Appendix F:

# Hydrology and Water Quality Supporting Information

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# F.1 - Preliminary Hydrology Report

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# 3150 BEAR STREET

## COSTA MESA, CALIFORNIA

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## PRELIMINARY HYDROLOGY REPORT

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PREPARED FOR:


Meritage Homes

5 Peters Canyon Road

Irvine, CA 92606

855-588-6374


Date Prepared: June 2024

PREPARED BY:


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Project Manager: Eric Lissner


Project Number: 117-007

ENGINEERING & CONSULTING

This report was prepared by or under the supervision of the undersigned registered civil engineer who attests to the technical information contained herein.

_____ _____

Eric Lissner, PE Date

ENGINEERING & CONSULTING

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- OCPW HSG Soil Map Plate B
- OCFD Drainage Facilities Base Map 13
- OCPW Santa Ana Watershed

# I. INTRODUCTION

## A. PROJECT SITE DESCRIPTION

The subject site is located at 3150 Bear Street, in the City of Costa Mesa. The site area consists of one lot that was consolidated from two parcels, APNs 141-521-48 & 141-521-49 covering 6.12 acres, bounded by the Interstate 405 (I-405) to the north, residential developments to the east and south, and Bear Street and its overpass embankment to the west. See Vicinity Map in **Section I.C**. This technical report will review the project as totaling 6.78 acres with inclusion of offsite areas within the study watershed.

Formerly agricultural land, the existing site has been fully developed since the early 1960s. The Trinity Broadcasting Network owned and used the site until 2017. The site consists of three-interconnected buildings in the northern half of the site, parking lots surrounding an outdoor gathering area in the southern half of the site, and an existing utility building to the southeast corner of the site. The entire existing development will be demolished and redeveloped into a high-density residential development with approximately 146 dwelling units.

Based on the FEMA flood map revised December 3, 2009, FIRM panel 06059C0267J, the site is located in Flood Zone X, and area of 0.2% annual chance flood, of 1% annual chance flood with average depths of less than 1 foot or drainage areas of less than 1 square mile, or protected by levees from the 1% chance annual flood.

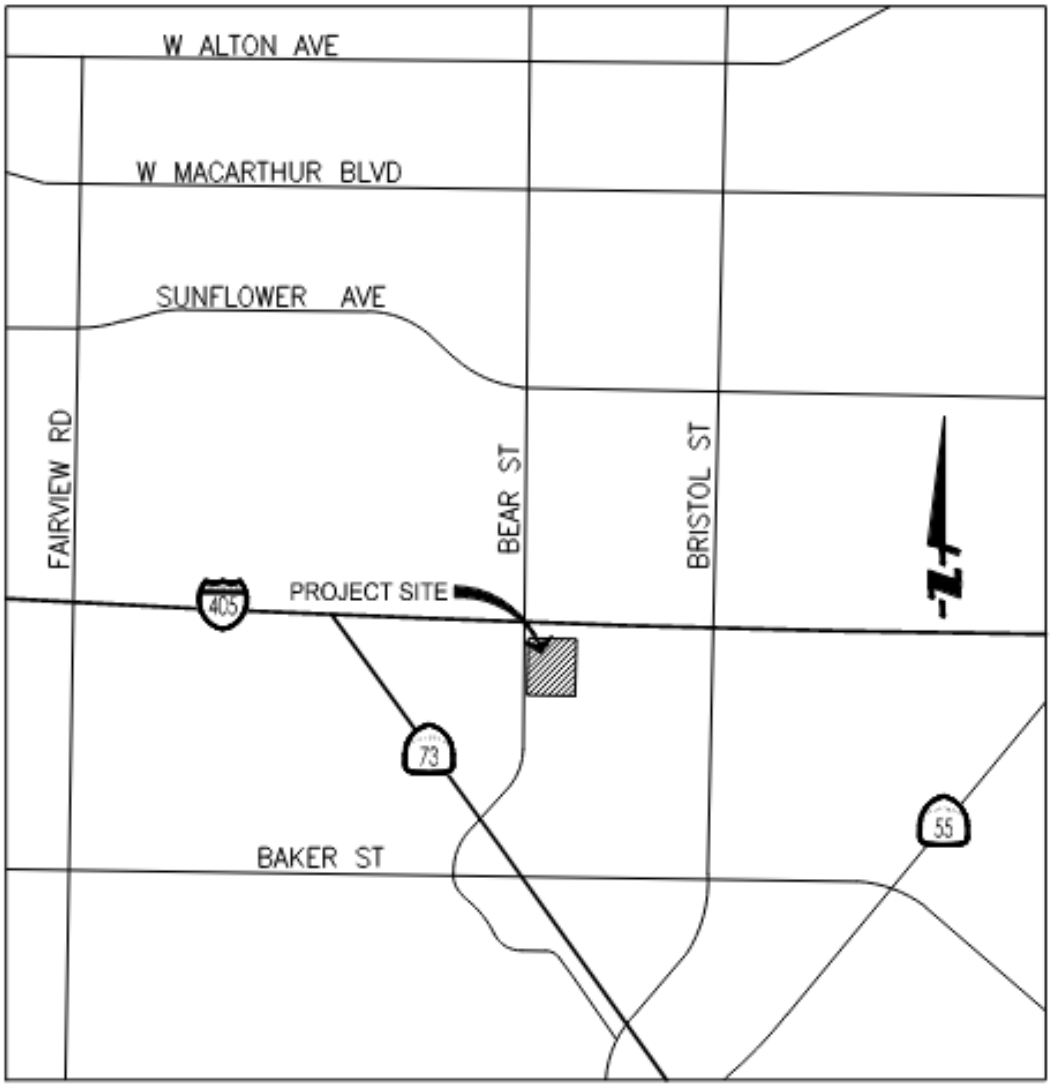
## B. PURPOSE AND SCOPE

The purpose of this preliminary study is to analyze the pre- and post-development drainage conditions in order to provide adequate drainage facilities for the proposed development project and demonstrate no adverse flood protection impact to the watershed.

The scope of this study includes:

1. Determination of the existing and proposed drainage patterns
2. Peak flow analysis of the discharge points for both existing and proposed drainage conditions.

### C. PROJECT LOCATION MAP




## II. EXISTING TOPOGRAPHIC AND HYDROLOGIC CONDITIONS

### A. EXISTING TOPOGRAPHY

The existing topography is sloped approximately 0.5% from south to north, with elevations ranging between 31' and 36. Along the east to west axis, the existing topography is sloped approximately 0.5% with elevations ranging from 38.4' to 35.5. Per the soils report dated March 2019 by GMU Geotechnical Inc. and geotechnical studies by SA Geotechnical in January 2024, the site is underlain by young alluvial deposits consisting of moist to wet, firm to stiff clay and silty material, and moist to very most, medium dense to very dense sand

materials. Historic groundwater depth ranges between 10 to 30 feet below existing grade. Soils in this region are categorized as Hydrologic Soils Group (HSG) class D. HSG analysis was determined with the Orange County Hydrology Manual, Hydrologic Classification of Soils, Plate B (see **Appendix B** for soils map). Additionally, HSG classification was confirmed from percolation test results in the GMU geotechnical report listing infiltration rates of less than 0.05 inches per hour.

### B. EXISTING DRAINAGE PATTERN

The project site is located within the Santa Ana Watershed and is not subject to hydromodification requirements, which are covered separately in the project's Water Quality Management Plan.

In general, drainage flows from south to north. Peak flow originates as sheet flow in the south which then transitions into piped flow for conveyance at the offsite discharge point at the northwest corner of the property. See **Figure 1** in **Appendix A** for Existing Condition Hydrology Map).

The entire site discharges to the existing Orange County Flood Control District (OCFCD) 72" public storm drain that lies at the northwest corner of the site at node 110. This storm drain known as OCFCD D03S03 Gisler Storm Channel, flows into the Greenville Banning Channel, connecting to the Santa Ana River Channel, which ultimately discharges to the Pacific Ocean.

### C. EXISTING STORM DRAIN FACILITIES

The existing onsite drainage is collected by area drains and conveyed by onsite storm drains that eventually join with the existing 27" and 72" public storm drains to the southwest and northwest corner of the site, respectively.

## III. HYDROLOGIC ANALYSIS

### A. STORM FREQUENCY

This report includes hydrology analysis for the existing and proposed project conditions based on a 25-year frequency storm event. In North Orange County, California storm drains with a tributary area of less than 640 acres are to be designed for a minimum 10-year storm event below top of curb. In sump conditions, catch basins, and connecting storm drains are to be designed at a 25-year storm event. The storm frequency chosen for this analysis is the 25-year storm event (Reference 1).

### B. METHODOLOGY

The City of Costa Mesa is an incorporated city within Orange County. Accordingly, the City of Costa Mesa accepts methodologies and practices as described in the 1986 Orange County Hydrology Manual and its 1996 Addendum.

The rational method, as described in Section D of the County's hydrology manual, is used for determining all peak runoff rates and times of concentration for this study. The rational method is implemented using CivilD software, 2018 version, developed by Civil Design Corporation and Joseph E. Bonadiman and Associates, Inc. ROC software is accepted by the County of Orange for hydrologic study purposes.

## C. EXISTING CONDITION

As described in **Section II.B**, drainage areas of the existing project site are depicted in **Figure 1**.

Peak flow existing drainage is summarized into 3 separate regions:

1. *Southern Tributary Areas A-1 through A-3 and A-7*

Peak runoff from this area originates as overland flow from a highpoint in subarea A-1 (node 101), and sheet flows to the drainage inlet located at node 102. Storm water is conveyed by a 12-inch storm drain to node 103. Peak flows from subarea A-2 are collected by approximately 4 drainage inlets in the middle of the property and conveyed to node 103 by a 24-inch storm drain. Storm water from the southern region enters a 60-inch storm drain at node 103 and flows west to node 104. Stormwater peak runoff is collected from A-3 and A-7 tributary subareas consisting of greenspace and terminates at node 110 confluencing with the central and northern tributary areas. Stormwater then exits the site and enters a 72-inch public storm drain.

2. *Central Tributary Areas A-4 and A-5*

Stormwater peak flows originate in the central tributary region of A-5 at node 105 to enter the drainage inlet at node 106. A 12-inch storm drain travels through tributary A-6 to intersect node 107. Peak runoff from A-5 sheet flows north to node 107 and enters a 24-inch storm drain combined with peak runoff from A-4. Peak runoff is conveyed to node 110 and confluences with the southern and northern tributary areas.

3. *Northern Tributary Area A-6*

Stormwater originates at a high point in tributary subarea A-6 at node 108 and sheet flows north to node 109. A concrete trapezoidal ditch conveys peak flow from this area and confluences with stormwater from the central and southern tributary areas.

*Table III.1 Existing Condition Study Area Runoff*

| Subarea | Existing Condition 25-Year Storm | | |
|---|---|---|---|
| | QPEAK (cfs) | Area (AC) | CivilD file name |
| A-1 | 2.3 | 0.59 | 117007BearExist25ver7 |
| A-2 | 12.4 | 3.3 | 117007BearExist25ver7 |
| A-3 | 0.8 | 0.32 | 117007BearExist25ver7 |
| A-4 | 3.4 | 0.90 | 117007BearExist25ver7 |
| A-5 | 1.1 | 0.52 | 117007BearExist25ver7 |
| A-6 | 2.9 | 0.89 | 117007BearExist25ver7 |
| A-7 | 0* | 0.24 | 117007BearExist25ver7 |
| **Total Project** | **22.5** | **6.78** | |

*Tributary area added to stream does not add flow per paragraph 6B, page D-15 of the Orange County Hydrology Manual. Peak flow is total for study area at confluence.

## D. PROPOSED CONDITION

The project proposes to develop a high-density residential development comprising approximately 140 dwelling units. The proposed drainage layout is available in **Figure 2**.

The overall proposed condition drainage will ultimately retain the existing condition flow drainage in the north to south direction. The existing condition topography previously

discussed has an overall grade tilting from southeast to northwest. However, the proposed condition will be graded from southwest to northeast. The subsurface storm drain network will retain the overall existing drainage pattern.

# IV. PROPOSED ONSITE DRAINAGE FACILITIES

## A. PROPOSED STORMWATER FACILITIES

All existing storm drains within the confines of the project will be removed and replaced. Stormwater from the proposed development will be intercepted by downspouts and new area drains that convey stormwater into two separate proprietary biofiltration BMPs to meet water quality objectives as required by the MS4 Permit. Stormwater flows then enter the public storm drain.

## B. UNMITIGATED PEAK STORM FLOWS

As described in Section III. D, the proposed drainage patterns are depicted in **Figure 2** in **Appendix A**. Unmitigated peak flow drainage pattern for the project is described as follows:

1. *Southern Tributary Areas A-1 through A-8*

Peak runoff from this area originates as overland flow from a highpoint in subarea A-1 (node 101), which flows into a gutter along Private Drive A into a catch basin at node 103 in subarea A-2. Storm water is then conveyed as pipe flow. Storm drain inlets capture runoff from subarea A-3 through A-8 which is routed to the southern proprietary water quality facility at node 107. Storm water flows to node 108 where runoff from tributary subarea A-9 is also collected by way of grading and drainage inlets. Storm water is conveyed through an existing 60-inch storm drain to node 117.

2. *Northern Tributary Areas A-10 through A-19*

Peak runoff originates at node 109 and sheet flows to node 110 into a catch basin in tributary subarea A-9. Stormwater is then conveyed in storm drains and collects drainage from tributary subareas A-11 through A-17 and enters node 116 at the northern proprietary water quality facility. After stormwater is routed through the facility, stormwater is conveyed to node 117 and collects drainage from tributary subarea A-19. At node 117, stormwater confluences with the peak flows from the southern tributary areas, enters the 72-inch public storm drain system and flows west.

*Table IV.1 Proposed Condition Study Area Runoff (Unmitigated)*

| Subarea | Proposed Unmitigated Condition 25-Year Storm | | |
|---|---|---|---|
| | QPEAK (cfs) | Area (AC) | CivilD file name |
| A-1 | 0.7 | 0.18 | 117007Bear25Prop20240619 |
| A-2 | 1.0 | 0.34 | 117007Bear25Prop20240619 |
| A-3 | 1.8 | 0.53 | 117007Bear25Prop20240619 |
| A-4 | 0.4 | 0.12 | 117007Bear25Prop20240619 |
| A-5 | 2.7 | 0.81 | 117007Bear25Prop20240619 |
| A-6 | 0.7 | 0.26 | 117007Bear25Prop20240619 |

| | | | |
|---|---|---|---|
| A-7 | 1.1 | 0.40 | 117007Bear25Prop20240619 |
| A-8 | 1.2 | 0.45 | 117007Bear25Prop20240619 |
| A-9 | 0 | 0.11 | 117007Bear25Prop20240619 |
| A-10 | 0.6 | 0.15 | 117007Bear25Prop20240619 |
| A-11 | 1.5 | 0.41 | 117007Bear25Prop20240619 |
| A-12 | 0.3 | 0.10 | 117007Bear25Prop20240619 |
| A-13 | 0.9 | 0.33 | 117007Bear25Prop20240619 |
| A-14 | 1.6 | 0.63 | 117007Bear25Prop20240619 |
| A-15 | 0.9 | 0.31 | 117007Bear25Prop20240619 |
| A-16 | 0.5 | 0.47 | 117007Bear25Prop20240619 |
| A-17 | 1.5 | 0.48 | 117007Bear25Prop20240619 |
| A-18 | 1.0 | 0.50 | 117007Bear25Prop20240619 |
| A-19 | 0 | 0.20 | 117007Bear25Prop20240619 |
| **Total Project** | **19.1** | **6.78** | 117007Bear25Prop20240619 |

# V. CONCLUSION

In Table V.1, selected nodes are evaluated between the existing and proposed conditions. These locations were chosen due to the project maintaining these connection points to the existing public storm drain.

*Table V.1 Existing versus Proposed Condition Peak Flows*

| Node | 25-Year Storm | |
|---|---|---|
| | QPEAK (cfs) | Time of Concentration (min) |
| 104-E | 15.4 | 6.7 |
| 108-P | 9.6 | 9.4 |
| 110-E | 22.5 | 7.5 |
| 117-P | 19.1 | 10.4 |

*E designates Existing Condition. P designates Proposed Condition.

Based upon the analyses completed in this preliminary study, the proposed condition of this project has been designed to adequately convey the 25-year storm flows to maintain design storm flood protection for the onsite areas as well as for the surrounding neighbors, and no adverse impacts to the Bear Street public storm drain system and overall watershed.

# VI. REFERENCES

1. Orange County Environmental Agency. 1986. Orange County Hydrology Manual. October 1986.

2. Orange County Public Works. 2021. Local Drainage Manual. May 25, 2021.

3. Fuscoe Engineering. 2019. Preliminary Hydrology Report, EF International Language Campus Costa Mesa, 3150 Bear Street, Costa Mesa, California. August 2019. Project No. 1793-001-01.

4. Orange County Public Works. 2023. Orange County Flood Control District Design Manual, 2nd Edition. January 2023.

5. GMU Geotechnical, Inc. 2019. Report of Geotechnical Foundation Investigation, EF International Language Campus – New Dormitory Buildings and Site Improvements, 3150 Bear Street, City of Costa Mesa, California. March 1, 2019. Project No. 18-252-00.

6. SA Geotechnical, 2024. Geotechnical Due Diligence Study and Preliminary Geotechnical Recommendations, Proposed Residential Development, 3150 Bear Street, City of Costa Mesa, California. January 5, 2024. Project No. 23150-01.

# FIGURES


## LEGEND

- MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED BOUNDARY
- PROPERTY BOUNDARY
- L=270' — SURFACE FLOW PATH LENGTH
- SURFACE FLOW PATH
- NODE NUMBER
- 101 / 781.0 / *771.0 — FLOWLINE ELEVATION; *INDICATES INVERT ELEVATION
- A / 0.64 — SUBAREA DESIGNATION; SUBAREA ACREAGE
- DIRECTION OF SURFACE FLOW
- EXISTING STORM DRAIN
- L=270' — FLOW PATH LENGTH OF STORM DRAIN
- DIRECTION OF STORM DRAIN FLOW

## DRAINAGE SUMMARY

| NODE DESIGNATION | INCLUDED SUBAREAS | TOTAL ACREAGE | TOTAL RUNOFF (CFS) | $T_C$ (MIN) |
|---|---|---|---|---|
| 104 | A-1 TO A-3 | 4.24 | 15.4 | 6.7 |
| 110 | A-4 TO A-5 | 1.42 | 4.5 | 8.5 |
| | A-6 TO A-7 | 0.89 | 2.9 | 8.6 |
| PROJECT TOTAL | | 6.78 | 22.5** | 7.5 |

* TRIBUTARY AREA ADDED TO STREAM DOES NOT ADD FLOW PER PARAGRAPH 6B, PAGE D-15 OF THE ORANGE COUNTY HYDROLOGY MANUAL. PEAK FLOW IS TOTAL FOR STUDY AREA AT CONFLUENCE.

** STUDY AREA HAS 3 STREAMS THAT CONFLUENCE AT NODE 110: (1) NODE 101–110; (2) NODE 105–110; (3) NODE 108–110

30' 0' 15' 30'
SCALE: 1" = 30'

# FIGURE 1: EXISTING CONDITION HYDROLOGY MAP

3150 BEAR STREET
COSTA MESA, CA

**X ENGINEERING & CONSULTING, INC.**
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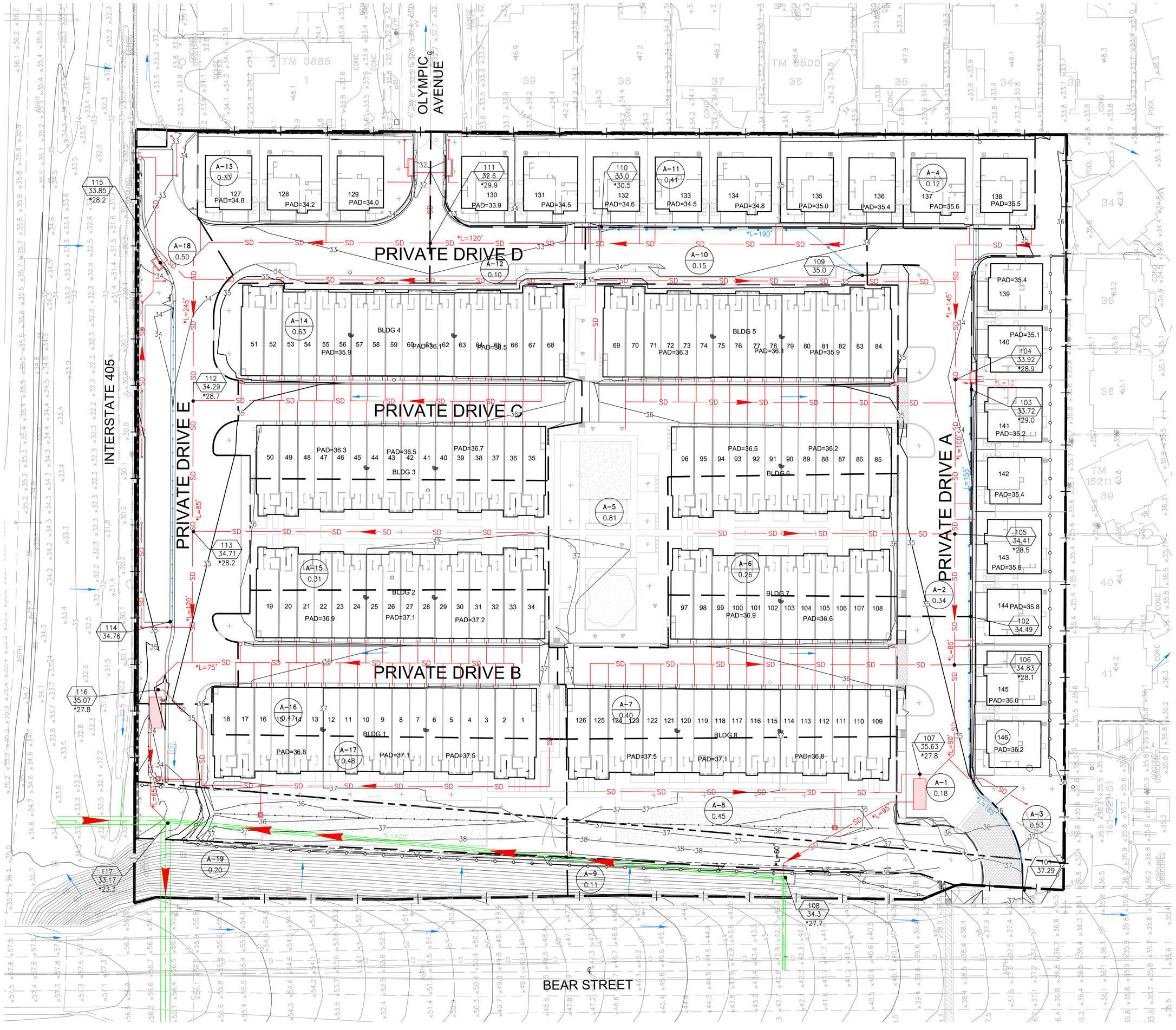
Santa Ana, California 92707
949.522.7100 | xengineeringinc.com




## LEGEND

- MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED BOUNDARY
- *L=270' — SURFACE FLOW PATH LENGTH
- SURFACE FLOW PATH
- 101 / 781.0 / *771.0 — NODE NUMBER, FLOWLINE ELEVATION, *INDICATES INVERT ELEVATION
- A / 0.64 — SUBAREA DESIGNATION, SUBAREA ACREAGE
- DIRECTION OF SURFACE FLOW
- EXISTING STORM DRAIN
- *L=270' — FLOW PATH LENGTH OF STORM DRAIN
- SD — PROPOSED STORM DRAIN
- DIRECTION OF STORM DRAIN FLOW
- PROPOSED BMP

## DRAINAGE SUMMARY

| NODE DESIGNATION | INCLUDED SUBAREA | TOTAL ACREAGE | TOTAL RUNOFF (CFS) | $T_C$ (MIN) |
|---|---|---|---|---|
| 108 | A–1 TO A–9 | 3.2 | 9.6 | 9.4 |
| 117 | A–10 TO A–19 | 3.58 | 9.8 | 11.2 |
| PROJECT TOTAL | | 6.78 | 19.1 | 10.4 |

* STUDY AREA HAS 2 STREAMS THAT CONFLUENCE AT NODE 117: (1) NODE 101–117; (2) NODE 109–117.

30' 0' 15' 30'
SCALE: 1" = 30'

FIGURE 2: PROPOSED CONDITION HYDROLOGY MAP
3150 BEAR STREET
COSTA MESA, CALIFORNIA

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# APPENDIX A

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2018 Version 9.0
Rational Hydrology Study, Date: 06/19/24 File Name: 117007BearExist25ver7.roc

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117-007 3150 Bear Street, Costa Mesa, California
Existing Condition Hydrology, 25-year storm event

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Program License Serial Number 6440

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

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Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

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

---

APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.040(In/Hr)
Initial subarea data:
Initial area flow distance = 160.000(Ft.)
Top (of initial area) elevation = 35.800(Ft.)
Bottom (of initial area) elevation = 33.900(Ft.)
Difference in elevation = 1.900(Ft.)
Slope = 0.01187 s(%)= 1.19
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.988 min.

```
Rainfall intensity =      4.356(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.892
Subarea runoff =      2.292(CFS)
Total initial stream area =        0.590(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    30.400(Ft.)
Downstream point/station elevation =    27.800(Ft.)
Pipe length  =   150.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.292(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.292(CFS)
Normal flow depth in pipe =    5.92(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =    7.77(In.)
Pipe flow velocity =      5.94(Ft/s)
Travel time through pipe =    0.42 min.
Time of concentration (TC) =     6.41 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     6.41 min.
Rainfall intensity =      4.191(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =     12.355(CFS) for    3.330(Ac.)
Total runoff =     14.646(CFS)  Total area =        3.92(Ac.)
Area averaged Fm value =    0.040(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    27.800(Ft.)
```

```
Downstream point/station elevation =    27.700(Ft.)
Pipe length  =    60.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.646(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    14.646(CFS)
Normal flow depth in pipe =   21.73(In.)
Flow top width inside pipe =   26.81(In.)
Critical Depth =   15.49(In.)
Pipe flow velocity =      3.85(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =     6.67 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
_______________________________________________________________________________
UNDEVELOPED (dense cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 80.00
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.200(In/Hr)
Time of concentration =     6.67 min.
Rainfall intensity =      4.098(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.889
Subarea runoff =      0.794(CFS) for    0.320(Ac.)
Total runoff =     15.440(CFS)  Total area =        4.24(Ac.)
Area averaged Fm value =    0.052(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_______________________________________________________________________________
Upstream point/station elevation =    27.700(Ft.)
Downstream point/station elevation =    23.300(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.440(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    15.440(CFS)
Normal flow depth in pipe =   16.01(In.)
Flow top width inside pipe =   17.88(In.)
Critical Depth =   17.44(In.)
Pipe flow velocity =      7.85(Ft/s)
Travel time through pipe =    0.85 min.
Time of concentration (TC) =     7.52 min.
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (dense cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 80.00
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.200(In/Hr)
The area added to the existing stream with this TC
does not add flow per Para 6b, Page D-15 of the OCHM,
therefore the upstream flow rate of Q =     15.440(CFS) is being used
Time of concentration =     7.52 min.
Rainfall intensity =      3.829(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.886
Subarea runoff =      0.000(CFS) for    0.230(Ac.)
Total runoff =     15.440(CFS)  Total area =        4.47(Ac.)
Area averaged Fm value =    0.060(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      110.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      4.470(Ac.)
Runoff from this stream =     15.440(CFS)
Time of concentration =    7.52 min.
Rainfall intensity =     3.829(In/Hr)
Area averaged loss rate (Fm) =    0.0597(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2984
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
MOBILE HOME PARK subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
```

```
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2500  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.050(In/Hr)
Initial subarea data:
Initial area flow distance =   240.000(Ft.)
Top (of initial area) elevation =    37.300(Ft.)
Bottom (of initial area) elevation =    31.400(Ft.)
Difference in elevation =     5.900(Ft.)
Slope =    0.02458  s(%)=       2.46
TC = k(0.336)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.314 min.
Rainfall intensity =      4.227(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.889
Subarea runoff =      3.383(CFS)
Total initial stream area =        0.900(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    28.400(Ft.)
Downstream point/station elevation =    26.200(Ft.)
Pipe length  =   490.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.383(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.383(CFS)
Normal flow depth in pipe =    9.98(In.)
Flow top width inside pipe =   14.16(In.)
Critical Depth =    8.89(In.)
Pipe flow velocity =      3.90(Ft/s)
Travel time through pipe =    2.09 min.
Time of concentration (TC) =     8.41 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
MOBILE HOME PARK subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2500  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.050(In/Hr)
Time of concentration =     8.41 min.
Rainfall intensity =      3.595(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
```

```
rational method)(Q=KCIA) is C = 0.887
Subarea runoff =      1.147(CFS) for    0.520(Ac.)
Total runoff =      4.530(CFS)  Total area =        1.42(Ac.)
Area averaged Fm value =    0.050(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      110.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    26.200(Ft.)
Downstream point/station elevation =    23.300(Ft.)
Pipe length  =    75.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.530(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.530(CFS)
Normal flow depth in pipe =    7.02(In.)
Flow top width inside pipe =   11.82(In.)
Critical Depth =   10.66(In.)
Pipe flow velocity =      9.49(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =     8.54 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      110.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.420(Ac.)
Runoff from this stream =      4.530(CFS)
Time of concentration =    8.54 min.
Rainfall intensity =     3.563(In/Hr)
Area averaged loss rate (Fm) =    0.0500(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2500
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.5000  Max loss rate(Fp)=     0.200(In/Hr)
```

```
Max Catchment Loss (Fm) =     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   260.000(Ft.)
Top (of initial area) elevation =    37.400(Ft.)
Bottom (of initial area) elevation =    32.300(Ft.)
Difference in elevation =     5.100(Ft.)
Slope =    0.01962  s(%)=       1.96
TC = k(0.389)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.896 min.
Rainfall intensity =      3.724(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff =      2.903(CFS)
Total initial stream area =        0.890(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =    32.300(Ft.)
Downstream point elevation =    23.300(Ft.)
Channel length thru subarea  =   235.000(Ft.)
Channel base width      =    2.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =      2.903(CFS)
Depth of flow =   0.204(Ft.), Average velocity =   5.916(Ft/s)
Channel flow top width =    2.815(Ft.)
Flow Velocity =    5.92(Ft/s)
Travel time  =    0.66 min.
Time of concentration =    8.56 min.
Critical depth =      0.355(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      110.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.890(Ac.)
Runoff from this stream =      2.903(CFS)
Time of concentration =    8.56 min.
Rainfall intensity =     3.559(In/Hr)
Area averaged loss rate (Fm) =    0.1000(In/Hr)
Area averaged Pervious ratio (Ap) = 0.5000
Summary of stream data:
```

```
Stream  Area  Flow rate      TC     Fm       Rainfall Intensity
 No.    (Ac.)   (CFS)       (min) (In/Hr)     (In/Hr)


1      4.47    15.440      7.52    0.060      3.829
2      1.42     4.530      8.54    0.050      3.563
3      0.89     2.903      8.56    0.100      3.559
Qmax(1) =
           1.000 *    1.000 *    15.440) +
           1.076 *    0.881 *     4.530) +
           1.078 *    0.878 *     2.903) + =      22.481
Qmax(2) =
           0.929 *    1.000 *    15.440) +
           1.000 *    1.000 *     4.530) +
           1.001 *    0.998 *     2.903) + =      21.780
Qmax(3) =
           0.928 *    1.000 *    15.440) +
           0.999 *    1.000 *     4.530) +
           1.000 *    1.000 *     2.903) + =      21.758

Total of 3 main streams to confluence:
Flow rates before confluence point:
      16.440       5.530       3.903
Maximum flow rates at confluence using above data:
       22.481       21.780       21.758
Area of streams before confluence:
        4.470        1.420        0.890
Effective area values after confluence:
        6.502        6.778        6.780


Results of confluence:
Total flow rate =     22.481(CFS)
Time of concentration =     7.518 min.
Effective stream area after confluence  =      6.502(Ac.)
Study area average Pervious fraction(Ap) =  0.315
Study area average soil loss rate(Fm) =    0.063(In/Hr)
Study area total =       6.78(Ac.)
End of computations, total study area =            6.78 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.315
Area averaged SCS curve number (AMC 2) =  75.4
```

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2018 Version 9.0
Rational Hydrology Study, Date: 06/19/24 File Name: 117007Bear25Prop20240619.roc

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117-007 3150 Bear Street, Costa Mesa, California
Proposed Condition Hydrology
25-year storm event

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Program License Serial Number 6440

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

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Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

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

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RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 75.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fp)= 0.200(In/Hr)
Max Catchment Loss (Fm) = 0.040(In/Hr)
Initial subarea data:
Initial area flow distance = 185.000(Ft.)
Top (of initial area) elevation = 37.290(Ft.)
Bottom (of initial area) elevation = 34.490(Ft.)
Difference in elevation = 2.800(Ft.)
Slope = 0.01514 s(%)= 1.51
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.045 min.

```
Rainfall intensity =      4.332(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.892
Subarea runoff =      0.695(CFS)
Total initial stream area =        0.180(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =    34.490(Ft.)
End of street segment elevation =    33.720(Ft.)
Length of street segment  =   155.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   0.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      1.253(CFS)
Depth of flow =   0.297(Ft.), Average velocity =   1.470(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.519(Ft.)
Flow velocity =   1.47(Ft/s)
Travel time =    1.76 min.     TC =    7.80  min.
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.020(In/Hr)
Rainfall intensity =      3.750(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.894
Subarea runoff =      1.047(CFS) for    0.340(Ac.)
Total runoff =      1.742(CFS)  Total area =        0.52(Ac.)
Area averaged Fm value =    0.027(In/Hr)
Street flow at end of street =      1.742(CFS)
Half street flow at end of street =      1.742(CFS)
Depth of flow =   0.324(Ft.), Average velocity =   1.583(Ft/s)
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Flow width (from curb towards crown)=   9.870(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     7.80 min.
Rainfall intensity =      3.750(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.892
Subarea runoff =      1.769(CFS) for    0.530(Ac.)
Total runoff =      3.512(CFS)  Total area =        1.05(Ac.)
Area averaged Fm value =    0.034(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     7.80 min.
Rainfall intensity =      3.750(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.892
Subarea runoff =      0.401(CFS) for    0.120(Ac.)
Total runoff =      3.912(CFS)  Total area =        1.17(Ac.)
Area averaged Fm value =    0.034(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =    29.000(Ft.)
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Downstream point/station elevation =    28.900(Ft.)
Pipe length  =    10.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.912(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.912(CFS)
Normal flow depth in pipe =    8.42(In.)
Flow top width inside pipe =   14.89(In.)
Critical Depth =    9.60(In.)
Pipe flow velocity =      5.51(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     7.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     7.83 min.
Rainfall intensity =      3.741(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      2.690(CFS) for    0.810(Ac.)
Total runoff =      6.602(CFS)  Total area =        1.98(Ac.)
Area averaged Fm value =    0.037(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =    28.900(Ft.)
Downstream point/station elevation =    28.500(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.602(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     6.602(CFS)
Normal flow depth in pipe =   14.65(In.)
Flow top width inside pipe =   14.01(In.)
Critical Depth =   11.92(In.)
Pipe flow velocity =      4.29(Ft/s)
Travel time through pipe =    0.39 min.
Time of concentration (TC) =     8.22 min.
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      105.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     8.22 min.
Rainfall intensity =      3.640(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      0.662(CFS) for    0.260(Ac.)
Total runoff =      7.264(CFS)  Total area =        2.24(Ac.)
Area averaged Fm value =    0.037(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    28.500(Ft.)
Downstream point/station elevation =    28.100(Ft.)
Pipe length  =    85.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.264(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     7.264(CFS)
Normal flow depth in pipe =   12.56(In.)
Flow top width inside pipe =   20.59(In.)
Critical Depth =   11.96(In.)
Pipe flow velocity =      4.84(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =     8.51 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      106.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
```

```
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     8.51 min.
Rainfall intensity =      3.569(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      1.127(CFS) for    0.400(Ac.)
Total runoff =      8.391(CFS)  Total area =        2.64(Ac.)
Area averaged Fm value =    0.037(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      107.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    28.100(Ft.)
Downstream point/station elevation =    27.800(Ft.)
Pipe length  =    90.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.391(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     8.391(CFS)
Normal flow depth in pipe =   15.83(In.)
Flow top width inside pipe =   18.09(In.)
Critical Depth =   12.91(In.)
Pipe flow velocity =      4.31(Ft/s)
Travel time through pipe =    0.35 min.
Time of concentration (TC) =     8.86 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      107.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     8.86 min.
Rainfall intensity =      3.489(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =      1.207(CFS) for    0.450(Ac.)
Total runoff =      9.598(CFS)  Total area =        3.09(Ac.)
Area averaged Fm value =    0.038(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =    27.800(Ft.)
Downstream point/station elevation =    27.700(Ft.)
Pipe length  =    95.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.598(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =     9.598(CFS)
Normal flow depth in pipe =   21.12(In.)
Flow top width inside pipe =   22.29(In.)
Critical Depth =   12.80(In.)
Pipe flow velocity =      2.88(Ft/s)
Travel time through pipe =    0.55 min.
Time of concentration (TC) =     9.41 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      108.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
UNDEVELOPED (dense cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 80.00
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.200(In/Hr)
The area added to the existing stream with this TC
does not add flow per Para 6b, Page D-15 of the OCHM,
therefore the upstream flow rate of Q =      9.598(CFS) is being used
Time of concentration =     9.41 min.
Rainfall intensity =      3.372(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.888
Subarea runoff =      0.000(CFS) for    0.110(Ac.)
Total runoff =      9.598(CFS)  Total area =        3.20(Ac.)
Area averaged Fm value =    0.043(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      117.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =    27.700(Ft.)
Downstream point/station elevation =    23.300(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
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```
No. of pipes = 1  Required pipe flow  =     9.598(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     9.598(CFS)
Normal flow depth in pipe =   13.00(In.)
Flow top width inside pipe =   16.13(In.)
Critical Depth =   14.36(In.)
Pipe flow velocity =      7.02(Ft/s)
Travel time through pipe =    0.95 min.
Time of concentration (TC) =    10.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      117.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      3.200(Ac.)
Runoff from this stream =      9.598(CFS)
Time of concentration =   10.36 min.
Rainfall intensity =     3.194(In/Hr)
Area averaged loss rate (Fm) =    0.0434(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2169
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      110.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Initial subarea data:
Initial area flow distance =   190.000(Ft.)
Top (of initial area) elevation =    35.000(Ft.)
Bottom (of initial area) elevation =    33.000(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.01053  s(%)=       1.05
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.570 min.
Rainfall intensity =      4.133(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.891
Subarea runoff =      0.553(CFS)
Total initial stream area =        0.150(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      110.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     6.57 min.
Rainfall intensity =      4.133(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      1.510(CFS) for    0.410(Ac.)
Total runoff =      2.063(CFS)  Total area =        0.56(Ac.)
Area averaged Fm value =    0.040(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    30.500(Ft.)
Downstream point/station elevation =    29.900(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.063(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.063(CFS)
Normal flow depth in pipe =    8.26(In.)
Flow top width inside pipe =   11.12(In.)
Critical Depth =    7.36(In.)
Pipe flow velocity =      3.58(Ft/s)
Travel time through pipe =    0.56 min.
Time of concentration (TC) =     7.13 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
```

```
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.020(In/Hr)
Time of concentration =     7.13 min.
Rainfall intensity =      3.946(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.892
Subarea runoff =      0.259(CFS) for    0.100(Ac.)
Total runoff =      2.322(CFS)  Total area =        0.66(Ac.)
Area averaged Fm value =    0.037(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      112.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    29.900(Ft.)
Downstream point/station elevation =    28.700(Ft.)
Pipe length  =   245.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.322(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.322(CFS)
Normal flow depth in pipe =    9.17(In.)
Flow top width inside pipe =   10.19(In.)
Critical Depth =    7.83(In.)
Pipe flow velocity =      3.61(Ft/s)
Travel time through pipe =    1.13 min.
Time of concentration (TC) =     8.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      112.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     8.26 min.
Rainfall intensity =      3.630(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.891
Subarea runoff =      0.879(CFS) for    0.330(Ac.)
Total runoff =      3.201(CFS)  Total area =        0.99(Ac.)
Area averaged Fm value =    0.038(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      112.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     8.26 min.
Rainfall intensity =      3.630(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =      2.036(CFS) for    0.630(Ac.)
Total runoff =      5.236(CFS)  Total area =        1.62(Ac.)
Area averaged Fm value =    0.039(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      113.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    28.700(Ft.)
Downstream point/station elevation =    28.200(Ft.)
Pipe length  =    85.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.236(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.236(CFS)
Normal flow depth in pipe =   10.57(In.)
Flow top width inside pipe =   17.72(In.)
Critical Depth =   10.57(In.)
Pipe flow velocity =      4.85(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =     8.55 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      113.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
```

```
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     8.55 min.
Rainfall intensity =      3.560(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =      0.879(CFS) for    0.310(Ac.)
Total runoff =      6.115(CFS)  Total area =        1.93(Ac.)
Area averaged Fm value =    0.039(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      113.000 to Point/Station      116.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =    28.200(Ft.)
Downstream point/station elevation =    27.800(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.115(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     6.115(CFS)
Normal flow depth in pipe =   12.56(In.)
Flow top width inside pipe =   20.59(In.)
Critical Depth =   10.94(In.)
Pipe flow velocity =      4.07(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =     9.04 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      116.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     9.04 min.
Rainfall intensity =      3.449(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =      1.250(CFS) for    0.470(Ac.)
Total runoff =      7.365(CFS)  Total area =        2.40(Ac.)
Area averaged Fm value =    0.039(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      116.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.2000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.040(In/Hr)
Time of concentration =     9.04 min.
Rainfall intensity =      3.449(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =      1.473(CFS) for    0.480(Ac.)
Total runoff =      8.838(CFS)  Total area =        2.88(Ac.)
Area averaged Fm value =    0.039(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      114.000 to Point/Station      115.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
_____________________________________________________________________________
Top of street segment elevation =    34.760(Ft.)
End of street segment elevation =    33.850(Ft.)
Length of street segment  =   235.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =   0.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =      2.722(CFS)
Half street flow before street inlet =      2.722(CFS)
Existing pipe flow before street inlet =      6.115(CFS)
Number of street inlets = 1
Depth of flow =   0.376(Ft.), Average velocity =   1.625(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =     12.000(Ft.)
```

```
 Flow rate in gutter section of street = Qw =      1.288(CFS)
 Ratio of frontal flow to total flow = E0 =  0.4731
 Given curb inlet length  L =      0.100(Ft.)
Street slope is less than .5% , depth of flow indicates an orifice flow
condition exists for an opening height of    3.00(In.)
Using equation Qi = .67hL(2gd0)^.5
Total inlet flow capacity=      0.067(CFS)

Half street cross section data points at curb inlet:
                X-coordinate (Ft.)   Y-coordinate (Ft.)
              0.0000                 0.7500 right of way
             10.0000                 0.5000 top of curb
             10.0000                 0.0000 flow line
             12.0000                 0.1667 gutter/depression end
             21.5000                 0.3567 grade break
             22.0000                 0.3667 crown
 Gutter depression depth =      0.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  0.0247

Pipe calculations for under street flow rate of      6.183(CFS)
Using a pipe slope =      0.387 %
Upstream point/station elevation =    34.760(Ft.)
Downstream point/station elevation =    33.850(Ft.)
Pipe length  =   235.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.183(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     6.183(CFS)
Normal flow depth in pipe =   13.95(In.)
Flow top width inside pipe =   15.03(In.)
Critical Depth =   11.53(In.)
Pipe flow velocity =      4.21(Ft/s)
Travel time through pipe =    0.93 min.
Time of concentration (TC) =     9.98 min.
Maximum flow rate of street inlet(s) =      0.067(CFS)
Maximum pipe flow capacity =      6.183(CFS)
Remaining flow in street below inlet =      2.655(CFS)
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 75.00
Pervious ratio(Ap) = 0.1000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.020(In/Hr)
Rainfall intensity =      3.263(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.890
Subarea runoff =      0.977(CFS) for    0.500(Ac.)
```

```
Total runoff =      9.815(CFS)  Total area =        3.38(Ac.)
Area averaged Fm value =    0.036(In/Hr)
Street flow at end of street =      3.632(CFS)
Half street flow at end of street =      3.632(CFS)
Depth of flow =   0.402(Ft.), Average velocity =   1.822(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      115.000 to Point/Station      116.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =    28.200(Ft.)
Downstream point/station elevation =    27.800(Ft.)
Pipe length  =   245.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.815(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =     9.815(CFS)
Normal flow depth in pipe =   18.01(In.)
Flow top width inside pipe =   25.45(In.)
Critical Depth =   12.97(In.)
Pipe flow velocity =      3.48(Ft/s)
Travel time through pipe =    1.17 min.
Time of concentration (TC) =    11.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      116.000 to Point/Station      117.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =    27.800(Ft.)
Downstream point/station elevation =    23.300(Ft.)
Pipe length  =    65.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.815(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.815(CFS)
Normal flow depth in pipe =    8.18(In.)
Flow top width inside pipe =   14.94(In.)
Critical Depth =   14.14(In.)
Pipe flow velocity =     14.35(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    11.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      117.000 to Point/Station      117.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
UNDEVELOPED (dense cover) subarea
```

```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 80.00
Pervious ratio(Ap) = 1.0000  Max loss rate(Fp)=     0.200(In/Hr)
Max Catchment Loss (Fm) =     0.200(In/Hr)
The area added to the existing stream with this TC
does not add flow per Para 6b, Page D-15 of the OCHM,
therefore the upstream flow rate of Q =      9.815(CFS) is being used
Time of concentration =    11.22 min.
Rainfall intensity =      3.052(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.887
Subarea runoff =      0.000(CFS) for    0.200(Ac.)
Total runoff =      9.815(CFS)  Total area =        3.58(Ac.)
Area averaged Fm value =    0.046(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      117.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.580(Ac.)
Runoff from this stream =      9.815(CFS)
Time of concentration =   11.22 min.
Rainfall intensity =     3.052(In/Hr)
Area averaged loss rate (Fm) =    0.0456(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2279
Summary of stream data:

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


1      3.20     9.598     10.36    0.043      3.194
2      3.58     9.815     11.22    0.046      3.052
Qmax(1) =
           1.000 *    1.000 *     9.598) +
           1.047 *    0.923 *     9.815) + =      19.085
Qmax(2) =
           0.955 *    1.000 *     9.598) +
           1.000 *    1.000 *     9.815) + =      18.983

Total of 2 main streams to confluence:
Flow rates before confluence point:
      10.598      10.815
Maximum flow rates at confluence using above data:
```

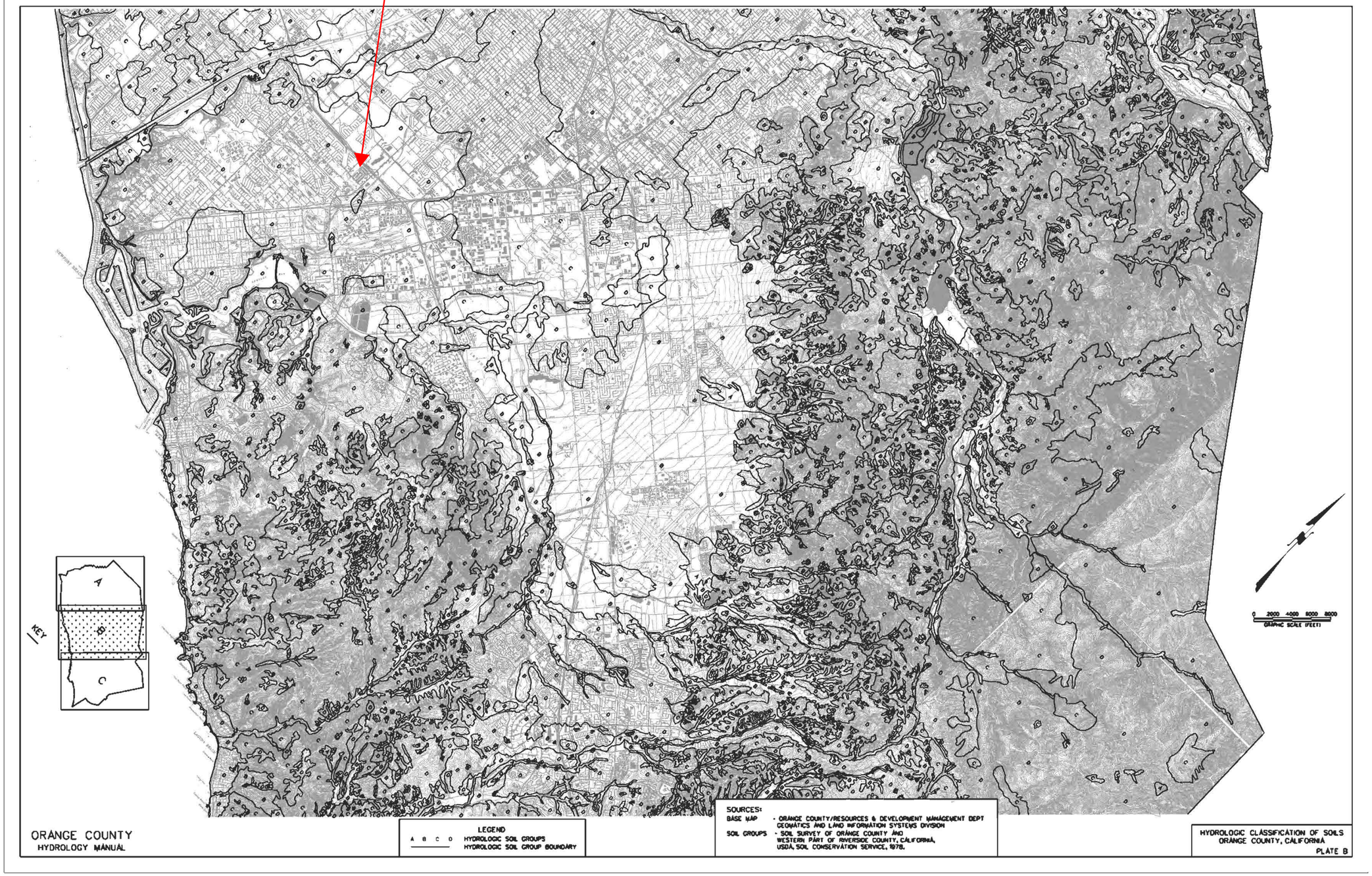
```
       19.085       18.983
Area of streams before confluence:
        3.200        3.580
Effective area values after confluence:
        6.505        6.780

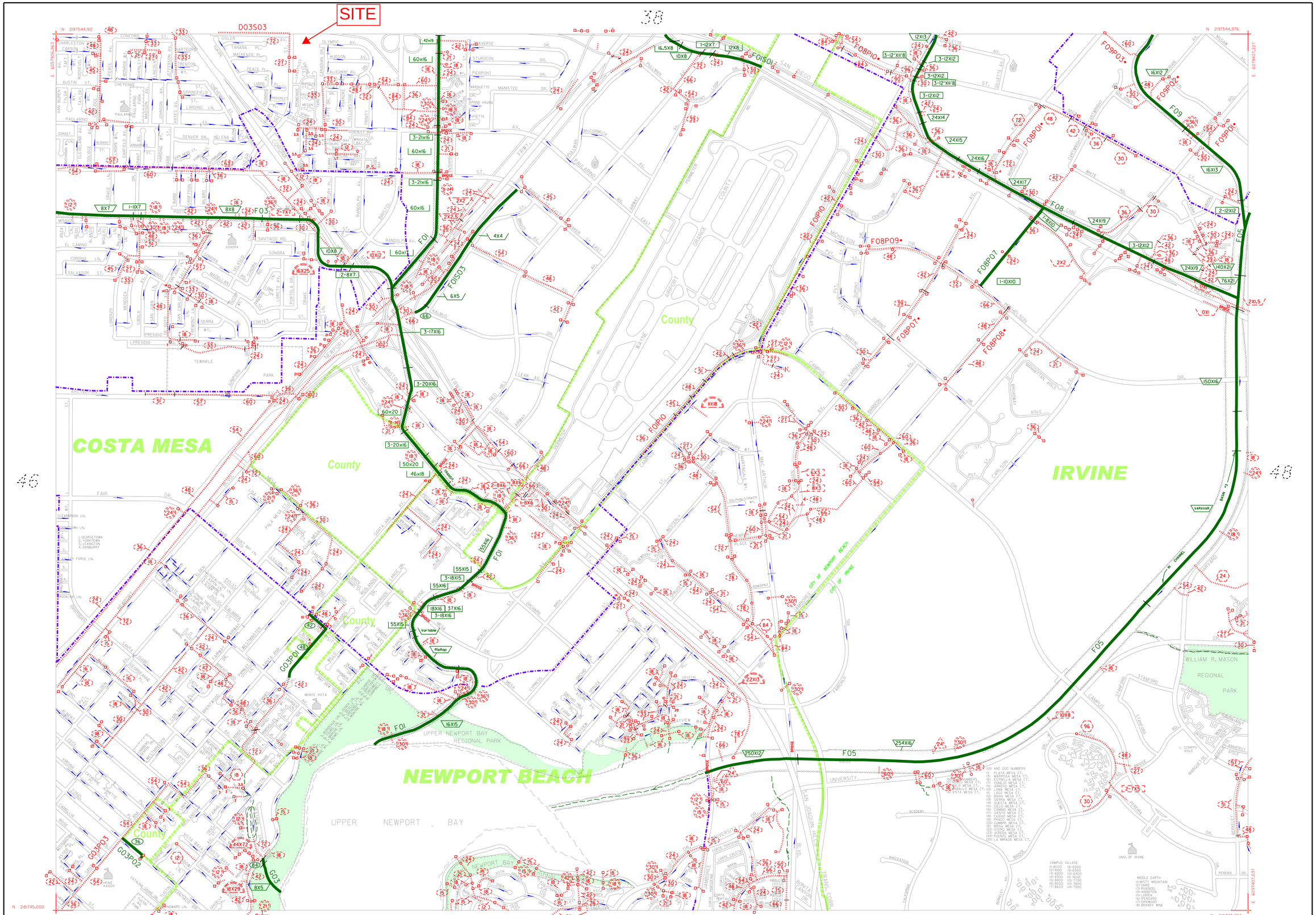

Results of confluence:
Total flow rate =     19.085(CFS)
Time of concentration =    10.362 min.
Effective stream area after confluence  =      6.505(Ac.)
Study area average Pervious fraction(Ap) =  0.223
Study area average soil loss rate(Fm) =    0.045(In/Hr)
Study area total =       6.78(Ac.)
End of computations, total study area =            6.78 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.223
Area averaged SCS curve number (AMC 2) =  75.2
```

# APPENDIX B

SITE


KEY
A
B
C
0 2000 4000 6000 8000
GRAPHIC SCALE (FEET)
LEGEND
A B C D HYDROLOGIC SOIL GROUPS
HYDROLOGIC SOIL GROUP BOUNDARY
SOURCES:
BASE MAP - ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION
SOIL GROUPS - SOIL SURVEY OF ORANGE COUNTY AND WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA, USDA, SOIL CONSERVATION SERVICE, 1978.
ORANGE COUNTY
HYDROLOGY MANUAL
HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA
PLATE B




## NOTICE

The drainage information has been prepared for information purposes only. The location, ownership, facility information and limits have been determined from available information provided by public agencies, but may not be exact, accurate, or up-to-date. The user of this information is responsible for verifying exact location, ownership, accuracy, and the regional versus local character of drainage facilities.

