVATE" WILL BE VALID. FOR YOUR DIGALERT I.D. NUMBER CALL UNDERGROUND SERVICE ALERT TOLL FREE 1-800-422-4133 TWO WORKING DAYS BEFORE YOU DIG

CITY SUBMITTAL
SEPTEMBER 18, 2003

No	By	Date	REVISIONS
1-HH	MF	9-15-04	REVISED SHT 19

Engineering — Proj. — Utility — App'd 9-15-04

BENCH MARK
BASIS OF ELEVATION: EL=845.350
CITY OF CORONA BENCHMARK D-11A A 2" BRASS CAP IN TOP OF CURB AT THE NORTHEAST CORNER OF THE INTERSECTION OF SIXTH STREET AND MAGNOLIA AVE.

No	By	Date	REVISIONS
1-PA	PA	6-4-03	REVISION TO NTE LINE (SHT 9 OF 17) AS
2-PA	PA	6-18-03	DELETED DRAINAGE AREA INTERCEPTED BY
3-DA	DA	7-2-03	CURB RETURN REFINEMENT NTS 13
4-DA	DA	7-8-03	CURB RETURN REFINEMENT NTS 13

Reference Plans for these Improvements

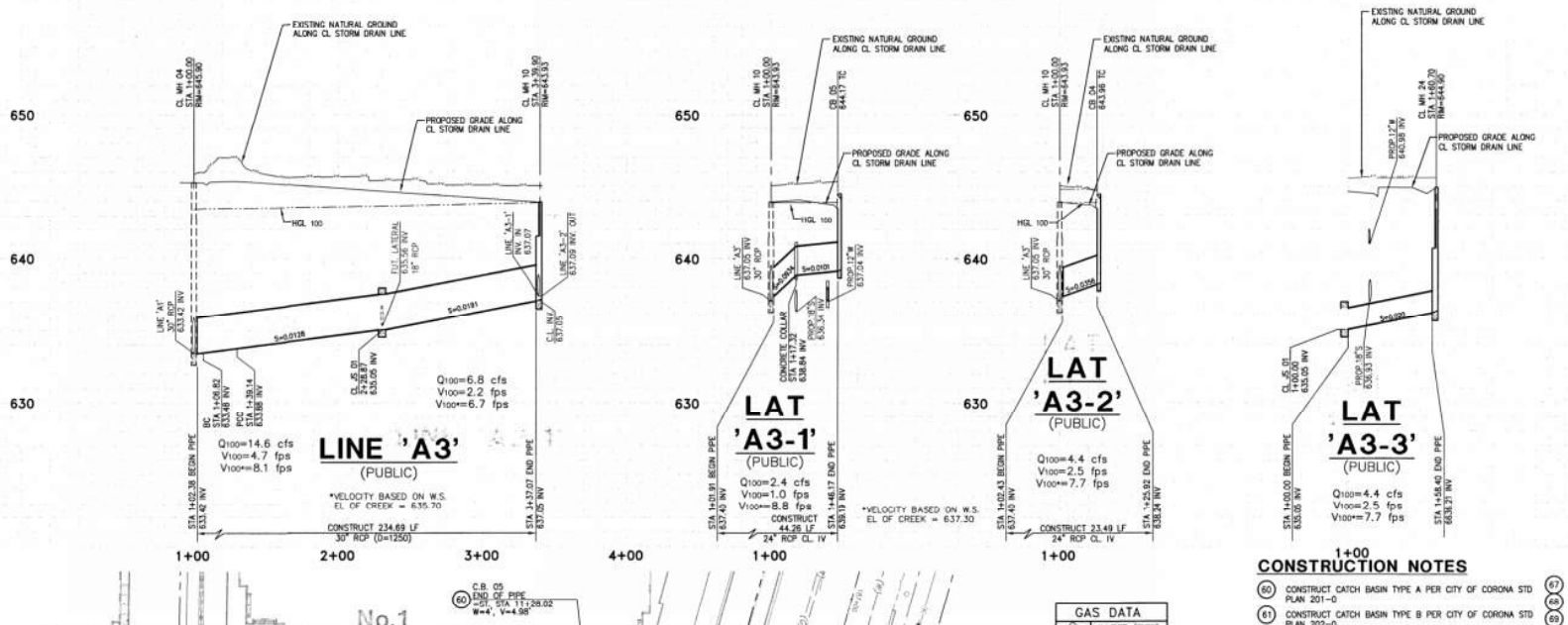
Designed by D.M.A. — Drawn by L.B.A. — Checked by D.M.A.
PLANS PREPARED UNDER SUPERVISION OF: DURY ATASI
Date 9/15/03 — R.C.E. No. 43122

HUITT-ZOLLARS Irvine
Huitt-Zollars, Inc.
430 Exchange, Suite 200
Irvine, California 92602-1309
Phone (714) 734-5100 Fax (714) 734-5155

Approved: JOHN M. LICATA — Date 10/14/03
R.C.E. No. 60816 Expiration 12/31/2004

CITY OF CORONA
STREET IMPROVEMENT PLAN
TITLE SHEET (PM 31369)
MAGNOLIA AVENUE AND SHERBORN STREET

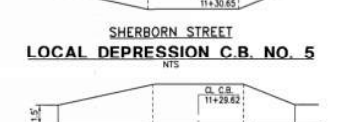
Drawing No. 03-0815
Sh 1 of 20



STORM LINE 'A3'