Additional information may be obtained from public plans and recorded deeds. Facility designations included with this information are for convenience only and are not controlling or intended to imply ownership by the County or the Orange County Flood Control District (OCFCD). The information is being provided as a courtesy and neither the County of Orange nor OCFCD assume any liabilities for inaccuracy of the information.

To notify OC Public Works Flood Control Section of additions or corrections, please contact Sal Gutierrez at (714) 647-3992 or by email at sal.gutierrez@ocpw.ocgov.com

0 200 400 600 800 FEET

ORANGE COUNTY FLOOD CONTROL DISTRICT

# BASE MAP OF DRAINAGE FACILITIES IN ORANGE COUNTY

| REVISION | DATE | SHEET NO. | DWG. NO. |
|---|---|---|---|
| S. GUTIERREZ | JAN. 26 2012 | 47 | MAPS-113-3 |

- Channel Drainage Area Boundary
- Major Sub-Area Drainage Boundary
- Minor Sub-Area Drainage Boundary
- Existing O.C.F.C.D. Facility
- Existing Local Facility
- Existing Retarding Basin or Reservoir
- Natural Watercourse
- City Limits
- G G Greenbelt
- P.S. P.S. Pump Station
- Catch Basin (length in feet)
- Drop Inlet or Other Entry
- OCFCD Basins or Reservoirs

Ownership (If other than City or County): Private = P State = S Federal = F

EXISTING FACILITIES

| O.C.F.C.D. | LOCAL |
|---|---|
| | Earth Trapezoidal Channel (base width by height in feet) |
| | Reinforced Concrete Trapezoidal Channel (base width by height in feet) |
| | Reinforced Concrete Rectangular Channel (base width by height in feet) |
| | Reinforced Concrete Box (RCB) (number of barrels-span by height in feet) |
| | Reinforced Concrete Pipe (RCP) (diameter in inches) |
| | Metal Sheet Channel (MSC) (Base width by pile height in feet /Sheet pile total length) |
| | Corrugated Metal Pipe (CMP) (diameter in inches) |
| | Concrete Pipe (diameter in inches) |
| | Concrete Oval Pipe (width by height in inches) |
| | Steel Pipe (diameter in inches) |
| | Reinforced Concrete Arch (base span by height in inches) |
| | Corrugated Metal Arch (base span by height in inches) |

# WATERSHED D

D01 Huntington Beach Channel
D01B01 Bartlett Retarding Basin
D01P05 Huntington Beach Storm Drain
D01P06 Adams Storm Drain
D01PS1 Huntington Beach Pump Station
D01PS2 Huntington Beach Pump Station
D02 Talbert Channel
D03 Greenville-Banning Channel
D03P01 Hyland Storm Drain
D03P02 Mesa Verde Storm Drain
D03P08 Times Storm Drain
D03S03 Gisler Storm Channel
D04 Fairview Channel
D05 Fountain Valley Channel




**CITIES IN THE WATERSHED:**

**COSTA MESA**
**FOUNTAIN VALLEY**
**HUNTINGTON BEACH**
**NEWPORT BEACH**
**SANTA ANA**
**UNINCORPORATED**

**NOTICE**

This drainage map has been prepared for information purposes only. The listed facilities have been determined from available information provided by public agencies, but may not be exact or up to date. The user of this map is responsible for verifying exact location, ownership and maintenance responsibilities of the drainage facilities. Additional information may be obtained from public plans and recorded deeds. Neither the County of Orange nor the Orange County Flood Control District (OCFCD) assumes any liabilities for inaccuracy of this map.

# F.2 - Water Quality Management Plan

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**WQXX-XXXX**

# County of Orange/Santa Ana Region
# Priority Project
# Water Quality Management Plan (WQMP)

**Project Name:**

**3150 Bear Street**

**TBD**

**3150 Bear Street, Costa Mesa, CA 92626**

**APNs: 141-521-48 and 141-521-49**

**Prepared for:**

**Meritage Homes**

**5 Peters Canyon Road, Suite 310**

**Irvine, CA 92806**

**Meritage Homes/Johanna Crooker 855-588-6374**

**Prepared by:**

**X Engineering & Consulting, Inc.**

**6 Hutton Centre Drive, Suite 650**

**Santa Ana, CA 92707**

**949.522.1700 | info@xengineeringinc.com**

**Date Prepared/Revised** **June 2024**

| **Project Owner's Certification** | | | |
|---|---|---|---|
| Planning Application No. (If applicable) | **Meritage Homes** | Grading Permit No. | TBD |
| Tract/Parcel Map and Lot(s) No. | TTM No. 19334 | Building Permit No. | TBD |
| Address of Project Site and APN (If no address, specify Tract/Parcel Map and Lot Numbers) | | | 3150 Bear Street, Costa Mesa, CA 92626 |

This Water Quality Management Plan (WQMP) has been prepared for Meritage **Homes** by X Engineering & Consulting, Inc. The WQMP is intended to comply with the requirements of the County of Orange NPDES Stormwater Program requiring the preparation of the plan.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan , including the ongoing operation and maintenance of all best management practices (BMPs), and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the current Orange County Drainage Area Management Plan (DAMP) and the intent of the non-point source NPDES Permit for Waste Discharge Requirements for the County of Orange, Orange County Flood Control District and the incorporated Cities of Orange County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the WQMP. An appropriate number of approved and signed copies of this document shall be available on the subject site in perpetuity.

| **Owner:** | | | |
|---|---|---|---|
| Title | Ms. Johanna Crooker | | |
| Company | Meritage Homes | | |
| Address | 5 Peters Canyon Road, Sutie 310, Irvine, CA 92806 | | |
| Email | Johanna.Crooker@mlcholdings.net | | |
| Telephone # | 855-588-6374 | | |
| I understand my responsibility to implement the provisions of this WQMP including the ongoing operation and maintenance of the best management practices (BMPs) described herein. | | | |
| Owner Signature | | Date | |

| **Preparer (Engineer):** | | | |
|---|---|---|---|
| Title | Eric Lissner | PE Registration # | 84264 |
| Company | X Engineering & Consulting, Inc. | | |
| Address | 6 Hutton Centre Drive, Suite 650, Santa Ana, CA 92707 | | |
| Email | eric.lissner@xengineeringinc.com | | |
| Telephone # | 949-522-7100 | | |

I hereby certify that this Water Quality Management Plan is in compliance with, and meets the requirements set forth in, Order No. R8-2009-0030/NPDES No. CAS618030, of the Santa Ana Regional Water Quality Control Board**.**

| Preparer Signature | | Date | |
|---|---|---|---|
| Place Stamp Here | | | |

# Contents

**Page No.**



## Attachments

# Section I Permit(s) and Water Quality Conditions of Approval or Issuance

Provide discretionary or grading/building permit information and water quality conditions of approval, or permit issuance, applied to the project. If conditions are unknown, please request applicable conditions from staff. *Refer to Section 2.1 in the Technical Guidance Document (TGD) available on the OC Planning website (ocplanning.net).*

| **Project Infomation** | | | |
|---|---|---|---|
| Permit/Application No. (If applicable) | TBD | Grading or Building Permit No. (If applicable) | TBD |
| Address of Project Site (or Tract Map and Lot Number if no address) and APN | 3150 Bear Street, Costa Mesa, CA 92626<br>TTM No. 19334. APNs: 141-521-48 and 141-521-49 | | |
| | | | |
| **Water Quality Conditions of Approval or Issuance** | | | |
| Water Quality Conditions of Approval or Issuance applied to this project. (Please list verbatim.) | Pending, to be included in the Final WQMP | | |
| | | | |
| **Conceptual WQMP** | | | |
| Was a Conceptual Water Quality Management Plan previously approved for this project? | No | | |

| Watershed-Based Plan Conditions | |
|---|---|
| Provide applicable conditions from watershed - based plans including WIHMPs and TMDLS. | The Santa Ana Watershed does not currently have any approved WHIMPs or applicable TMDLs. |

# Section II Project Description

## II.1 Project Description

| Description of Proposed Project | | | | |
|---|---|---|---|---|
| Development Category (From Model WQMP, Table 7.11-2; or -3): | Priority project that creates or replaces 10,000 square feet or more of impervious surface. | | | |
| Project Area ($ft^2$): _281,681_____ | Number of Dwelling Units: __146_____ | | SIC Code: _____ | |
| Project Area | Pervious | | Impervious | |
| | Area (acres or sq ft) | Percentage | Area (acres or sq ft) | Percentage |
| Pre-Project Conditions | 34,848 | 12% | 301,243 | 88% |
| Post-Project Conditions | 75,466 | 25% | 301,243 | 75% |
| Drainage Patterns/Connections | The existing condition project was the former Trinity Broadcasting Network. It is a developed commercial site with a large irregular shaped building, minimal landscaping, and a parking lot. The existing condition site drainage flows from the southeast to the northwest. Drainage is collected from drainage inlets and directed to storm drains. Ultimately, drainage is directed west in the southern portion of the site to a 24-inch public storm drain that connects to a 72-inch public storm drain in the northwest corner of the property. Northern site drainage is collected in drainage inlets to storm drains to flow into the 72-inch public storm drain.<br><br>The proposed condition project will be developed into multi-family dwelling units. Project surface flow drainage will be directed east into a private storm drain system that will connect to subsurface storm drains. The subsurface storm drain system will retain the original drainage flow pattern flowing north and west. Before storm water is discharged into the public storm drain system, southern tributary peak flows will be directed into a modular wetland system then the 24-inch public storm drain to ultimately confluence with the northern tributary peak flow drainage at the 72-inch storm drain. | | | |

| | |
|---|---|
| | Before peak flows in the northern tributary portion of the site are conveyed to the 72-inch public storm drain, storm water will pass through a modular wetland system for water quality treatment. Treated stormwater then exits the site on Bear Street through the 72-inch public storm drain to enter the Gisler Storm Channel, flowing into the Greenville Banning Channel, connecting to the Santa Ana River Channel, which ultimately discharges to the Pacific Ocean. |
| Narrative Project Description:<br>(Use as much space as necessary.) | This redevelopment project will consist of the removal of existing commercial buildings and parking lot for the construction of a housing development. The completed project will consist of 146 dwelling units within the 6.47-property. There will be 372 parking spaces including 292 for garage parking. 84,691-square feet of open space is provided in this development.<br>This project qualifies as a priority project due to the creation and replacement of more than 10,000-square feet of impervious surface.<br>The proposed condition project has graded drainage to treat stormwater at two locations by modular wetland systems, a proprietary biotreatment BMP. Any increase of stormwater flows beyond the 85$^{th}$ percentile, 24-hour storm event, will enter the public storm drain. |

## II.2 Potential Stormwater Pollutants

| Pollutants of Concern | | | |
|---|---|---|---|
| Pollutant | Check One for each: E=Expected to be of concern N=Not Expected to be of concern | | Additional Information and Comments |
| Suspended-Solid/ Sediment | E ☒ | N ☐ | Grit and residue from landscaping and automobiles. |
| Nutrients | E ☒ | N ☐ | Commercial fertilizers for landscaping. |
| Heavy Metals | E ☐ | N ☒ | |
| Pathogens (Bacteria/Virus) | E ☒ | N ☐ | Household pets. |
| Pesticides | E ☒ | N ☐ | Commercial landscaping pesticides. |
| Oil and Grease | E ☒ | N ☐ | Residual oil from vehicles. |
| Toxic Organic Compounds | E ☐ | N ☒ | |
| Trash and Debris | E ☒ | N ☐ | Household trash and litter. |

## II.3 Hydrologic Conditions of Concern

☒ No – Show map

☐ Yes – Describe applicable hydrologic conditions of concern below. *Refer to Section 2.2.3 in the Technical Guidance Document (TGD).*

Refer to Attachment C- North Orange County Hydromodification Susceptibility Map. Attachment C shows the project site is in a region of no susceptibility.

## II.4 Post Development Drainage Characteristics

Post development drainage will mimic the existing condition drainage to the maximum extent possible. In the proposed condition, project peak flows sheet flow generally east to area drains and catch basins. Stormwater in the proposed storm drains will mimic the existing condition drainage patterns flowing southeast to northwest and directed to modular wetland systems for treatment. Post treatment, stormwater enters the public storm drain system and continues to flow west.

## II.5 Property Ownership/Management

Ownership of the site will be administered by the yet to be determined Homeowners Association (HOA). The HOA will be responsible for long term maintenance of the two modular wetland stormwater facilities.

# Section III Site Description

## III.1 Physical Setting

| | |
|---|---|
| Name of Planned Community/Planning Area (if applicable) | TBD |
| Location/Address | 3150 Bear Street |
| | Costa Mesa, CA 92626 |
| General Plan Land Use Designation | General Commercial (GC), Administrative & Professional (AP) |
| Zoning | General Commercial (GC), Administrative & Professional (AP) |
| Acreage of Project Site | 6.47 acres |
| Predominant Soil Type | Young Alluvial Deposits (Qaf) overlain by artificial fill (SA Geotechnical, Attachment D). Soils are Hydrologic Soil Group D. |

## III.2 Site Characteristics

| Site Characteristics | |
|---|---|
| Precipitation Zone | 0.7 inches, per Attachment C, OCTGD Rainfall Zone Map. |
| Topography | Property is flat and slopes approximately 0.5% from south to north, with elevations ranging between 31' and 36'. Elevations slope from east to west at an approximately 0.5% slope with elevations ranging from 38.4' to 35.5'. |
| Drainage Patterns/Connections | Project drainage will generally be directed east to be captured in area drains, catch basins, and then to the private storm drains. The storm drain layout will retain the existing drainage pattern of flowing west and northwest. Stormwater will be treated by 2 separate modular wetland systems before exiting the public storm drain. Further details are available in Section II.1 and the BMP Exhibit in Section VI. |
| Soil Type, Geology, and Infiltration Properties | Soil type is artificial fill within the upper 1 to 2 feet of soil, and Young Alluvial Deposits (Qya) underlying the artificial fill. Qya consists of moist to wet, firm to stiff clay and silt material, and moist to very moist, medium dense to very dense sand materials. The SA Geotechnical report percolation test results listed infiltration rates of less than 0.05 inches per hour and described that infiltration of storm water is not feasible on the site. |
| Hydrogeologic (Groundwater) Conditions | Historic groundwater levels are estimated to be approximately 10 to 30 feet below the existing grade. |
| Geotechnical Conditions (relevant to infiltration) | According to the Infiltration Screening Maps from the OCTGD in Attachment C, there are no additional constraints to infiltration except for class HSG Type D soils. |
| Off-Site Drainage | Offsite run-on does not exist for this project. Stormwater flows will not be diverted from the project. |

| | |
|---|---|
| Utility and Infrastructure Information | The proposed modular wetland systems do not conflict with any existing or proposed utilities. |

## III.3 Watershed Description

| | |
|---|---|
| Receiving Waters | Santa Ana River, Reach 1. |
| 303(d) Listed Impairments | No listed impairments for this reach of the Santa Ana River per the California 2020-2022 Integrated Report. |
| Applicable TMDLs | No TMDLs are applicable for the Santa Ana River Channel |
| Pollutants of Concern for the Project | Indicator bacteria may be a concern with household pets. |
| Environmentally Sensitive and Special Biological Significant Areas | Not applicable. |

# Section IV Best Management Practices (BMPs)

## IV. 1 Project Performance Criteria

| | | |
|---|---|---|
| (NOC Permit Area only) Is there an approved WIHMP or equivalent for the project area that includes more stringent LID feasibility criteria or if there are opportunities identified for implementing LID on regional or sub-regional basis? | YES ☐ | NO ☒ |
| If yes, describe WIHMP feasibility criteria or regional/sub-regional LID opportunities. | WHIMPs are currently not applicable in this region. | |

| Project Performance Criteria | |
|---|---|
| If HCOC exists, list applicable hydromodification control performance criteria (Section 7.II-2.4.2.2 in MWQMP) | Not applicable. |

| | |
|---|---|
| List applicable LID performance criteria (Section 7.II-2.4.3 from MWQMP) | The project will biofilter the 85th percentile, 24-hour storm event, or Design Capture Volume. |
| List applicable treatment control BMP performance criteria (Section 7.II-3.2.2 from MWQMP) | As indicated in Section III.2, infiltration is not feasible on this site due to the presence of HSG Type D soil. Therefore, the project DCV will be biofiltered on site by modular wetland systems before exiting the site to the public storm drain. |
| Calculate LID design storm capture volume for Project. | DCV = C x d x A x (43,560-sf/ac) x (1/12 in/ft)<br>C = (0.75 x imp + 0.15)<br>d = storm depth (inches), from the OCTGD Storm Depth Rainfall Zone Map<br>A = tributary area (acres)<br><br><u>Proposed Node 107 (BMP 1):</u><br>Pervious landscape, C = 0.3 (drought tolerant landscape), 41,700-sf.<br>Impervious landscape, C = 0.9, 92,900-sf.<br>Total Area = 3.09 Acres = 134,600-sf<br>C(weighted) = [0.3(41,700sf) + 0.9(92,900sf)]/134,600sf = 0.71<br>C = (0.75 x 0.71 + 0.15) = 0.68<br>d = 0.7 inches<br>A = 3.09 acres<br>DCV = 5,360-cubic feet |

| | |
|---|---|
| | <u>Proposed Node 116 (BMP 2):</u><br>Pervious landscape, C = 0.3 (drought tolerant landscape), 33,766-sf.<br>Impervious landscape, C = 0.9, 113,467-sf.<br>Total Area = 3.38 Acres = 142,233-sf<br>C(weighted) = [0.3(33,766sf) + 0.9(113,467sf)]/142,233sf = 0.76<br><br>C = (0.75 x 0.76 + 0.15) = 0.72<br>d = 0.7 inches<br>A = 3.38 acres<br>DCV = 6,180-cubic feet |

## IV.2. Site Design and Drainage

**DMA Summary**

| *DMA ID* | *Drainage Area ($ft^2$)* | *% Imp* | *Design Storm Depth (in)* | *Estimated Tc (min)* | *Rainfall Intensity (in/hr)* | *DCV ($ft^3$)* | *BMP Type* |
|---|---|---|---|---|---|---|---|
| 1 | 134,600 | 69 | 0.7 | 9.4 | 3.19 | 5,360 | Biofiltration |
| 2 | 147,233 | 77 | 0.7 | 11.2 | 3.05 | 6,180 | Biofiltration |

As described in the DMA Summary, DMA 1 is designed to drain to BMP 2 and DMA 2 will drain to BMP 2. Both BMPs will be modular wetland systems, proprietary biofiltration devices. The Design Capture Volume Method was incorporated as part of the design calculations. Design of the proposed storm water drains were routed such that all stormwater flows for the entire site will be treated by the modular wetland systems to the maximum extent possible. This is accomplished by having stormwater flow route through the MWS before exiting to the public storm drain. Refer to Section VI for the WQMP BMP exhibit.

Site design practices will be incorporated into the project.

- Where practicable, impervious area is minimized by incorporating landscape throughout the site.
- The existing drainage pattern will be retained through implementation of the private storm drain network. All project stormwater flow is conveyed to the storm drains and will generally flow southeast to northwest.
- Existing vegetation is protected where practicable. The greenspace will remain on the western border of the project.
- Drought resistant landscaping will be incorporated into the landscape design.

## IV.3 LID BMP Selection and Project Conformance Analysis

### IV.3.1 Hydrologic Source Controls (HSCs)

| Name | Included? |
|---|---|
| Localized on-lot infiltration | ☐ |
| Impervious area dispersion (e.g. roof top disconnection) | ☐ |
| Street trees (canopy interception) | ☐ |
| Residential rain barrels (not actively managed) | ☐ |
| Green roofs/Brown roofs | ☐ |
| Blue roofs | ☐ |
| Impervious area reduction (e.g. permeable pavers, site design) | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Hydrologic Source Controls are not implemented due to feasibility of biofiltration of the entire DCV by the MWS units.

## IV.3.2 Infiltration BMPs

| Name | Included? |
|---|---|
| Bioretention without underdrains | ☐ |
| Rain gardens | ☐ |
| Porous landscaping | ☐ |
| Infiltration planters | ☐ |
| Retention swales | ☐ |
| Infiltration trenches | ☐ |
| Infiltration basins | ☐ |
| Drywells | ☐ |
| Subsurface infiltration galleries | ☐ |
| French drains | ☐ |
| Permeable asphalt | ☐ |
| Permeable concrete | ☐ |
| Permeable concrete pavers | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Infiltration is not feasible on this site due to the presence of HSG Type D soils. Additionally, the SA Geotechnical Report in Appendix D listed percolation test results of less than 0.05 inches per hour.

## IV.3.3 Evapotranspiration, Rainwater Harvesting BMPs

If the full Design Storm Capture Volume cannot be met with infiltration BMPs, describe any evapotranspiration and/or rainwater harvesting BMPs included.

| Name | Included? |
|---|---|
| All HSCs; *See Section IV.3.1* | ☐ |
| Surface-based infiltration BMPs | ☐ |
| Biotreatment BMPs | ☐ |
| Above-ground cisterns and basins | ☐ |
| Underground detention | ☐ |
| Other: | ☐ |
| Other: | ☐ |
| Other: | ☐ |

Not applicable.

## IV.3.4 Biotreatment BMPs

| Name | Included? |
|---|---|
| Bioretention with underdrains | ☐ |
| Stormwater planter boxes with underdrains | ☐ |
| Rain gardens with underdrains | ☐ |
| Constructed wetlands | ☐ |
| Vegetated swales | ☐ |
| Vegetated filter strips | ☐ |
| Proprietary vegetated biotreatment systems | ☒ |
| Wet extended detention basin | ☐ |
| Dry extended detention basins | ☐ |
| Other: | ☐ |
| Other: | ☐ |

BMP categories.

| *DMA ID* | *DCV ($ft^3$)* | *Design Flow Rate ($ft^2$/hr)* | *% Imp* | *Design Storm Depth (in)* | *Estimated Tc (min)* | *Rainfall Intensity (in/hr)* | *Flow Rate Provided ($ft^2$/hr)* |
|---|---|---|---|---|---|---|---|
| 1 | 5,360 | 0.464 | 85 | 0.7 | 9.4 | 3.19 | 0.561 |
| 2 | 6,180 | 0.560 | 86 | 0.7 | 11.2 | 3.05 | 0.561 |

Design Capture Volume is met with proprietary vegetated biotreatment system BMPs. The biotreatment system chosen is modular wetland system (MWS-L-8-20-V). The Design Flow Rate calculated is based on the Capture Efficiency Method for Flow Based BMPs. This is described in Appendix III, Example III.7 of the OCTGD. Calculations are provided in Attachment A.

## IV.3.5 Hydromodification Control BMPs

Describe hydromodification control BMPs. *See Section 5 of the Technical Guidance Document (TGD).* Include sections for selection, suitability, sizing, and infeasibility, as applicable. Detail compliance with Prior Conditions of Approval (if applicable).

| Hydromodification Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Not applicable.

## IV.3.6 Regional/Sub-Regional LID BMPs

| Regional/Sub-Regional LID BMPs |
|---|
| Not applicable. |

## IV.3.7 Treatment Control BMPs

| Treatment Control BMPs | |
|---|---|
| **BMP Name** | **BMP Description** |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

Not applicable.

## IV.3.8 Non-structural Source Control BMPs

| Non-Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| N1 | Education for Property Owners, Tenants and Occupants | ☒ | ☐ | |
| N2 | Activity Restrictions | ☒ | ☐ | |
| N3 | Common Area Landscape Management | ☒ | ☐ | |
| N4 | BMP Maintenance | ☒ | ☐ | |
| N5 | Title 22 CCR Compliance (How development will comply) | ☒ | ☐ | |
| N6 | Local Industrial Permit Compliance | ☐ | ☒ | Not applicable, residential development. |
| N7 | Spill Contingency Plan | ☒ | ☐ | |
| N8 | Underground Storage Tank Compliance | ☐ | ☒ | Not applicable. |
| N9 | Hazardous Materials Disclosure Compliance | ☐ | ☒ | Not applicable. |
| N10 | Uniform Fire Code Implementation | ☒ | ☐ | |
| N11 | Common Area Litter Control | ☒ | ☐ | |
| N12 | Employee Training | ☒ | ☐ | |
| N13 | Housekeeping of Loading Docks | ☐ | ☒ | Not applicable. |
| N14 | Common Area Catch Basin Inspection | ☒ | ☐ | |
| N15 | Street Sweeping Private Streets and Parking Lots | ☒ | ☐ | |
| N16 | Retail Gasoline Outlets | ☐ | ☒ | Not applicable. |

## IV.3.9 Structural Source Control BMPs

| Structural Source Control BMPs | | | | |
|---|---|---|---|---|
| **Identifier** | **Name** | **Check One** | | **If not applicable, state brief reason** |
| | | **Included** | **Not Applicable** | |
| S1 | Provide storm drain system stenciling and signage | ☒ | ☐ | |
| S2 | Design and construct outdoor material storage areas to reduce pollution introduction | ☒ | ☐ | |
| S3 | Design and construct trash and waste storage areas to reduce pollution introduction | ☒ | ☐ | |
| S4 | Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control | ☒ | ☐ | |
| S5 | Protect slopes and channels and provide energy dissipation | ☐ | ☒ | Not applicable, slopes approximately 0.5% overall. |
| | Incorporate requirements applicable to individual priority project categories (from SDRWQCB NPDES Permit) | ☒ | ☐ | |
| S6 | Dock areas | ☐ | ☒ | Not applicable, residential development. |
| S7 | Maintenance bays | ☐ | ☒ | Not applicable, residential development. |
| S8 | Vehicle wash areas | ☒ | ☐ | |
| S9 | Outdoor processing areas | ☒ | ☐ | |
| S10 | Equipment wash areas | ☐ | ☒ | Not applicable, residential development. |
| S11 | Fueling areas | ☐ | ☒ | Not applicable, residential development. |
| S12 | Hillside landscaping | ☐ | ☒ | Not applicable, slopes approximately 0.5% overall. |
| S13 | Wash water control for food preparation areas | ☐ | ☒ | Not applicable, residential development. |
| S14 | Community car wash racks | ☒ | ☐ | |

## IV.4 Alternative Compliance Plan (If Applicable)

### IV.4.1 Water Quality Credits

<table>
<tr><th colspan="5">Description of Proposed Project</th></tr>
<tr><td colspan="5">Project Types that Qualify for Water Quality Credits (Select all that apply):</td></tr>
<tr><td>☐Redevelopment projects that reduce the overall impervious footprint of the project site.</td><td colspan="2">☐Brownfield redevelopment, meaning redevelopment, expansion, or reuse of real property which may be complicated by the presence or potential presence of hazardous substances, pollutants or contaminants, and which have the potential to contribute to adverse ground or surface WQ if not redeveloped.</td><td colspan="2">☐ Higher density development projects which include two distinct categories (credits can only be taken for one category): those with more than seven units per acre of development (lower credit allowance); vertical density developments, for example, those with a Floor to Area Ratio (FAR) of 2 or those having more than 18 units per acre (greater credit allowance).</td></tr>
<tr><td colspan="2">☐ Mixed use development, such as a combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that can demonstrate environmental benefits that would not be realized through single use projects (e.g. reduced vehicle trip traffic with the potential to reduce sources of water or air pollution).</td><td colspan="2">☐ Transit-oriented developments, such as a mixed use residential or commercial area designed to maximize access to public transportation; similar to above criterion, but where the development center is within one half mile of a mass transit center (e.g. bus, rail, light rail or commuter train station). Such projects would not be able to take credit for both categories, but may have greater credit assigned</td><td>☐ Redevelopment projects in an established historic district, historic preservation area, or similar significant city area including core City Center areas (to be defined through mapping).</td></tr>
<tr><td>☐Developments with dedication of undeveloped portions to parks, preservation areas and other pervious uses.</td><td>☐ Developments in a city center area.</td><td>☐ Developments in historic districts or historic preservation areas.</td><td>☐ Live-work developments, a variety of developments designed to support residential and vocational needs together – similar to criteria to mixed use development; would not be able to take credit for both categories.</td><td>☐In-fill projects, the conversion of empty lots and other underused spaces into more beneficially used spaces, such as residential or commercial areas.</td></tr>
<tr><td>Calculation of Water Quality Credits<br>(if applicable)</td><td colspan="4">Not applicable.</td></tr>
</table>

## IV.4.2 Alternative Compliance Plan Information

Not applicable.

# V Inspection/Maintenance Responsibility for BMPs

| BMP Inspection/Maintenance | | | |
|---|---|---|---|
| **BMP** | **Reponsible Party(s)** | **Inspection/ Maintenance Activities Required** | **Minimum Frequency of Activities** |
| MWS 1 | TBD HOA/Owner | Refer to the suggested operations and maintenance guide for MWS in Attachment B. | 1x per month along with before and after inspections of significant storm events. |
| MWS 2 | TBD HOA/Owner | Refer to the suggested operations and maintenance guide for MWS in Attachment B. | 1x per month along with before and after inspections of significant storm events. |
| | | | |
| | | | |

# Section VI BMP Exhibit (Site Plan)

## VI.1 BMP Exhibit (Site Plan)

Include a BMP Exhibit (Site Plan), at a size no less than 24" by 36," which includes the following minimum information:

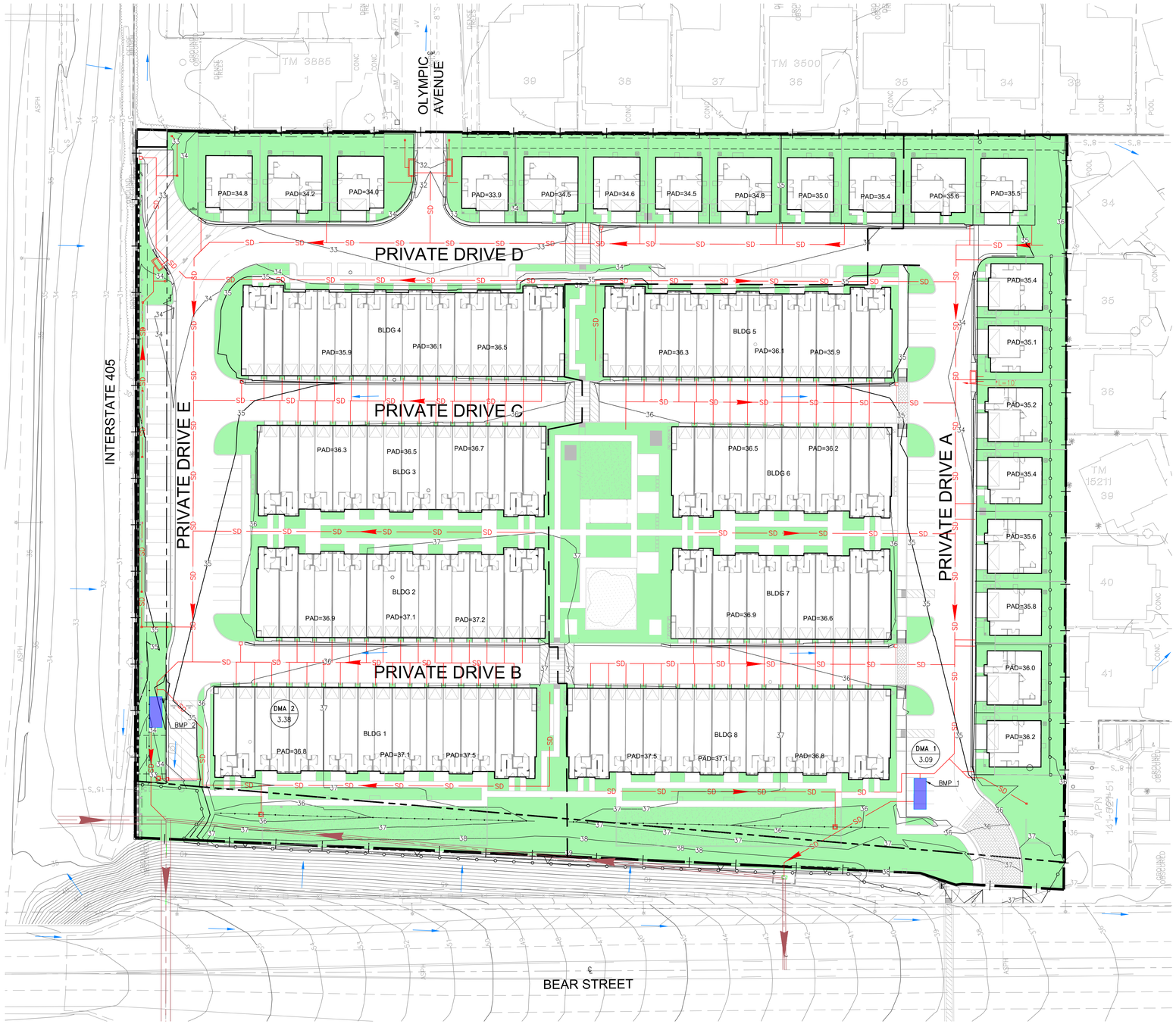
- Insert in the title block (lower right hand corner) of BMP Exhibit: the WQMP Number (assigned by staff) and the grading/building or Planning Application permit numbers
- Project location (address, tract/lot number(s), etc.)
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural BMP locations
- Drainage delineations and flow information
- Delineate the area being treated by each structural BMP
- GIS coordinates for LID and Treatment Control BMPs
- Drainage connections
- BMP details
- Preparer name and stamp

Please do not include any areas outside of the project area or any information not related to drainage or water quality. The approved BMP Exhibit (Site Plan) shall be submitted as a plan sheet on all grading and building plan sets submitted for plan check review and approval. The BMP Exhibit shall be at the same size as the rest of the plan sheets in the submittal and shall have an approval stamp and signature prior to plan check submittal.

## VI.2 Submittal and Recordation of Water Quality Management Plan

Following approval of the Final Project-Specific WQMP, three copies of the approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be submitted. In addition, these documents shall be submitted in a PDF format.

Each approved WQMP (including BMP Exhibit, Operations and Maintenance (O&M) Plan, and Appendices) shall be recorded in the Orange County Clerk-Recorder's Office, prior to close-out of grading and/or building permit. Educational Materials are not required to be included.

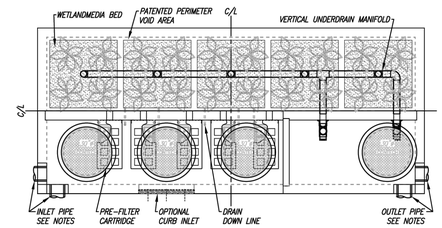



## LEGEND

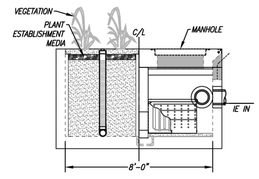
- MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED BOUNDARY
- SUBAREA DESIGNATION (A / 0.64)
- SUBAREA ACREAGE
- PROPOSED STORM DRAIN
- STORM DRAIN FLOW DIRECTION
- EXISTING STORM DRAIN
- DIRECTION OF SURFACE FLOW
- PERVIOUS AREA
- PROPOSED BMP

## PWQMP SUMMARY

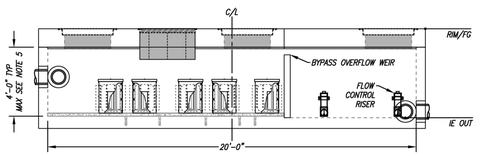
| DMA DESIGNATION | DMA 1 | DMA 2 |
|---|---|---|
| PERVIOUS AREA (AC) | 0.95 | 0.78 |
| IMPERVIOUS AREA (AC) | 2.14 | 2.60 |
| TOTAL AREA (AC) | 3.09 | 3.38 |
| DESIGN CAPTURE VOL (CF) | 5,360 | 6,185 |
| REQUIRED DESIGN FLOW RATE (CFS) | 0.464 | 0.560 |
| PROVIDED DESIGN FLOW RATE (CFS) | 0.561 | 0.561 |
| BMP | MWS-L-8-20-V | MWS-L-8-20-V |



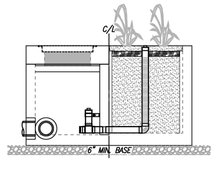

PLAN VIEW




LEFT END VIEW




ELEVATION VIEW




RIGHT END VIEW

30' 0' 15' 30'

SCALE: 1" = 30'

# BMP EXHIBIT

3150 BEAR STREET
COSTA MESA, CALIFORNIA

**X ENGINEERING & CONSULTING, INC.**
6 Hutton Centre Drive, Suite 650
Santa Ana, California 92707
949.522.7100 | xengineeringinc.com

# Section VII Educational Materials

| Education Materials | | | |
|---|---|---|---|
| **Residential Material (http://www.ocwatersheds.com)** | **Check If Applicable** | **Business Material (http://www.ocwatersheds.com)** | **Check If Applicable** |
| The Ocean Begins at Your Front Door | ☒ | Tips for the Automotive Industry | ☐ |
| Tips for Car Wash Fund-raisers | ☒ | Tips for Using Concrete and Mortar | ☐ |
| Tips for the Home Mechanic | ☒ | Tips for the Food Service Industry | ☐ |
| Homeowners Guide for Sustainable Water Use | ☒ | Proper Maintenance Practices for Your Business | ☐ |
| Household Tips | ☒ | **Other Material** | **Check If Attached** |
| Proper Disposal of Household Hazardous Waste | ☒ | | |
| Recycle at Your Local Used Oil Collection Center (North County) | ☒ | | ☐ |
| Recycle at Your Local Used Oil Collection Center (Central County) | ☐ | | ☐ |
| Recycle at Your Local Used Oil Collection Center (South County) | ☐ | | ☐ |
| Tips for Maintaining a Septic Tank System | ☐ | | ☐ |
| Responsible Pest Control | ☒ | | ☐ |
| Sewer Spill | ☒ | | ☐ |
| Tips for the Home Improvement Projects | ☒ | | ☐ |
| Tips for Horse Care | ☐ | | ☐ |
| Tips for Landscaping and Gardening | ☒ | | ☐ |
| Tips for Pet Care | ☒ | | ☐ |
| Tips for Pool Maintenance | ☐ | | ☐ |
| Tips for Residential Pool, Landscape and Hardscape Drains | ☐ | | ☐ |
| Tips for Projects Using Paint | ☒ | | ☐ |

Educational Materials are provided in Attachment E.

# Attachment A: Calculations, Worksheets, and Cross Sections

- A1 – OCTGD Simple DCV Method
- A2 – Capture Efficiency Method Flow Based BMP
- A3 – OCTGD Capture Efficiency Nomograph
- A4 – OCTGD BIO-7 Proprietary Biotreatment Document
- A5 – Modular Wetland System L-8-20-V Standard Detail

**Worksheet B: Simple Design Capture Volume Sizing Method**

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.7 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0 | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.7 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 3.09 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.71 | |
| 3 | Calculate runoff coefficient, *C= (0.75 x imp) + 0.15* | C= | 0.68 | |
| 4 | Calculate runoff volume, $V_{design}$= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))* | $V_{design}$= | 5,360 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (**Appendix VII**) | $K_{observed}$= | -- | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{total}$ (unitless) | $S_{total}$= | -- | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$ | $K_{design}$= | -- | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | -- | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | -- | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | -- | sq-ft |

[1] $K_{observed}$ is the vertical infiltration measured in the field, before applying a factor of safety. If field testing measures a rate that is different than the vertical infiltration rate (for example, three-dimensional borehole percolation rate), then this rate must be adjusted by an acceptable method (for example, Porchet method) to yield the field estimate of vertical infiltration rate, $K_{observed}$. See Appendix VII.

Infiltration is not incorporated on site.

**Worksheet B: Simple Design Capture Volume Sizing Method**

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter design capture storm depth from Figure III.1, *d* (inches) | d= | 0.7 | inches |
| 2 | Enter the effect of provided HSCs, $d_{HSC}$ (inches) (Worksheet A) | $d_{HSC}$= | 0 | inches |
| 3 | Calculate the remainder of the design capture storm depth, $d_{remainder}$ (inches) (Line 1 – Line 2) | $d_{remainder}$= | 0.7 | inches |
| ***Step 2: Calculate the DCV*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 3.38 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.76 | |
| 3 | Calculate runoff coefficient, *C= (0.75 x imp) + 0.15* | C= | 0.72 | |
| 4 | Calculate runoff volume, $V_{design}$= *(C x* $d_{remainder}$ *x A x 43560 x (1/12))* | $V_{design}$= | 6,180 | cu-ft |
| ***Step 3: Design BMPs to ensure full retention of the DCV*** | | | | |
| **Step 3a: Determine design infiltration rate** | | | | |
| 1 | Enter measured infiltration rate, $K_{observed}$[1] (in/hr) (**Appendix VII**) | $K_{observed}$= | -- | In/hr |
| 2 | Enter combined safety factor from Worksheet H, $S_{total}$ (unitless) | $S_{total}$= | -- | |
| 3 | Calculate design infiltration rate, $K_{design} = K_{observed} / S_{total}$ | $K_{design}$= | -- | In/hr |
| **Step 3b: Determine minimum BMP footprint** | | | | |
| 4 | Enter drawdown time, *T* (max 48 hours) | T= | -- | Hours |
| 5 | Calculate max retention depth that can be drawn down within the drawdown time (feet), $D_{max} = K_{design} \times T \times (1/12)$ | $D_{max}$= | -- | feet |
| 6 | Calculate minimum area required for BMP (sq-ft), $A_{min} = V_{design} / d_{max}$ | $A_{min}$= | -- | sq-ft |

[1] $K_{observed}$ is the vertical infiltration measured in the field, before applying a factor of safety. If field testing measures a rate that is different than the vertical infiltration rate (for example, three-dimensional borehole percolation rate), then this rate must be adjusted by an acceptable method (for example, Porchet method) to yield the field estimate of vertical infiltration rate, $K_{observed}$. See Appendix VII.

Infiltration is not incorporated on site.

**Worksheet D: Capture Efficiency Method for Flow-Based BMPs** BMP 1

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See **Appendix IV.2**) | $T_c$= | 9.4 | |
| 2 | Using **Figure III.4**, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.22 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (**Worksheet A**) | $d_{HSC}$= | 0 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (**Worksheet A**) | $Y_2$= | 0 | % |
| 5 | Using **Figure III.4**, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$ | $I_{design}$= | 0.22 | |
| ***Step 2: Calculate the design flowrate*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 3.09 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.71 | |
| 3 | Calculate runoff coefficient, $C= (0.75 \times imp) + 0.15$ | C= | 0.68 | |
| 4 | Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$ | $Q_{design}$= | 0..464 | cfs |

***Supporting Calculations***

Describe system:

Proprietary Biotreatment system is a Modular Wetland System MWS-L-8-20-V

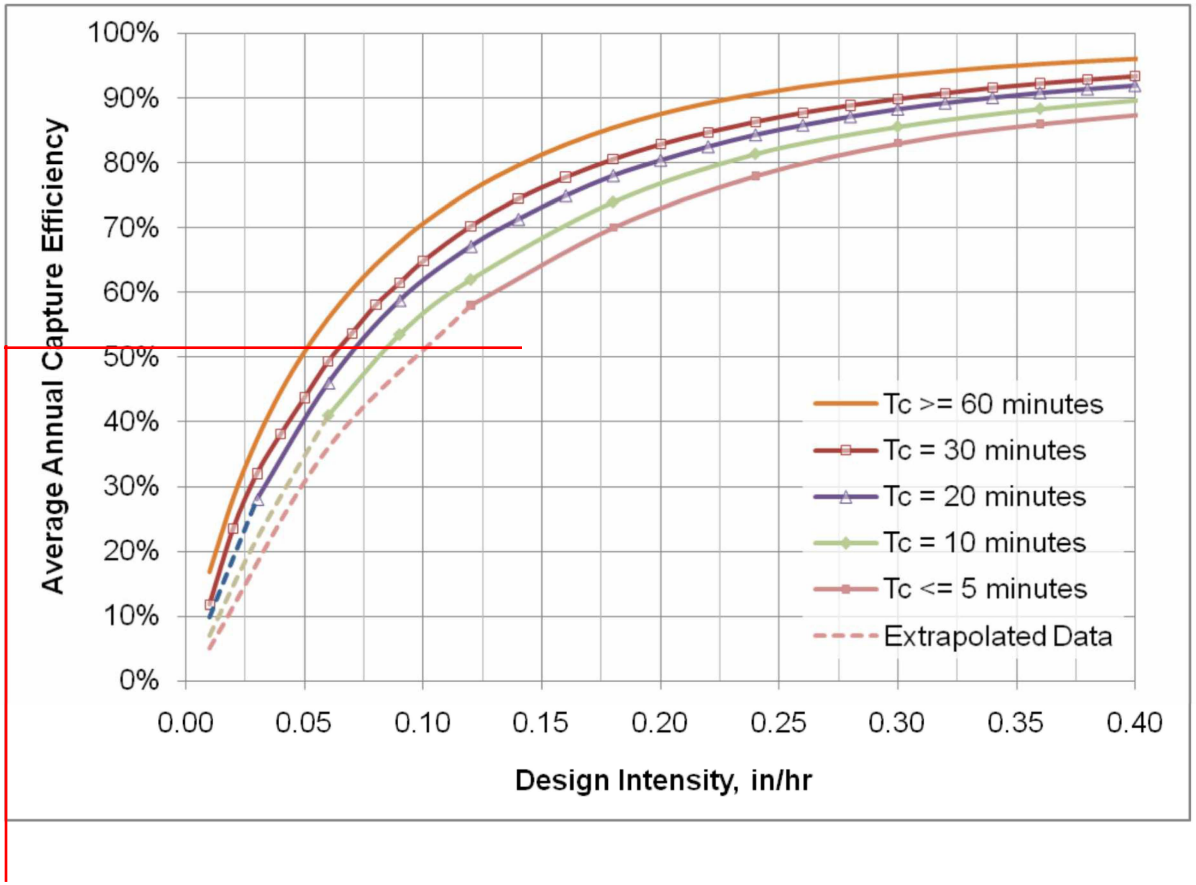
Provide time of concentration assumptions:

Time of concentration was calculated using CivilD software 2018 by Civil Design Corporation, 2018 and Joseph E. Bonadiem and Associates. This is acceptable by the County of Orange for hydrologic studies. The Time of concentration was then used on th Capture Efficiency Nomograph at 80% Capture Efficiency to obtain the design rainfall intensity.

**Worksheet D: Capture Efficiency Method for Flow-Based BMPs** BMP 2

| | | | | |
|---|---|---|---|---|
| ***Step 1: Determine the design capture storm depth used for calculating volume*** | | | | |
| 1 | Enter the time of concentration, $T_c$ (min) (See **Appendix IV.2**) | $T_c$= | 11.2 | |
| 2 | Using **Figure III.4**, determine the design intensity at which the estimated time of concentration ($T_c$) achieves 80% capture efficiency, $I_1$ | $I_1$= | 0.23 | in/hr |
| 3 | Enter the effect depth of provided HSCs upstream, $d_{HSC}$ (inches) (**Worksheet A**) | $d_{HSC}$= | 0 | inches |
| 4 | Enter capture efficiency corresponding to $d_{HSC}$, $Y_2$ (**Worksheet A**) | $Y_2$= | 0 | % |
| 5 | Using **Figure III.4**, determine the design intensity at which the time of concentration ($T_c$) achieves the upstream capture efficiency($Y_2$), $I_2$ | $I_2$= | 0 | |
| 6 | Determine the design intensity that must be provided by BMP, $I_{design}= I_1-I_2$ | $I_{design}$= | 0.23 | |
| ***Step 2: Calculate the design flowrate*** | | | | |
| 1 | Enter Project area tributary to BMP (s), *A* (acres) | A= | 3.38 | acres |
| 2 | Enter Project Imperviousness, *imp* (unitless) | imp= | 0.76 | |
| 3 | Calculate runoff coefficient, *C= (0.75 x imp) + 0.15* | C= | 0.72 | |
| 4 | Calculate design flowrate, $Q_{design}= (C \times i_{design} \times A)$ | $Q_{design}$= | 0.560 | cfs |
| ***Supporting Calculations*** | | | | |
| Describe system:<br>Proprietary Biotreatment system is a Modular Wetland System MWS-L-8-20-V | | | | |
| Provide time of concentration assumptions:<br>Time of concentration was calculated using CivilD software 2018 by Civil Design Corporation, 2018 and Joseph E. Bonadiem and Associates. This is acceptable by the County of Orange for hydrologic studies. The Time of concentration was then used on th Capture Efficiency Nomograph at 80% Capture Efficiency to obtain the design rainfall intensity. | | | | |

**Figure III.4. Capture Efficiency Nomograph for Off-line Flow-based Systems in Orange County**



BIO-7: Proprietary Biotreatment

Proprietary biotreatment devices are devices that are manufactured to mimic natural systems such as bioretention areas by incorporating plants, soil, and microbes engineered to provide treatment at higher flow rates or volumes and with smaller footprints than their natural counterparts. Incoming flows are typically filtered through a planting media (mulch, compost, soil, plants, microbes, etc.) and either infiltrated or collected by an underdrain and delivered to the storm water conveyance system. Tree box filters are an increasingly common type of proprietary biotreatment device that are installed at curb level and filled with a bioretention type soil. For low to moderate flows they operate similarly to bioretention systems and are bypassed during high flows. Tree box filters are highly adaptable solutions that can be used in all types of development and in all types of soils but are especially applicable to dense urban parking lots, street, and roadways.

*Also known as:*

- *Catch basin planter box*
- *Bioretention vault*
- *Tree box filter*

Proprietary biotreatment
*Source: http://www.americastusa.com /index.php/filterra/*

### *Feasibility Screening Considerations*

- Proprietary biotreatment devices that are unlined may cause incidental infiltration. Therefore, an evaluation of site conditions should be conducted to evaluate whether the BMP should include an impermeable liner to avoid infiltration into the subsurface.

### *Opportunity Criteria*

- Drainage areas of 0.25 to 1.0 acres.
- Land use may include commercial, residential, mixed use, institutional, and subdivisions. Proprietary biotreatment facilities may also be applied in parking lot islands, traffic circles, road shoulders, and road medians.
- Must not adversely affect the level of flood protection provided by the drainage system.

### *OC-Specific Design Criteria and Considerations*

☐ Frequent maintenance and the use of screens and grates to keep trash out may decrease the likelihood of clogging and prevent obstruction and bypass of incoming flows.

☐ Consult proprietors for specific criteria concerning the design and performance.

☐ Proprietary biotreatment may include specific media to address pollutants of concern. However, for proprietary device to be considered a biotreatment device the media must be capable of supporting rigorous growth of vegetation.

☐ Proprietary systems must be acceptable to the reviewing agency. Reviewing agencies shall have the discretion to request performance information. Reviewing agencies shall have the discretion to deny the use of a proprietary BMP on the grounds of performance, maintenance considerations, or other relevant factors.

☐ In right of way areas, plant selection should not impair traffic lines of site. Local jurisdictions may also limit plant selection in keeping with landscaping themes.

### *Computing Sizing Criteria for Proprietary Biotreatment Device*

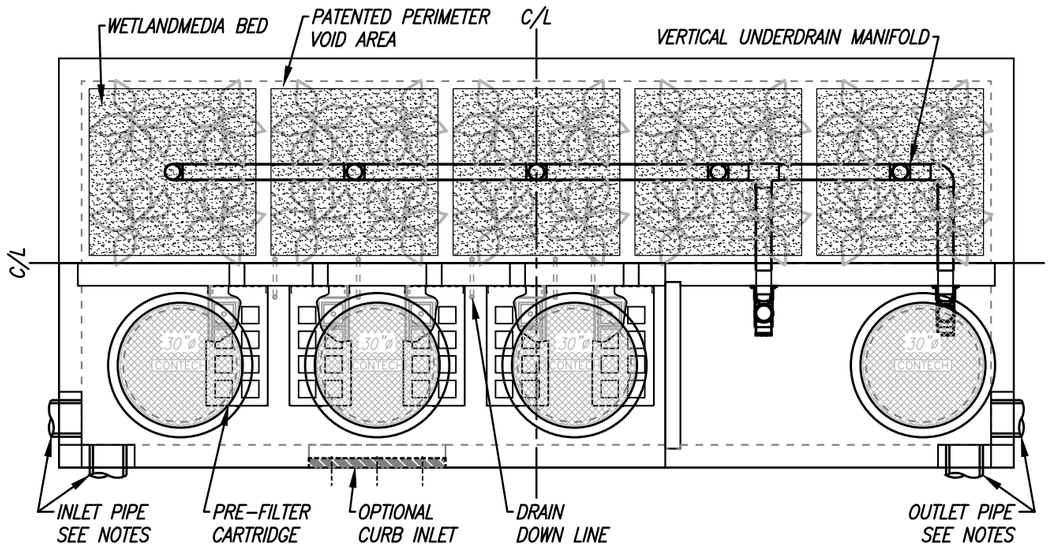
- Proprietary biotreatment devices can be volume based or flow-based BMPs.
- Volume-based proprietary devices should be sized using the Simple Design Capture Volume Sizing Method described in **Appendix III.3.1** or the Capture Efficiency Method for Volume-Based, Constant Drawdown BMPs described in **Appendix III.3.2**.
- The required design flowrate for flow-based proprietary devices should be computed using the Capture Efficiency Method for Flow-based BMPs described in **Appendix III.3.3)**.

### *Additional References for Design Guidance*

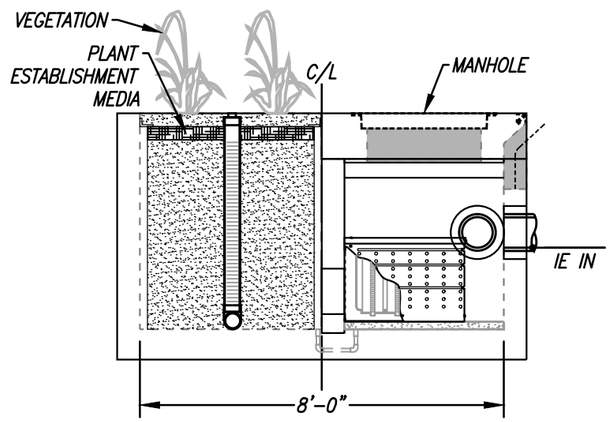
- Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: **http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850**
- Los Angeles County Stormwater BMP Design and Maintenance Manual, Chapter 9: **http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf**
- Santa Barbara BMP Guidance Manual, Chapter 6: **http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf**

| SITE SPECIFIC DATA | | | |
|---|---|---|---|
| PROJECT NUMBER | | | |
| PROJECT NAME | | | |
| PROJECT LOCATION | | | |
| STRUCTURE ID | | | |
| TREATMENT REQUIRED | | | |
| TREATMENT FLOW (CFS) | | | |
| PRETREATMENT LOADING RATE (GPM/SF) | | | 2.1 GPM/SF |
| WETLAND MEDIA LOADING RATE (GPM/SF) | | | 1.0 |
| PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE | | | _____ (CFS) |
| PIPE DATA | I.E. | MATERIAL | DIAMETER |
| INLET PIPE 1 | | | |
| INLET PIPE 2 | | | |
| OUTLET PIPE | | | |
| | PRETREATMENT | BIOFILTRATION | DISCHARGE |
| RIM ELEVATION | | | |
| SURFACE LOAD | PEDESTRIAN | | |
| NOTES: | | | |

* PRELIMINARY ONLY - NOT FOR CONSTRUCTION



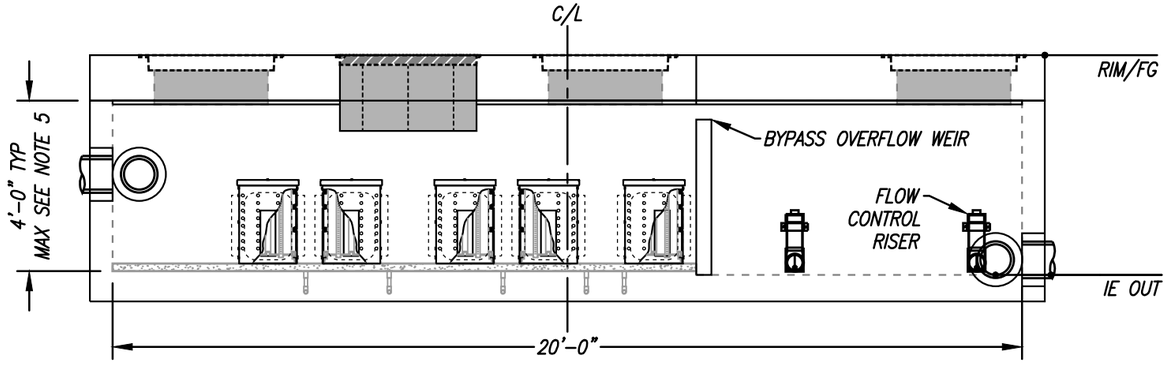

**PLAN VIEW**



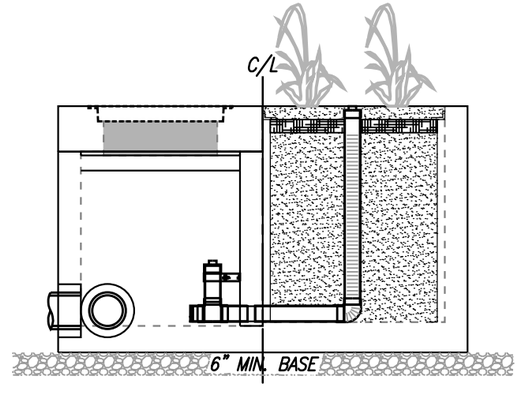

**LEFT END VIEW**

## INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.




**ELEVATION VIEW**




**RIGHT END VIEW**



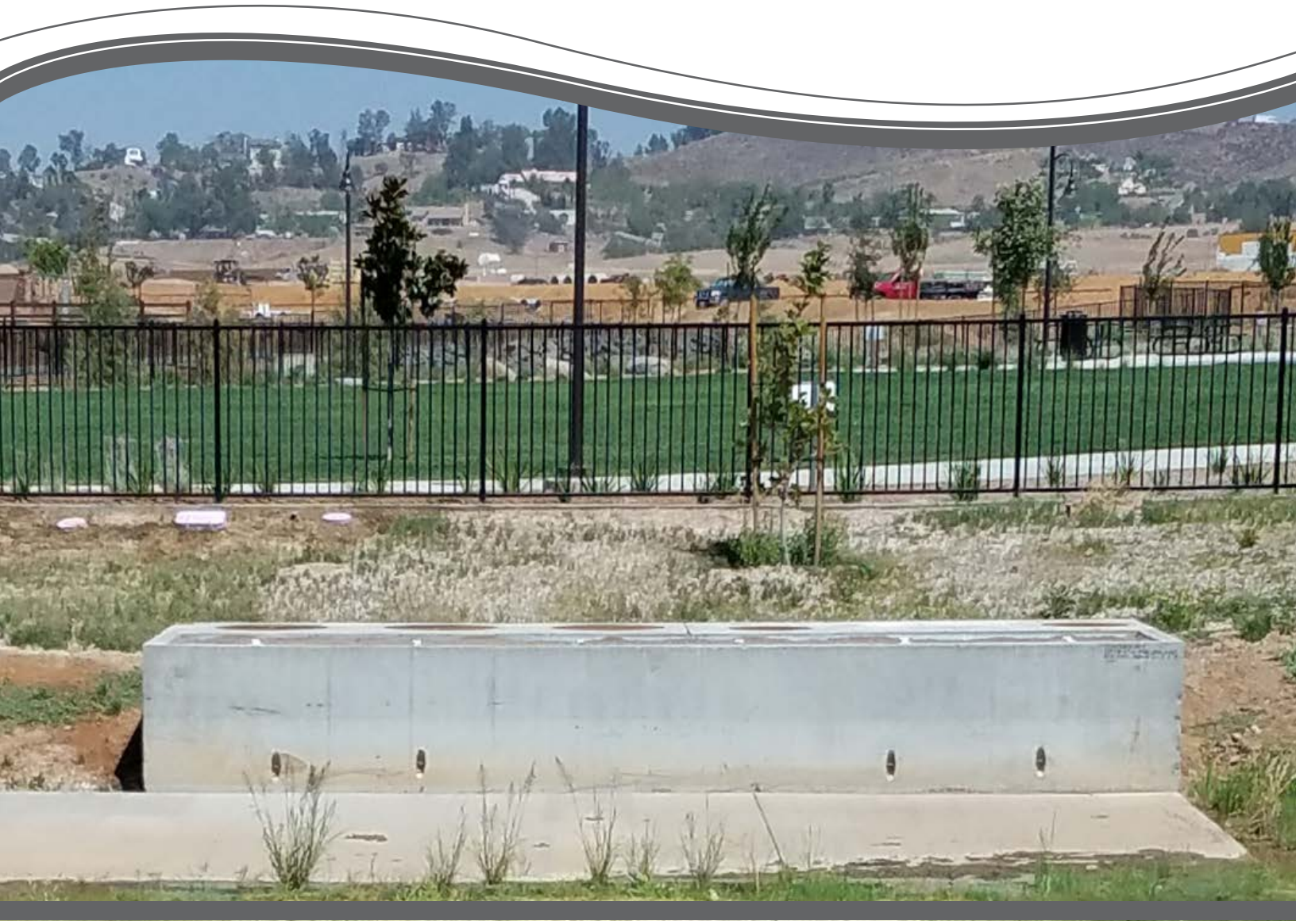
# MWS-L-8-20-V
## STORMWATER BIOFILTRATION SYSTEM
## STANDARD DETAIL

8/14/23SCOTT.SERTICH

# Attachment B: Operations and Maintenance Plan – Modular Wetland System

CONTECH®
ENGINEERED SOLUTIONS

# Modular Wetlands® Linear Operatons & Maintenance Manual



MODULAR WETLANDS®

# MODULAR WETLANDS LINEAR
# OPERATION & MAINTENANCE MANUAL

## TABLE OF CONTENTS

## OVERVIEW

This operation and maintenance (O&M) manual is for the Modular Wetlands Linear Biofilter (MWL). Please read the instructions and equipment lists closely prior to starting. It is important to follow all necessary safety procedures associated with state and local regulations. Please contact Contech for more information on pre-authorized third-party service providers who can provide inspection and maintenance services in your area. For a list of service providers in your area, please visit www.conteches.com/maintenance.

## WARNING

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

## SAFETY NOTICE & PERSONAL SAFETY EQUIPMENT

Job site safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Service Provider(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Service Provider's responsibility and outside the scope of Contech Engineered Solutions.

Safety Boots

Gloves

Hard Hat

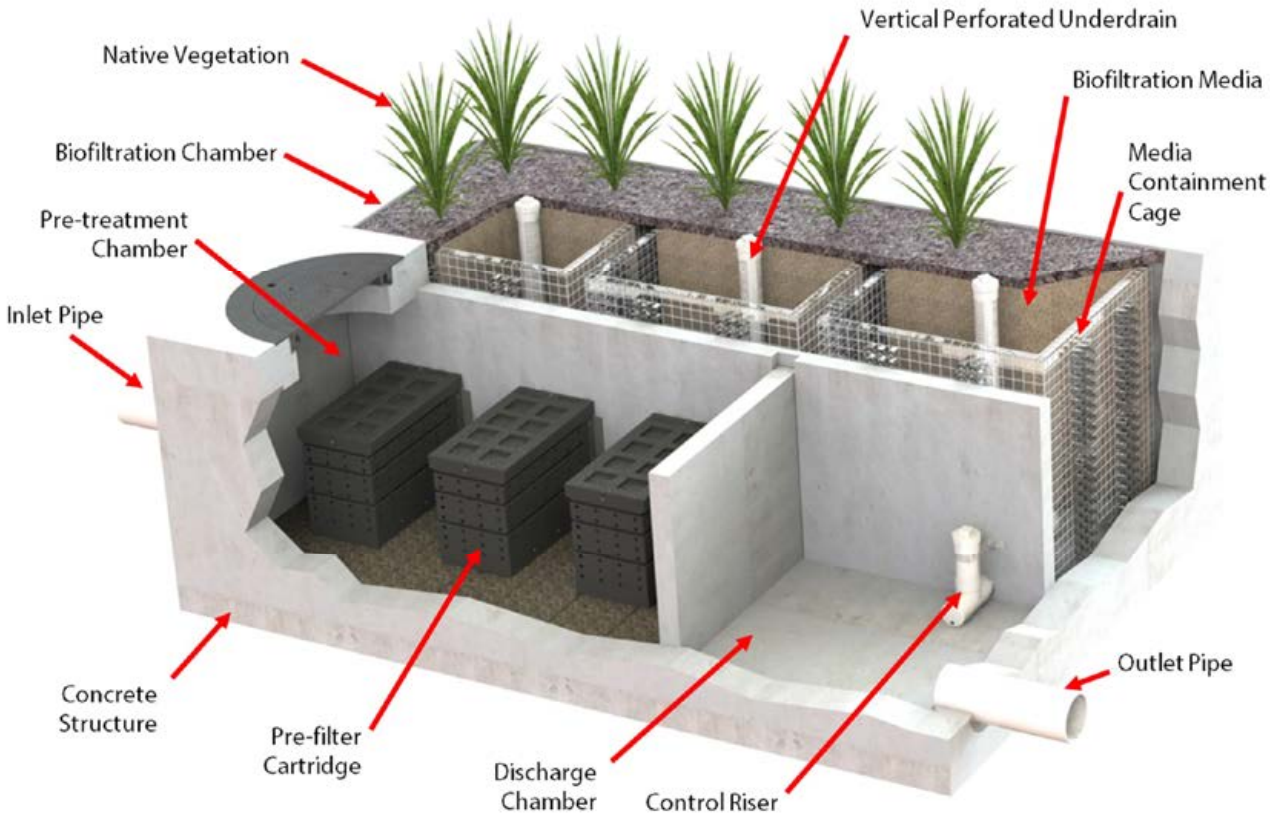
Eye Protection

Maintenance and Protection of Traffic Plan

# MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL system comes in multiple sizes and configurations, including side by side or end to end layouts, both as open planters or underground systems. See shop drawings (plans) for project specific details.

The standard MWL system is comprised of the following components:



# INSPECTION SUMMARY & EQUIPMENT LIST

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site-specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the MWL:

Modular Wetlands Linear Inspection Form

Flashlight

Tape Measure

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

## INSPECTION & MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics, and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the biofiltration chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

## INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and in need of replacement.


6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.

7. The discharge chamber houses the control riser (if applicable), drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating condition and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above.

8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.

## MAINTENANCE INDICATORS

Based upon the observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet and/or outlet pipes.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18".
- Excessive accumulation of sediment in the pre-treatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models).
- Overgrown vegetation.

## MAINTENANCE SUMMARY & EQUIPMENT LIST

The time has come to maintain your MWL. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and maintenance equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.
    - A gas meter should be used to detect the presence of any hazardous gases prior to entering the system. If hazardous gases are present, do not enter the vault. Following appropriate confined space procedures, take steps such as utilizing a venting system to address the hazard. Once it is determined to be safe, enter the system utilizing appropriate entry equipment such as a ladder and tripod with harness.

The following is a list of equipment required for maintenance of the MWL:

Modular Wetlands Linear Maintenance Form

Flashlight

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

Vacuum Assisted Truck with Pressure Washer

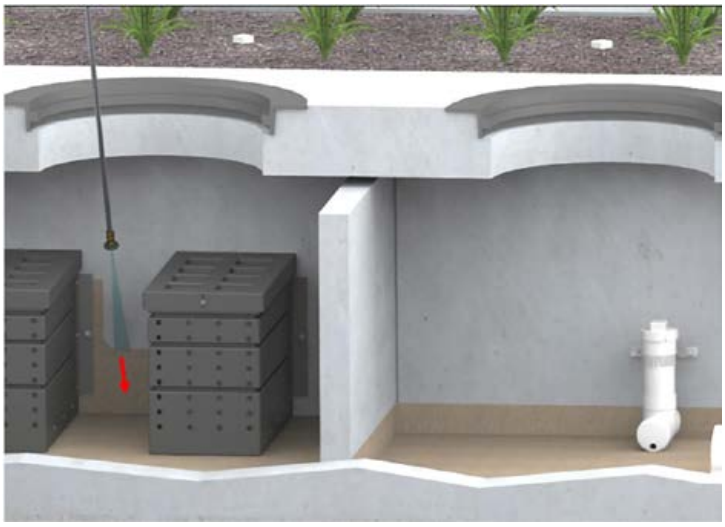
Replacement
BioMediaGREEN
(If Required)

(order BioMediaGREEN from Contech's Maintenance Team members at https://www.conteches.com/maintenance)

# MAINTENANCE INSTRUCTIONS

### 1. ACCESS COVER REMOVAL

Upon determining that the vault is safe for entry, remove all access cover(s) and position the vacuum truck accordingly.



### 2. PRESSURE WASH SYSTEM CHAMBERS

With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridge(s).

### 3. VACUUM SYSTEM CHAMBERS

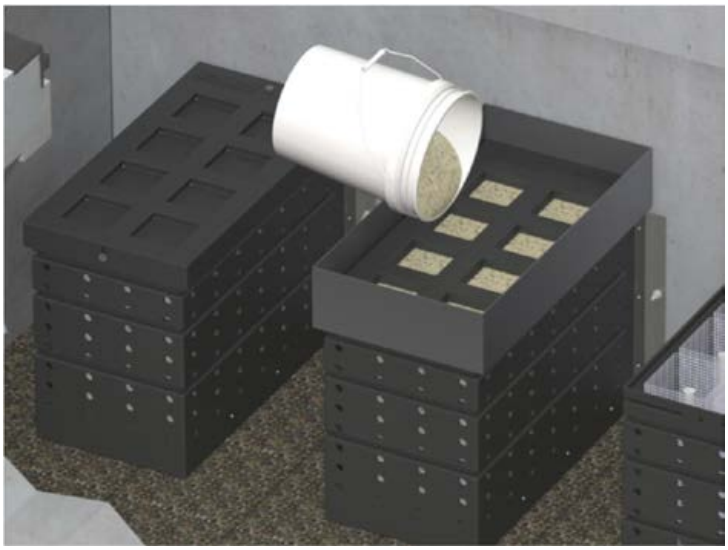
Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the pervious pavers are visible and clean. **(MWL systems outside of California may or may not have pervious pavers on the floor in the pre-treatment chamber)** If pre-filter cartridges require media replacement, proceed to **Step 4**. If not, replace the access cover(s) and proceed to **Step 7**.

## 4. PRE-FILTER CARTRIDGE LID REMOVAL

After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lid(s) from the pre-filter cartridge(s) by removing the two thumb screws. (Older pre-filter cartridges have two bolts holding the lids on that require a 7/16" socket to remove)

## 5. VACUUM EXISTING PRE-FILTER MEDIA

Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.



## 6. PRE-FILTER MEDIA REPLACEMENT

Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.

## 7. MAINTAINING VEGETATION

In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.

## 8. INSPECT UNDERDRAIN SYSTEM

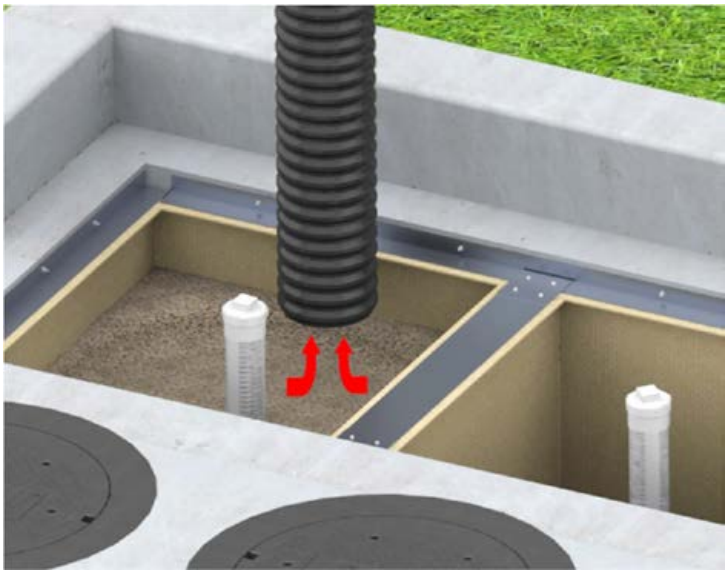
Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed.

## 9. REPLACE ACCESS COVERS

Once maintenance is complete, replace all access cover(s)

## REPLACING BIOFILTRATION MEDIA IF REQUIRED

As with all biofilter systems, at some point the biofiltration media will need to be replaced, either due to physical clogging or sorptive exhaustion (for dissolved pollutants) of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading, so replacing the biofiltration media should not be a common occurrence. In the event that the biofiltration media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new biofiltration media. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Biofiltration media replacement can be done following the steps below:



### 1. VACUUM EXISTING BIOFILTRATION MEDIA

Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer.

### 2. INSTALLING NEW BIOFILTRATION MEDIA

Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cage(s). Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cage(s) up to the same level as the old media.

### 3. REPLANT VEGETATION

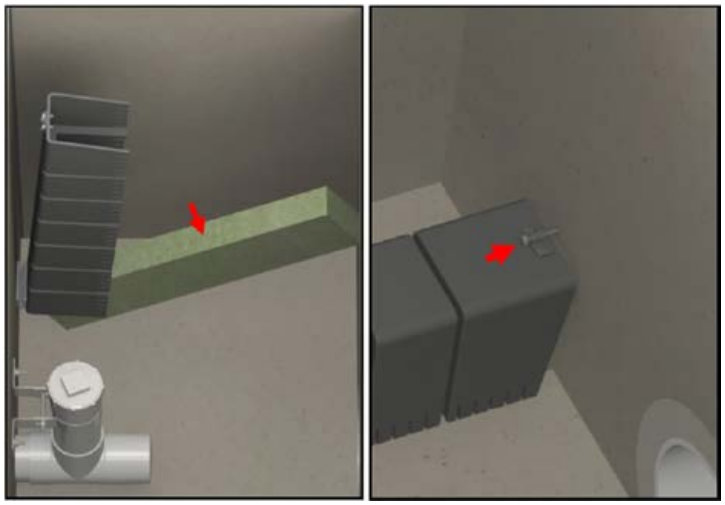
Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new plant establishment media.

# REPLACING DRAIN DOWN FILTER MEDIA (ONLY ON OLDER CALIFORNIA MODELS)

NOTE: The drain down filter is only found on units installed in California prior to 2023
If during inspection it was determined that the drain down filter media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new media.

## 1. REMOVE EXISTING DRAIN DOWN MEDIA

Pull knob back to unlock the locking mechanism and lift the drain down filter housing to remove the used BioMediaGREEN filter block.



## 2. INSTALL NEW DRAIN DOWN MEDIA

Ensure that the chamber and housing are fully cleaned prior to installation of new media, and then insert the new BioMediaGREEN filter block. The media filter block should fit snugly between the chamber walls and be centered under the filter housing. Lower the housing over the filter block and secure the locking mechanism.

## NOTES

CONTECH® ENGINEERED SOLUTIONS

# Inspection Report
# Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

| For Office Use Only |
|---|
| (Reviewed By) |
| (Date) |
| Office personnel to complete section to the left. |

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

## Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

| **Structural Integrity:** | **Yes** | **No** | **Comments** |
|---|---|---|---|
| Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure? | | | |
| Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure? | | | |
| Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)? | | | |
| Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly? | | | |
| **Working Condition:** | | | |
| Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit? | | | |
| Is there standing water in inappropriate areas after a dry period? | | | |
| Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system? | | | |
| Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber. | | | Depth: |
| Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber? | | | Chamber: |
| Any signs of improper functioning in the discharge chamber? Note issues in comments section. | | | |
| **Other Inspection Items:** | | | |
| Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)? | | | |
| Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below. | | | |
| Is there a septic or foul odor coming from inside the system? | | | |

| **Waste:** | **Yes** | **No** |
|---|---|---|
| Sediment / Silt / Clay | | |
| Trash / Bags / Bottles | | |
| Green Waste / Leaves / Foliage | | |

| **Recommended Maintenance** | |
|---|---|
| No Cleaning Needed | |
| Schedule Maintenance as Planned | |
| Needs Immediate Maintenance | |

| **Plant Information** | |
|---|---|
| Damage to Plants | |
| Plant Replacement | |
| Plant Trimming | |

Additional Notes: _____

CONTECH®
ENGINEERED SOLUTIONS

# Cleaning and Maintenance Report
# Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

| For Office Use Only |
|---|
| (Reviewed By) |
| (Date) |
| Office personnel to complete section to the left. |

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

| Site Map # | GPS Coordinates of Insert | Manufacturer / Description / Sizing | Trash Accumulation | Foliage Accumulation | Sediment Accumulation | Total Debris Accumulation | Condition of Media 25/50/75/100 (will be changed @ 75%) | Operational Per Manufactures' Specifications (If not, why?) |
|---|---|---|---|---|---|---|---|---|
| | Lat:<br>Long: | MWS Catch Basins | | | | | | |
| | | MWS Sedimentation Basin | | | | | | |
| | | Media Filter Condition | | | | | | |
| | | Plant Condition | | | | | | |
| | | Drain Down Media Condition | | | | | | |
| | | Discharge Chamber Condition | | | | | | |
| | | Drain Down Pipe Condition | | | | | | |
| | | Inlet and Outlet Pipe Condition | | | | | | |

Comments:

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ENGINEERED SOLUTIONS



800-338-1122

WWW.CONTECHES.COM



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## SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

ModWetLinear OM Manual 03/24

# Attachment C: OCTGD Maps

- C1 – OCTGD Rainfall Zones Map
- C2 – OCTGD North Orange County Hydromodification Susceptibility Map
- C3 – OCTGD Infiltration Screening Maps

SUBJECT TO FURTHER REVISION

## LEGEND

- Orange County Precipitation Stations
- 24 Hour, 85th Percentile Rainfall (Inches)
- 24 Hour, 85th Percentile Rainfall (Inches) - Extrapolated
- City Boundaries

### Rainfall Zones

**Design Capture Storm Depth (inches)**

- 0.65"
- 0.7
- 0.75
- 0.80
- 0.85
- 0.90
- 0.95
- 1.00
- 1.10"

Note: Events defined as 24-hour periods (calendar days) with greater than 0.1 inches of rainfall.
For areas outside of available data coverage, professional judgment shall be applied.

0.65 0.7 0.75 0.8 0.85 0.9 0.95 1 1.05 1.1

SITE

LOS ANGELES COUNTY
ORANGE COUNTY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
Riverside County
San Diego County

0 3 6 12 Kilometers
0 1.8 3.6 7.2 Miles

TITLE: RAINFALL ZONES

JOB: ORANGE COUNTY TECHNICAL GUIDANCE DOCUMENT — ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.8 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/22/10 |
| JOB NO. | 9526-E |

PACE Advanced Water Engineering

FIGURE XVI-1

P:\9526E\16-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-1_RainfallZones_20110215.mxd

**Susceptibility**

Potential Areas of Erosion, Habitat, & Physical Structure Susceptibility

**Channel Type**

- Earth (Unstable)
- Earth (Stabilized)
- Stabilized

**Tidal Influence**

- <= Mean High Water Line (4.28')

**Water Body**

- Basin
- Dam
- Lake
- Reservoir

**Forest Areas**

- Cleveland National Forest

**Federal Lands**

- Amarus Salt Marsh

San Gabriel-Coyote Creek Watershed

San Bernardino County

Riverside County

South Orange County

Newport Bay Watershed

AnaheimBay-HuntingtonHarbor Watershed

Carbon Canyon

Yorba Linda Reservoir

Miller Retarding Basin

Anaheim Lake

Warner Basin

Kraemer Basin

Fletcher Retarding Basin

Olive Hills

Walnut Canyon Reservoir

Villa Park Dam

Peters Canyon Reservoir

Irvine Lake

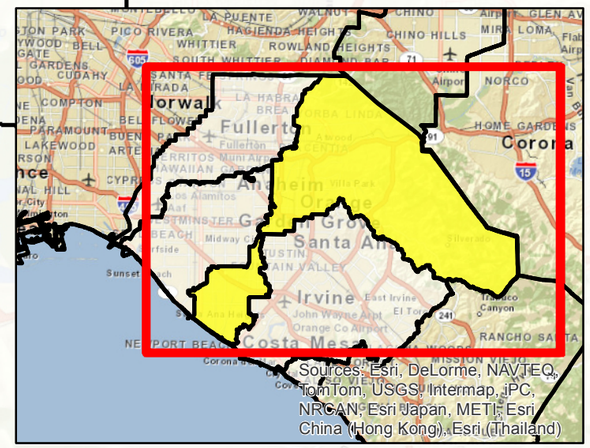
Cleveland National Forest

SOUTHPARK PUMP STATION

Bartlett Retarding Basin

Stabilized by Grade Control Structure

SITE




PRELIMINARY MAP – SUBJECT TO FURTHER REVISION

0 12,000 24,000 Feet

Sources: Esri, DeLorme, NAVTEQ, TomTom, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand)

P:\9526E\6-GIS\Mxds\SucceptibilityMaps_20100505\9526E_SantaAnaRiverSusceptibility_20100430.mxd

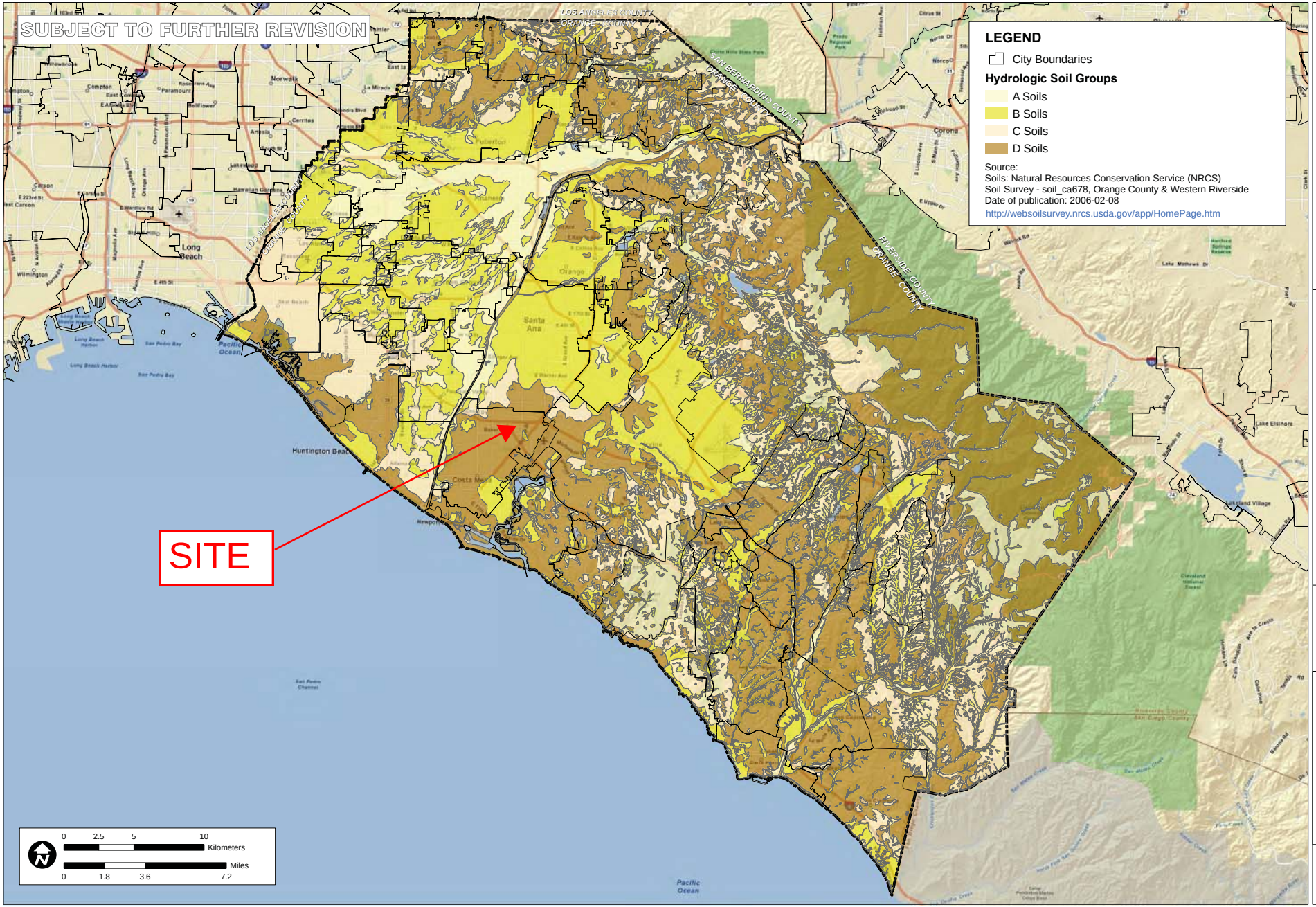
TITLE: SUSCEPTIBILITY ANALYIS SANTA ANA RIVER

JOB: ORANGE COUNTY WATERSHED MASTER PLANNING ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 12000' |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/30/10 |
| JOB NO. | 9526-E |

PACE Advanced Water Engineering

FIGURE 3




TITLE
NRCS HYDROLOGIC SOILS GROUPS

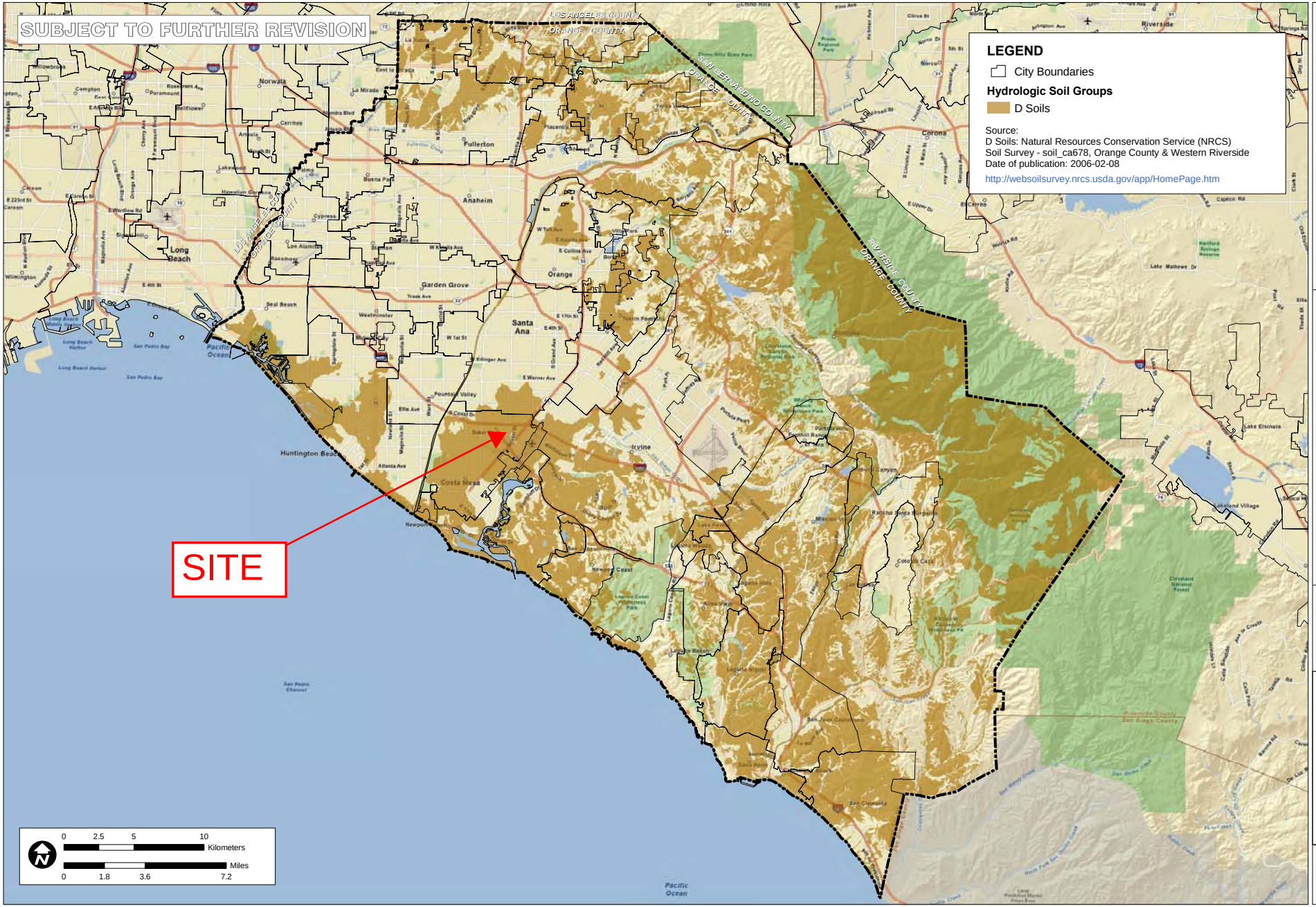
JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.6 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2a

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2a_HydroSols_20110215.mxd




TITLE
HYDROLOGIC SOIL GROUP
TYPE D NRCS SOIL SURVEY

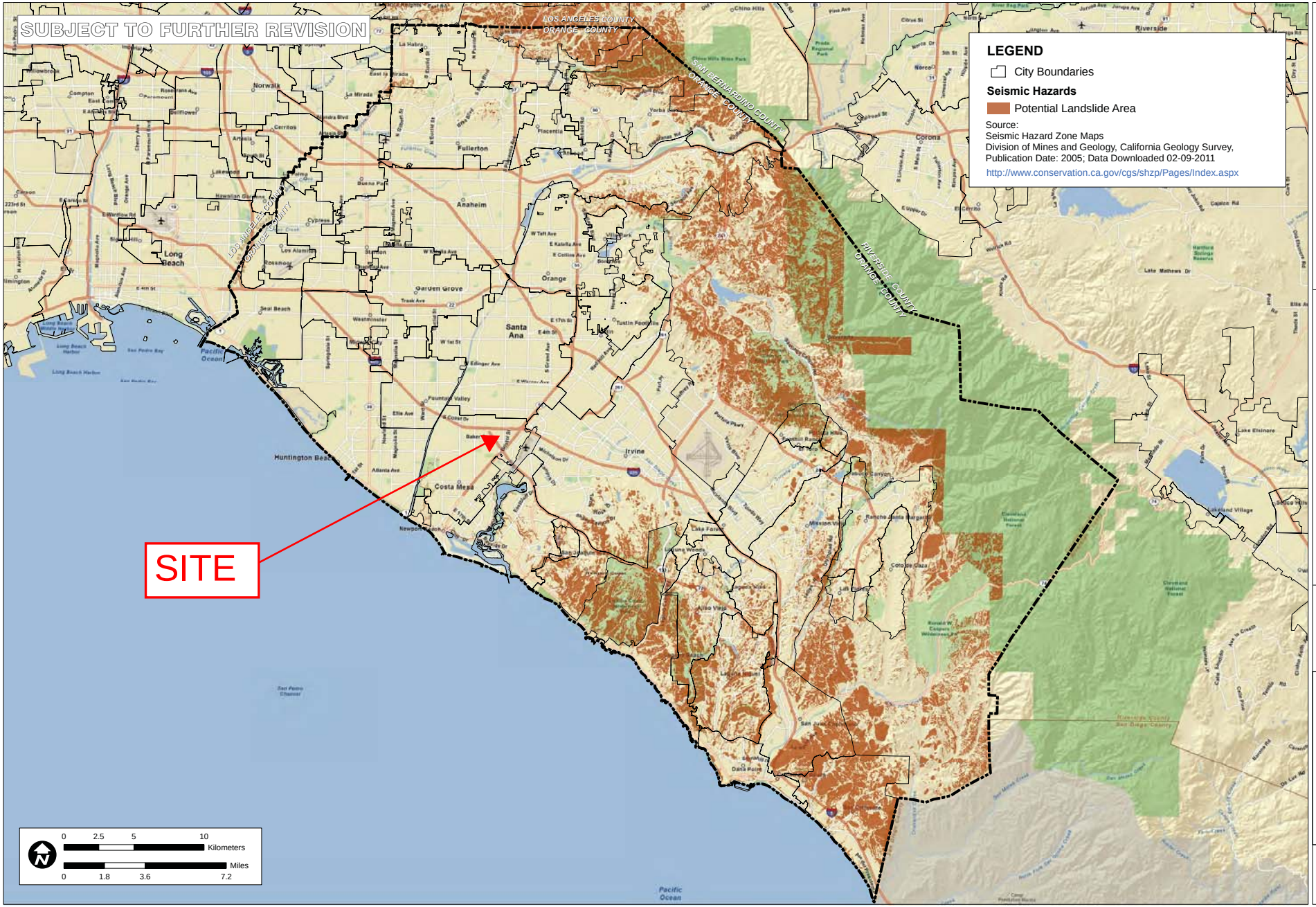
JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.6 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2b

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2b_D-Soils_20110215.mxd




P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2c_Landslides_20110215.mxd

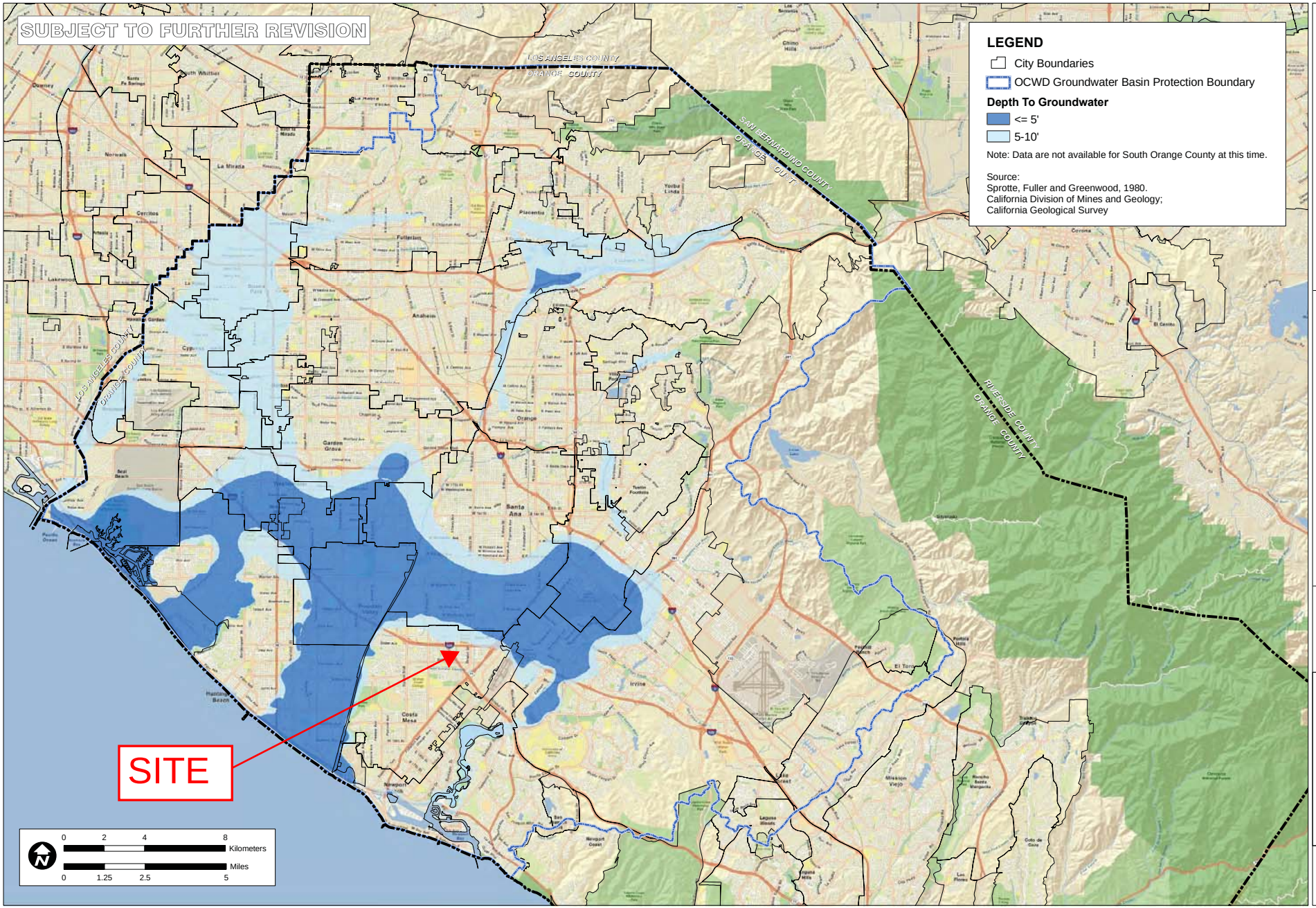
TITLE
HYDROLOGIC SOIL GROUP
TYPE D NRCS SOIL SURVEY

JOB
ORANGE COUNTY
INFILTRATION STUDY
CA
ORANGE CO.