(PUBLIC)

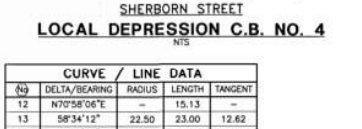
GAS DATA	
(No)	INVERT (PIPE)
DD	637.76 (24"SD)
EE	633.48 (30"SD)



SHERBORN STREET

LOCAL DEPRESSION C.B. NO. 5

NTS



SHERBORN STREET

LOCAL DEPRESSION C.B. NO. 4

NTS

CURVE / LINE DATA				
(No)	DELTA/BEARING	RADIUS	LENGTH	TANGENT
12	N70°58'06"E	–	15.13	–
13	58°34'12"	22.50	23.00	12.62
14	12°32'09"	967.00	211.57	106.21
15	N46°00'44"E	–	43.93	–
16	44°23'39"	22.50	17.43	9.18
17	N89°35'37"W	–	5.43	–
18	N75°22'20"E	–	46.17	–
19	N07°56'16"E	–	25.92	–

* TOTAL LENGTH

CONSTRUCTION NOTES

(60) CONSTRUCT CATCH BASIN TYPE A PER CITY OF CORONA STD PLAN 201-0
(61) CONSTRUCT CATCH BASIN TYPE B PER CITY OF CORONA STD PLAN 202-0
(62) CONSTRUCT STORM DRAIN MANHOLE PER CITY OF CORONA STD PLAN 207-0
(63) CONSTRUCT JUNCTION STRUCTURE PER CITY OF CORONA STD PLAN 208-1
(64) CONSTRUCT CONCRETE COLLAR CITY OF CORONA STD PLAN 209-0
(65) CONSTRUCT 10" PVC (SCHD 40)
(66) CONSTRUCT 12" PVC (SCHD 40)
(67) CONSTRUCT 15" RCP (CL. IV)
(68) CONSTRUCT 18" RCP (CL. IV)
(69) CONSTRUCT 24" RCP (CL. IV)
(70) CONSTRUCT 30" RCP (D-LOAD PER PLAN)
(71) CONSTRUCT 36" RCP (D-LOAD PER PLAN)
(72) CONSTRUCT 36" x 36" GRATE INLET (QUICKSET DB-3636 OR EQUAL)
(73) CONSTRUCT 24" x 24" GRATE INLET (QUICKSET DB-2424 OR EQUAL)
(74) CONSTRUCT 18" x 18" GRATE INLET (QUICKSET DB-1818 OR EQUAL)
(75) CONSTRUCT 12" x 12" GRATE INLET (QUICKSET DB-1212 OR EQUAL)
(76) CONSTRUCT TRENCH DRAIN PER DETAIL 1 ON SHEET 3
(77) CONSTRUCT BRICK & MORTAR PLUG
(78) CONSTRUCT 9"X9" GRATE INLET (NDS ATRIUM GRATE AND SPIGOT ADAPTER OR EQUAL)
(79) CONSTRUCT 4" P.V.C. (SCH. 40) WITH 4", 22.5 ELBOWS
(80) CONSTRUCT 48" RCP (D-LOAD PER PLAN)
(81) CONSTRUCT MANHOLE PIPE TO PIPE PER A.P.W.A STD. PLAN 322-1.
(82) CONSTRUCT TRANSITION STRUCTURE PER RIVERSIDE CO. F.C. STD. TS 303
(83) CONSTRUCT 42" RCP (D-LOAD PER PLAN)

PROFILE SCALE
HORIZONTAL: 1"=40'
VERTICAL: 1"=4'

KEY MAP
NOT TO SCALE

DIGALERT

IMPORTANT NOTICE
SECTION 4216/4217 OF THE GOVERNMENT CODE REQUIRES A DIGALERT IDENTIFICATION NUMBER BE ISSUED BEFORE A "PERMIT TO EXCAVATE" WILL BE VALID. FOR YOUR DIGALERT I.D. NUMBER CALL UNDERGROUND SERVICE ALERT TOLL FREE 1-800-422-4133 TWO WORKING DAYS BEFORE YOU DIG

CITY SUBMITTAL
SEPTEMBER 18, 2003

HUITT-ZOLLARS Inc.
Huitt-Zollars, Inc.
200 Exchange, Suite 200
Irvine, California 92602-1309
Phone (714) 734-5100 Fax (714) 734-5155

Designed by	Drawn by	Checked by
D.M.A.	L.B.A.	D.M.A.

PLANS PREPARED UNDER SUPERVISION OF
Date 9-19-03 R.C.E. No. 60816 Darrell Alasi 9/19/03

Reference Plans for these Improvements

Date	By	REVISIONS	App'd

BENCH MARK
SEE TITLE SHEET

Scale: AS SHOWN

Engineering A.P.
Fire
Utility

Approved
By JOHN N. UCATA
R.C.E. No. 60816 Expiration 12/31/2004
Date 10/14/03

CITY OF CORONA
STORM DRAIN PLAN & PROFILE
LINE 'A3' (PUBLIC SYSTEM) PM 31869
STA. 0+91.69 THRU STA. 3+37.65

Drawing No. 03-0815
Sh 18 of 20