| | |
|---|---|
| SCALE | 1" = 1.25 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2c




TITLE
NORTH ORANGE COUNTY
MAPPED SHALLOW GROUNDWATER

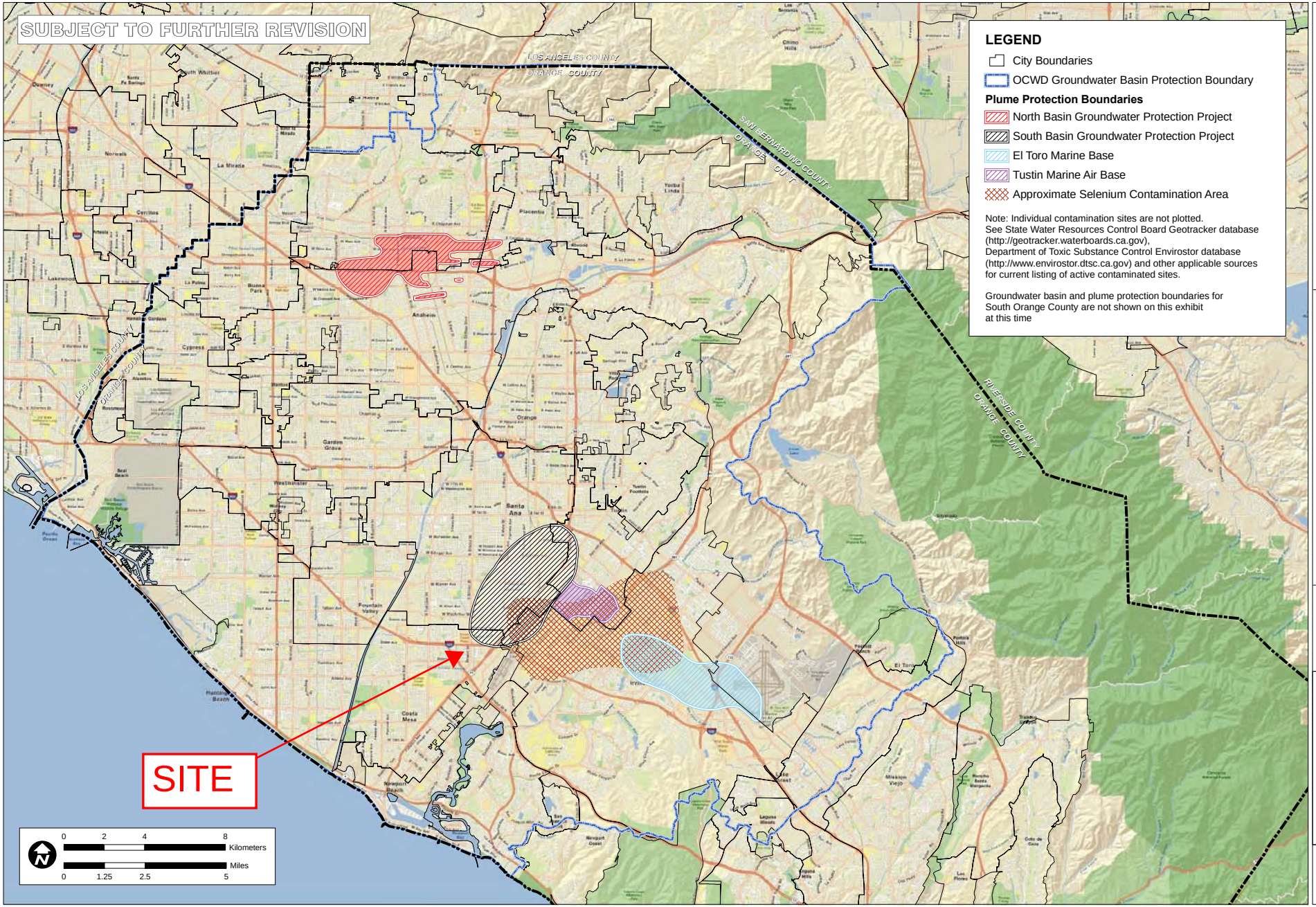
JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.25 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 02/09/11 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2e

P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2e_DepthToGroundwaterUSH_20110215.mxd




TITLE
NORTH ORANGE COUNTY GROUNDWATER PROTECTION AREAS

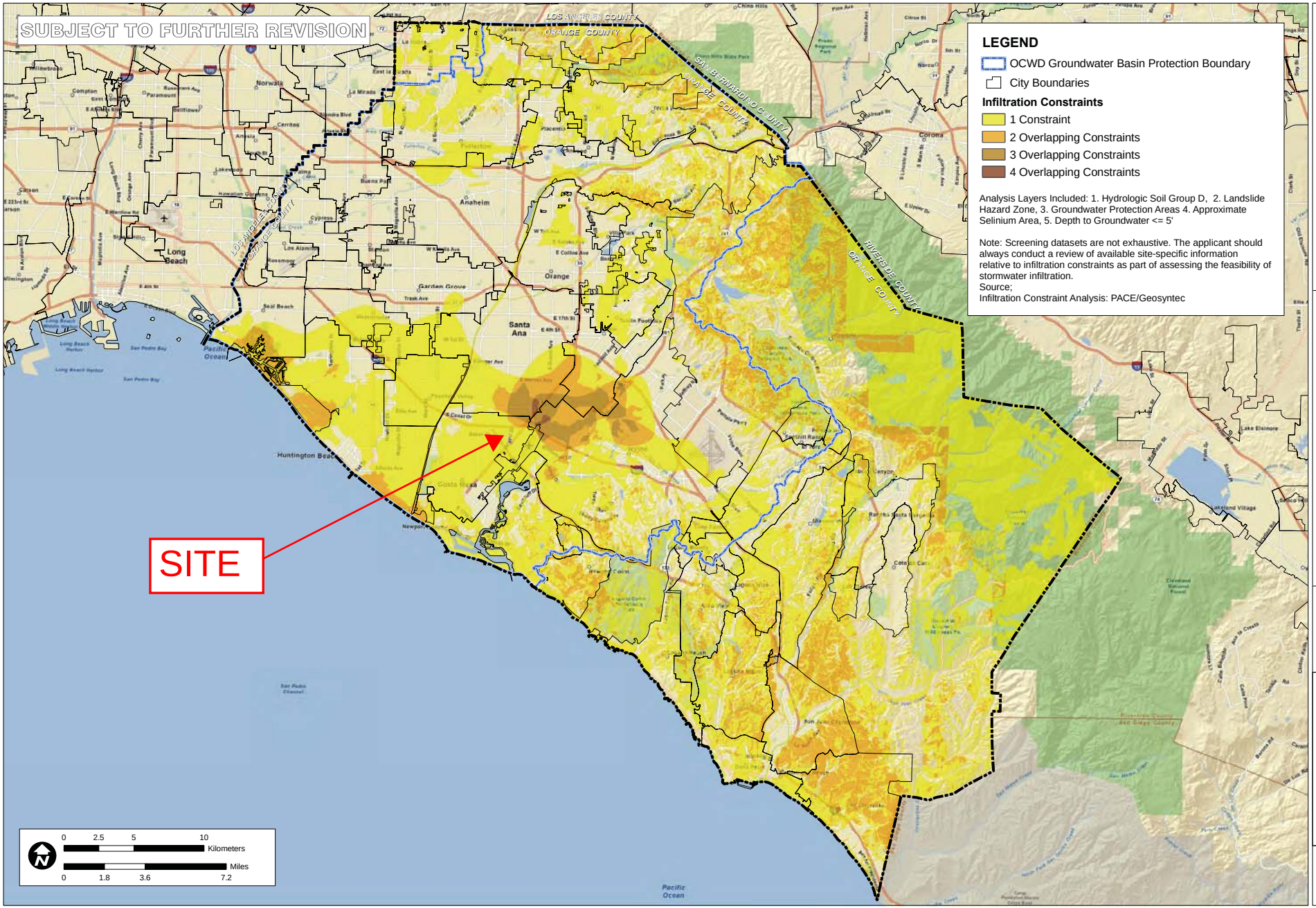
JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.25 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/23/10 |
| JOB NO. | 9526-E |

PACE Advanced Water Engineering

FIGURE
XVI-2f

P:\9526E\16-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2f_NorthOCGroundwaterProtectionAreaStreetMap_20110215.mxd

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TITLE
INFILTRATION ANALYSIS
OVERLAPPING CONSTRAINT
LOCATIONS

JOB
ORANGE COUNTY
INFILTRATION STUDY
ORANGE CO. CA

| | |
|---|---|
| SCALE | 1" = 1.6 miles |
| DESIGNED | TH |
| DRAWING | TH |
| CHECKED | BMP |
| DATE | 04/23/10 |
| JOB NO. | 9526-E |

PACE
Advanced Water Engineering

FIGURE
XVI-2g

# Attachment D: Geotechnical Report

References pertinent to the site are included in Appendix A. Boring/CPT logs and laboratory test data from the prior site-specific geotechnical study are included in Appendix B and C, respectively. Seismic design parameters are presented in Appendix D. Percolation test data and liquefaction hazard analysis performed during the prior study is presented in Appendix E and F, respectively. General earthwork and grading specifications are presented in Appendix G.

If you have any questions regarding this report, please contact our office. We appreciate the opportunity to provide our services.

Respectfully submitted,

SA GEOTECHNICAL, INC.

Anthony Zepeda, CEG 2681
Project Geologist

Reza Saberi, GE 3071
Principal Engineer

Peter Anderson, CEG 2596
Principal Engineering Geologist



# TABLE OF CONTENTS

# TABLE OF CONTENTS (Continued)

## List of Illustrations



## Appendices



## Plates

# EXECUTIVE SUMMARY

The subject site is underlain by thick Quaternary-age native alluvium that generally consists of interlayered clays, silty clays, clayey sands, silty sands, and sandy clays. The primary geotechnical constraints at the site include the following:

- Soft, compressible, wet/saturated, and highly expansive near-surface clayey soils;
- Potentially liquefiable subsurface soils;
- Potential difficulty performing remedial grading requiring special handling (i.e. top loading) and/or soft and saturated soil mitigation; and
- The potential for seismic shaking during an earthquake event.

Remedial grading for the site should consist of the removal and re-compaction of all undocumented fill materials, topsoil, and weathered or disturbed alluvium. Remedial removals are anticipated to be on the order of 5 feet below existing grades within the proposed building pads. Remedial grading for minor structures and within the proposed drive areas may be limited to removal and re-compaction of the soils in the upper 2 to 3 feet. Deeper removals may be required where existing trees, utility lines, structures, and foundations are to be abandoned/removed or where deeper undocumented fills are encountered. Considering that the onsite soils consist of wet/saturated highly expansive soils, achieving adequate compaction at acceptable moisture contents during fill placement may be difficult. Therefore, cement treating of the onsite soils should be considered. Cement treatment, if necessary, should consist of mixing the onsite soils with 6 percent cement.

As discussed above and per boring logs by others, the removal bottoms and/or trench excavations for utility lines may be saturated, soft, and require stabilization of the bottom. Near-surface soils may pump or be unable to support the weight of heavy equipment. Special handling (e.g., top-loading with excavator) may be required to complete remedial grading. Removal bottoms may require stabilization to support heavy compaction equipment and can be stabilized with a layer of geotextile material (Mirafi HP270 or equivalent) placed at the bottom of the excavation, with 12 to 24 inches of ¾-inch or 1-inch gravel (or crushed aggregate base) over the geotextile. Alternatively, removal bottoms may be stabilized with one foot of cement-treated soil with a minimum of 6 percent cement.

Groundwater was encountered during prior exploration by others, at depths ranging from 18.3 to 20.7 feet. Historic high groundwater is mapped between 10 and 30 feet below grade. In general, we anticipate groundwater to remain at least 10 feet below design grades upon the completion of grading. However, seepage/groundwater may be present at shallower depth locally and can fluctuate on an annual and seasonal basis. In general, we anticipate that localized dewatering, such as with a sump pump, may be feasible and sufficient during construction, if groundwater is encountered at shallow depth or within excavations for deep utility lines.

Considering the relatively minor grading anticipated to achieve design grades, the laboratory test data and liquefaction analysis by others, building foundations and slabs should be designed to tolerate a total settlement of 2.5 inches and a differential settlement of 1.25 inches over a span of 40 feet. However, please note that the liquefaction settlement analysis performed during the prior study was based on an outdated California Building Code and we understand the raw CPT data is not available for our use. Additional exploration during the design phase of the project will be

required to update settlement estimates in accordance with the current building code. Onsite soils are anticipated to have "High" to "Very High" expansion potential at the completion of grading and are considered corrosive to concrete and metals.

Based on our findings, we conclude that the proposed residential development is feasible from a geotechnical viewpoint, provided it is designed and constructed in accordance with the recommendations presented in this report and the future design/plan review report(s). The site is not considered suitable for infiltration of storm water.

# 1.0 INTRODUCTION

## 1.1 Introduction and Scope of Services

At your request, SA Geotechnical, Inc. (SA GEO) has conducted a geotechnical due diligence review for the proposed residential development located at 3150 Bear Street in the City of Costa Mesa, California (Figure 1). The purpose of our review was to assess the onsite geologic and geotechnical conditions and provide preliminary recommendations for design, grading, and construction of the proposed improvements. At this time, no conceptual site plan or topographic survey was available for our review. We have utilized a Google Earth satellite image as the base for our Boring Location Map (Plate 1).

Our scope of services for this due diligence study included the following tasks:

- Review of available geologic and geotechnical maps, reports, and data for the subject site and surrounding area, include the site-specific study performed by others. A list of references is included in Appendix A.
- Review of boring logs, laboratory test data, percolation test data, and liquefaction analysis by others are included in Appendices B, C, E, and F, respectively.
- Historic aerial photograph review, dating back to 1952.
- Preliminary evaluation of faulting, seismicity, and seismic and static settlement in accordance with the 2022 California Building Code (CBC).
- Preparation of this report including our findings, conclusions, preliminary recommendations, and accompanying illustrations.

SA GEO's expertise and scope of services do not include assessment of potential subsurface environmental contaminants or environmental health hazards.

## 1.2 Site Condition and History

The subject site is located at 3150 Bear Street, Costa Mesa, California (see Figure 1). The approximately 6.2-acre site is bounded by Interstate 405 freeway to the north, residential neighborhoods to the east and south, and Bear Street to the west. The site is currently developed, with a two-story commercial building with at-grade concrete paved parking lot, drive aisles, and landscaping/hardscaping in the northern and central portions of the property.

Based on our review of available historic aerial photographs dating back to 1952, the earliest land use at the subject site and surrounding areas were for agricultural purposes (row crops). Development of the surrounding area for residential use began by 1972, although the site itself remained undeveloped. The existing two-story commercial building at the site was constructed by 1980. No significant changes were observed on the subject site since initial development and construction of the existing commercial building.

## 1.3 Proposed Grading and Improvements

Prior to any site development or grading, the existing structures, pavements, utilities, and hardscape will be demolished. Considering the site is relatively flat, we anticipate design grading to consist of cuts and fills on the order of 1 to 3 feet to reach pad grades and provide for proper site drainage.

The proposed project is anticipated to include grading/construction for residential development, and street and utility infrastructure to support the development. At this time, the building size, story count/height, and type (single-family, multifamily, etc.) are unknown.

## 1.4 Prior Geotechnical Studies

GMU Geotechnical, Inc. (GMU) performed a preliminary geotechnical exploration and infiltration study at the subject site in 2019. Their subsurface exploration included excavation of nine hollow-stem auger borings (DH-1 through DH-5, DH-7, and DH-9 through DH-11) and two hand-auger borings (DH-6 and DH-8), to depths ranging from 5 to 31.5 feet. Percolation testing to determine stormwater infiltration feasibility was also performed in three borings (DH-3, DH-7, and DH-9) at a depth of 5 feet. Four Cone Penetration Tests (CPTs) (CPT-1, CPT-2A, CPT-3A, and CPT-4) were also performed to a maximum depth of 50.5 feet.

Laboratory testing included moisture content and dry density, grain size analysis, Atterberg limits, consolidation, direct shear, expansion index, maximum density and optimum moisture content, R-value, and chemical/corrosivity. The approximate boring locations are shown on the Boring Location Map (Plate 1). The associated boring/CPT logs and laboratory test data are provided in Appendices B and C, respectively. The percolation test data and liquefaction analysis performed during this study are provided in Appendix E and F, respectively.

# 2.0 GEOTECHNICAL FINDINGS

## 2.1 Geologic Setting and Geotechnical Conditions

The subject site is located in the southwestern portion of the Tustin Plain, near the northwestern margin of the Newport Bay watershed, within the Peninsular Ranges geomorphic province of Southern California. The site is mapped by the U.S. Geological Survey (USGS, 2006) as underlain by extensive Quaternary-age alluvial fan deposits. The alluvium encountered during the prior subsurface exploration (GMU, 2019) generally consisted of olive brown, yellowish brown, brown, and brownish gray clay, silty clay, sandy clay, clayey sands, and silty sands. Limited topsoil materials were encountered in several borings, up to 1.2 feet thick.

Based on our review of the prior geotechnical exploration and laboratory testing (Appendix C; GMU, 2019), the site geotechnical conditions are generally as follows:

**Soil Moisture Content and Dry Density**: Native alluvial soils had in-situ moisture contents and dry densities ranging from 4.0 to 38.8 percent and 77 to 136 pounds per cubic foot (pcf), respectively. Blow counts in the alluvial materials generally ranged from 11 to 51 and locally up to 80+ blows per foot. Alluvial soils were generally found to be moist to wet and soft to stiff/loose to dense.

**Soil Properties:** Grain-size distribution tests were conducted on three ring samples collected at depths of 5, 15, and 30 feet. The shallowest sample was classified in accordance with the Unified Soil Classification System (USCS) as fat clay (CH), while both other tested samples were classified as sand with silt (SP-SM), with fines contents (passing No. 200 sieve) of 97, 11, and 10 percent, respectively.

Soil plasticity testing was performed on three ring samples. Two samples were collected at a depth of 5 feet bgs, and one was collected at a depth of 15 feet bgs. The 5-foot samples were classified as CH with Plasticity Indices of 40 and 66 and Liquid Limits of 61 and 97 percent. Testing of the sample collected at 15 feet bgs, which contained only 11% fines passing the #200 sieve, was non-plastic (USCS classification of SP-SM).

Maximum dry density testing of three near surface samples (collected from the uppermost 5 feet) indicates that the near surface clayey soil (CL/CH) has maximum dry densities ranging from 113.5 to 124.0 pcf at optimum moisture contents of 11.5 to 15.5 percent.

**Shear Strength:** Three direct shear tests were conducted which included one remolded sample prepared from a bulk sample collected from the uppermost 5 feet, and two undisturbed samples collected at depths of 2.5 and 5 feet. The remolded direct shear test results indicate that the sample had ultimate and peak internal friction angles of 28.1 and 26.0 degrees, with ultimate and peak cohesions of 324 and 564 pounds per square foot (psf), respectively. The undisturbed direct shear test results indicate that the samples had ultimate and peak internal friction angle of 19.5 degrees (2.5-foot sample) and 27.0 and 31.0 degrees (5-foot sample). Ultimate and peak cohesions were 558 and 708 psf (2.5-foot sample), and 18 and 84 psf (5-foot sample), respectively.

**Consolidation**: Tests were performed on seven samples collected at depths ranging from 5 to 12.5 feet. The testing showed that the materials are low to moderately compressible. The samples generally had minor collapse and swell (less than 1 percent) upon the addition of water at various loads. The majority of the samples swelled upon the addition of water which indicates that the onsite soils are expansive.

**Expansion Potential:** Expansion index testing was performed on three samples collected in the upper 0 to 5 feet. The results indicate a "High" expansion potential (EI ranging from 120 to 129).

**Chemical Properties:** Chemical properties testing was performed on three bulk samples collected from the uppermost 5 feet. Testing included electrical resistivity, pH, soluble sulfate, and chloride content. The electrical resistivity tests (515 to 692 ohm-cm) indicate that the onsite soils are severely corrosive to ferrous metals. Soil pH value ranged from 7.4 to 8.5. Chloride contents ranged from 696 to 936 ppm and soluble sulfate contents ranged from 68 to 2943 ppm. Soluble sulfate contents indicate the soils are classified as "S0" and "S2" per Table 19.3.1.1 of ACI-318-14.

**R-Value:** R-value testing was performed on a sample collected from 1 to 5 feet. The test results indicate an R-value of 8.

## 2.2 Groundwater

Groundwater was encountered during the prior exploration at depths ranging from 18.3 to 20.7 feet bgs. Historic high groundwater mapping indicates high groundwater between 10 and 30 feet bgs (CDMG, 1997). Groundwater well data available on the State of California Water Resources Control Board database ("GeoTracker") shows depth to groundwater at nearby sites have been recorded between 20 and 29 feet bgs. Groundwater is anticipated to fluctuate both seasonally and annually.

## 2.3 Regional Faulting and Seismicity

**Regional Faults:** The site is not located within a fault-rupture hazard zone as defined by the Alquist-Priolo Special Studies Zones Act (CGS, 2018). Also, based on mapping by the State (Jennings and Bryant, 2010), there are no active faults mapped at the site.

**Seismicity:** Properties in southern California are subject to seismic hazards of varying degrees depending upon the proximity, degree of activity, and capability of nearby faults. These hazards can be primary (i.e., directly related to the energy release of an earthquake) or secondary (i.e., related to the effect of earthquake energy on the physical world). Since there are no active faults at the site, the potential for primary ground rupture is considered very low. The primary seismic hazard for this site is ground shaking during a future earthquake.

Using the USGS deaggregation computer program (USGS, 2023) and the site coordinates of 33.6862 north latitude and –117.8911 west longitude, the closest major active faults include the Newport-Inglewood Fault and San Joaquin Hills Fault. The maximum moment magnitude for the controlling fault is 7.1 $M_W$, which would be generated from the San Joaquin Hills Fault; however, numerous other regionally active faults could also produce ground shaking at the site during an earthquake.

The site is located within an area of potential liquefaction, as defined by the State's Seismic Hazard Mapping (CDMG, 1997). Liquefaction hazard assessment is discussed in the following section. Other secondary seismic hazards, such as tsunami and seiche are considered nil due to site elevation and distance from the ocean or other confined body of water (CGS, 2021).

## 2.4 Liquefaction Potential

Liquefaction is a phenomenon in which earthquake-induced stress generates excess pore water pressure in low density, saturated, sandy and silty soils below the groundwater table. Liquefaction causes a loss of strength and is often accompanied by ground settlement. For liquefaction to occur, the following four conditions must be present at the site: 1) Severe ground shaking, such as during a strong earthquake, 2) Soil must be saturated or nearly saturated, generally below the groundwater table, 3) Corrected normalized standard penetration test (SPT) blow counts (N1) and/or CPT tip resistance (Qt) must be relatively low, and 4) Soils must be granular (typically sand or sandy silt) with low plasticity; clays and silts of relatively high plasticity are generally not liquefiable.

As discussed in Section 2.3, the subject site is situated within a mapped liquefaction hazard zone; thus, a liquefaction hazard assessment was performed as part of the prior geotechnical study (GMU, 2019). Their assessment was performed using the collected CPT data and CLiq software, version 1.7.6.49 by Geologismiki. Please note that the seismic settlement analysis was performed in accordance with the prior building code (2016 CBC and ASCE 7-10 criteria). Thus, the seismic input and settlement values discussed herein are subject to change, following additional subsurface exploration and analysis during the design phase of the project.

The liquefaction potential of onsite soils was estimated based on a peak ground acceleration of 0.54g and a maximum earthquake magnitude of 6.5Mw, as determined in the site seismicity analysis (GMU, 2019). An in-situ groundwater table of 18 feet bgs and a seismic (design) groundwater table of 10 feet were used in the analysis.

**Seismic Settlement:** The results of the analysis performed by GMU indicate that liquefiable layers are present and, when subjected to ground accelerations generated during a large earthquake event near the subject site, may be prone to settlement. Based on the calculations, settlement due to liquefaction is estimated to be approximately 0.5 to 1.25 inches. The graphic representations of the CPT soundings are included in Appendix B and the liquefaction analysis is presented in Appendix F.

**Loss of Bearing and Surface Manifestations:** The potential for loss of bearing was reviewed based on the thickness of the liquefiable layers that will be left in-place, versus the amount of fill and non-liquefiable native soils overlying liquefiable soils. Considering the depth to design groundwater, the clayey nature of the soils in the upper 10 feet, and that the proposed structures will be underlain by compacted fill, the potential for local surface disruptions, loss of bearing strength and surface manifestations is considered very low. Please also note that the liquefiable layers are generally deep (below 24 feet) which further reduces the potential for loss of bearing and surface manifestation.

**Lateral Spread:** Considering the proposed improvements are not located near any sloping ground or free face and the relatively flat grades across the site, we anticipate the potential for lateral spread as a result of seismic shaking to be very low.

## 2.5 Settlement and Foundation Considerations

In general, the anticipated settlements depend upon the building loads, type of foundations, and the geotechnical properties of the supporting subgrade. We have reviewed the consolidation test data included in the prior geotechnical report by others (GMU, 2019). Considering the subsurface soil conditions and laboratory test data, and relatively lightly loaded residential structures, we estimate the total static settlement to be on the order of 1 inch and the differential static settlement to be on the order of ½-inch over a 40-foot span. This assumes remedial grading measures recommended in Section 3.2 of this report are implemented during site grading.

As discussed above, we have reviewed the liquefaction assessment performed during the prior study (GMU, 2019). Based on their analysis, the total seismic settlement at the site is anticipated to be on the order of 1.5 inches. Differential seismic settlement is estimated to be ¾-inch over a 40-foot span. However, please note that the analysis was performed in accordance with a prior building code and will need to be updated during the design phase following additional subsurface exploration. Seismic settlement estimates provided herein are subject to change based on the additional subsurface exploration.

## 2.6 Stormwater Infiltration Feasibility

Percolation testing was performed in three exploratory borings, DH-3, DH-7, and DH-9 (GMU, 2019). The borings were 5 feet deep each and were tested in general accordance with County of Orange requirements. Tested infiltration rates (no factor-of-safety applied) were found to range from 0.02 to 0.04 inches per hour. The percolation test data sheets are provided in Appendix E.

## 2.7 Shrinkage and Bulking

The shrinkage and bulking (reduction or increase in volume of excavated materials on recompaction as fill) varies by soil type and location. The volume changes depend primarily on in-situ density and the maximum dry density of the soil type. We anticipate that the near surface (uppermost 5 feet) alluvial materials will have shrinkage of 2 to 7 percent. Ground subsidence at the site is estimated to be on the order of 0.1 foot. These values exclude losses due to removal of vegetation and debris and are dependent on the accuracy of the site topographic survey and type of equipment and compaction method used by the contractor.

# 3.0 CONCLUSION AND PRELIMINARY RECOMMENDATIONS

## 3.1 General Conclusion and Recommendation

Based on our review, construction of the proposed residential development, as described herein, is considered geotechnically feasible provided the preliminary recommendations in this report are implemented during design, grading, and construction. Additional geotechnical exploration will need to be performed during the design phase in order to finalize seismic liquefaction hazard and settlement estimates in accordance with the current building code. Also, grading, foundation, structural and wall plans for the project should be reviewed by the geotechnical consultant during the design phase. Updated recommendations should be provided once the project plans are finalized and as needed.

The recommendations in this report should be considered minimum and may be superseded by more restrictive requirements of others. In addition to the following recommendations, General Earthwork and Grading Specifications are provided in Appendix G.

## 3.2 Site Preparation and Earthwork

Site preparation and grading should be performed in accordance with the recommendations herein and the requirements of the City of Costa Mesa.

### 3.2.1 Site Demolition and Clearing

Prior to remedial grading, the existing structures, foundations, hardscape/landscape, and utilities to be abandoned should be demolished and removed. Deleterious materials and debris should be cleared from the site and disposed of offsite. Concrete material may be mixed with onsite soils and placed as compacted fill provided it is broken into pieces that are smaller than 6 inches in the largest diameter. Placement of concrete as compacted fill should also be approved by the project environmental consultant. Excavations for the removal of existing foundations, utilities, and vegetation, including onsite trees, should be observed by the geotechnical consultant. Large roots, highly organic soils, and existing utilities should be removed and should not be incorporated into new fills.

Cesspools, septic tanks and/or wells may be encountered at the site. If encountered, they should be removed in accordance with Orange County Health Care Agency requirements and the project environmental consultant's recommendations.

Soil that is disturbed as part of excavations or removal of trees or underground utilities should be evaluated by the geotechnical consultant. Excavations that require backfill should be properly documented and compacted under the observation and testing of the geotechnical consultant in accordance with the recommendations provided in Section 3.2.4.

### 3.2.2 Protection of Existing Improvements and Utilities

Existing improvements, and utilities on or adjacent to the site that are to be protected in place should be located and visually marked prior to grading operations. Excavations adjacent to improvements to be protected in-place or any utility easement should be performed with care, so as not to undermine existing foundations or destabilize the adjacent ground.

Stockpiling of soils more than 5 feet in height at or near existing structures and over utility lines should not be allowed. If deeper removals are required, shoring or other special measures (i.e., setback or laybacks) to provide safety and mitigate the potential for lateral/vertical movements may be required.

### 3.2.3 Remedial Grading Measures

Remedial grading at the site should consist of removal of undocumented fill materials in their entirety and weathered/unsuitable alluvium. In general, we recommend that remedial grading for the proposed building pads consist of removal and recompaction of soils in the upper 5 feet (from existing grade) to remove any undocumented artificial fill materials and unsuitable/weathered native alluvial soils. Removals within the proposed drive areas and for minor site structures may be limited to removal and re-compaction of the upper 2 to 3 feet, below existing grades. Where deeper undocumented fill/unsuitable material is encountered, the removals should be extended to the bottom of undocumented fill and/or unsuitable materials to competent native soils.

Based on our review of prior onsite data, saturated and soft soils may be encountered as shallow as 2.5 feet bgs. The near-surface soils may pump and/or lose bearing under the weight of heavy equipment. Special handling (e.g., top-loading with excavator) may be required to complete the remedial grading. In addition, we anticipate that achieving adequate compaction at acceptable moisture contents will be difficult considering the presence of wet/saturated highly expansive soils at the site. Therefore, cement treatment of the soils may be necessary and should be anticipated during the grading. If needed, we recommend that the onsite soils be mixed with 6 percent cement.

If removal bottoms expose wet/saturated soft materials, stabilization of the removal bottom will be required. Removal bottoms may be stabilized with a layer of geotextile material (Mirafi HP270 or equivalent) placed at the bottom of the excavation, with 12 to 24 inches of ¾-inch or 1-inch gravel (or crushed aggregate base) over the geotextile. Alternatively, bottoms may be stabilized with one foot of cement-treated soil with a minimum of 6 percent cement.

The geotechnical consultant should review and approve the removal bottoms prior to fill placement and should provide additional specific recommendations based on actual conditions, if necessary.

Excavations deeper than 4 feet will need to be laid back at a minimum inclination of 1:1 (horizontal to vertical) or provided with shoring. Shallow excavations (4 feet or less) may consist of near-vertical excavation. Excavations should be performed in accordance with Cal/OSHA requirements for Soil Type "B"; however, Type "C" soils may also be encountered and require a 1.5:1 layback. The contractor's qualified person should verify compliance with Cal/OSHA requirements. Excavations near existing structures (within a 1:1 projection) should be provided with shoring that is designed to support the surcharge load of the existing structure. If groundwater is encountered in near-vertical excavations, caving should be anticipated.

### 3.2.4 Fill Placement

Upon the completion of remedial grading measures, the approved removal bottoms should be scarified a minimum of 6 inches. Onsite soils may be used as fill material, provided that adequate compaction at acceptable moisture contents is achievable. In general, we anticipate that achieving adequate compaction at acceptable moisture contents will be difficult considering the presence of wet/saturated highly expansive soils at the site. Therefore, cement treatment of the soils may be necessary and should be anticipated during the grading and fill placement. If needed, we recommend that the onsite soils be mixed with 6 percent cement. Other measures such as mixing, drying, etc. may also be used; however, these measures are typically time-consuming and logistically difficult to perform. The removal bottoms and fill materials should be compacted to at least 90 percent of maximum dry density, as determined by ASTM Test Method D1557. The moisture content of the fill materials should be 3 to 4 percent above the optimum moisture content but within the compactable levels. Fill materials should be placed in loose lifts no thicker than 8 inches.

Concrete material may be mixed with onsite soils and placed as compacted fill if it is broken into pieces that are smaller than 6 inches in the largest diameter. Placement of concrete as compacted fill should be approved by the project environmental consultant.

### 3.2.5 Import

The geotechnical consultant should evaluate and accept any import soils prior to transportation to the subject site. We recommend that import soils have similar or better engineering properties to onsite soils. At minimum, the import materials should have an Expansion Index of less than 90 and a Plasticity Index of less than 25.

## 3.3 Settlement Potential

The amount of settlement will depend upon the type of foundation(s) selected and future loading by additional fill and structures. Based on our review of the subsurface data and liquefaction analysis performed during the prior study, considering the remedial grading recommendations provided in this report are implemented during grading, and structural loads typically associated with the anticipated 2- to 3-story residential units, we estimate that total and differential post-construction settlement (combined static and seismic) will be on the order of 2.5 inches and 1.25 inches over a span of 40 feet, respectively.

As discussed previously, the liquefaction settlement analysis performed during the prior study was based on a former Building Code and we understand the raw CPT data is not available for our use. Additional exploration during the design phase of the project will be required in order to update/finalize settlement estimates in accordance with the current building code. Also, SA GEO should be provided with the foundation plans and structural loads, once available, in order to further evaluate the potential for post-construction settlement of the proposed buildings and associated improvements. The parameters provided herein will then be confirmed/updated based on the planned foundations and loads and additional testing and/or analysis.

## 3.4 Foundation Design

The slab and foundations should be designed by the project structural engineer based on the proposed structure type and the anticipated loading conditions. The foundation soils are anticipated to have expansive soil conditions ("High" to "Very High expansion potential) and will be subject to climatic and landscape moisture fluctuations. Post-tensioned slab should be anticipated for the proposed residential buildings. The following foundation recommendations are provided with the assumption that the recommendations included in Section 3.2 of this report are implemented during site grading.

The recommended net allowable bearing capacity for continuous and isolated footings may be calculated based on the following equation:

$q_{all} = 500\ D + 200\ B + 800$ (but not to exceed 3,000 psf, see below for post-tensioned/mat slabs)

where:
D = embedment depth of footing, in feet
B = width of footing, in feet

Also, the following parameters may be used for design of foundation and slabs:

- Soil unit weight = 120 pcf
- Soil internal friction angle = 27 degrees
- Coefficient of Friction = 0.33
- Subgrade modulus (k) of 50 pci (corrected for large slabs)
- Soil elastic modulus (Es) of 1,000 psi

The allowable bearing capacity of 1,200 psf may be used for design of post-tensioned/mat foundation.

The dead load of concrete below adjacent grades (buried concrete foundations) may be neglected. The allowable bearing pressure and friction coefficient may be increased by one-third for wind and seismic loading.

We recommend that strip and isolated footings for the buildings have a minimum embedment depth of 18 inches below the lowest adjacent grade. Continuous footings should be at least 12 inches wide and isolated column footings should be at least 24 inches wide. The footings of freestanding and isolated structures, such as walls and pilasters, should have a minimum embedment depth of 24 inches into approved soils.

The following table provides our general guidelines and preliminary recommendations for design of post-tensioned foundations and slabs on expansive soil in accordance with the 2022 California Building Code (CBC) and Post-Tension Institute (PTI) DC 10.5 Edition provisions.

## GEOTECHNICAL GUIDELINES FOR DESIGN OF POST-TENSIONED SLABS

| Parameter | Recommendation |
|---|---|
| **Center Lift** | |
| Edge Moisture Variation Distance, $e_m$ | 7.00 feet |
| Center Lift, $y_m$ | 1.20 inches |
| **Edge Lift** | |
| Edge Moisture Variation Distance, $e_m$ | 3.5 feet |
| Edge Lift, $y_m$ | 1.50 inch |
| Presaturation, as needed, to obtain the minimum moisture down to the minimum depth | 1.4 x optimum down to 24 inches |

We recommend that post-tensioned slabs have a thickened edge such that the slab is embedded a minimum of 18 inches below the lowest adjacent grade.

In addition, as indicated in the DC 10.5 Edition of PTI, shape factor calculations should be performed by the project structural engineer in order to determine if strengthening/modification of foundations are necessary. Per PTI guidelines, modifications to the foundations design should be considered if the shape factor (ratio of square of foundation perimeter over foundation area) exceeds 24.

If non-post-tensioned slabs-on-grade and foundations are considered at the site, an effective Plasticity Index of 50 is considered appropriate for the upper 15 feet of soil materials, in accordance with Wire Reinforcement Institute (WRI) method (per the 2022 California Building Code). For non-post-tensioned slabs, we recommend a minimum embedment of 24 inches below the lowest adjacent grade for the perimeter footings. Also, the upper 24 inches of subgrade soil should be pre-saturated to 140 percent of optimum moisture content prior to placement of moisture barrier and concrete.

The foundations and slabs should also be designed to tolerate the total and differential settlements discussed in Section 3.3 of this report.

For the design of pole-type foundations (i.e., light poles, shade structures, etc.), an allowable soil-bearing pressure ($s_1$) of 320 psf/ft may be used for Equation 18-1 (the "pole" equation) of the 2022 California Building Code (CBC) Section 1807.3.2.1 to determine the depth of embedment for the footings, considering level ground conditions. The equation is applicable for designed embedment depths of less than 12 feet for the purpose of computing lateral pressure. Also, for vertical loads on pole-type foundations, an allowable skin friction of 250 pounds per square foot may be used. Pole foundations should have a minimum embedment of 30 inches below adjacent grades. For cast-in-place pole-type foundations, the vertical end bearing pressure should be neglected.

## 3.5 Retaining Walls Design and Lateral Earth Pressures

Recommendations for lateral earth pressures for permanent retaining walls and structures (if any) with approved onsite drained soils and above the groundwater table are as follows:

| *Conditions* | *Level (pcf)* | *2:1 Sloping* |
|---|---|---|
| Active | 45 | 75 |
| At-Rest | 65 | 100 |
| Passive | 320 | 160 (sloping down) |

These parameters are based on a soil internal friction angle of 27 degrees and soil unit weight of 120 pcf.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, the at-rest pressure should be used. Passive pressure is used to compute lateral soils resistance developed against lateral structural movement. The passive pressures provided above may be increased by one-third for wind and seismic loads. The passive resistance is taken into account only if it is ensured that the soil against embedded structure will remain intact with time. Future landscaping/planting and improvements adjacent to the retaining walls should also be taken into account in the design of the retaining walls. Excessive soil disturbance, trenches (excavation and backfill), future landscaping adjacent to footings and over-saturation can adversely impact retaining structures and result in reduced lateral resistance.

For sliding resistance, the friction coefficient of 0.33 may be used at the concrete and soil interface. The coefficient of friction may be increased by one-third for wind and seismic loading. The retaining walls may also need to be designed for additional lateral loads if other structures or walls are planned within a 1H:1V projection.

The seismic lateral earth pressure for walls retaining more than 6 feet of soil, if any, and level backfill conditions may be estimated to be an additional 18 pcf for active and at-rest conditions. The earthquake soil pressure has a triangular distribution and is added to the static pressures. For the active and at-rest conditions, the additional earthquake loading is zero at the top and maximum at the base. The seismic lateral earth pressure does not apply to walls retaining less than, or equal to, 6 feet of soil (2022 CBC Section 1803.5.12).

Drainage behind walls retaining more than 30 inches of soil should also be provided in accordance with the attached Figure 4. Specific drainage connections, outlets and avoiding open joints should be considered for the retaining wall design.

## 3.6 Seismic Design Parameters

The following table summarizes the seismic design criteria for the subject site. The seismic design parameters are developed in accordance with ASCE 7-16 and 2022 CBC. Please note that, considering the proposed structures and anticipated structural periods, site-specific ground-motion hazard analysis was not performed for the site. Per Supplement 3 of ASCE 7-16, the value of $S_{M1}$, and therefore $S_{D1}$, have been increased by 50 percent. The seismic response coefficient, Cs, should be determined per the parameters provided below and using equation 12.8-2 of ASCE 7-16.

| *Selected Seismic Design Parameters from 2022 CBC/ASCE 7-16* | *Seismic Design Values* | *Reference* |
|---|---|---|
| Latitude | 33.6862 North | |
| Longitude | -117.8911 West | |
| Controlling Seismic Source | San Joaquin Hills | USGS, 2023 |
| Site Class per Table 20.3-1 of ASCE 7-16 | D | |
| Spectral Acceleration for Short Periods (Ss) | 1.298 g | SEA/OSHPD, 2023 |
| Spectral Accelerations for 1-Second Periods ($S_1$) | 0.465 g | SEA/OSHPD, 2023 |
| Site Coefficient $F_a$, Table 11.4-1 of ASCE 7-16 | 1.0 | SEA/OSHPD, 2023 |
| Site Coefficient $F_v$, Table 11.4-2 of ASCE 7-16 | 1.835 | |
| Design Spectral Response Acceleration at Short Periods ($S_{DS}$) from Equation 11.4-4 of ASCE 7-16 | 0.865 g | SEA/OSHPD, 2023 |
| Design Spectral Response Acceleration at 1-Second Period ($S_{D1}$) from Equation 11.4-4 of ASCE 7-16 (Includes 50% increase per Supplement 3) | 0.853 g | |
| $T_S$, $S_{D1}$ /$S_{DS}$ 11.4.6 of ASCE 7-16 | 0.986 sec | |
| $T_L$, Long-Period Transition Period | 8 sec | SEA/OSHPD, 2023 |
| Peak Ground Acceleration Corrected for Site Class Effects ($PGA_M$) from Equation 11.8-1 of ASCE 7-16 | 0.612 g | SEA/OSHPD, 2023 |
| Seismic Design Category, Section 11.6 of ASCE 7-16 | D | SEA/OSHPD, 2023 |

## 3.7 Corrosivity

Based on prior laboratory testing, soluble sulfates exposure in the onsite soils were classified as "S2" per Table 19.3.1.1 of ACI-318-14. Structural concrete elements in contact with soil include footings and building slabs-on-grade. The flatwork and sidewalk concrete are typically not considered structural elements. Concrete mix for structural elements should be based on the "S2" soluble sulfate exposure class of Table 19.3.2.1 in ACI-318-14. Other ACI guidelines for structural concrete are recommended. Also, based on the prior laboratory testing, onsite soils are severely corrosive to metals.

## 3.8 Expansion Potential

At the completion of grading, we anticipate that onsite soils will have "High" to "Very High" expansion potential. The geotechnical recommendations provided in this report including the design parameters for foundations, slab-on-grade and flatwork improvement should be implemented during design and construction. Updated recommendations will be provided upon additional testing at the completion of grading at the site and as needed.

Homeowners and their design/construction team should be familiar with the recommendations in this report as well as principles described in a useful reference published by the California Geotechnical Engineers Association (CalGeo), titled, "Coexisting with Expansive Soil: An Informational Guide for Homeowners." This free booklet can be downloaded at www.calgeo.org.

## 3.9 Interior Slab Moisture Mitigation

In addition to geotechnical and structural considerations, the project owner should also consider interior moisture mitigation when designing and constructing slabs-on-grade.

The intended use of the interior space, type of flooring, and the type of goods in contact with the floor may dictate the need for, and design of, measures to mitigate potential effects of moisture emission from and/or moisture vapor transmission through the slab. Typically, for human occupied structures, a vapor retarder or barrier is recommended under the slab to help mitigate moisture transmission through slabs. The most recent guidelines by the American Concrete Institute (ACI 302.1R-04) suggest that the vapor retarder be placed directly under the slab (no sand layer). However, the location of the vapor retarder may also be subject to the builder's past successful practice. Placement of 1 or 2 inches of sand over the moisture retardant has been common practice by builders in southern California. Specifying the strength of the retarder to resist puncture and its permeance rating is important. These qualities are not necessarily a function of the retarder thickness. A minimum of 10-mil is typical but some materials, such as 10-mil polyethylene ("Visqueen"), may not meet the desired standards for toughness and permeance.

Vapor retarders, when used, should be installed in accordance with standards such as ASTM E 1643 and/or those specified by the manufacturer.

Concrete mix design and curing are also significant factors in mitigating slab moisture problems. Concrete with lower water/cement ratios results in denser, less permeable slabs that also "dry" faster with regard to when flooring can be installed (reduced moisture emissions quantities and rates). Rewetting of the slab following curing should be avoided since it can result in additional drying time required prior to flooring installation. Proper concrete slab testing prior to flooring installation is also important.

Concrete mix design, the type and location of the vapor retarder should be determined in coordination with all parties involved in the finished product, including the project owner, architect, structural engineer, geotechnical consultant, concrete subcontractors, and flooring subcontractors.

## 3.10 Exterior Concrete

The driveway, patio slabs and other flatwork elements should be at least 4 inches thick. We recommend that the concrete flatwork be reinforced with No. 3 bars be placed at 24 inches on center both ways. Concrete slabs should be provided with construction or weakened plane control joints at a maximum spacing of 6 feet. The control joints should have a thickness that is ¼ of the total concrete thickness. Upon the placement and compaction of subgrade soils (per Section 3.2 of these recommendations), the upper 24 inches of the subgrade soils should be pre-saturated to 140 percent of optimum moisture content prior to placement of concrete and reinforcement. We also recommend that 6 inches of granular materials/aggregate base be placed over the compacted subgrade prior to placement of reinforcement and concrete.

For exterior slabs, the use of a granular sublayer is primarily intended to facilitate presaturation and subsequent construction by providing a better working surface over the saturated soil. It also helps retain the added moisture in the native soil in the event that the slab is not placed immediately.

Exterior concrete elements such as curb and gutter, driveways, sidewalks, and patios are susceptible to lifting and cracking when constructed over expansive soils. With expansive soils, the impacts to flatwork/hardscape can be significant, generally requiring removal and replacement of the affected improvements. Please also note that reducing concrete problems is often a function of proper slab design, concrete mix design, placement, and curing/finishing practices. Adherence to guidelines of the American Concrete Institute (ACI) is recommended. Also, the amount of post-construction watering, or lack thereof, can have a very significant impact on the adjacent concrete flatwork.

On projects with expansive soils, additional measures such as thickened concrete edges/footings, subdrains and/or moisture barriers should be considered where planter or natural areas with irrigation are located adjacent to the concrete improvements. Design and maintenance of proper surface drainage is also very important. If the concrete will be subject to heavy loading from cars/trucks or other heavy objects, thicker pavement section will be required the design of which should be performed by the geotechnical consultant, as needed.

The above recommendations typically are not applied to curb and gutter but should be considered in areas with highly expansive soils.

## 3.11 Preliminary Asphalt Concrete Pavement Design

Final structural pavement sections should be based on R-value testing after the completion of grading and in accordance with city of Costa Mesa requirements. Based on an R-value of 5 and estimated traffic indices (TIs), we recommend the following preliminary pavement sections:

| ***Street Location*** | ***Estimated TIs*** | ***Pavement Section*** |
|---|---|---|
| Parking Stalls | TI – 4.0 | 0.25' AC / 0.50' AB |
| General Drives | TI – 5.5 | 0.35' AC / 0.80' AB |
| *AC = Asphalt Concrete, AB = Aggregate Base* | | |

Please note that for two-stage paving operations, we recommend that the final AC cap be a minimum of 0.10 foot thick and the base AC course have a minimum thickness of 0.25 foot.

Asphalt concrete pavement should be placed in accordance with the requirements of Sections 301 and 302 of the Standard Specifications of Public Works Construction (the Greenbook). Prior to construction of pavement sections, the subgrade soils should be scarified to a minimum depth of 6 inches, moisture-conditioned as needed, and recompacted in-place to a minimum of 90 percent relative compaction (per ASTM D1557). Subgrade should be firm prior to AB placement.

AB materials can be crushed aggregate base or crushed miscellaneous base in accordance with the Greenbook (Section 200-2). The materials should be free of any deleterious materials. Aggregate base materials should be placed in 6- to 8-inch-thick loose lifts, moisture-conditioned as necessary, and compacted to a minimum of 95 percent relative compaction (per ASTM D1557). Asphalt concrete should also be compacted to a minimum relative compaction of 95 percent.

Unpaved median and parkway areas should be provided with vertical moisture barriers.

## 3.12 Trench Excavation and Backfill

Excavations should be performed in accordance with the requirements set forth by Cal/OSHA Excavation Safety Regulations (Construction Safety Orders, Section 1504, 1539 through 1547, Title 8, California Code of Regulations). In general, onsite soils may be classified as Type "B" soils for excavations into compacted fill and fine-grained native alluvium and Type "C" for any excavations with groundwater/seepage or friable sand. Cal/OSHA regulations indicate that, for workmen in confined conditions, the steepest allowable slopes in Type "B" and "C" soils are 1:1 and 1.5:1 (horizontal to vertical), respectively, for excavations less than 20 feet deep. Where there is no room for these layback slopes, we anticipate that shoring will be necessary. The subsurface soils may be wet to saturated and prone to caving. Adequate shoring (i.e., shields) should be provided, as deemed necessary. The soils within the adjacent streets are anticipated to be similar to onsite soils. Excavations should be reviewed periodically by the contractor's qualified person to confirm compliance with Cal/OSHA requirements.

As discussed previously, wet, soft, and highly expansive clays that may require stabilization measures prior to placement of the utility lines should be anticipated. Excavation bottoms may be stabilized with a layer of geotextile material (Mirafi HP270 or equivalent) placed at the bottom of the excavation, with 6 to 18 inches of ¾-inch or 1-inch gravel (or crushed aggregate base) over the geotextile. Alternatively, bottoms may be stabilized with one 12 to 18 inches of ¾-inch or 1-inch gravel (or crushed aggregate base).

Native soils should be suitable for use as trench backfill with the exception of wet/saturated materials. Utility trench backfill should be in accordance with City of Costa Mesa and/or the governing jurisdiction's specifications. Native backfill materials should be compacted to a minimum of 90 percent relative compaction (per ASTM D1557). Rocks greater than 3 inches in largest diameter should generally not be used as trench backfill unless approved by the agency and geotechnical consultant of record. Excavation and backfilling of HDPE pipes (if any) should be in accordance with the manufacturer’s requirement and the Greenbook. Select granular backfill (i.e., clean sand with SE 30 or better) may be used in lieu of native soils but should also be compacted or densified with water jetting and flooding.

Trenches excavated next to structures and foundations should also be properly backfilled and compacted to provide full lateral support and reduce settlement potential.

## 3.13 Groundwater

Groundwater was encountered during the GMU exploration at depths ranging from 18.3 to 20.7 feet in Borings DH-1, DH-2, DH-4, DH-5, DH-10, and DH-11. While some saturated soil may be encountered during grading and/or utility trench excavation, we do not anticipate significant

dewatering/mitigation measures will be necessary. In general, groundwater is anticipated to remain more than 5 feet below the building foundations. However, shallow, perched groundwater/seepage may occur on an annual and seasonal basis as a result of rainfall, irrigation and/or seepage from adjacent properties.

## 3.14 Stormwater Infiltration

Based on the preliminary testing by others, onsite stormwater infiltration rates were found to be very low. Additionally, considering the susceptibility to liquefaction, presence of near-surface highly expansive soils, and relatively shallow groundwater, stormwater infiltration at the site is not feasible from a geotechnical viewpoint. Other methods of filtration/treatment should be evaluated by the project civil engineer.

## 3.15 Surface Drainage and Irrigation

Maintaining adequate surface drainage, proper disposal of run-off water, and control of irrigation will help reduce the potential for future moisture-related problems and differential movements from soil heave/settlement. This is especially important considering the highly expansive nature of the onsite soils.

Surface drainage should be carefully taken into consideration during grading, landscaping, and building construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Buildings should have roof gutter systems and the run-off should be directed to parking lot/street gutters by area drainpipes or by sheet flow over paved areas. Paved areas should be provided with adequate drainage devices, gradients, and curbing to prevent run-off flowing from paved areas onto adjacent unpaved areas.

Considering the climatic conditions in southern California and provided that the recommendations included in this report are implemented during grading and construction, a minimum two-percent slope away from structures is considered acceptable and in substantial compliance with the 2022 CBC. Also, swales with one-percent slopes are acceptable from a geotechnical standpoint and are common practice in this locale.

Construction of planter areas immediately adjacent to structures should be avoided if possible. If planter boxes are constructed adjacent to or near buildings, the planters should be provided with controls to prevent excessive penetration of the irrigation water into the foundation and flatwork subgrades. Provisions should be made to drain excess irrigation water from the planters without saturating the subgrade below or adjacent to the planters. Raised planter boxes may be drained with weepholes. Deep planters (such as palm tree planters) should be drained with below-ground, water-tight drainage lines connected to a suitable outlet. Moisture barriers should also be considered.

It is also important to maintain a consistent level of soil moisture, not allowing the subgrade soils to become overly dry or overly wet. Properly designed landscaping and irrigation systems can help in that regard.

## 3.16 Additional Subsurface Exploration and Laboratory Testing

Additional subsurface exploration during the design phase of the project will be required in order to perform updated settlement and liquefaction analyses in accordance with current building code requirements. Additional laboratory testing should be performed during and upon completion of the grading to confirm/update the design parameters provided herein.

## 3.17 Review of Future Plans

The project grading, foundation, street improvement, wall, and landscape plans should be reviewed and accepted by the geotechnical consultant prior to grading and construction. Additional recommendations should be provided upon the review of the project plans and as needed.

## 3.18 Observation and Testing during Grading and Construction

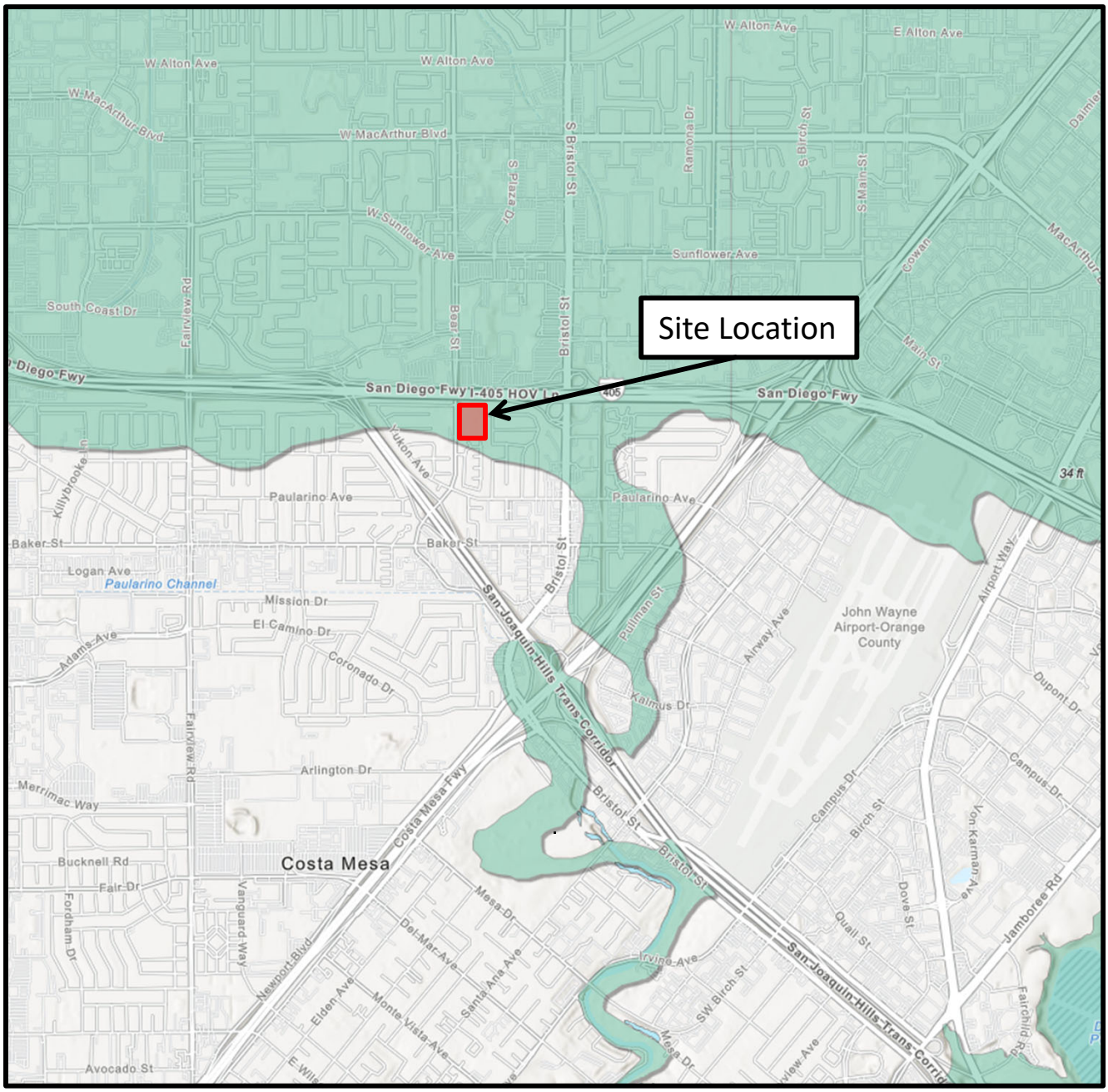
Geotechnical observation and testing should be performed by SA GEO during the following phases of grading and construction:

- During site demolition, preparation and clearing;
- During excavations performed for the remedial grading and to relocate or remove existing underground improvements;
- During earthwork, including observation and acceptance of remedial removal bottoms and fill placement, including import material (if any);
- During subgrade stabilization and soil-cement mixing operation (if needed);
- Following the completion of grading, in order to verify soil properties for foundations, slab-on-grade and pavements;
- Upon completion of any foundation or structural excavation, prior to pouring concrete;
- During slab and flatwork subgrade preparation prior to pouring of concrete;
- During placement of backfill for utility trenches;
- During construction of stormwater filtration devices/basins;
- During placement of backfill for retaining structures (if any);
- During installation and backfill of subdrainage systems (if any); and
- When any unusual soil conditions are encountered.

# 4.0 LIMITATIONS

This report has been prepared for the exclusive use of our client, Meritage Homes, within the scope of services requested for the subject property described herein. This report or its contents should not be used or relied upon for other projects or purposes, or by other parties without the acknowledgement of SA GEO and the consultation of a geotechnical professional. The means and methods used by SA GEO for this study are based on local geotechnical standards of practice, care, and requirements of governing agencies. No warranty or guarantee, expressed or implied, is given.

Our findings, conclusions, and recommendations are professional opinions based on interpretations and inferences made from geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can vary from point to point, can be very different in-between exploration points, and can also change over time. Our conclusions and recommendations are, by nature, preliminary and subject to verification and/or modification during grading and construction when more subsurface data is exposed.




Source: Seismic Hazard Zones Map, Newport Beach Quadrangle (CDMG, 1998)

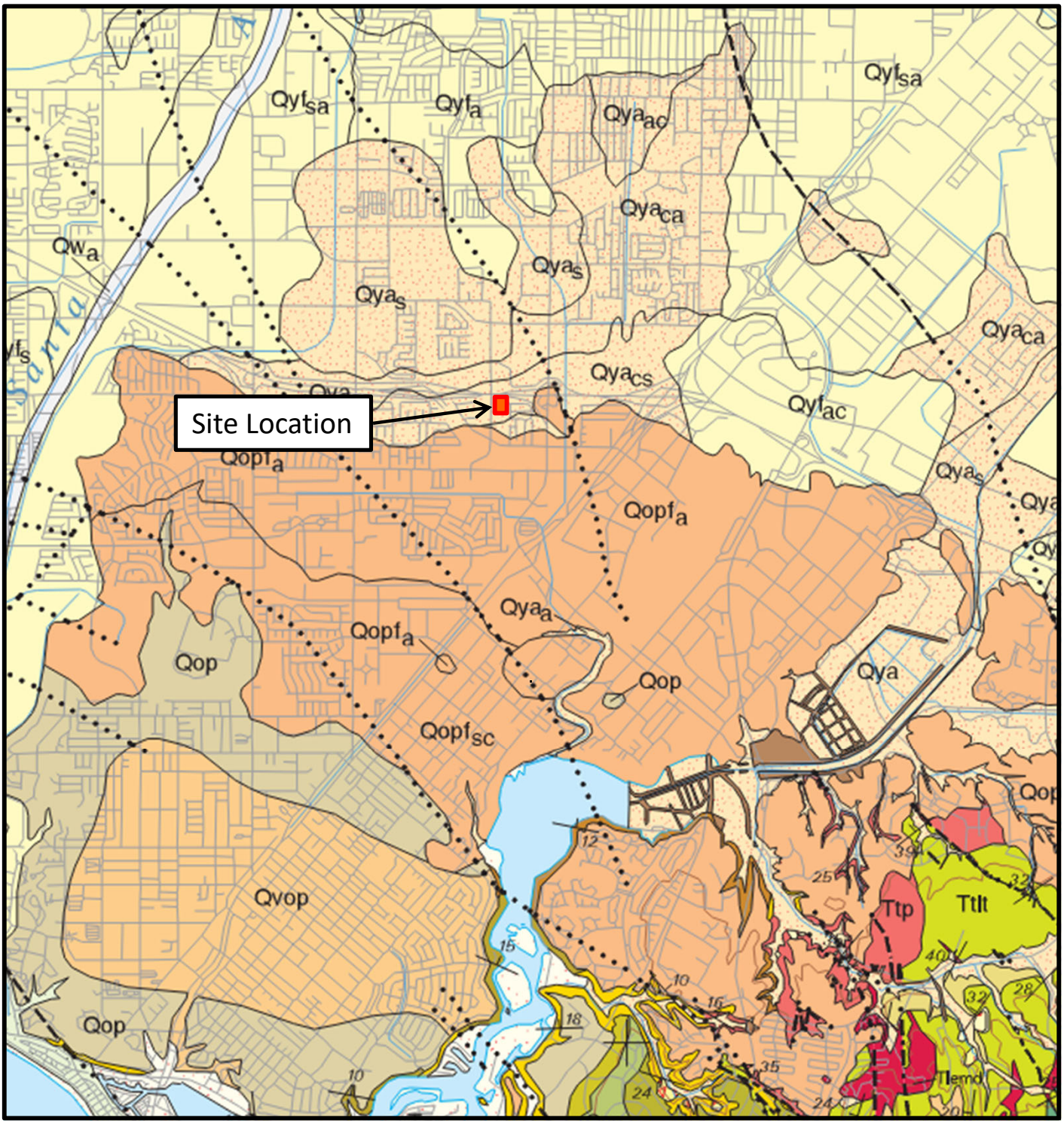
**Liquefaction**
Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resource Code Section 2693(c) would be required.

**Earthquake-Induced Landslides**
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resource Code Section 2693(c) would be required.

## Site Location & Seismic Hazard Map

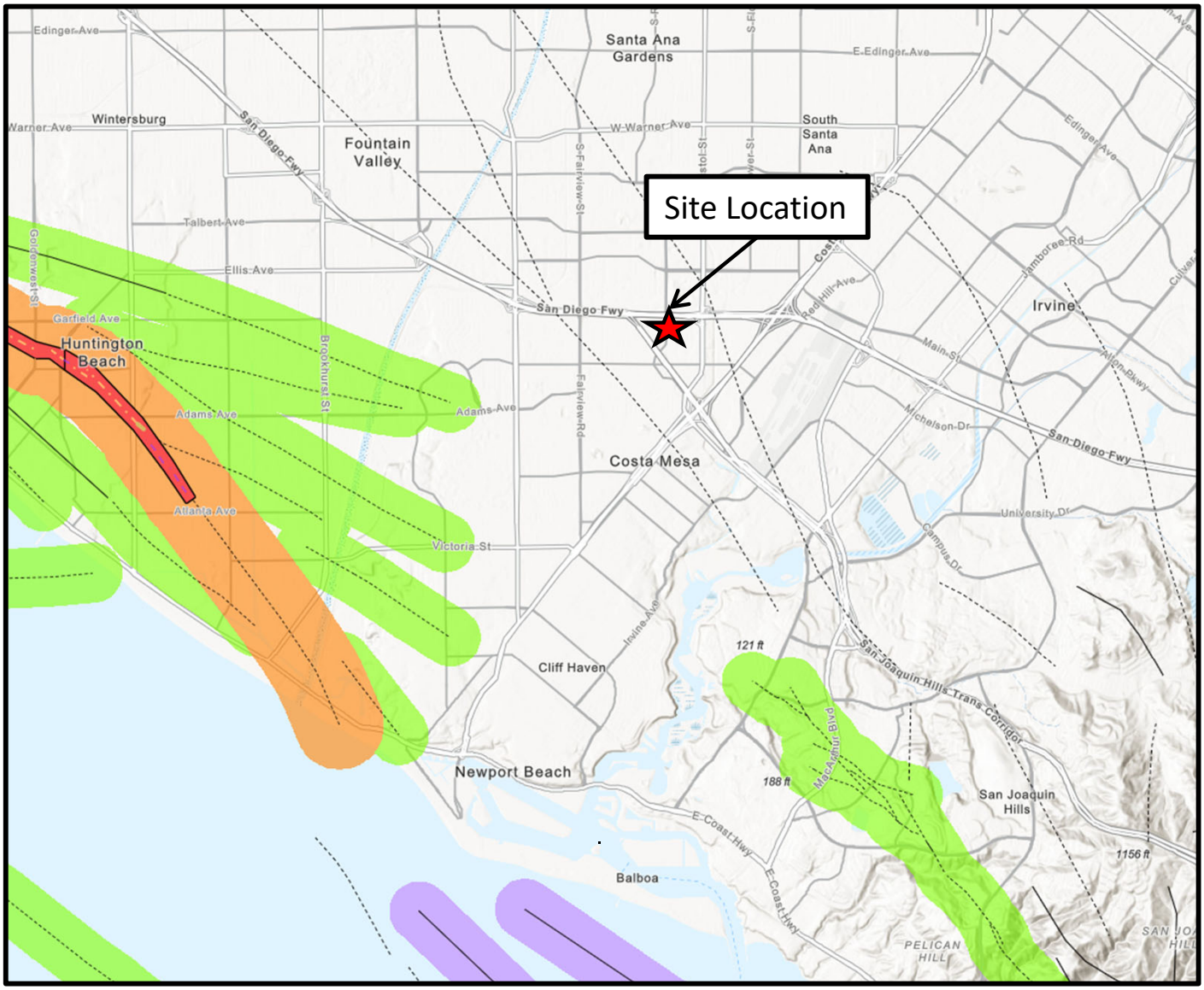
Meritage Homes
Proposed Residential Development
3150 Bear Street
Costa Mesa, California

Project Number: 23150-01
Date: January 2024
Figure 1




Source: Geologic Map of the San Bernadino and Santa Ana 30'x60' Quadrangles (USGS, 2006)

| Regional Geologic Map | | |
|---|---|---|
| Meritage Homes<br>Proposed Residential Development<br>3150 Bear Street<br>Costa Mesa, California | Project Number: 23150-01<br>Date: January 2024<br>Figure 2 | S//A |




Source: Fault Activity Map of California (Jennings and Bryant, 2010)

Holocene fault displacement (during past 11,700 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

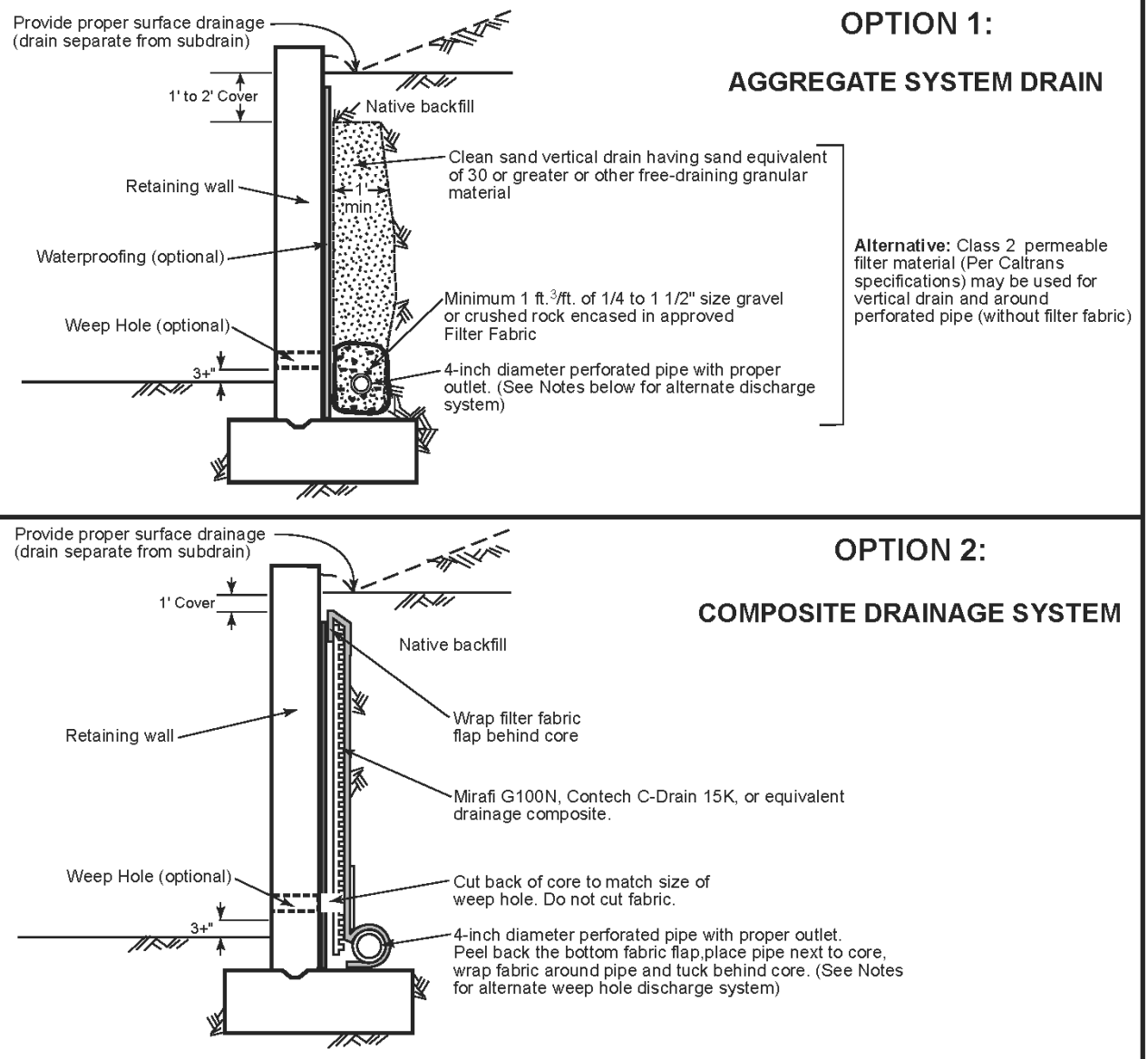
Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Unnumbered Quaternary faults were based on Fault Map of California, 1975. See Bulletin 201, Appendix D for source data.

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissnce nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

## Regional Fault Map

Meritage Homes
Proposed Residential Construction
3150 Bear Street
Costa Mesa, California

Project Number: 23150-01
Date: January 2024
Figure 3




**NOTES:**

1. PIPE TYPE SHOULD BE PVC OR ABS, SCHEDULE 40 OR SDR35 SATISFYING THE REQUIREMENTS OF ASTM TEST STANDARD D1527, D1785, D2751 , OR D3034.
2. FILTER FABRIC SHALL BE APPROVED PERMEABLE NON-WOVEN POLYESTER, NYLON, OR POLYPROPYLENE MATERIAL.
3. DRAIN PIPE SHOULD HAVE A GRADIENT OF 1 PERCENT MINIMUM.
4. WATERPROOFING MEMBRANE MAY BE REQUIRED FOR A SPECIFIC RETAINING WALL (SUCH AS A STUCCO OR BASEMENT WALL).
5. WEEP HOLES MAY BE PROVIDED FOR LOW RETAINING WALLS (LESS THAN 3 FEET IN HEIGHT) IN LIEU OF A VERTICAL DRAIN AND PIPE AND WHERE POTENTIAL WATER FROM BEHIND THE RETAINING WALL WILL NOT CREATE A NUISANCE WATER CONDITION. IF EXPOSURE IS NOT PERMITTED, A PROPER SUBDRAIN OUTLET SYSTEM SHOULD BE PROVIDED.
6. IF EXPOSURE IS PERMITTED, WEEP HOLES SHOULD BE 2-INCH MINIMUM DIAMETER AND PROVIDED AT 25-FOOT MAXIMUM SPACING ALONG WALL. WEEP HOLES SHOULD BE LOCATED 3+ INCHES ABOVE FINISHED GRADE.
7. SCREENING SUCH AS WITH A FILTER FABRIC SHOULD BE PROVIDED FOR WEEP HOLES/OPEN JOINTS TO PREVENT EARTH MATERIALS FROM ENTERING THE HOLES/JOINTS.
8. OPEN VERTICAL MASONRY JOINTS (I.E., OMIT MORTAR FROM JOINTS OF FIRST COURSE ABOVE FINISHED GRADE) AT 32-INCH MAXIMUM INTERVALS MAY BE SUBSTITUTED FOR WEEP HOLES.
9. THE GEOTECHNICAL CONSULTANT MAY PROVIDE ADDITIONAL RECOMMENDATIONS FOR RETAINING WALLS DESIGNED FOR SELECT SAND BACKFILL.

# Retaining Wall Drainage Detail

Figure 4

# Appendix A

# APPENDIX A

# REFERENCES

California Division of Mines and Geology (CDMG), 1997, Seismic Hazard Zone Report for the Anaheim and Newport Beach 7.5-Minute Quadrangles, Orange County, California, Seismic Hazard Zone Report 03.

California Division of Mines and Geology (CDMG), 1998, Seismic Hazard Zones Map, Newport Beach Quadrangle, Official Map dated April 17, 1997, and April 15, 1998.

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Structural Engineers Association/Office of Statewide Health Planning and Development (SEA/OSHPD), 2023, U.S. Seismic Design Maps, web site address: https://seismicmaps.org/; Date Accessed: December 21, 2023.

U.S. Geological Survey, 2006, Geologic Map of the San Bernardino and Santa Ana 30' X 60' Quadrangles, California, dated 2006, Open File Report 2006-1217.

U.S. Geological Survey, 2023, Unified Hazard Tool, NSHM 2014 Dynamic Deaggregation Program; web site address: https://earthquake.usgs.gov/hazards/interactive/; Date Accessed: December 21, 2023.

# Appendix B

| MAJOR DIVISIONS | | | Group Letter | Symbol | TYPICAL NAMES |
|---|---|---|---|---|---|
| **COARSE-GRAINED SOILS** More Than 50% Retained On No.200 Sieve<br><br>Based on The Material Passing The 3-Inch (75mm) Sieve.<br><br>Reference: ASTM Standard D2487 | **GRAVELS** 50% or More of Coarse Fraction Retained on No.4 Sieve | Clean Gravels | GW | | Well Graded Gravels and Gravel-Sand Mixtures, Little or No Fines. |
| | | | GP | | Poorly Graded Gravels and Gravel-Sand Mixtures Little or No Fines. |
| | | Gravels With Fines | GM | | Silty Gravels, Gravel-Sand-Silt Mixtures. |
| | | | GC | | Clayey Gravels, Gravel-Sand-Clay Mixtures. |
| | **SANDS** More Than 50% of Coarse Fraction Passes No.4 Sieve | Clean Sands | SW | | Well Graded Sands and Gravelly Sands, Little or No Fines. |
| | | | SP | | Poorly Graded Sands and Gravelly Sands, Little or No Fines. |
| | | Sands With Fines | SM | | Silty Sands, Sand-Silt Mixtures. |
| | | | SC | | Clayey Sands, Sand-Clay Mixtures. |
| **FINE-GRAINED SOILS** 50% or More Passe The No.200 Sieve<br><br>Based on The Material Passing The 3-Inch (75mm) Sieve.<br><br>Reference: ASTM Standard D2487 | **SILTS AND CLAYS** Liquid Limit Less Than 50% | | ML | | Inorganic Silts, Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts With Slight Plasticity. |
| | | | CL | | Inorganic Clays of Low To Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays. |
| | | | OL | | Organic Silts and Organic Silty Clays of Low Plasticity |
| | **SILTS AND CLAYS** Liquid Limit 50% or Greater | | MH | | Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils, Elastic Silts. |
| | | | CH | | Inorganic Clays of High Plasticity, Fat Clays. |
| | | | OH | | Organic Clays of Medium To High Plasticity, Organic Silts. |
| **HIGHLY ORGANIC SOILS** | | | PT | | Peat and Other Highly Organic Soils. |

The descriptive terminology of the logs is modified from current ASTM Standards to suit the purposes of this study

## ADDITIONAL TESTS

DS = Direct Shear
HY = Hydrometer Test
TC = Triaxial Compression Test
UC = Unconfined Compression
CN = Consolidation Test
(T) = Time Rate
EX = Expansion Test
CP = Compaction Test
PS = Particle Size Distribution
EI = Expansion Index
SE = Sand Equivalent Test
AL = Atterberg Limits
FC = Chemical Tests
RV = Resistance Value
SG = Specific Gravity
SU = Sulfates
CH = Chlorides
MR = Minimum Resistivity
pH
(N) = Natural Undisturbed Sample
(R) = Remolded Sample
CS = Collapse Test/Swell-Settlement

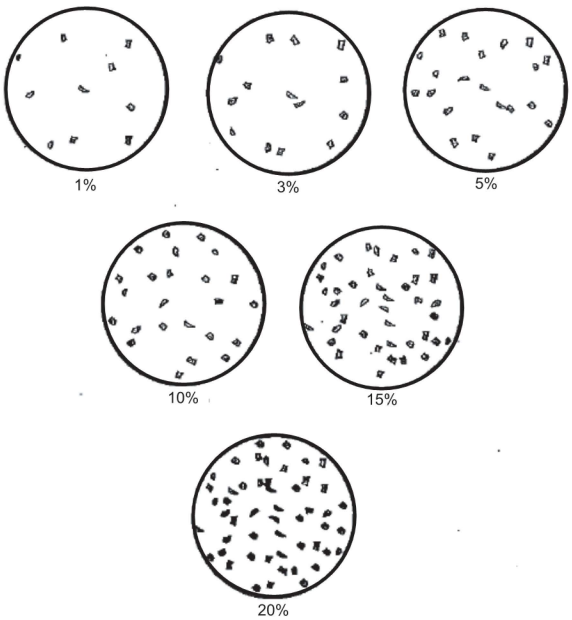
## GEOLOGIC NOMENCLATURE

B = Bedding C = Contact J = Joint
F = Fracture Flt = Fault S = Shear
RS = Rupture Surface = Seepage
= Groundwater

## SAMPLE SYMBOLS

Undisturbed Sample (California Sample)
Undisturbed Sample (Shelby Tube)
Bulk Sample
Unsuccessful Sampling Attempt
SPT Sample

10: 10 Blows for 12-Inches Penetration
6/4: 6 Blows Per 4-Inches Penetration
P: Push
(13): Uncorrected Blow Counts ("N" Values) for 12-Inches Penetration- Standard Penetration Test (SPT)




GMU GEOTECHNICAL, INC.

# LEGEND TO LOGS

ASTM Designation: D 2487
(Based on Unified Soil Classification System)

Plate
**A-1**

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 1

Sheet 1 of 2

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | AAV | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 30.9 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 34.7 |
| Groundwater Depth [Elevation], feet | 20.5 [14.2] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Bentonite Chips and Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | NUMBER OF BLOWS / 6" | DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL**<br>some rootlets | | SILTY CLAY (CL); olive brown with white and olive mottling, moist, firm to stiff, some fine to medium grained sand, some fine gravel | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)** | | FAT CLAY (CH); olive brown with white and olive mottling, moist, firm to stiff, some fine to medium grained sand, some fine gravel | | 4<br>8<br>8 | 140 | 21 | 101 | |
| 30 | 5 | | some caliche | | stiff | | 4<br>5<br>8 | 140 | 38 | 82 | |
| | | | increase in caliche | | | | 7<br>11<br>13 | 140 | 30 | 89 | |
| 25 | 10 | | | | becomes olive with orange root stains, trace fine to medium grained sand | | 8<br>8<br>10 | 140 | 28 | 94 | |
| | | | | | SILTY CLAY (CL); yellowish brown, moist, stiff | | 5<br>5<br>10 | 140 | 16 | 113 | |
| | | | | | POORLY GRADED SAND WITH SILT (SP-SM); yellowish brown with orange staining, moist, medium dense, sand is very fine to fine grained | | | | | | |
| 20 | 15 | | | | sand becomes fien to medium grained with some coarse grained sand, some fine gravel with trace coarse gravel | | 8<br>10<br>13 | 140 | 4 | | |
| | | | some caliche | | SILTY CLAY (CL); olive brown, very moist to wet, stiff, trace gravel | | | | | | |
| 15 | | | | | | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 1



| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | some caliche | | ▽ | | 11<br>16<br>22 | 140 | 20 | 107 | |
| 10 | 25 | | | | | | 6<br>19<br>25 | 140 | | | |
| | | | | | SILTY SAND (SM); yellowish brown, wet, medium dense to dense, sand is fine to medium grained with coarse grained, some fine gravel | | | | | | |
| 5 | 30 | | | | POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); yellowish brown, wet, very dense, sand is medium to coarse grained, gravel is fine to coarse | | 26<br>50/5" | 140 | 8 | 136 | |
| | | | | | Total Depth = 30.92 ft<br>Groundwater encountered at 20.5 ft below ground surface | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 2

Sheet 1 of 2

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | AAV | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 31.5 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 35.3 |
| Groundwater Depth [Elevation], feet | 18.3 [16.9] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Bentonite Chips and Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | NUMBER OF BLOWS / 6" | DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | | | **TOPSOIL**<br>some rootlets | | LEAN CLAY (CL); brown to dark brown with some orange mottling, moist to very moist, stiff | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)**<br>some rootlets, some caliche | | FAT CLAY (CH); brown to dark brown with some orange mottling, moist to very moist, stiff | | 5<br>7<br>12 | 140 | 23 | 99 | |
| 30 | 5 | | | | brown, moist, stiff, some fine grained sand | | 5<br>6<br>9 | 140 | 28 | 92 | |
| | | | | | becomes brown with orange and black mottling | | 8<br>11<br>14 | 140 | 15 | 117 | |
| 25 | 10 | | | | becomes light brown with some very fine grained sand pockets | | 6<br>7<br>12 | 140 | 21 | 106 | |
| | | | some caliche | | SANDY SILT (ML); light brown with orange staining, damp to moist, stiff, sand is very fine grained, few fine gravel | | 8<br>11 | 140 | 17 | 115 | |
| | | | | | CLAYEY SILT (ML); light brown, moist, stiff, some very fine grained sand pockets | | 13 | | | | |
| 20 | 15 | | | | SANDY CLAY (CL); light brown with orange mottling and white veins, moist, stiff | | 9<br>10<br>12 | 140 | 26 | 100 | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 2



| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | | | | | no white veins, becomes very moist, some fine grained sand | | 3<br>4<br>7 | 140 | | | |
| | 25 | | | | | | | | | | |
| 10 | | | | | SILTY SAND (SM); light yellowish brown, wet, dense, sand is very fine to fine grained with trace coarse sand | | 13<br>16<br>29 | 140 | 17 | 114 | |
| | | | | | POORLY GRADED SAND (SP) with GRAVEL; light brown, wet, medium dense to dense, sand is fine to medium grained with some coarse grained sand, some fine to coarse gravel | | 12<br>14<br>19 | 140 | | | |
| 5 | 30 | | | | Total Depth = 31.5 ft<br>Groundwater encountered at 18.33 ft below ground surface | | | | | | |



GMU GEOTECHNICAL, INC.

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 3

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | AAV | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 5.0 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 34.7 |
| Groundwater Depth [Elevation], feet | N/A [] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Native |
| Remarks | Infiltration test location | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL**<br>some rootlets, some caliche | | SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)** | | SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand | | 6<br>6<br>13 | 140 | 19 | 108 | |
| 30 | 5 | | | | Total Depth = 5 ft<br>No groundwater encountered<br>Performed infiltration testing at this location | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

Drill Hole DH- 3

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 4

Sheet 1 of 2

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/4/19 | Logged By | MTF | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 31.5 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 34.7 |
| Groundwater Depth [Elevation], feet | 20.0 [14.7] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Bentonite Chips and Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | NUMBER OF BLOWS / 6" | DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL**<br>some rootlets | | SILTY CLAY (CL); brown, very moist, firm to stiff, with trace fine to medium grained sand | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS** | | FAT CLAY (CH); brown, very moist, firm to stiff, with trace fine to medium grained sand | | | | | | |
| | | | | | brown, gray, and dark gray, very moist, stiff | | 4<br>6<br>9 | 140 | 24 | 99 | |
| 30 | 5 | | | | | | 7<br>8<br>13 | 140 | 28 | 86 | |
| | | | some caliche | | becomes light gray | | 7<br>9<br>11 | 140 | 32 | 84 | |
| 25 | 10 | | numerous caliche | | SILTY CLAY (CL); light brown, very moist, stiff | | 8<br>10<br>11 | 140 | 17 | 113 | |
| | | | | | LEAN CLAY (CL); light gray and white, very moist, very stiff | | 8<br>10<br>18 | 140 | 17 | 108 | |
| 20 | 15 | | numerous concretions | | SITLY CLAY (CL); light brown, very moist, stiff | | 4<br>6<br>8 | 140 | | | |
| 15 | | | | | ▽ | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

**Drill Hole DH- 4**

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 4



| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 11<br>14<br>17 | 140 | 16 | 112 | |
| 10 | 25 | | | | CLAYEY SAND (SC); brown and light brown, very moist to saturated, dense, sand is fine to medium grained | | 6<br>12<br>22 | 140 | | | |
| 5 | 30 | | | | POORLY GRADED SAND (SP); light brown, saturated, dense to very dense, sand is medium grained | | 8<br>22<br>38 | 140 | 16 | 118 | |
| | | | | | Total Depth = 31.0 ft<br>Groundwater Encountered at 20.0 ft below ground surface | | | | | | |



GMU GEOTECHNICAL, INC.

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 5



| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/4/19 | Logged By | MTF | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 31.5 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 34.7 |
| Groundwater Depth [Elevation], feet | 20.7 [14.0] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Bentonite Chips and Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | NUMBER OF BLOWS / 6" | DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL**<br>some rootlets | | SILTY CLAY (CL); brown, very moist, firm to stiff, with some fine to medium grained sand | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS** | | SILTY CLAY (CL); brown, very moist, firm to stiff, with some fine to medium grained sand | | | | | | |
| 30 | 5 | | | | CLAYEY SAND (SC); orangeish brown, moist to very moist, medium dense, fine to medium grained sand with trace coarse grained sand | | 9<br>10<br>13 | 140 | 10 | 105 | |
| | | | | | SILTY CLAY (CL); light brown, damp to moist, very stiff, with some fine grained sand | | 15<br>15<br>29 | 140 | 6 | 120 | |
| 25 | 10 | | | | | | 10<br>14<br>24 | 140 | 11 | 124 | |
| | | | | | CLAYEY SAND (SC); light brown, moist to very moist, medium dense, medium grained sand | | 12<br>11<br>13 | 140 | 8 | 114 | |
| | | | | | SILTY SAND (SM); light gray, very moist, very stiff, with some fine grained sand | | 9<br>12<br>16 | 140 | 5 | 107 | |
| 20 | 15 | | numerous caliche | | SILTY CLAY (CL); light gray, very moist to saturated, stiff | | 5<br>7<br>12 | 140 | 20 | 104 | |
| 15 | | | | | | | | | | | |

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GMU GEOTECHNICAL, INC.

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 5



| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 7<br>10<br>13 | 140 | 26 | 95 | |
| 10 | 25 | | | | becomes saturated | | 8<br>10<br>10 | 140 | | | |
| 5 | 30 | | | | POORLY GRADED SAND WITH SILT (SP-SM); white, gray, and black, saturated, medium dense, medium grained sand | | 4<br>7<br>13 | 140 | | | |
| | | | | | Total Depth = 31.5 ft<br>Groundwater encountered at 20.7 ft below ground surface | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 6

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | MTF | Checked By | NS |
| Drilling Method | Hand Auger | Drilling Contractor | Earthworks Techniques, Inc. | Total Depth of Drill Hole | 5.8 feet |
| Drill Rig Type | N/A | Diameter(s) of Hole, inches | 3 | Approx. Surface Elevation, ft MSL | 36.0 |
| Groundwater Depth [Elevation], feet | N/A [] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL** | | CLAYEY SAND (SC); brown, moist, medium dense, sand is fine to medium grained | | | | | | |
| 35 | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)** | | SANDY CLAY (CL); brown, moist, stiff, sand is fine to medium grained | | | | | | |
| | | | | | becomes orangish brown, moist to wet | | | | 15 | 107 | |
| | | | | | becomes very moist, sand is fine to coarse grained | | | | | | |
| | 5 | | | | FAT CLAY (CH); dark grayish brown, very moist, stiff to very stiff | | | | 30 | 77 | |
| | | | | | Total Depth = 5.83 ft<br>No groundwater encountered | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

**Drill Hole DH- 6**

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 7

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | AAV | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 5.0 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 33.5 |
| Groundwater Depth [Elevation], feet | N/A [] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Native |
| Remarks | Infiltration test location | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL**<br>some rootlets | | SILTY CLAY (CL); brown to dark gray with white and orange mottling, moist, stiff | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)** | | FAT CLAY (CH); brown to dark gray with white and orange mottling, moist, stiff | | | | | | |
| 30 | | | | | | | 4<br>7<br>11 | 140 | 39 | 82 | |
| | 5 | | | | Total Depth = 5 ft<br>No groundwater encountered<br>Performed infiltration testing at this location | | | | | | |

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GMU GEOTECHNICAL, INC.

Drill Hole DH- 7

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 8

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | MTF | Checked By | NS |
| Drilling Method | Hand Auger | Drilling Contractor | Earthworks Techniques, Inc. | Total Depth of Drill Hole | 5.7 feet |
| Drill Rig Type | N/A | Diameter(s) of Hole, inches | 3 | Approx. Surface Elevation, ft MSL | 35.4 |
| Groundwater Depth [Elevation], feet | N/A [] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | | | **TOPSOIL** | | CLAYEY SAND (SC); brown, damp to moist, medium dense, sand is fine to medium grained | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)**<br>some rootlets | | SANDY CLAY (CL); brown to light brown, very moist, sand is fine grained, highly plastic | | | | 23 | 94 | |
| | | | | | becomes light yellowish brown, with siltstone fragments | | | | | | |
| | | | | | FAT CLAY (CH); dark grayish black, moist, stiff to very stiff | | | | | | |
| 30 | 5 | | | | | | | | 15 | 90 | |
| | | | | | Total Depth = 5.67 ft<br>No groundwater encountered | | | | | | |

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GMU GEOTECHNICAL, INC.

**Drill Hole DH- 8**

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH- 9

Sheet 1 of 1

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | AAV | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 5.0 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 34.0 |
| Groundwater Depth [Elevation], feet | N/A [] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Native |
| Remarks | Infiltration test location | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL**<br>some rootlets, some caliche | | SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)** | | SILTY CLAY (CL); dark brown with some orange mottling, moist, stiff, trace fine to medium grained sand | X | | | | | |
| 30 | | | | | | | | | | | |
| | 5 | | | | Total Depth = 5 ft<br>No groundwater encountered<br>Performed infiltration testing at this location | | | | | | |

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GMU GEOTECHNICAL, INC.

Drill Hole DH- 9

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH-10

Sheet 1 of 2

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | AAV | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 31.5 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 34.6 |
| Groundwater Depth [Elevation], feet | 18.5 [16.1] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Bentonite Chips and Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | NUMBER OF BLOWS / 6" | DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | DRY UNIT WEIGHT, pcf | ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **PORTLAND CEMENT CONCRETE (PCC)** | | PORTLAND CEMENT CONCRETE (PCC) = 6-inches | | | | | | |
| | | | **AGGREGATE BASE (AB)** | | AGGREGATE BASE (AB); 3/4-inch crushed aggregate, dry to damp, very dense, subangular to angular, significant fines | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)** | | SILTY CLAY (CL); brown to dark brown, damp to moist, stiff, some fine to coarse grained sand, some fine to coarse gravel becomes dark gray | | 14<br>8<br>10 | 140 | 11 | 98 | |
| 30 | | | | | becomes brown | | | | | | |
| | 5 | | | | | | 7<br>7<br>17 | 140 | 21 | 104 | |
| | | | | | becomes light gray, dry to damp, no sand or gravel | | | | | | |
| | | | | | becomes gray with orange staining, some fine to medium grained sand | | 10<br>10<br>13 | 140 | 10 | 122 | |
| 25 | | | | | | | | | | | |
| | 10 | | | | becomes brown with orange staining, few fine gravel | | 10<br>13<br>20 | 140 | 10 | 124 | |
| | | | | | CLAYEY SAND (SC); orangish brown, damp, dense, sand is fine to medium grained with coarse grained sand, some fine to coarse gravel | | 12<br>15<br>21 | 140 | 4 | 119 | |
| 20 | | | | | | | | | | | |
| | 15 | | | | SANDY CLAY (CL) with GRAVEL; yellowish brown, moist, dense to very dense, sand is fine to coarse grained, gravel is fine to coarse | | 13<br>22<br>29 | 140 | 11 | 122 | |
| | | | | | ▽ | | | | | | |
| 15 | | | | | | | | | | | |

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GMU GEOTECHNICAL, INC.

**Drill Hole DH-10**

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH-10



| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 25 | | | | CLAYEY SAND (SC); yellowish brown, wet, dense, sand is fine to coarse grained, some fine gravel | | 14<br>23<br>23 | 140 | | | |
| | | | | | GRAVELLY SAND (SG) with CLAY; yellowish brown, wet, very dense, sand is medium to coarse grained, gravel is fine to coarse | | 32<br>50/5" | 140 | 11 | 130 | |
| 5 | 30 | | | | POORLY GRADED SAND (SP) with SILT; grayish brown, wet, medium dense, sand is very fine to fine grained | | 7<br>12<br>10 | 140 | | | |
| | | | | | Total Depth = 31.5 ft<br>Groundwater encountered at 18.5 ft below ground surface | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

| Project: EF International Language Campus<br>Project Location: 3150 Bear Street, Costa Mesa<br>Project Number: 18-252-00 | **Log of Drill Hole DH-11**<br>Sheet 1 of 2 |
|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Date(s) Drilled | 1/2/19 | Logged By | AAV | Checked By | NS |
| Drilling Method | Hollow Stem Auger | Drilling Contractor | 2R Drilling, Inc. | Total Depth of Drill Hole | 31.5 feet |
| Drill Rig Type | CME 75 | Diameter(s) of Hole, inches | 8 | Approx. Surface Elevation, ft MSL | 33.7 |
| Groundwater Depth [Elevation], feet | 18.9 [14.8] | Sampling Method(s) | Open drive sampler with 6-inch sleeve, SPT, and bulk samples | Drill Hole Backfill | Bentonite Chips and Native |
| Remarks | | | | Driving Method and Drop | 140lb hammer, 30" drop |

| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **TOPSOIL**<br>some rootlets | | SILTY CLAY (CL); dark brown, damp, firm to stiff, some fine to medium grained sand | | | | | | |
| | | | **YOUNG AXIAL CHANNEL DEPOSITS (Qya)** | | SILTY CLAY (CL); dark brown, damp, firm to stiff, some fine to medium grained sand | | 4<br>5<br>7 | 140 | 14 | 118 | |
| 30 | | | | | SANDY CLAY (CL); reddish brown, damp, firm, sand is very fine to fine grained | | | | | | |
| | 5 | | | | SILTY CLAY (CL); reddish brown, moist, firm, some very fine to fine grained sand | | 3<br>5<br>6 | 140 | | | |
| 25 | | | | | SANDY CLAY (CL); yellowish brown, moist to very moist, stiff, sand is very fine to fine grained | | 6<br>12<br>12 | 140 | 14 | 114 | |
| | 10 | | | | | | 6<br>9<br>11 | 140 | | | |
| 20 | | | | | CLAYEY SAND (SM); light yellowish brown, damp, medium dense, sand is very fine to fine grained | | 9<br>12<br>15 | 140 | 8 | 110 | |
| | 15 | | | | CLAYEY SILT (ML); light olive brown, moist to very moist, firm | | 4<br>5<br>7 | 140 | | | |
| 15 | | | | | SILTY SAND (SM); light yellowish brown, wet, medium dense, sand is very fine to fine grained ▽ | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

GMU GEOTECHNICAL, INC.

**Drill Hole DH-11**

**Project:** EF International Language Campus
**Project Location:** 3150 Bear Street, Costa Mesa
**Project Number:** 18-252-00

# Log of Drill Hole DH-11



| ELEVATION, feet | DEPTH, feet | GRAPHIC LOG | GEOLOGICAL CLASSIFICATION AND DESCRIPTION | ORIENTATION DATA | ENGINEERING CLASSIFICATION AND DESCRIPTION | SAMPLE DATA: SAMPLE | SAMPLE DATA: NUMBER OF BLOWS / 6" | SAMPLE DATA: DRIVING WEIGHT, lbs | TEST DATA: MOISTURE CONTENT, % | TEST DATA: DRY UNIT WEIGHT, pcf | TEST DATA: ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 7<br>9<br>14 | 140 | 21 | 110 | |
| | | | | | SILTY CLAY (CL); ligth yellowish brown with orange staining, wet, stiff, trace fine gravel | | | | | | |
| 10 | | | | | | | | | | | |
| | 25 | | | | becomes very moist | | 5<br>12<br>15 | 140 | | | |
| 5 | | | | | | | | | | | |
| | | | | | POORLY GRADED SAND (SP); light yellowish brown, wet, dense, sand is fine grained with medium grained sand | | | | | | |
| | 30 | | | | | | 7<br>14<br>26 | 140 | 22 | 102 | |
| | | | | | Total Depth = 31.5 ft<br>Groundwater encountered at 18.92 ft below ground surface | | | | | | |

DH_REV3 18-252-00.GPJ GMULAB.GPJ 1/30/19

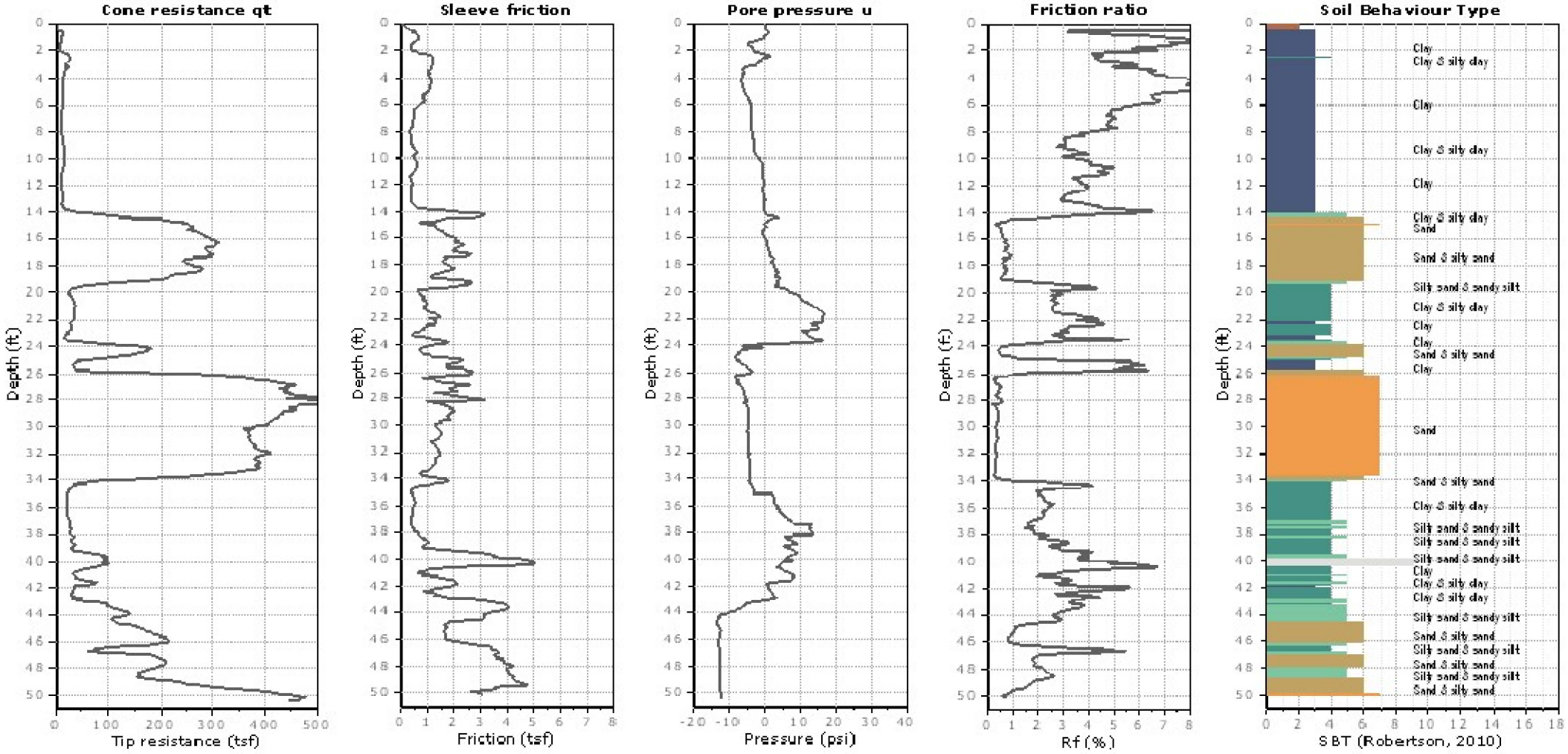
GMU GEOTECHNICAL, INC.

**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**CPT-1**

**Project:** **GMU Geotechnical / EF International**
**Location:** **3150 Bear St, Costa Mesa, CA**

Total depth: 50.46 ft, Date: 1/2/2019
Cone Type: Vertek

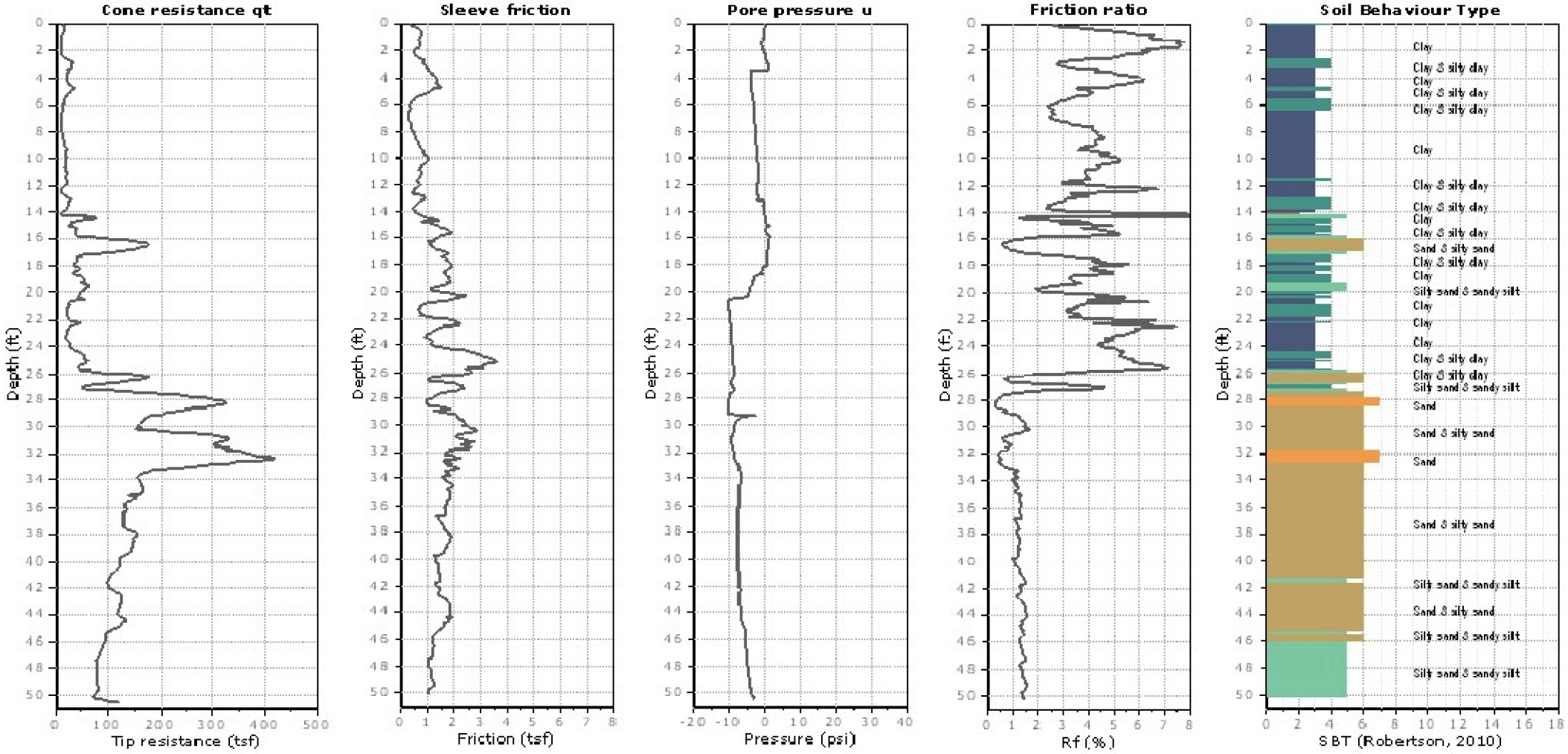


**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**CPT-2A**

**Project:** **GMU Geotechnical / EF International**
**Location:** **3150 Bear St, Costa Mesa, CA**

Total depth: 50.54 ft, Date: 1/2/2019
Cone Type: Vertek

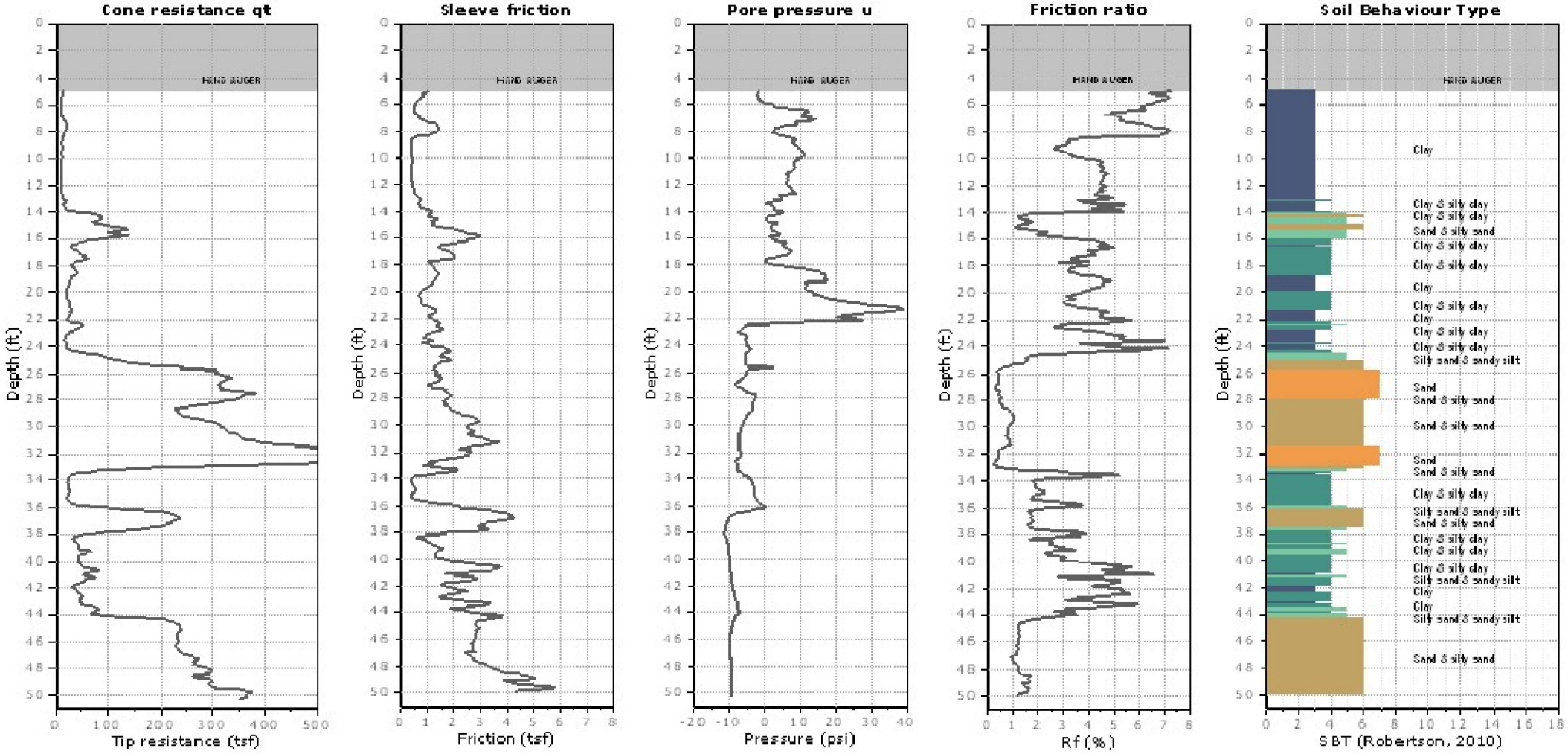


**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**CPT-3A**

**Project:** **GMU Geotechnical / EF International**
**Location:** **3150 Bear St, Costa Mesa, CA**

Total depth: 50.34 ft, Date: 1/2/2019
Cone Type: Vertek

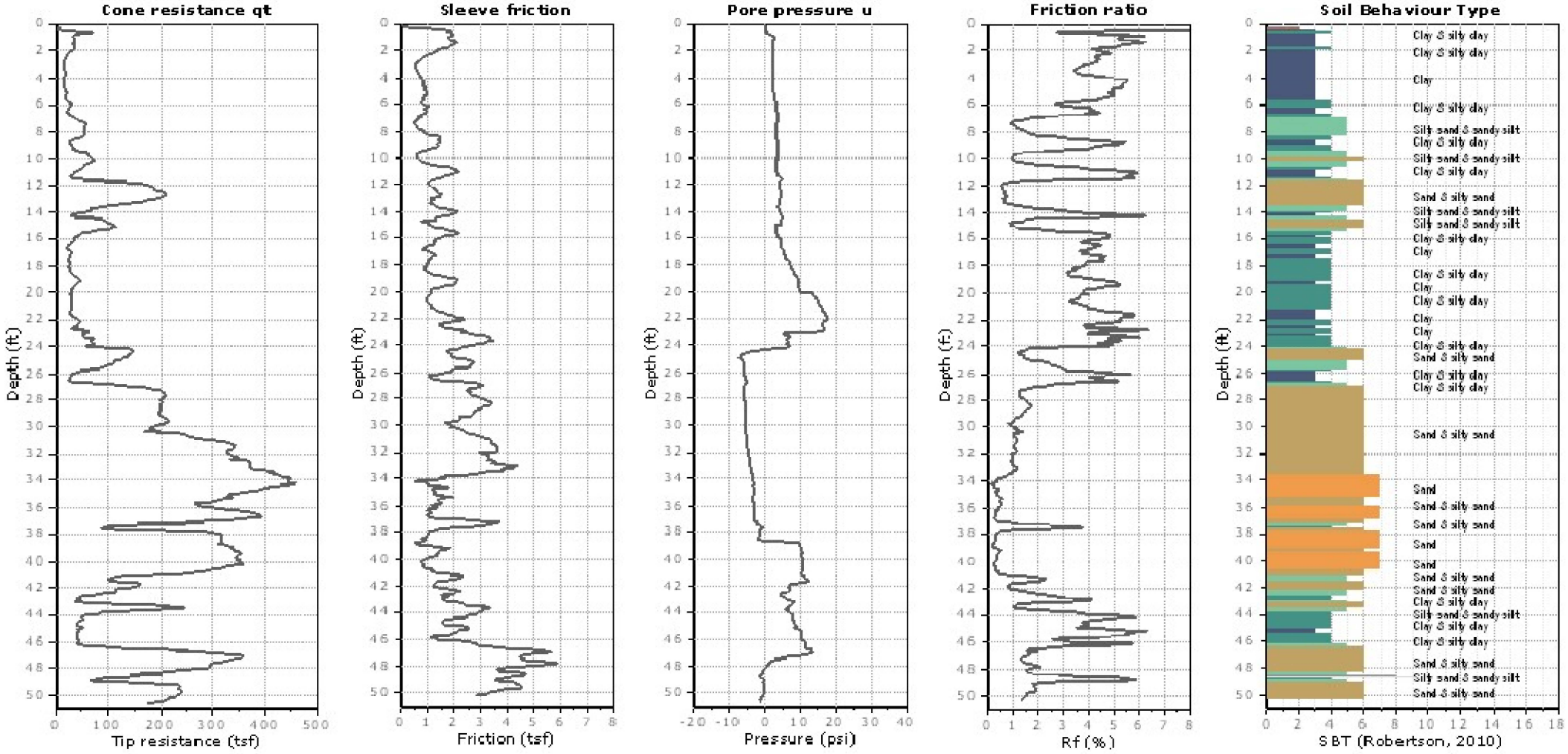


**Kehoe Testing and Engineering**
714-901-7270
steve@kehoetesting.com
www.kehoetesting.com

**CPT-4**

**Project:** **GMU Geotechnical / EF International**
**Location:** **3150 Bear St, Costa Mesa, CA**

Total depth: 50.61 ft, Date: 1/2/2019
Cone Type: Vertek



# Appendix C

# TABLE B-1
# SUMMARY OF SOIL LABORATORY DATA

| Sample Information | | | | | | | | Sieve/Hydrometer | | | | Atterberg Limits | | | Compaction | | | | Chemical Test Results | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boring Number | Depth, feet | Elevation, feet | Geologic Unit | USCS Group Symbol | In Situ Water Content, % | In Situ Dry Unit Weight, pcf | In Situ Saturation, % | Gravel, % | Sand, % | <#200, % | <2μ, % | LL | PL | PI | Maximum Dry Unit Weight, pcf | Optimum Water Content, % | Expansion Index | R-Value | pH | Sulfate (ppm) | Chloride (ppm) | Min. Resistivity (ohm/cm) |
| DH- 1 | 0 | 34.7 | Qya | CL | | | | | | | | | | | | | 121 | | 7.8 | 68 | 696 | 692 |
| DH- 1 | 2.5 | 32.2 | Qya | CH | 21.3 | 101 | 89 | | | | | | | | | | | | | | | |
| DH- 1 | 5 | 29.7 | Qya | CH | 38.1 | 82 | 99 | | | | | | | | | | | | | | | |
| DH- 1 | 7.5 | 27.2 | Qya | CH | 30.3 | 89 | 93 | | | | | | | | | | | | | | | |
| DH- 1 | 10 | 24.7 | Qya | CH | 28.3 | 94 | 100 | | | | | | | | | | | | | | | |
| DH- 1 | 12.5 | 22.2 | Qya | CL | 15.6 | 113 | 89 | | | | | | | | | | | | | | | |
| DH- 1 | 15 | 19.7 | Qya | SP-SM | 4.0 | | | 11 | 78 | 11 | 5 | NP | NP | NP | | | | | | | | |
| DH- 1 | 20 | 14.7 | Qya | CL | 20.5 | 107 | 99 | | | | | | | | | | | | | | | |
| DH- 1 | 30 | 4.7 | Qya | SP-SM | 8.1 | 136 | 97 | | | | | | | | | | | | | | | |
| DH- 2 | 0 | 35.3 | Qal/Qt | CL | | | | | | | | | | | 113.5 | 15.5 | | | | | | |
| DH- 2 | 2.5 | 32.8 | Qya | CH | 23.2 | 99 | 93 | | | | | | | | | | | | | | | |
| DH- 2 | 5 | 30.3 | Qya | CH | 28.0 | 92 | 93 | | | | | 61 | 21 | 40 | | | | | | | | |
| DH- 2 | 7.5 | 27.8 | Qya | CH | 15.2 | 117 | 96 | | | | | | | | | | | | | | | |
| DH- 2 | 10 | 25.3 | Qya | CH | 20.6 | 106 | 99 | | | | | | | | | | | | | | | |
| DH- 2 | 12.5 | 22.8 | Qya | ML | 16.5 | 115 | 100 | | | | | | | | | | | | | | | |
| DH- 2 | 15 | 20.3 | Qya | CL | 26.3 | 100 | 106 | | | | | | | | | | | | | | | |
| DH- 2 | 25 | 10.3 | Qya | SM | 17.4 | 114 | 101 | | | | | | | | | | | | | | | |
| DH- 3 | 2.5 | 32.2 | Qya | CL | 19.4 | 108 | 97 | | | | | | | | | | | | | | | |
| DH- 4 | 0 | 34.7 | Qya | CL | | | | | | | | | | | | | 129 | | 7.4 | 2943 | 936 | 515 |
| DH- 4 | 2.5 | 32.2 | Qya | CH | 24.3 | 99 | 96 | | | | | | | | | | | | | | | |
| DH- 4 | 5 | 29.7 | Qya | CH | 28.4 | 86 | 81 | 0 | 3 | 97 | 69 | 97 | 31 | 66 | | | | | | | | |
| DH- 4 | 7.5 | 27.2 | Qya | CH | 32.1 | 84 | 88 | | | | | | | | | | | | | | | |
| DH- 4 | 10 | 24.7 | Qya | CL | 17.0 | 113 | 97 | | | | | | | | | | | | | | | |
| DH- 4 | 12.5 | 22.2 | Qya | CL | 17.0 | 108 | 86 | | | | | | | | | | | | | | | |
| DH- 4 | 20 | 14.7 | Qya | CL | 16.2 | 112 | 91 | | | | | | | | | | | | | | | |



Project: EF International Language Campus
Project No. 18-252-00

# TABLE B-1
# SUMMARY OF SOIL LABORATORY DATA

| Sample Information | | | | | | | | Sieve/Hydrometer | | | | Atterberg Limits | | | Compaction | | | | Chemical Test Results | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boring Number | Depth, feet | Elevation, feet | Geologic Unit | USCS Group Symbol | In Situ Water Content, % | In Situ Dry Unit Weight, pcf | In Situ Saturation, % | Gravel, % | Sand, % | <#200, % | <2μ, % | LL | PL | PI | Maximum Dry Unit Weight, pcf | Optimum Water Content, % | Expansion Index | R-Value | pH | Sulfate (ppm) | Chloride (ppm) | Min. Resistivity (ohm/cm) |
| DH- 4 | 30 | 4.7 | Qya | SP | 15.6 | 118 | 102 | | | | | | | | | | | | | | | |
| DH- 5 | 0 | 34.7 | Qya | CL | | | | | | | | | | | 114.0 | 14.0 | 120 | | 8.5 | 443 | 696 | 692 |
| DH- 5 | 2.5 | 32.2 | Qya | CL | 9.9 | 105 | 45 | | | | | | | | | | | | | | | |
| DH- 5 | 5 | 29.7 | Qya | CL | 5.9 | 120 | 41 | | | | | | | | | | | | | | | |
| DH- 5 | 7.5 | 27.2 | Qya | CL | 11.1 | 124 | 87 | | | | | | | | | | | | | | | |
| DH- 5 | 10 | 24.7 | Qya | SC | 7.6 | 114 | 45 | | | | | | | | | | | | | | | |
| DH- 5 | 12.5 | 22.2 | Qya | SM | 5.4 | 107 | 26 | | | | | | | | | | | | | | | |
| DH- 5 | 15 | 19.7 | Qya | CL | 20.4 | 104 | 93 | | | | | | | | | | | | | | | |
| DH- 5 | 20 | 14.7 | Qya | CL | 26.2 | 95 | 94 | | | | | | | | | | | | | | | |
| DH- 5 | 30 | 4.7 | Qya | SP-SM | | | | 0 | 90 | 10 | 5 | | | | | | | | | | | |
| DH- 6 | 2.5 | 33.5 | Qya | CL | 15.0 | 107 | 72 | | | | | | | | | | | | | | | |
| DH- 6 | 5 | 31.0 | Qya | CH | 29.5 | 77 | 68 | | | | | | | | | | | | | | | |
| DH- 7 | 2.5 | 31.0 | Qya | CH | 38.8 | 82 | 101 | | | | | | | | | | | | | | | |
| DH- 8 | 2.5 | 32.9 | Qya | CL | 22.5 | 94 | 78 | | | | | | | | | | | | | | | |
| DH- 8 | 5 | 30.4 | Qya | CH | 15.5 | 90 | 49 | | | | | | | | | | | | | | | |
| DH- 9 | 0 | 34.0 | Qya | CL | | | | | | | | | | | | | | 8 | | | | |
| DH-10 | 0 | 34.6 | Qya | CL | | | | | | | | | | | 124.0 | 11.5 | | | | | | |
| DH-10 | 2.5 | 32.1 | Qya | CL | 10.7 | 98 | 41 | | | | | | | | | | | | | | | |
| DH-10 | 5 | 29.6 | Qya | CL | 21.2 | 104 | 94 | | | | | | | | | | | | | | | |
| DH-10 | 7.5 | 27.1 | Qya | CL | 10.4 | 122 | 77 | | | | | | | | | | | | | | | |
| DH-10 | 10 | 24.6 | Qya | CL | 10.2 | 124 | 80 | | | | | | | | | | | | | | | |
| DH-10 | 12.5 | 22.1 | Qya | SC | 4.1 | 119 | 28 | | | | | | | | | | | | | | | |
| DH-10 | 15 | 19.6 | Qya | CL | 10.9 | 122 | 81 | | | | | | | | | | | | | | | |
| DH-10 | 25 | 9.6 | Qya | SG | 10.5 | 130 | 103 | | | | | | | | | | | | | | | |
| DH-11 | 2.5 | 31.2 | Qya | CL | 14.2 | 118 | 93 | | | | | | | | | | | | | | | |



Project: EF International Language Campus
Project No. 18-252-00

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# TABLE B-1
# SUMMARY OF SOIL LABORATORY DATA

| Sample Information | | | Geologic Unit | USCS Group Symbol | In Situ Water Content, % | In Situ Dry Unit Weight, pcf | In Situ Saturation, % | Sieve/Hydrometer | | | | Atterberg Limits | | | Compaction | | Expansion Index | R-Value | Chemical Test Results | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boring Number | Depth, feet | Elevation, feet | | | | | | Gravel, % | Sand, % | <#200, % | <2μ, % | LL | PL | PI | Maximum Dry Unit Weight, pcf | Optimum Water Content, % | | | pH | Sulfate (ppm) | Chloride (ppm) | Min. Resistivity (ohm/cm) |
| DH-11 | 7.5 | 26.2 | Qya | CL | 14.0 | 114 | 83 | | | | | | | | | | | | | | | |
| DH-11 | 12.5 | 21.2 | Qya | SC | 8.5 | 110 | 44 | | | | | | | | | | | | | | | |
| DH-11 | 20 | 13.7 | Qya | SM | 20.9 | 110 | 109 | | | | | | | | | | | | | | | |
| DH-11 | 30 | 3.7 | Qya | SP | 22.2 | 102 | 95 | | | | | | | | | | | | | | | |

Project: EF International Language Campus
Project No. 18-252-00

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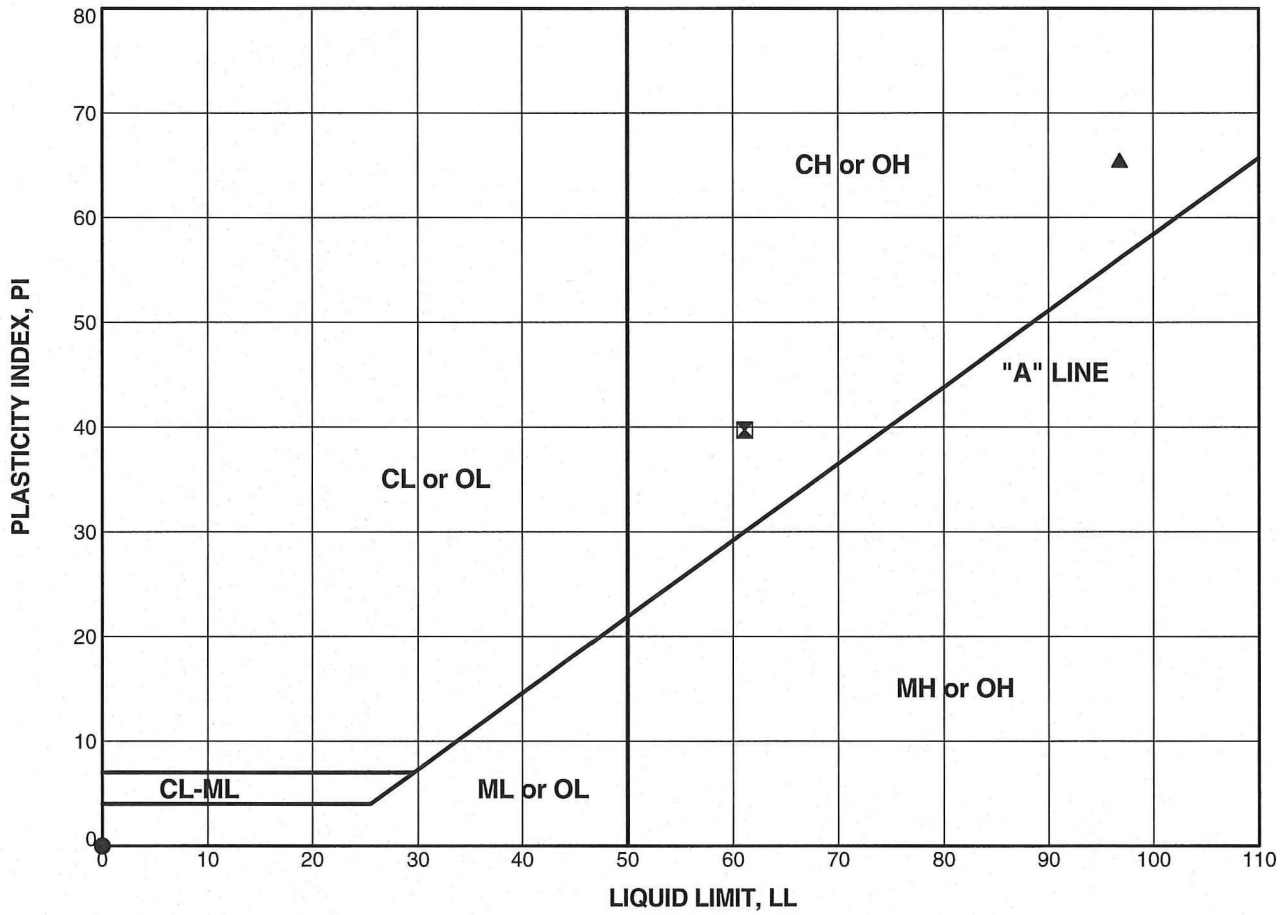


| Boring Number | Depth (feet) | Geologic Unit | Test Symbol | Water Content (%) | LL | PL | PI | Classification |
|---|---|---|---|---|---|---|---|---|
| DH- 1 | 15.0 | Qya | ● | 4 | NP | NP | NP | POORLY GRADED SAND WITH SILT (SP-SM) |
| DH- 2 | 5.0 | Qya | ⊠ | 28 | 61 | 21 | 40 | FAT CLAY (CH) |
| DH- 4 | 5.0 | Qya | ▲ | 28 | 97 | 31 | 66 | FAT CLAY (CH) |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
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| | | | | | | | | |
| | | | | | | | | |

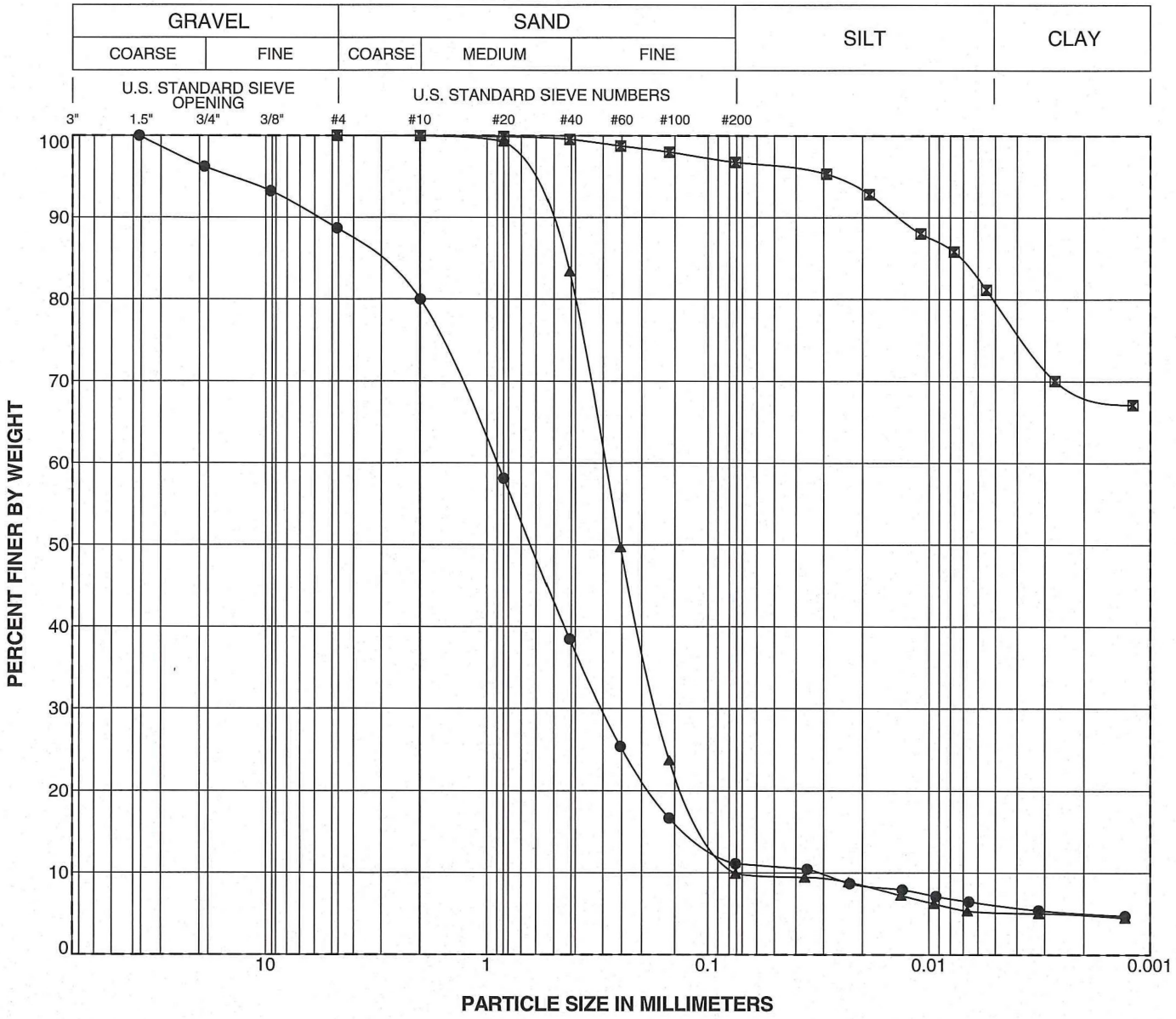
GMU_ATTERBERG_LIMITS_12 PTS 18-252-00.GPJ GM&U.GDT 1/30/19

# ATTERBERG LIMITS

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.




| Boring Number | Depth (feet) | Geologic Unit | Symbol | LL | PI | Classification |
|---|---|---|---|---|---|---|
| DH- 1 | 15.0 | Qya | ● | NP | NP | POORLY GRADED SAND WITH SILT (SP-SM) |
| DH- 4 | 5.0 | Qya | ⊠ | 97 | 66 | FAT CLAY (CH) |
| DH- 5 | 30.0 | Qya | ▲ | | | POORLY GRADED SAND WITH SILT (SP-SM) |

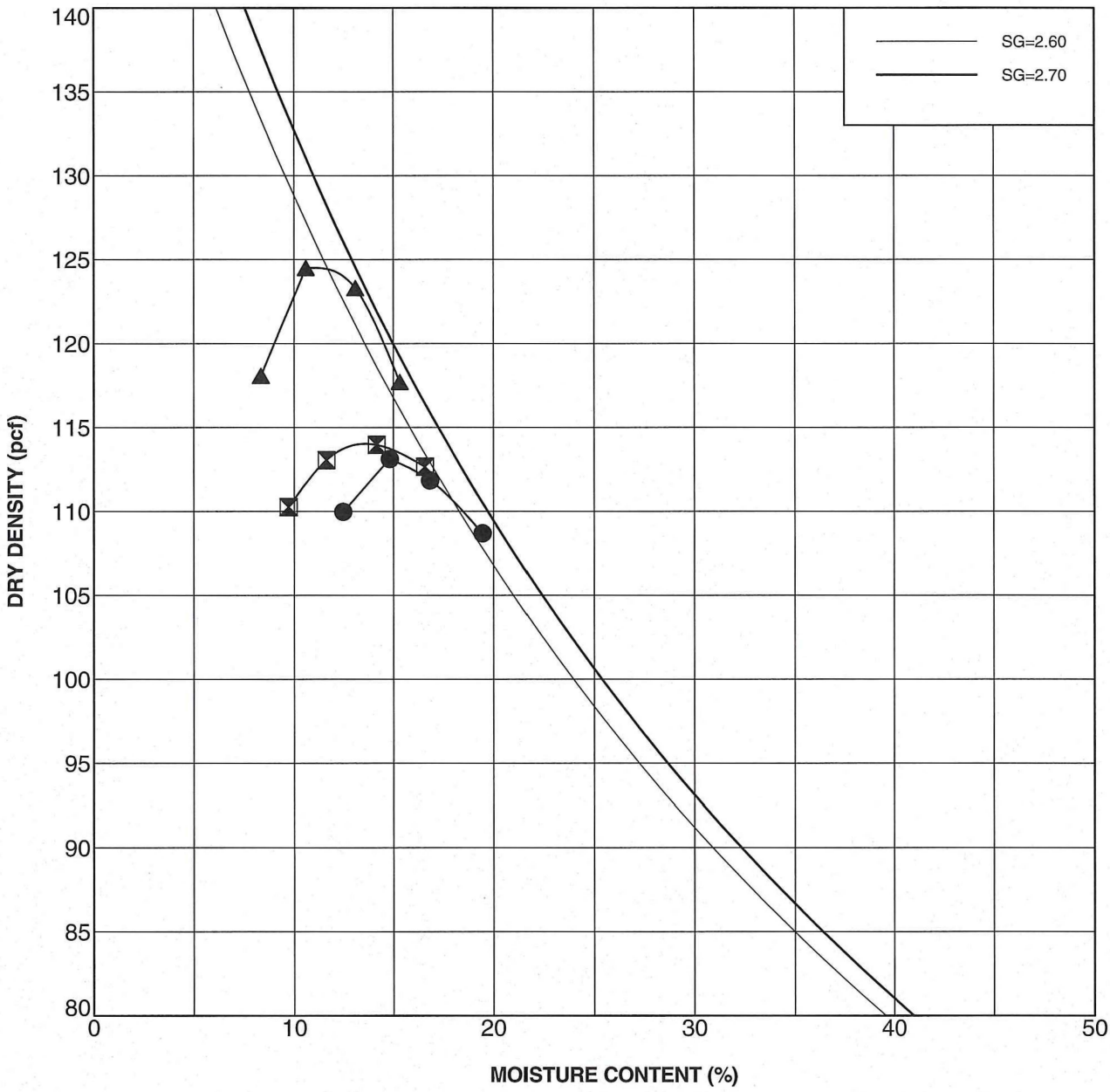
GMU_GRAIN_SIZE 18-252-00.GPJ 1/30/19

# PARTICLE SIZE DISTRIBUTION

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.




| Boring Number | Depth (feet) | Geologic Unit | Symbol | Maximum Dry Density, pcf | Optimum Moisture Content, % | Classification |
|---|---|---|---|---|---|---|
| DH- 2 | 0.0 | Qal/Qt | ● | 113.5 | 15.5 | LEAN CLAY (CL) |
| DH- 5 | 0.0 | Qya | ⊠ | 114 | 14 | SILTY CLAY (CL) |
| DH-10 | 0.0 | Qya | ▲ | 124 | 11.5 | SITLY CLAY (CL) |
| | | | | | | |

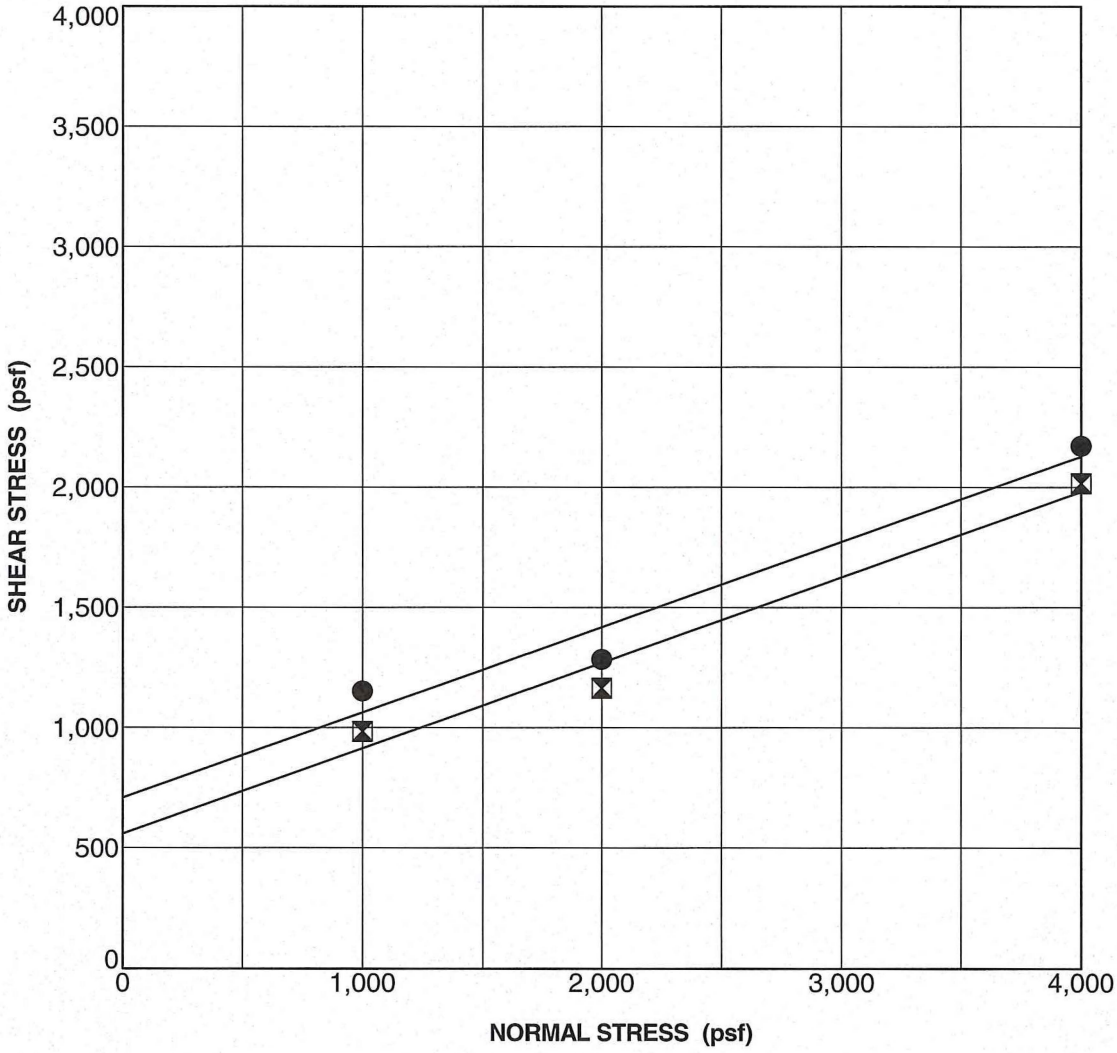
# COMPACTION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_COMPACTION_4_SETS 18-252-00.GPJ 1/30/19




| SAMPLE AND TEST DESCRIPTION |
|---|
| **Sample Location:** DH- 1 @ 2.5 ft **Geologic Unit:** Qya **Classification:** FAT CLAY (CH) |
| **Strain Rate (in/min):** 0.005 **Sample Preparation:** Undisturbed |
| **Notes:** Sample saturated prior and during shearing |

| STRENGTH PARAMETERS | | |
|---|---|---|
| **STRENGTH TYPE** | **COHESION (psf)** | **FRICTION ANGLE (degrees)** |
| ● Peak Strength | 708 | 19.5 |
| ⊠ Ultimate Strength | 558 | 19.5 |

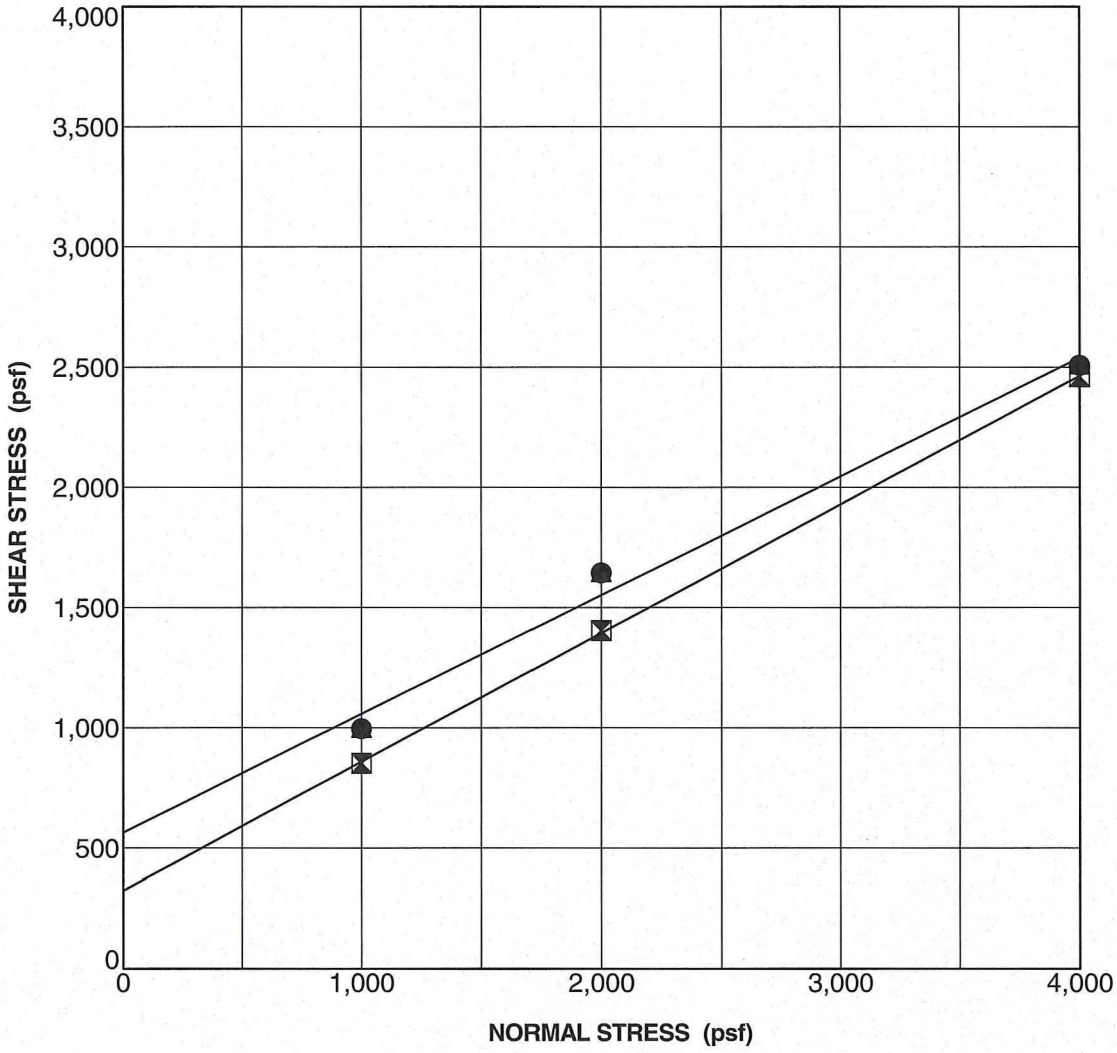
# SHEAR TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_DIRECT_SHEAR 18-252-00.GPJ GM&U.GDT 1/30/19




| SAMPLE AND TEST DESCRIPTION |
|---|
| **Sample Location:** DH- 4 @ 0.0 ft **Geologic Unit:** Qya **Classification:** SILTY CLAY (CL)<br>**Strain Rate (in/min):** 0.005 **Sample Preparation:** Remolded<br>**Notes:** |

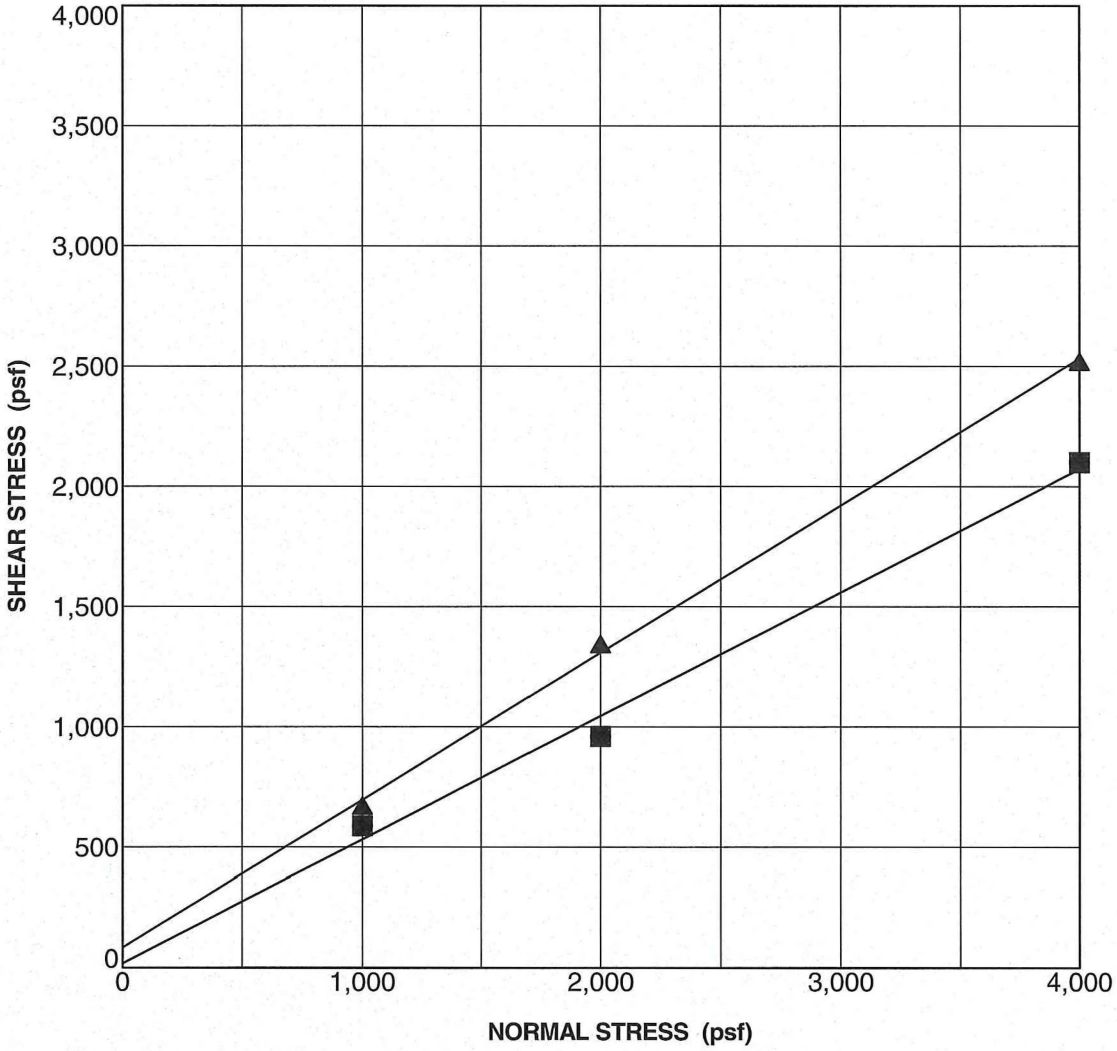
| STRENGTH PARAMETERS | | |
|---|---|---|
| **STRENGTH TYPE** | **COHESION (psf)** | **FRICTION ANGLE (degrees)** |
| ● Peak Strength | 564 | 26.0 |
| ⊠ Ultimate Strength | 324 | 28.1 |

# SHEAR TEST DATA

Project: EF International Language Campus
Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_DIRECT_SHEAR 18-252-00.GPJ GM&U.GDT 1/30/19




| SAMPLE AND TEST DESCRIPTION |
|---|
| **Sample Location:** DH- 5 @ 5.0 ft **Geologic Unit:** Qya **Classification:** SILTY CLAY (CL) |
| **Strain Rate (in/min):** 0.005 **Sample Preparation:** Undisturbed |
| **Notes:** Sample saturated prior and during shearing |

| STRENGTH PARAMETERS | | |
|---|---|---|
| **STRENGTH TYPE** | **COHESION (psf)** | **FRICTION ANGLE (degrees)** |
| ● Peak Strength | 84 | 31.0 |
| ⊠ Ultimate Strength | 18 | 27.0 |

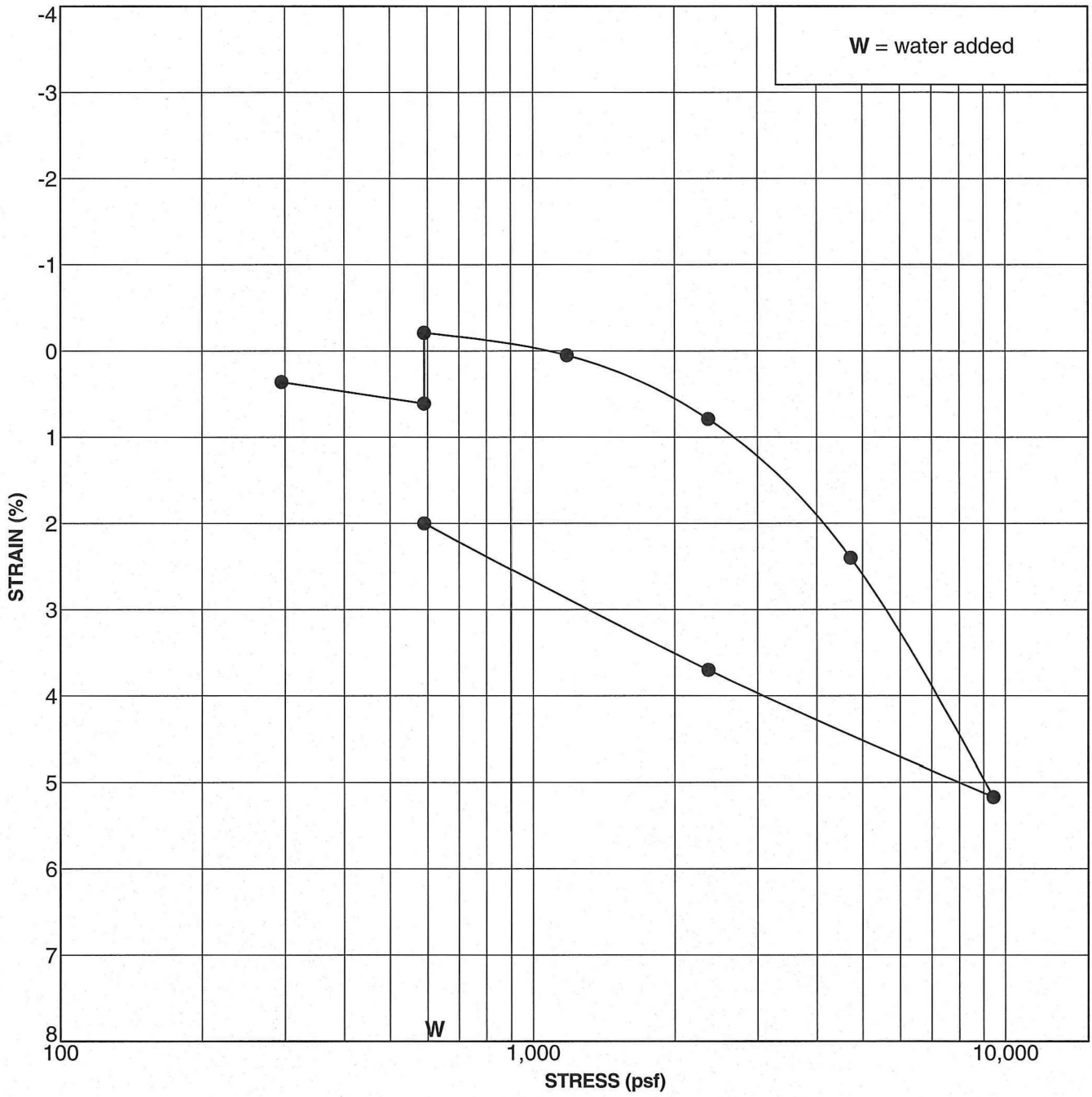
# SHEAR TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_DIRECT_SHEAR 18-252-00.GPJ GM&U.GDT 1/30/19




| Boring Number | Depth (feet) | Geologic Unit | Symbol | In Situ or Remolded Sample | % Hydro-Collapse | Classification |
|---|---|---|---|---|---|---|
| DH- 1 | 5.0 | Qya | ● | In Situ | -0.82 | FAT CLAY (CH) |
| | | | | | | |
| | | | | | | |
| | | | | | | |

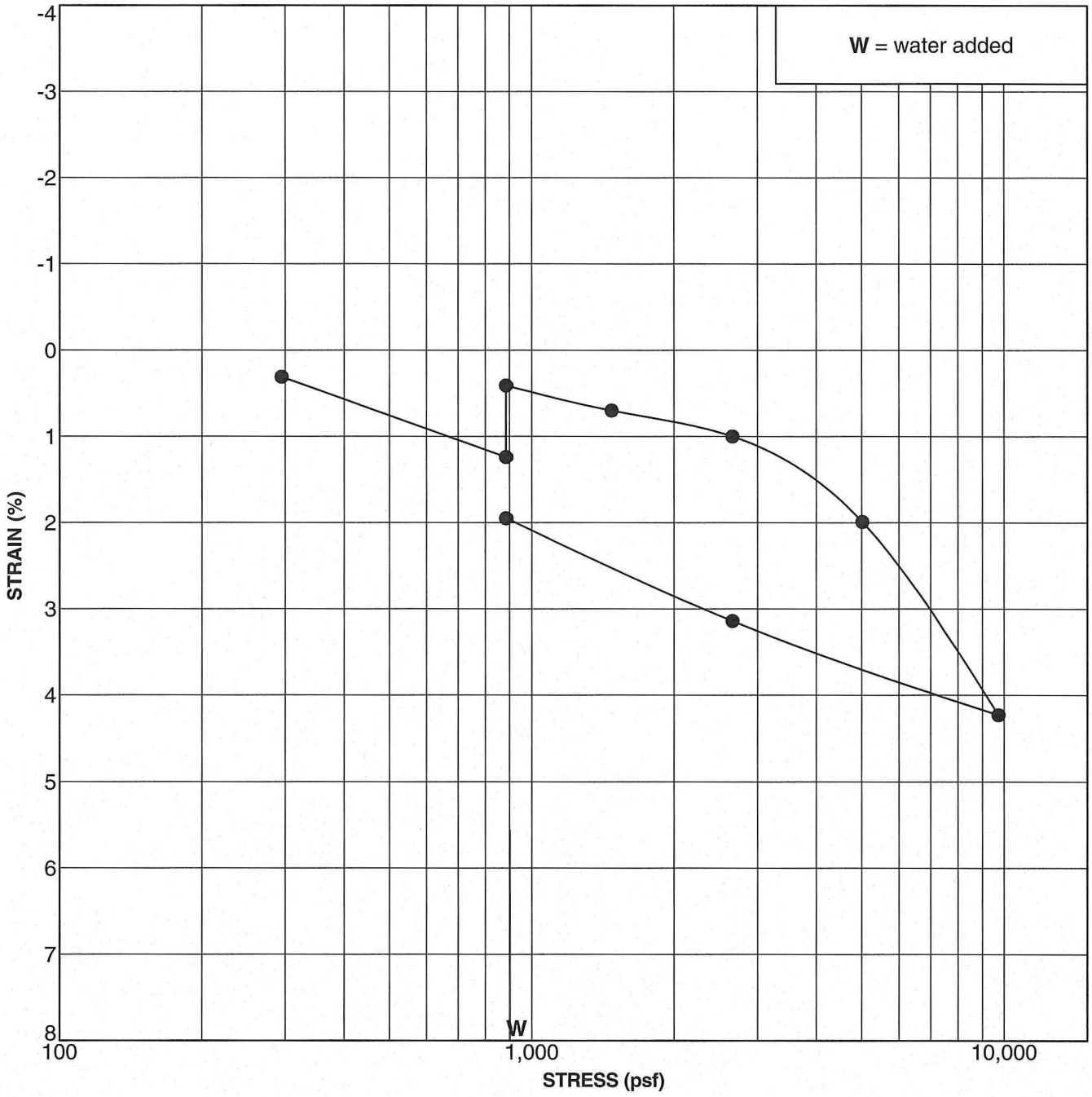
# CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19




| Boring Number | Depth (feet) | Geologic Unit | Symbol | In Situ or Remolded Sample | % Hydro-Collapse | Classification |
|---|---|---|---|---|---|---|
| DH- 1 | 7.5 | Qya | ● | In Situ | -0.83 | FAT CLAY (CH) |
| | | | | | | |
| | | | | | | |
| | | | | | | |

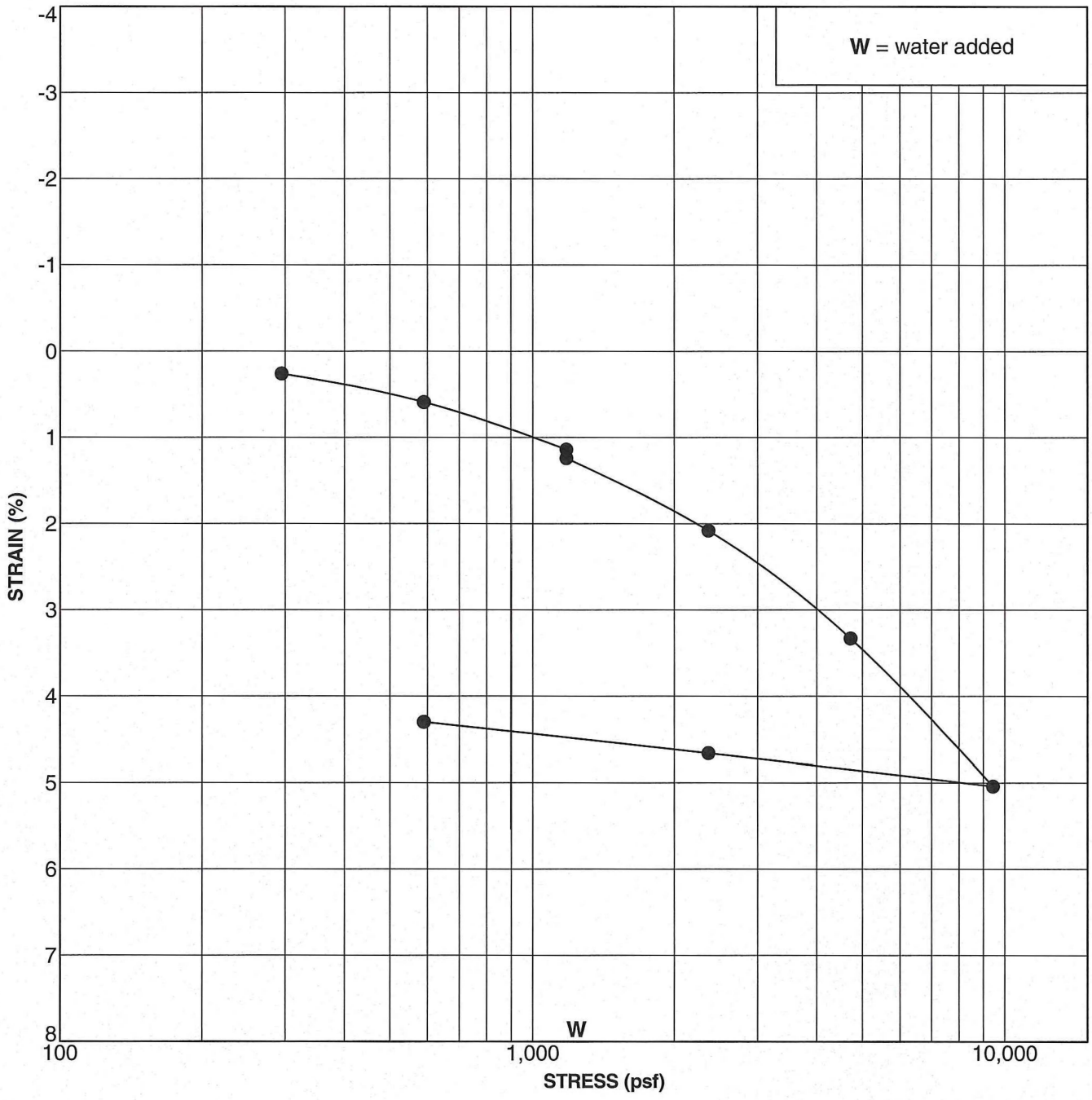
GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19

# CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.




| Boring Number | Depth (feet) | Geologic Unit | Symbol | In Situ or Remolded Sample | % Hydro-Collapse | Classification |
|---|---|---|---|---|---|---|
| DH- 2 | 10.0 | Qya | ● | In Situ | 0.1 | FAT CLAY (CH) |
| | | | | | | |
| | | | | | | |
| | | | | | | |

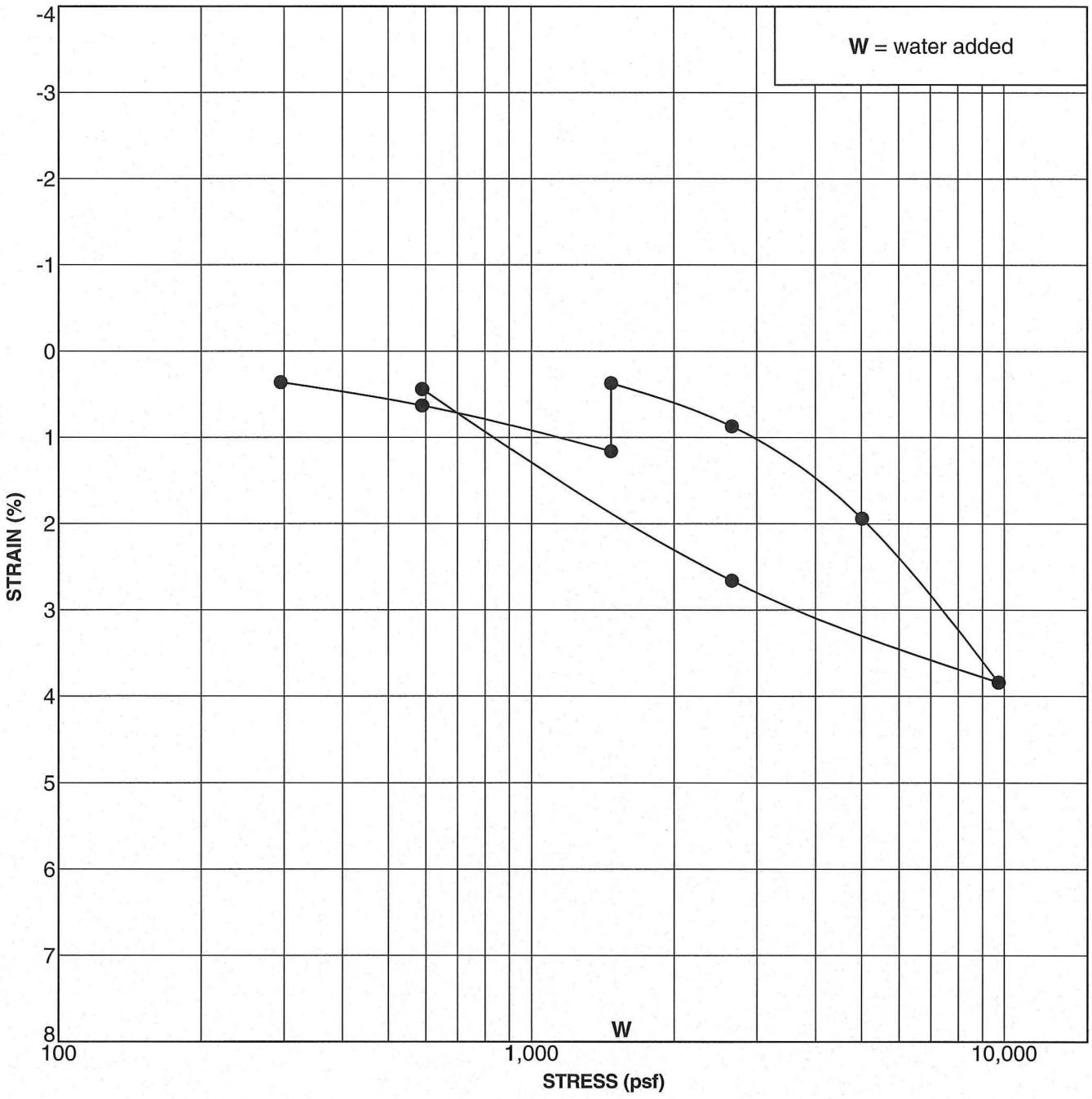
# CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19




| Boring Number | Depth (feet) | Geologic Unit | Symbol | In Situ or Remolded Sample | % Hydro-Collapse | Classification |
|---|---|---|---|---|---|---|
| DH- 4 | 12.5 | Qya | ● | In Situ | -0.79 | LEAN CLAY (CL) |
| | | | | | | |
| | | | | | | |
| | | | | | | |

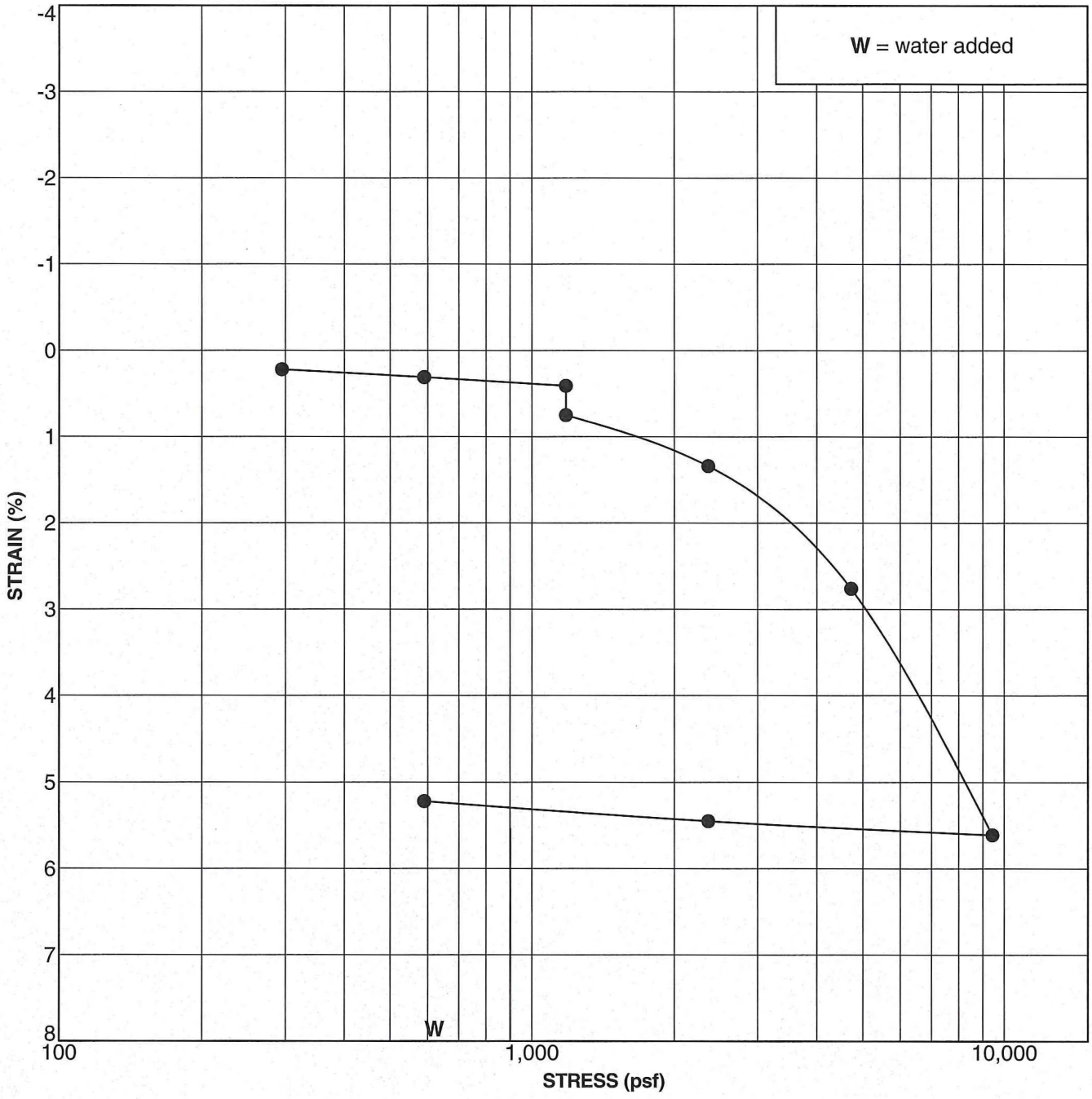
# CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19




| Boring Number | Depth (feet) | Geologic Unit | Symbol | In Situ or Remolded Sample | % Hydro-Collapse | Classification |
|---|---|---|---|---|---|---|
| DH- 5 | 5.0 | Qya | ● | In Situ | 0.34 | SILTY CLAY (CL) |
| | | | | | | |
| | | | | | | |
| | | | | | | |

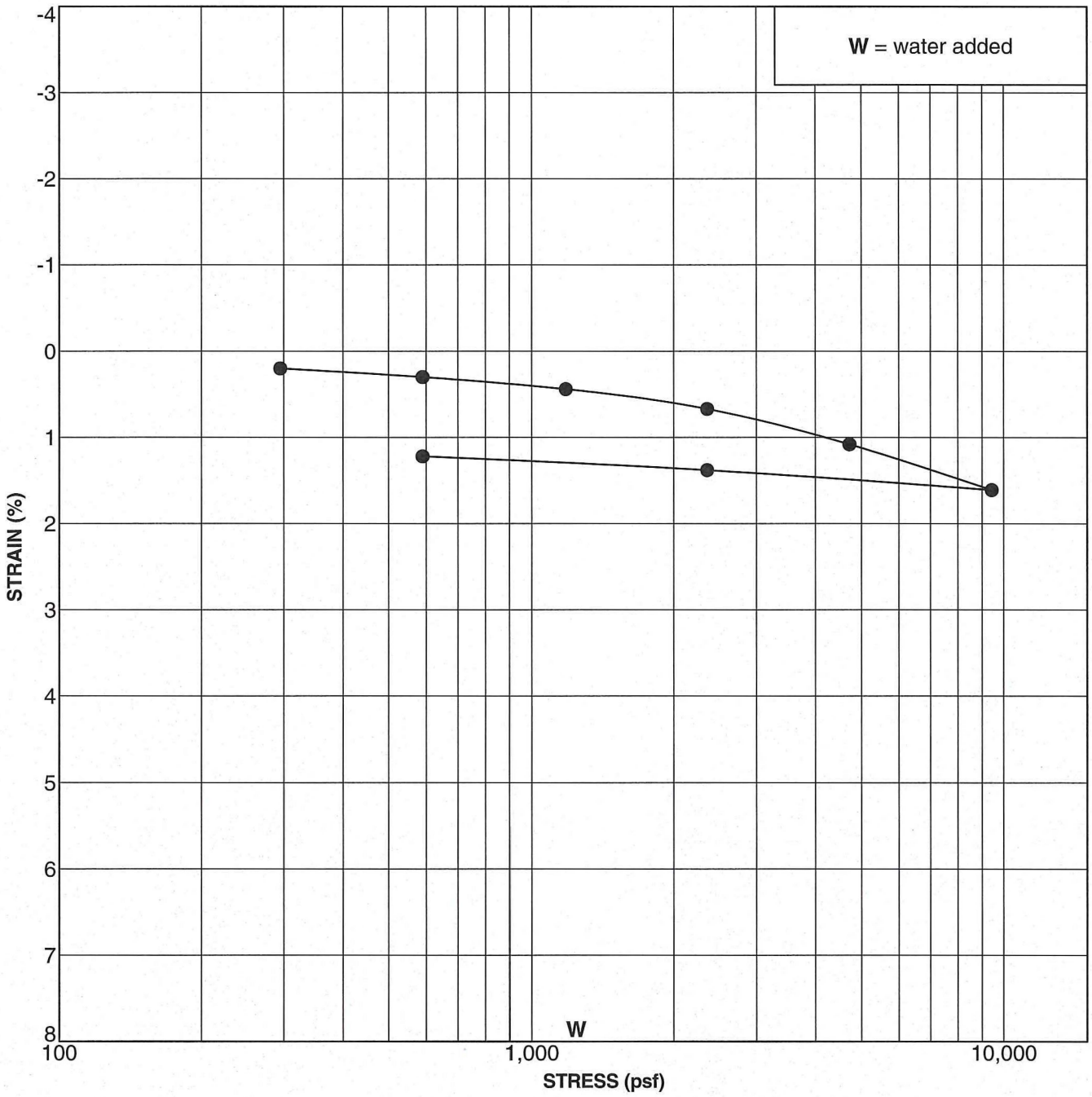
# CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19




| Boring Number | Depth (feet) | Geologic Unit | Symbol | In Situ or Remolded Sample | % Hydro-Collapse | Classification |
|---|---|---|---|---|---|---|
| DH-10 | 10.0 | Qya | ● | In Situ | 0 | SITLY CLAY (CL) |
| | | | | | | |
| | | | | | | |
| | | | | | | |

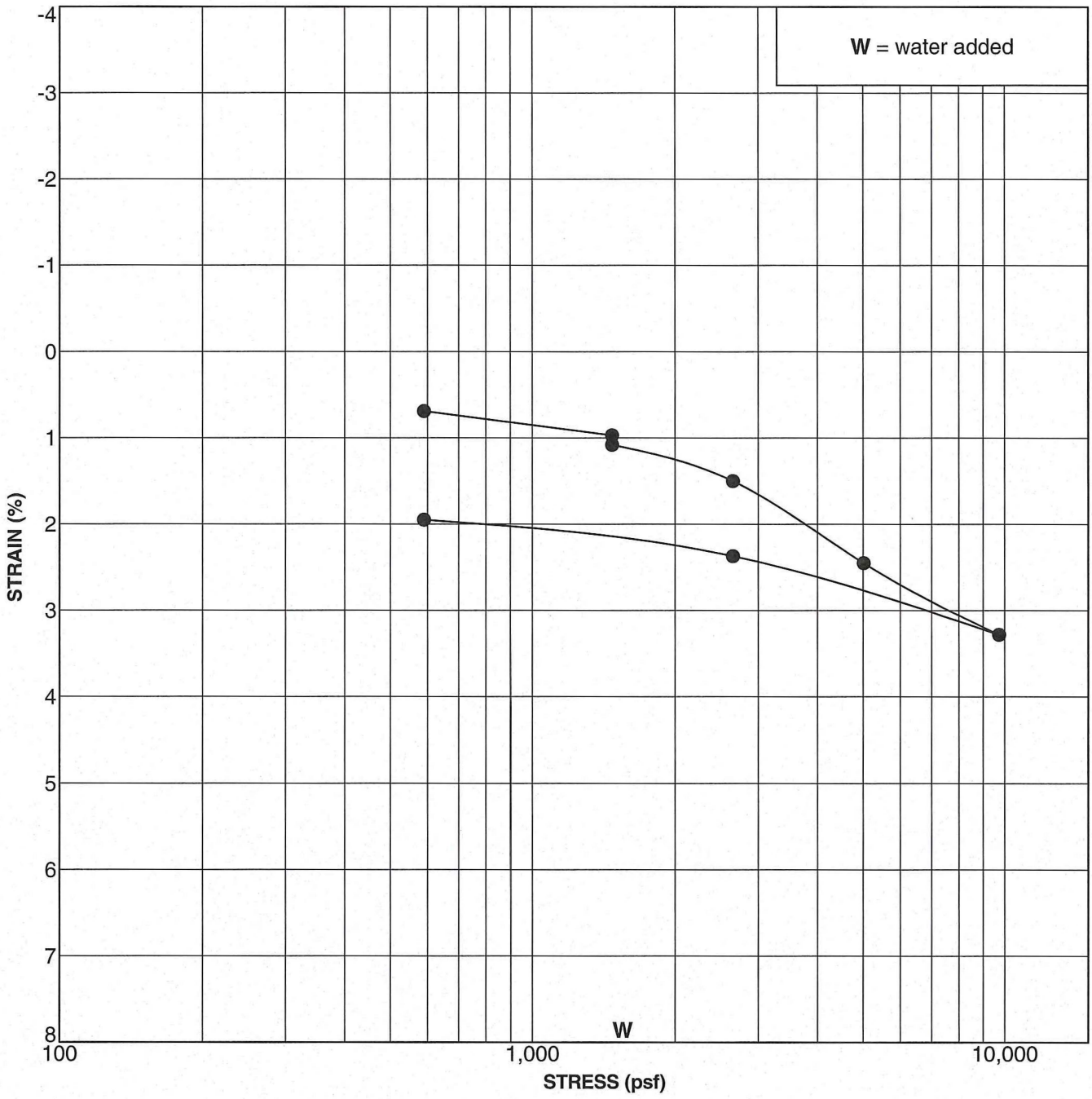
# CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19




| Boring Number | Depth (feet) | Geologic Unit | Symbol | In Situ or Remolded Sample | % Hydro-Collapse | Classification |
|---|---|---|---|---|---|---|
| DH-10 | 12.5 | Qya | ● | In Situ | 11 | CLAYEY SAND (SC) |
| | | | | | | |
| | | | | | | |
| | | | | | | |

# CONSOLIDATION TEST DATA

Project: EF International Language Campus

Project No. 18-252-00

GMU GEOTECHNICAL, INC.

GMU_CONSOL 18-252-00.GPJ GM&U.GDT 1/30/19

# Appendix D

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

OSHPD

## Latitude, Longitude: 33.6862, -117.8911


| | |
|---|---|
| **Date** | 12/21/2023, 10:08:50 AM |
| **Design Code Reference Document** | ASCE7-16 |
| **Risk Category** | II |
| **Site Class** | D - Stiff Soil |

| Type | Value | Description |
|---|---|---|
| $S_S$ | 1.298 | $MCE_R$ ground motion. (for 0.2 second period) |
| $S_1$ | 0.465 | $MCE_R$ ground motion. (for 1.0s period) |
| $S_{MS}$ | 1.298 | Site-modified spectral acceleration value |
| $S_{M1}$ | null -See Section 11.4.8 | Site-modified spectral acceleration value |
| $S_{DS}$ | 0.865 | 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 | 0.557 | $MCE_G$ peak ground acceleration |
| $F_{PGA}$ | 1.1 | Site amplification factor at PGA |
| $PGA_M$ | 0.612 | Site modified peak ground acceleration |
| $T_L$ | 8 | Long-period transition period in seconds |
| SsRT | 1.298 | Probabilistic risk-targeted ground motion. (0.2 second) |
| SsUH | 1.407 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration |
| SsD | 2.112 | Factored deterministic acceleration value. (0.2 second) |
| S1RT | 0.465 | Probabilistic risk-targeted ground motion. (1.0 second) |
| S1UH | 0.503 | Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration. |
| S1D | 0.729 | Factored deterministic acceleration value. (1.0 second) |
| PGAd | 0.868 | Factored deterministic acceleration value. (Peak Ground Acceleration) |
| $PGA_{UH}$ | 0.557 | Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration |
| $C_{RS}$ | 0.922 | Mapped value of the risk coefficient at short periods |
| $C_{R1}$ | 0.925 | Mapped value of the risk coefficient at a period of 1 s |
| $C_V$ | 1.36 | Vertical coefficient |

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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.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

## Input

Edition

Dynamic: Conterminous U.S. 2014 (updat…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

33.6862

Time Horizon

Return period in years

2475

Longitude

Decimal degrees, negative values for western longitudes

-117.8911

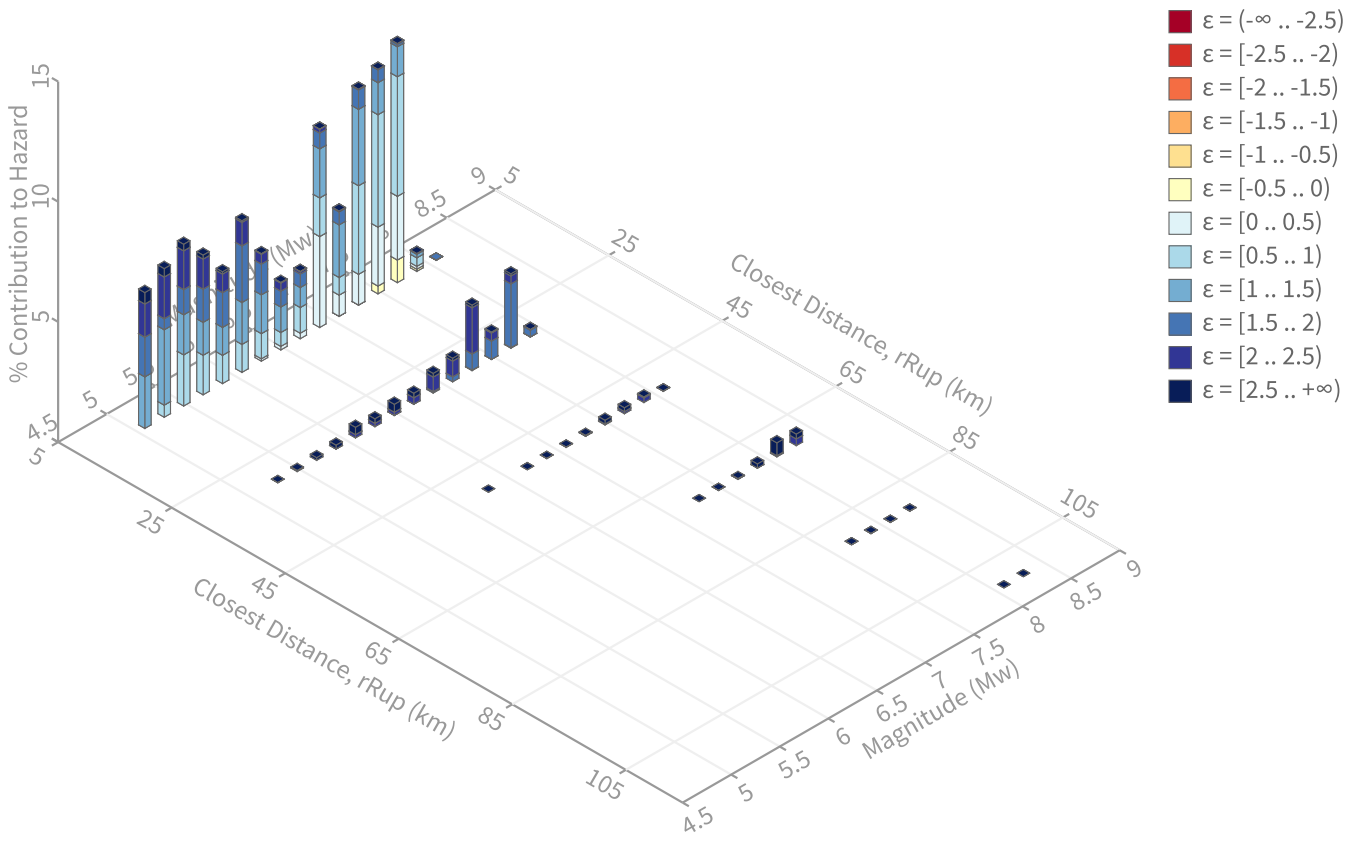
Site Class

259 m/s (Site class D)

## Deaggregation

Component

Total



# Summary statistics for, Deaggregation: Total

## Deaggregation targets

**Return period:** 2475 yrs
**Exceedance rate:** 0.0004040404 $yr^{-1}$
**PGA ground motion:** 0.65272917 g

## Recovered targets

**Return period:** 2960.4814 yrs
**Exceedance rate:** 0.0003377829 $yr^{-1}$

## Totals

**Binned:** 100 %
**Residual:** 0 %
**Trace:** 0.06 %

## Mean (over all sources)

**m:** 6.64
**r:** 11.33 km
**$\varepsilon_0$:** 1.29 σ

## Mode (largest m-r bin)

**m:** 7.69
**r:** 6.83 km
**$\varepsilon_0$:** 0.58 σ
**Contribution:** 9.94 %

## Mode (largest m-r-$\varepsilon_0$ bin)

**m:** 7.68
**r:** 7.63 km
**$\varepsilon_0$:** 0.68 σ
**Contribution:** 4.98 %

## 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 | $\varepsilon_0$ | lon | lat | az | % |
|---|---|---|---|---|---|---|---|---|
| UC33brAvg_FM32 | System | | | | | | | 29.75 |
| San Joaquin Hills [0] | | 3.45 | 7.14 | 0.48 | 117.895°W | 33.672°N | 191.48 | 10.41 |
| Newport-Inglewood alt 2 [0] | | 8.18 | 7.49 | 0.88 | 117.956°W | 33.638°N | 228.08 | 5.49 |
| Compton [0] | | 14.99 | 7.34 | 1.12 | 118.043°W | 33.702°N | 277.37 | 3.58 |
| Palos Verdes [6] | | 26.18 | 7.46 | 2.02 | 118.134°W | 33.567°N | 239.46 | 1.68 |
| Whittier alt 2 [2] | | 26.39 | 7.65 | 1.88 | 117.755°W | 33.895°N | 28.40 | 1.09 |
| Newport-Inglewood (Offshore) [0] | | 10.85 | 6.61 | 1.62 | 117.915°W | 33.591°N | 191.60 | 1.04 |
| Anaheim [0] | | 12.46 | 6.94 | 1.36 | 117.943°W | 33.780°N | 335.47 | 1.02 |
| UC33brAvg_FM31 | System | | | | | | | 26.35 |
| San Joaquin Hills [0] | | 3.45 | 7.52 | 0.38 | 117.895°W | 33.672°N | 191.48 | 7.28 |
| Newport-Inglewood alt 1 [0] | | 8.28 | 7.45 | 0.88 | 117.958°W | 33.639°N | 229.49 | 6.06 |
| Compton [0] | | 14.99 | 7.27 | 1.15 | 118.043°W | 33.702°N | 277.37 | 3.41 |
| Palos Verdes [6] | | 26.18 | 7.29 | 2.12 | 118.134°W | 33.567°N | 239.46 | 1.55 |
| Whittier alt 1 [3] | | 26.46 | 7.59 | 1.91 | 117.758°W | 33.897°N | 27.62 | 1.37 |
| Newport-Inglewood (Offshore) [0] | | 10.85 | 6.52 | 1.66 | 117.915°W | 33.591°N | 191.60 | 1.11 |
| Anaheim [0] | | 12.46 | 6.89 | 1.38 | 117.943°W | 33.780°N | 335.47 | 1.01 |
| UC33brAvg_FM31 (opt) | Grid | | | | | | | 22.11 |
| PointSourceFinite: -117.891, 33.700 | | 5.30 | 5.60 | 1.12 | 117.891°W | 33.700°N | 0.00 | 5.30 |
| PointSourceFinite: -117.891, 33.700 | | 5.30 | 5.60 | 1.12 | 117.891°W | 33.700°N | 0.00 | 5.30 |
| PointSourceFinite: -117.891, 33.763 | | 8.95 | 5.94 | 1.55 | 117.891°W | 33.763°N | 0.00 | 1.54 |
| PointSourceFinite: -117.891, 33.763 | | 8.95 | 5.94 | 1.55 | 117.891°W | 33.763°N | 0.00 | 1.54 |
| PointSourceFinite: -117.891, 33.799 | | 12.04 | 5.97 | 1.88 | 117.891°W | 33.799°N | 0.00 | 1.04 |
| PointSourceFinite: -117.891, 33.799 | | 12.04 | 5.97 | 1.88 | 117.891°W | 33.799°N | 0.00 | 1.04 |
| PointSourceFinite: -117.891, 33.772 | | 10.17 | 5.77 | 1.77 | 117.891°W | 33.772°N | 0.00 | 1.03 |
| PointSourceFinite: -117.891, 33.772 | | 10.17 | 5.77 | 1.77 | 117.891°W | 33.772°N | 0.00 | 1.03 |
| UC33brAvg_FM32 (opt) | Grid | | | | | | | 21.80 |
| PointSourceFinite: -117.891, 33.700 | | 5.31 | 5.58 | 1.12 | 117.891°W | 33.700°N | 0.00 | 5.13 |
| PointSourceFinite: -117.891, 33.700 | | 5.31 | 5.58 | 1.12 | 117.891°W | 33.700°N | 0.00 | 5.13 |
| PointSourceFinite: -117.891, 33.763 | | 8.96 | 5.93 | 1.55 | 117.891°W | 33.763°N | 0.00 | 1.55 |
| PointSourceFinite: -117.891, 33.763 | | 8.96 | 5.93 | 1.55 | 117.891°W | 33.763°N | 0.00 | 1.55 |
| PointSourceFinite: -117.891, 33.772 | | 10.19 | 5.76 | 1.78 | 117.891°W | 33.772°N | 0.00 | 1.07 |
| PointSourceFinite: -117.891, 33.772 | | 10.19 | 5.76 | 1.78 | 117.891°W | 33.772°N | 0.00 | 1.07 |
| PointSourceFinite: -117.891, 33.799 | | 12.05 | 5.97 | 1.89 | 117.891°W | 33.799°N | 0.00 | 1.01 |
| PointSourceFinite: -117.891, 33.799 | | 12.05 | 5.97 | 1.89 | 117.891°W | 33.799°N | 0.00 | 1.01 |

# Appendix E

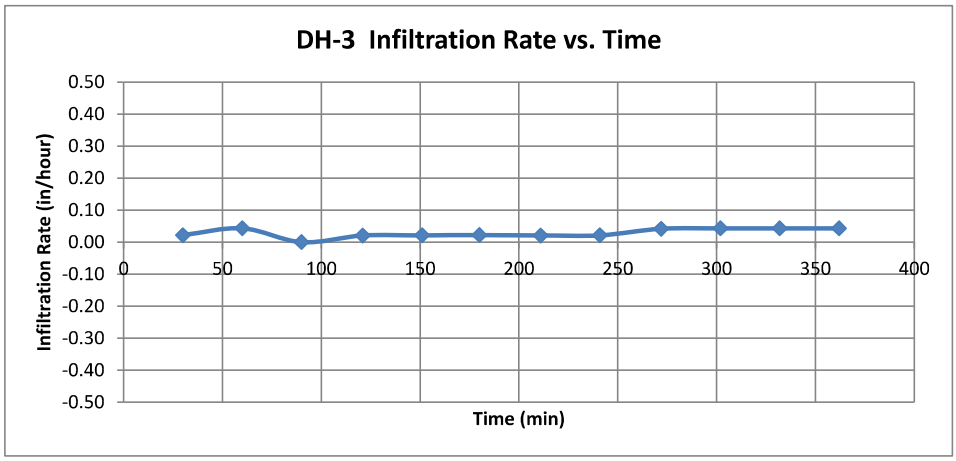
## Riverside/Orange County - Infiltration Test in a Boring

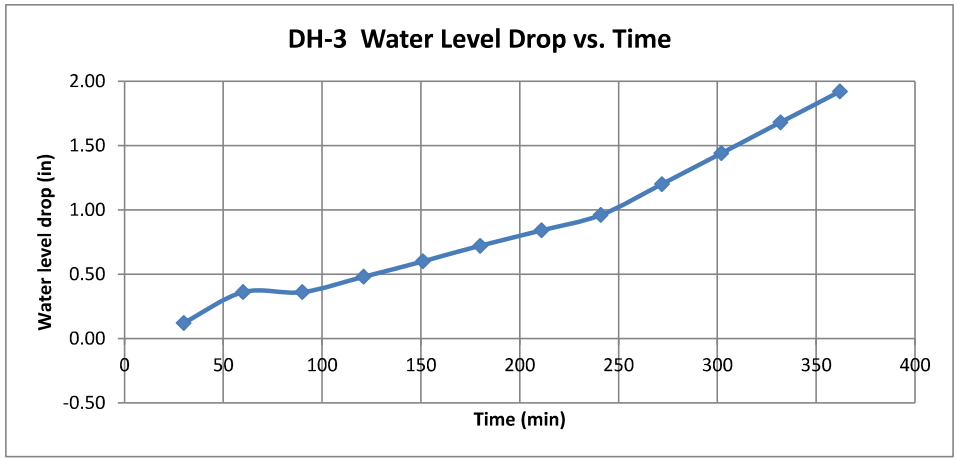
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-3
Total Depth : 4.92 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

| Trial | Start Time | End Time | ΔT | Total Time | Initial Depth of Water | Final Depth of Water | ΔD | ∑ΔD | ΔHavg | Infiltration Rate |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | *(min)* | *(min)* | *(ft)* | *(ft)* | *(in)* | *(in)* | *(in)* | *(in/hour)* |
| 1 | 7:55 | 8:25 | 30.0 | 30.0 | 3.22 | 3.23 | 0.12 | 0.12 | 20.34 | 0.02 |
| 2 | 8:25 | 8:55 | 30.0 | 60.0 | 3.23 | 3.25 | 0.24 | 0.36 | 20.16 | 0.04 |
| 3 | 8:55 | 9:25 | 30.0 | 90.0 | 3.21 | 3.21 | 0.00 | 0.36 | 20.52 | 0.00 |
| 4 | 9:25 | 9:56 | 31.0 | 121.0 | 3.21 | 3.22 | 0.12 | 0.48 | 20.46 | 0.02 |
| 5 | 9:56 | 10:26 | 30.0 | 151.0 | 3.21 | 3.22 | 0.12 | 0.60 | 20.46 | 0.02 |
| 6 | 10:26 | 10:55 | 29.0 | 180.0 | 3.21 | 3.22 | 0.12 | 0.72 | 20.46 | 0.02 |
| 7 | 10:55 | 11:26 | 31.0 | 211.0 | 3.21 | 3.22 | 0.12 | 0.84 | 20.46 | 0.02 |
| 8 | 11:26 | 11:56 | 30.0 | 241.0 | 3.21 | 3.22 | 0.12 | 0.96 | 20.46 | 0.02 |
| 9 | 11:56 | 12:27 | 31.0 | 272.0 | 3.21 | 3.23 | 0.24 | 1.20 | 20.40 | 0.04 |
| 10 | 12:27 | 12:57 | 30.0 | 302.0 | 3.21 | 3.23 | 0.24 | 1.44 | 20.4 | 0.04 |
| 11 | 12:57 | 13:27 | 30.0 | 332.0 | 3.21 | 3.23 | 0.24 | 1.68 | 20.4 | 0.04 |
| 12 | 13:27 | 13:57 | 30.0 | 362.0 | 3.21 | 3.23 | 0.24 | 1.92 | 20.4 | 0.04 |

**Average Infiltration Rate (in/hour) 0.04**



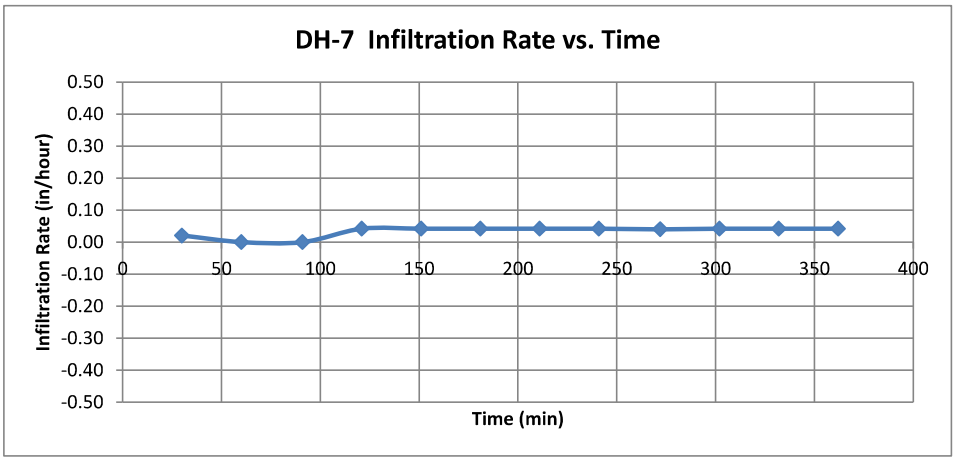
## Riverside/Orange County - Infiltration Test in a Boring

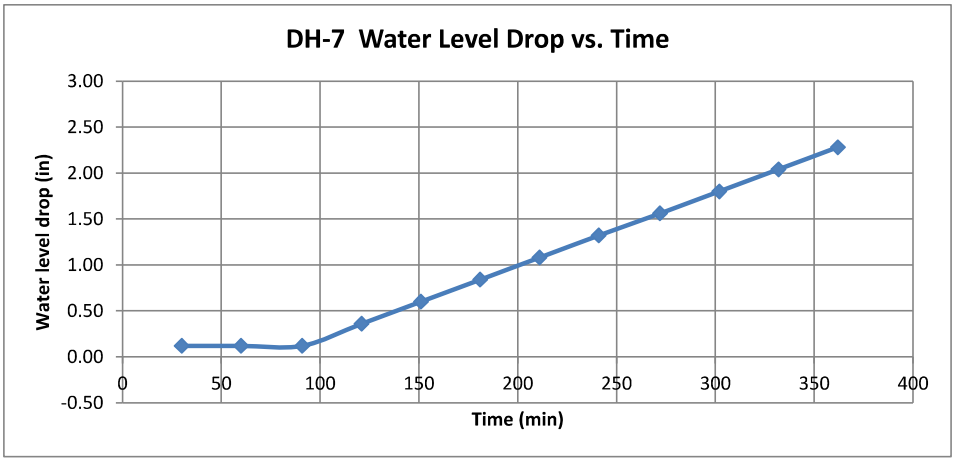
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-7
Total Depth : 5.00 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

| Trial | Start Time | End Time | ΔT | Total Time | Initial Depth of Water | Final Depth of Water | ΔD | ∑ΔD | ΔHavg | Infiltration Rate |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | *(min)* | *(min)* | *(ft)* | *(ft)* | *(in)* | *(in)* | *(in)* | *(in/hour)* |
| 1 | 8:02 | 8:32 | 30.0 | 30.0 | 3.23 | 3.24 | 0.12 | 0.12 | 21.18 | 0.02 |
| 2 | 8:32 | 9:02 | 30.0 | 60.0 | 3.24 | 3.24 | 0.00 | 0.12 | 21.12 | 0.00 |
| 3 | 9:02 | 9:33 | 31.0 | 91.0 | 3.24 | 3.24 | 0.00 | 0.12 | 21.12 | 0.00 |
| 4 | 9:33 | 10:03 | 30.0 | 121.0 | 3.24 | 3.26 | 0.24 | 0.36 | 21.00 | 0.04 |
| 5 | 10:03 | 10:33 | 30.0 | 151.0 | 3.24 | 3.26 | 0.24 | 0.60 | 21.00 | 0.04 |
| 6 | 10:33 | 11:03 | 30.0 | 181.0 | 3.24 | 3.26 | 0.24 | 0.84 | 21.00 | 0.04 |
| 7 | 11:03 | 11:33 | 30.0 | 211.0 | 3.24 | 3.26 | 0.24 | 1.08 | 21.00 | 0.04 |
| 8 | 11:33 | 12:03 | 30.0 | 241.0 | 3.24 | 3.26 | 0.24 | 1.32 | 21.00 | 0.04 |
| 9 | 12:03 | 12:34 | 31.0 | 272.0 | 3.24 | 3.26 | 0.24 | 1.56 | 21.00 | 0.04 |
| 10 | 12:34 | 13:04 | 30.0 | 302.0 | 3.24 | 3.26 | 0.24 | 1.80 | 21 | 0.04 |
| 11 | 13:04 | 13:34 | 30.0 | 332.0 | 3.24 | 3.26 | 0.24 | 2.04 | 21 | 0.04 |
| 12 | 13:34 | 14:04 | 30.0 | 362.0 | 3.24 | 3.26 | 0.24 | 2.28 | 21 | 0.04 |

**Average Infiltration Rate (in/hour) 0.04**



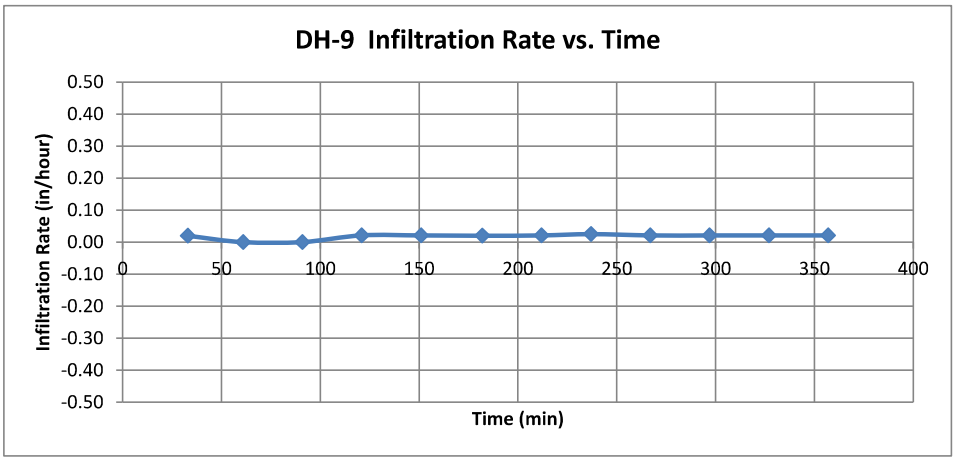
## Riverside/Orange County - Infiltration Test in a Boring

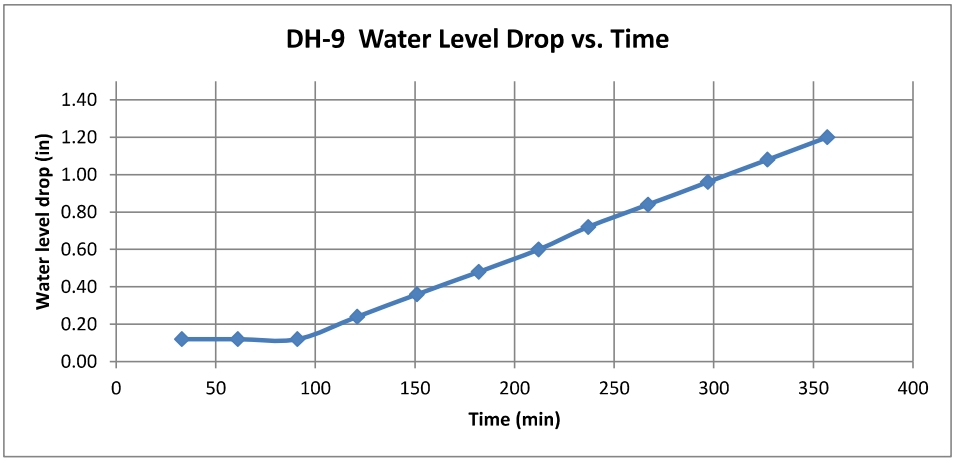
Project Name: EF International Language Campus
Project Number: 18-252-00

Test Hole Number: DH-9
Total Depth : 5.00 feet
Test Hole Diameter: 8.00 inches radius= 4 inches

| Trial | Start Time | End Time | ΔT | Total Time | Initial Depth of Water | Final Depth of Water | ΔD | ∑ΔD | ΔHavg | Infiltration Rate |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | *(min)* | *(min)* | *(ft)* | *(ft)* | *(in)* | *(in)* | *(in)* | *(in/hour)* |
| 1 | 8:10 | 8:43 | 33.0 | 33.0 | 3.33 | 3.34 | 0.12 | 0.12 | 19.98 | 0.02 |
| 2 | 8:43 | 9:11 | 28.0 | 61.0 | 3.28 | 3.28 | 0.00 | 0.12 | 20.64 | 0.00 |
| 3 | 9:11 | 9:41 | 30.0 | 91.0 | 3.28 | 3.28 | 0.00 | 0.12 | 20.64 | 0.00 |
| 4 | 9:41 | 10:11 | 30.0 | 121.0 | 3.26 | 3.27 | 0.12 | 0.24 | 20.82 | 0.02 |
| 5 | 10:11 | 10:41 | 30.0 | 151.0 | 3.26 | 3.27 | 0.12 | 0.36 | 20.82 | 0.02 |
| 6 | 10:41 | 11:12 | 31.0 | 182.0 | 3.26 | 3.27 | 0.12 | 0.48 | 20.82 | 0.02 |
| 7 | 11:12 | 11:42 | 30.0 | 212.0 | 3.26 | 3.27 | 0.12 | 0.60 | 20.82 | 0.02 |
| 8 | 11:42 | 12:07 | 25.0 | 237.0 | 3.26 | 3.27 | 0.12 | 0.72 | 20.82 | 0.03 |
| 9 | 12:07 | 12:37 | 30.0 | 267.0 | 3.26 | 3.27 | 0.12 | 0.84 | 20.82 | 0.02 |
| 10 | 12:37 | 13:07 | 30.0 | 297.0 | 3.26 | 3.27 | 0.12 | 0.96 | 20.82 | 0.02 |
| 11 | 13:07 | 13:37 | 30.0 | 327.0 | 3.26 | 3.27 | 0.12 | 1.08 | 20.82 | 0.02 |
| 12 | 13:37 | 14:07 | 30.0 | 357.0 | 3.26 | 3.27 | 0.12 | 1.20 | 20.82 | 0.02 |

**Average Infiltration Rate (in/hour) 0.02**



# Appendix F

**GMU GEOTECHNICAL, INC.**
23241 ARROYO VISTA
RANCHO SANTA MARGARITA, CA
www.GMUGEO.com

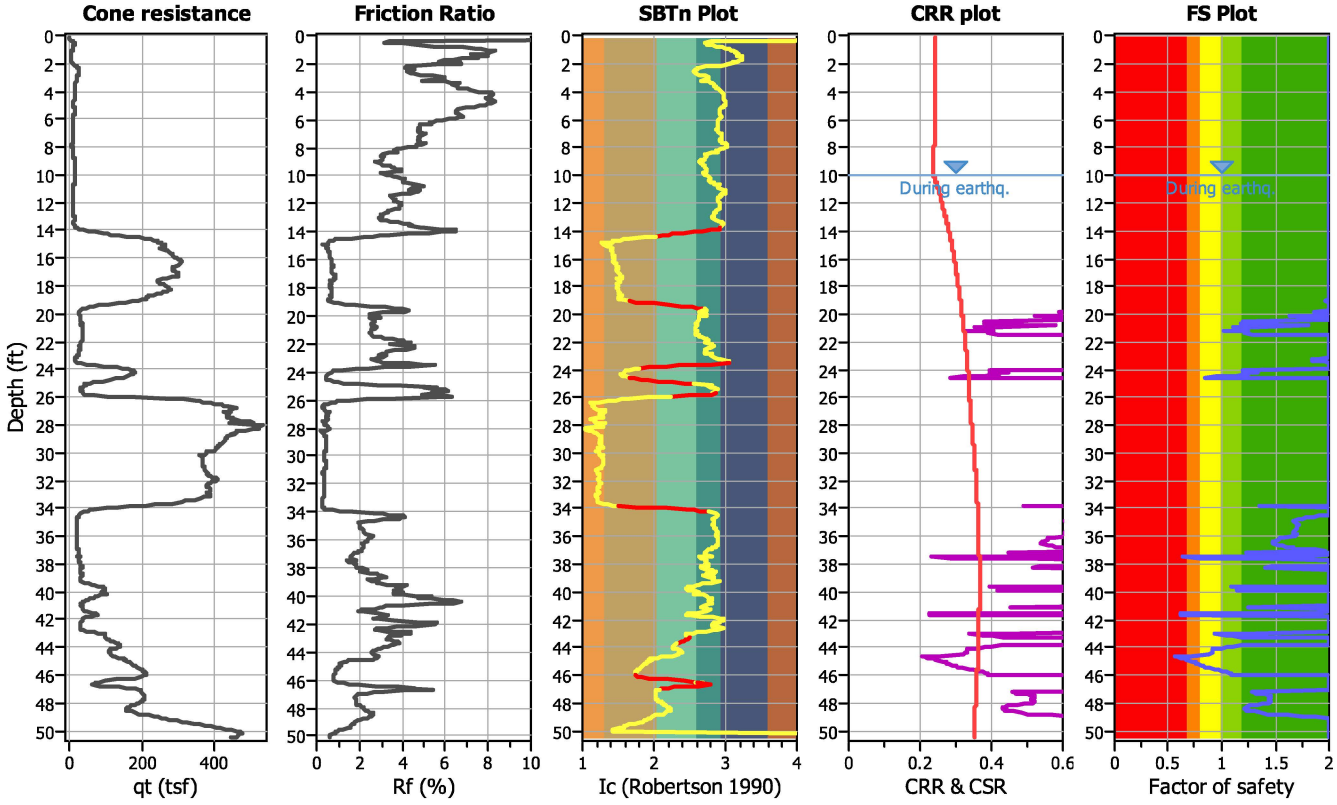
# LIQUEFACTION ANALYSIS REPORT

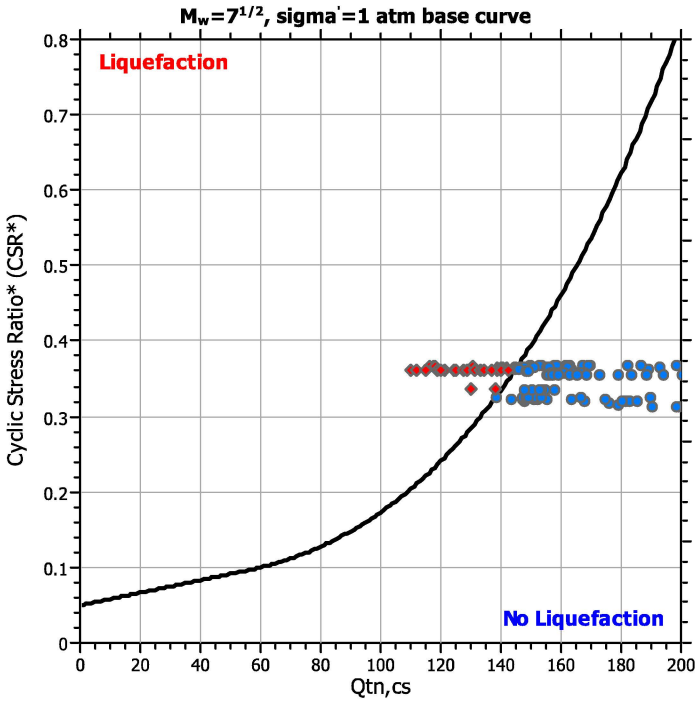
**Project title : EF International Language Campus** **Location : 3150 Bear St., Costa Mesa, CA**

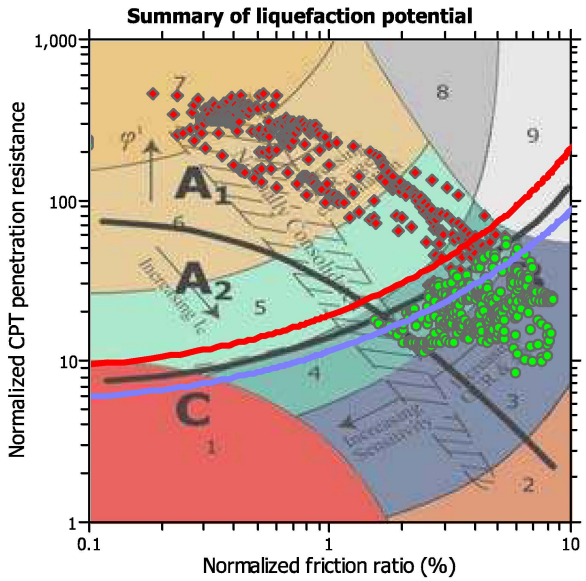
**CPT file : CPT-1**

**Input parameters and analysis data**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | G.W.T. (in-situ): | 18.00 ft | Use fill: | No | Clay like behavior applied: | All soils |
| Fines correction method: | Robertson (2009) | G.W.T. (earthq.): | 10.00 ft | Fill height: | N/A | | |
| Points to test: | Based on Ic value | Average results interval: | 1 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude $M_w$: | 6.50 | Ic cut-off value: | 2.60 | Trans. detect. applied: | Yes | Limit depth: | N/A |
| Peak ground acceleration: | 0.54 | Unit weight calculation: | Based on SBT | $K_\sigma$ applied: | Yes | MSF method: | Method based |

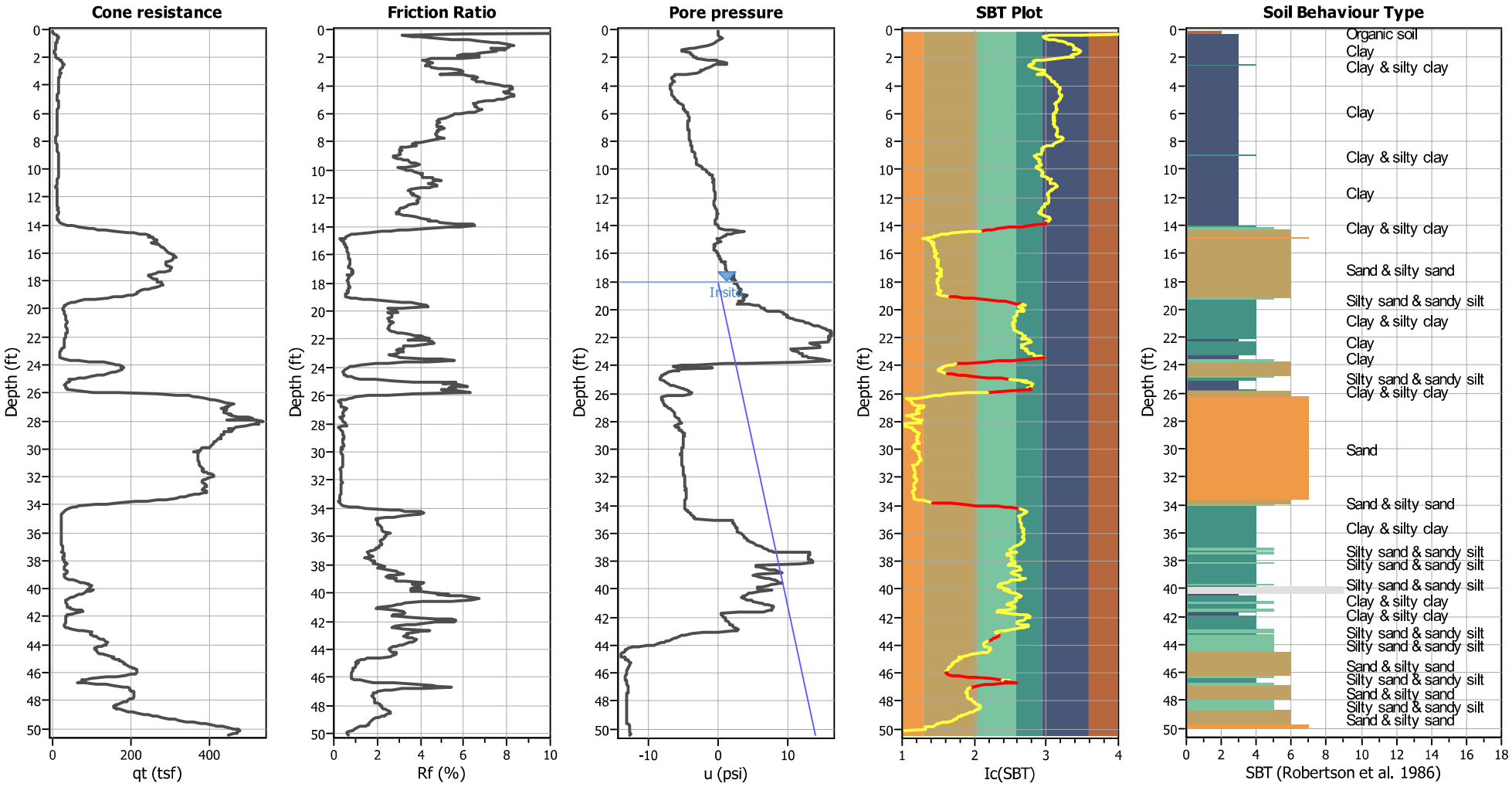



Zone $A_1$: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone $A_2$: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction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

# CPT basic interpretation plots



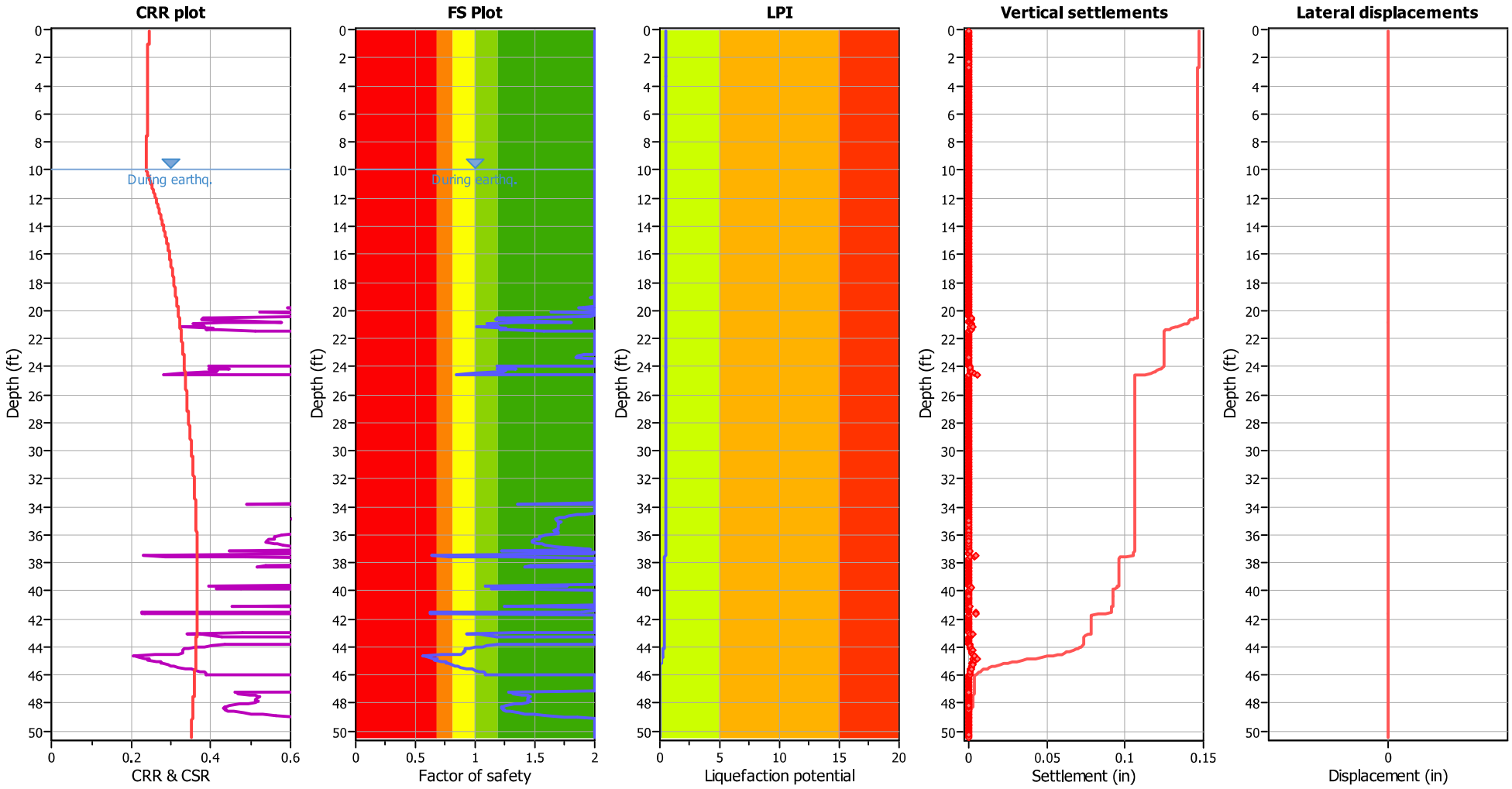

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

**SBT legend**

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

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

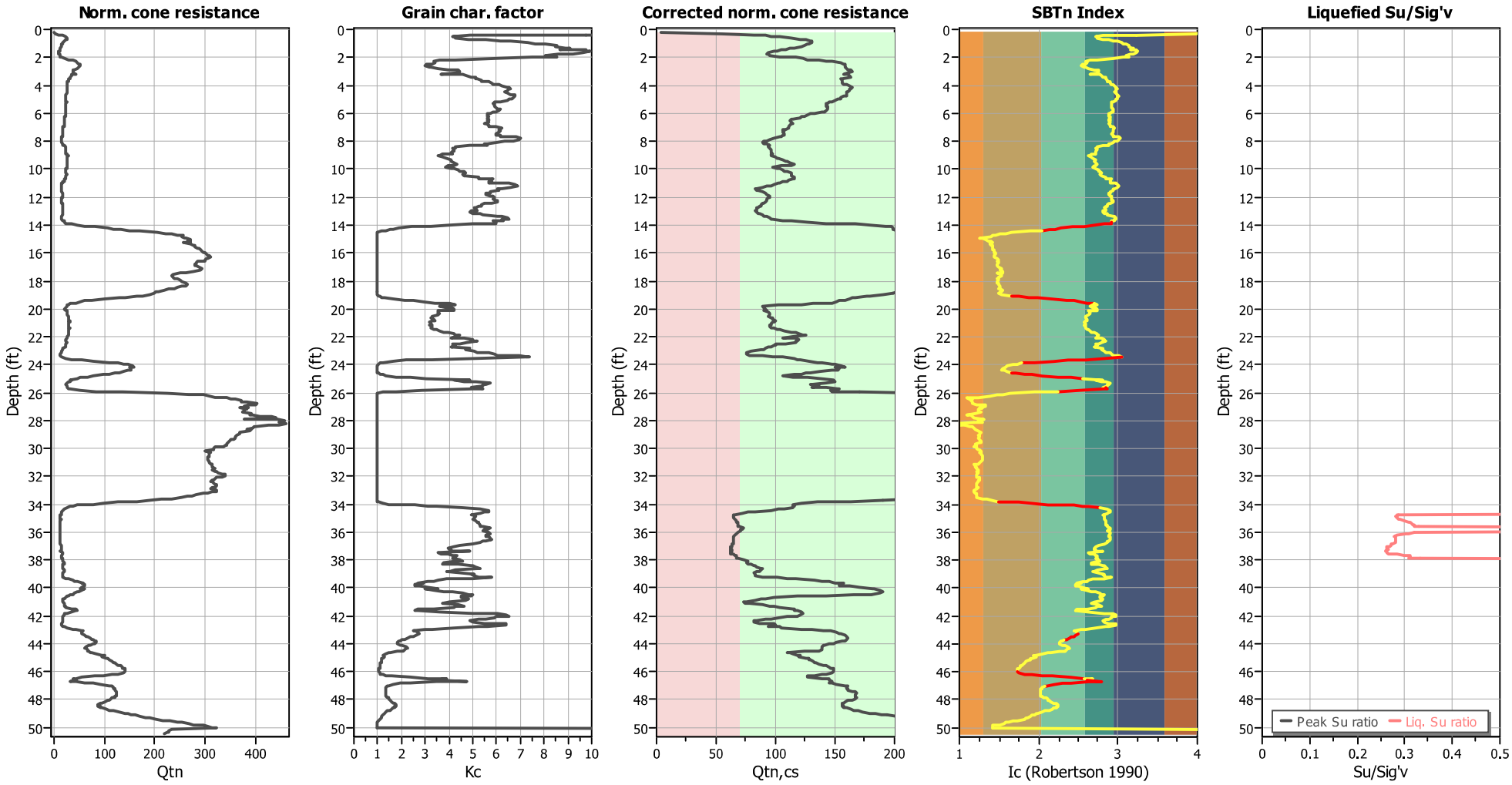
**F.S. color scheme**

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

**LPI color scheme**

- Very high risk
- High risk
- Low risk

## Check for strength loss plots (Robertson (2010))




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

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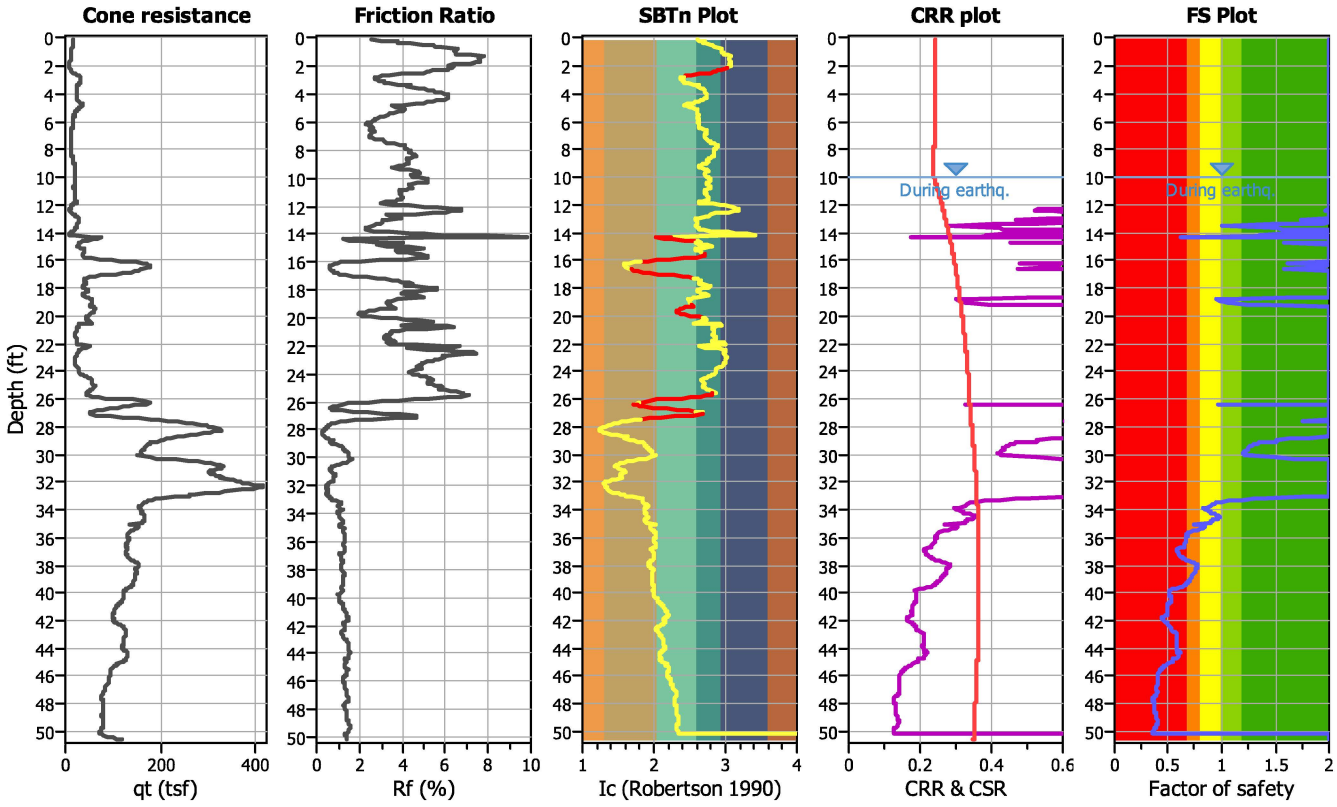
# LIQUEFACTION ANALYSIS REPORT

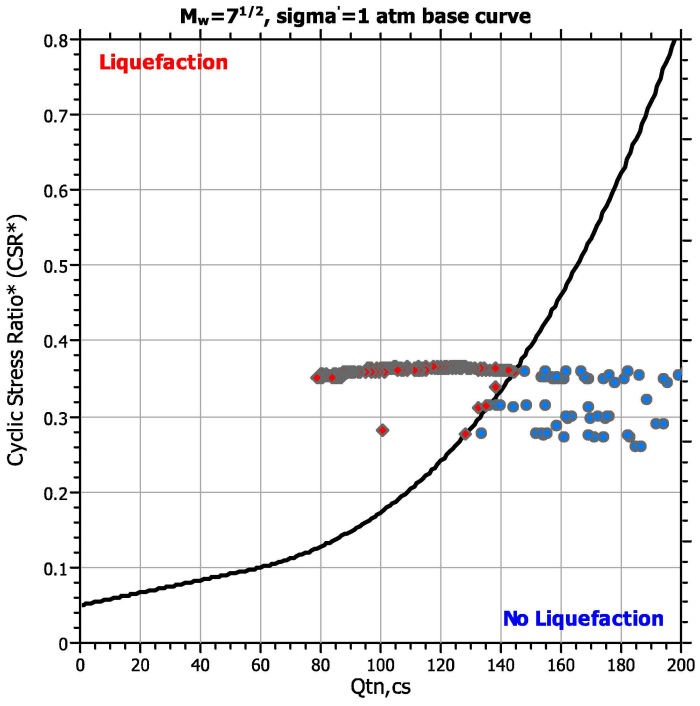
**Project title : EF International Language Campus** **Location : 3150 Bear St., Costa Mesa, CA**

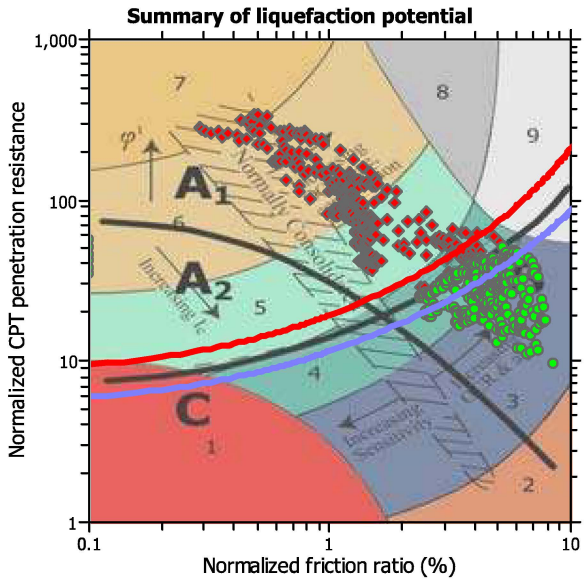
**CPT file : CPT-2A**

**Input parameters and analysis data**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | G.W.T. (in-situ): | 18.00 ft | Use fill: | No | Clay like behavior applied: | All soils |
| Fines correction method: | Robertson (2009) | G.W.T. (earthq.): | 10.00 ft | Fill height: | N/A | Limit depth applied: | No |
| Points to test: | Based on Ic value | Average results interval: | 1 | Fill weight: | N/A | Limit depth: | N/A |
| Earthquake magnitude $M_w$: | 6.50 | Ic cut-off value: | 2.60 | Trans. detect. applied: | Yes | MSF method: | Method based |
| Peak ground acceleration: | 0.54 | Unit weight calculation: | Based on SBT | $K_\sigma$ applied: | Yes | | |

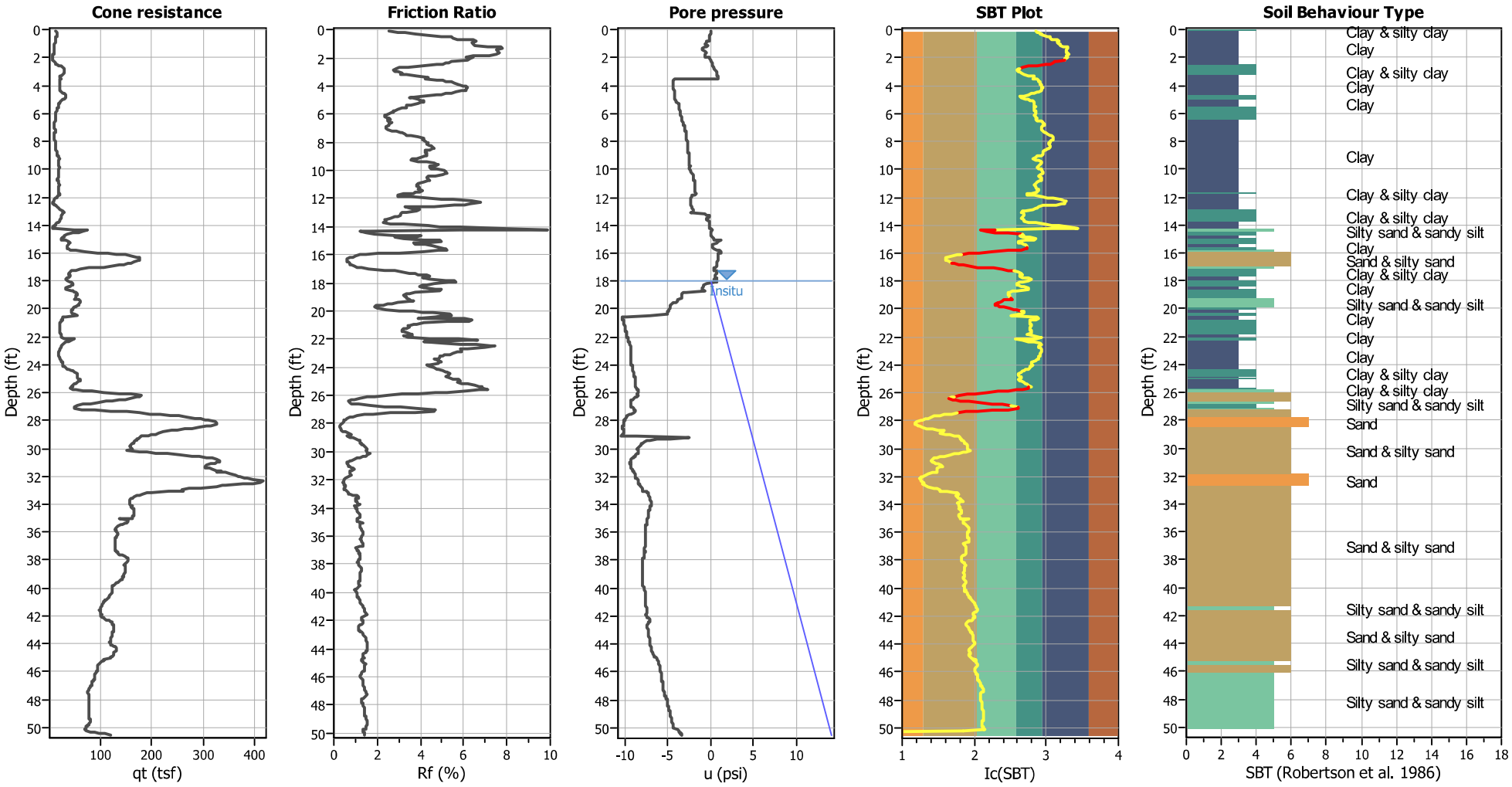



Zone $A_1$: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone $A_2$: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction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

# CPT basic interpretation plots



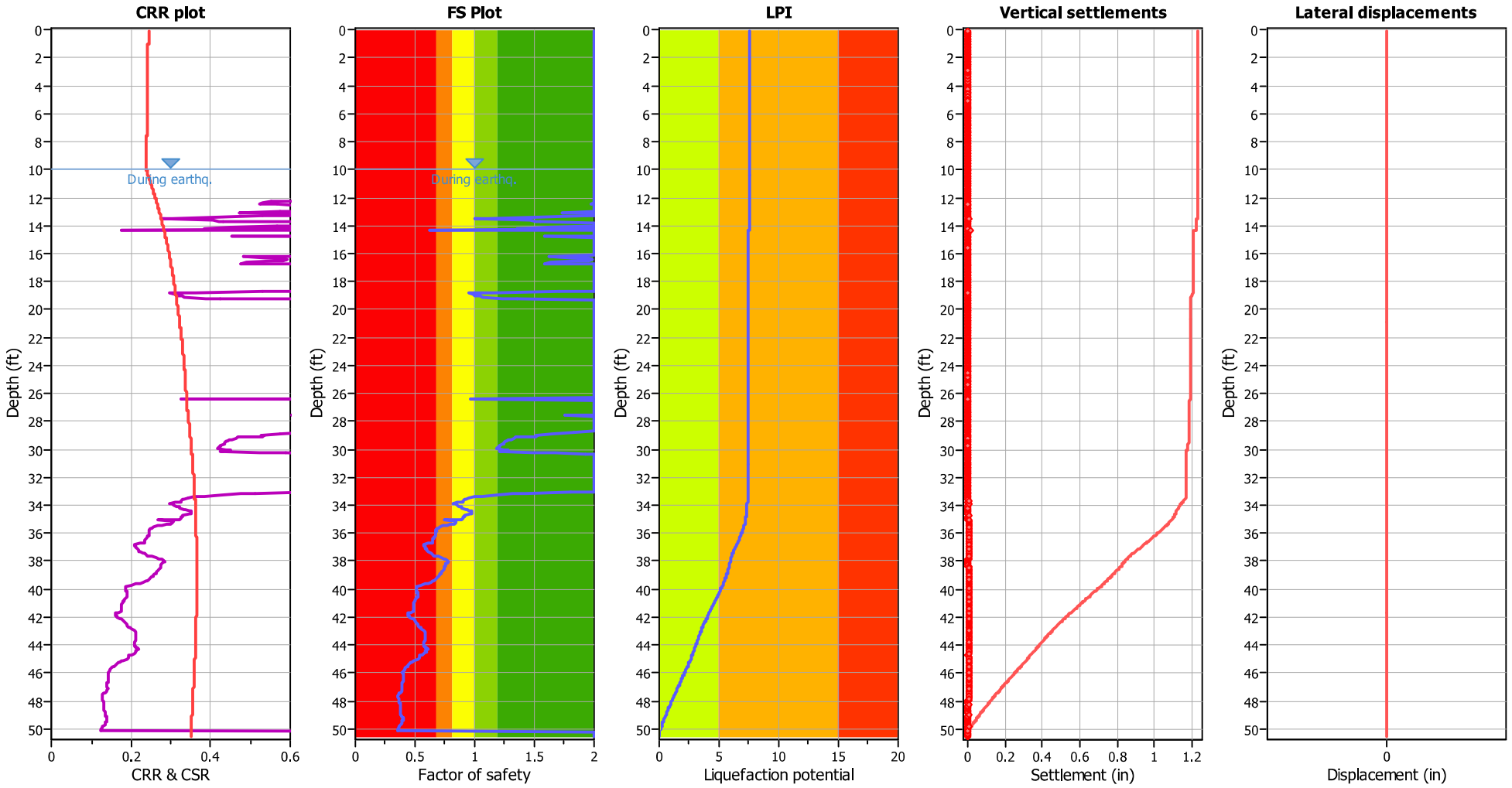

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

**SBT legend**

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

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

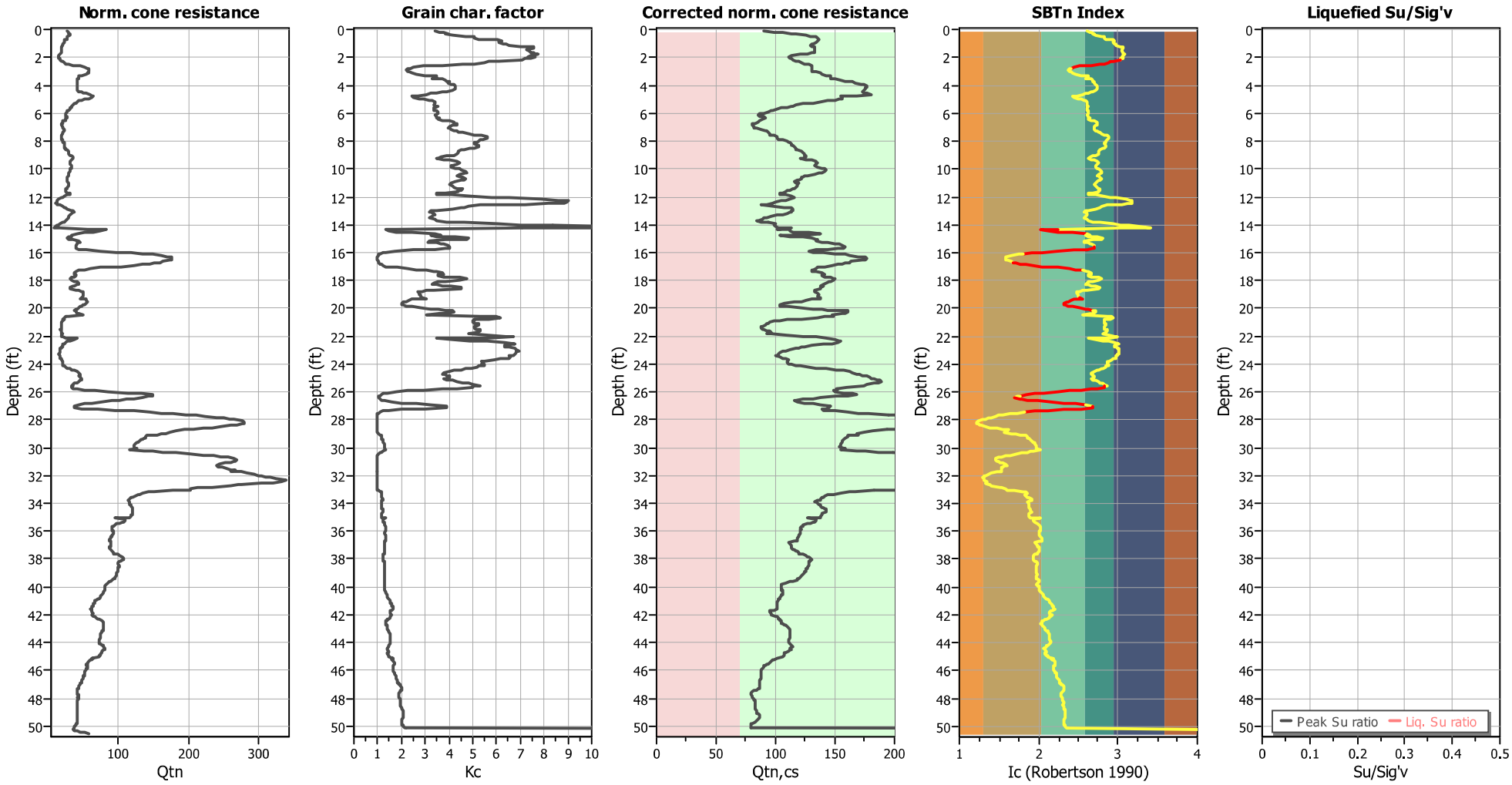
**F.S. color scheme**

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

**LPI color scheme**

- Very high risk
- High risk
- Low risk

## Check for strength loss plots (Robertson (2010))




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

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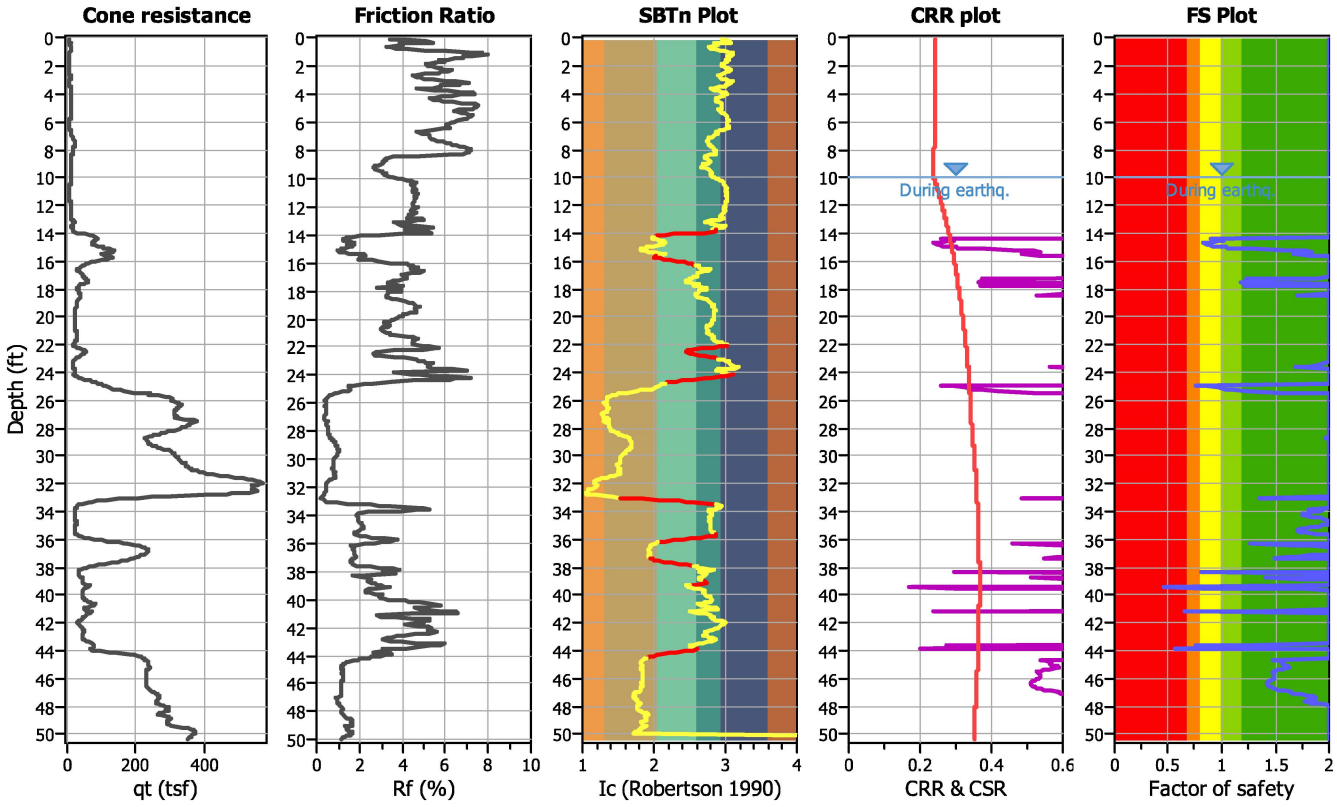
# LIQUEFACTION ANALYSIS REPORT

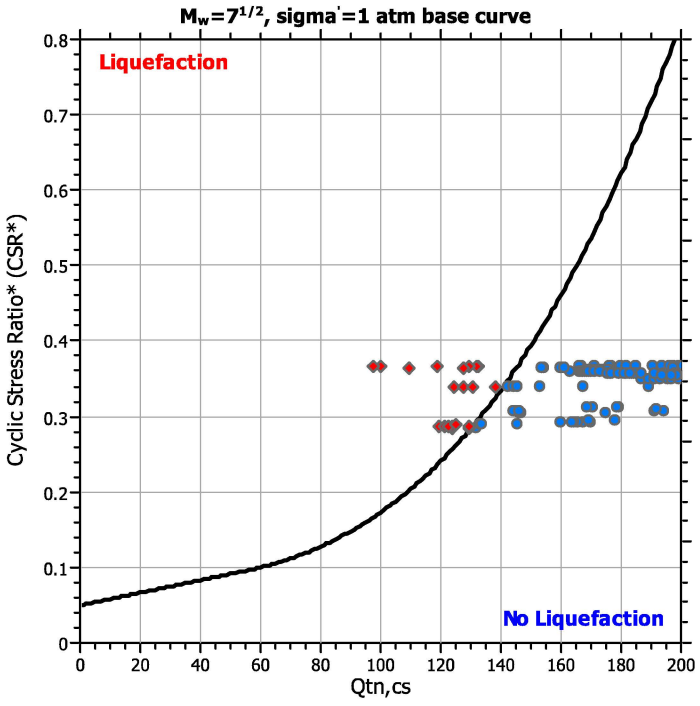
**Project title : EF International Language Campus** **Location : 3150 Bear St., Costa Mesa, CA**

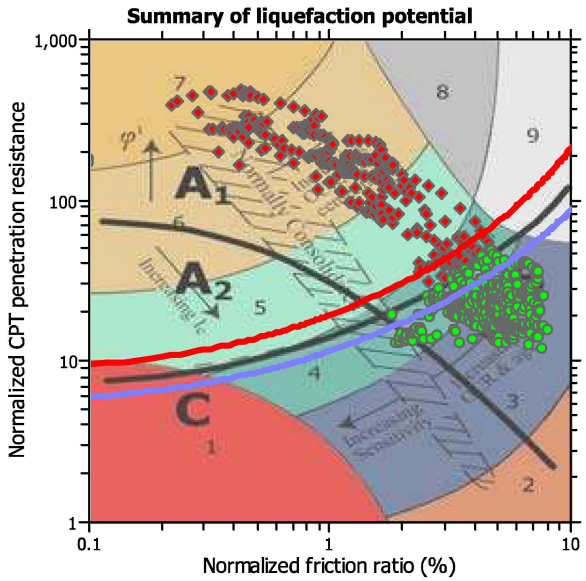
**CPT file : CPT-3A**

**Input parameters and analysis data**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | G.W.T. (in-situ): | 18.00 ft | Use fill: | No | Clay like behavior applied: | All soils |
| Fines correction method: | Robertson (2009) | G.W.T. (earthq.): | 10.00 ft | Fill height: | N/A | | |
| Points to test: | Based on Ic value | Average results interval: | 1 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude $M_w$: | 6.50 | Ic cut-off value: | 2.60 | Trans. detect. applied: | Yes | Limit depth: | N/A |
| Peak ground acceleration: | 0.54 | Unit weight calculation: | Based on SBT | $K_\sigma$ applied: | Yes | MSF method: | Method based |

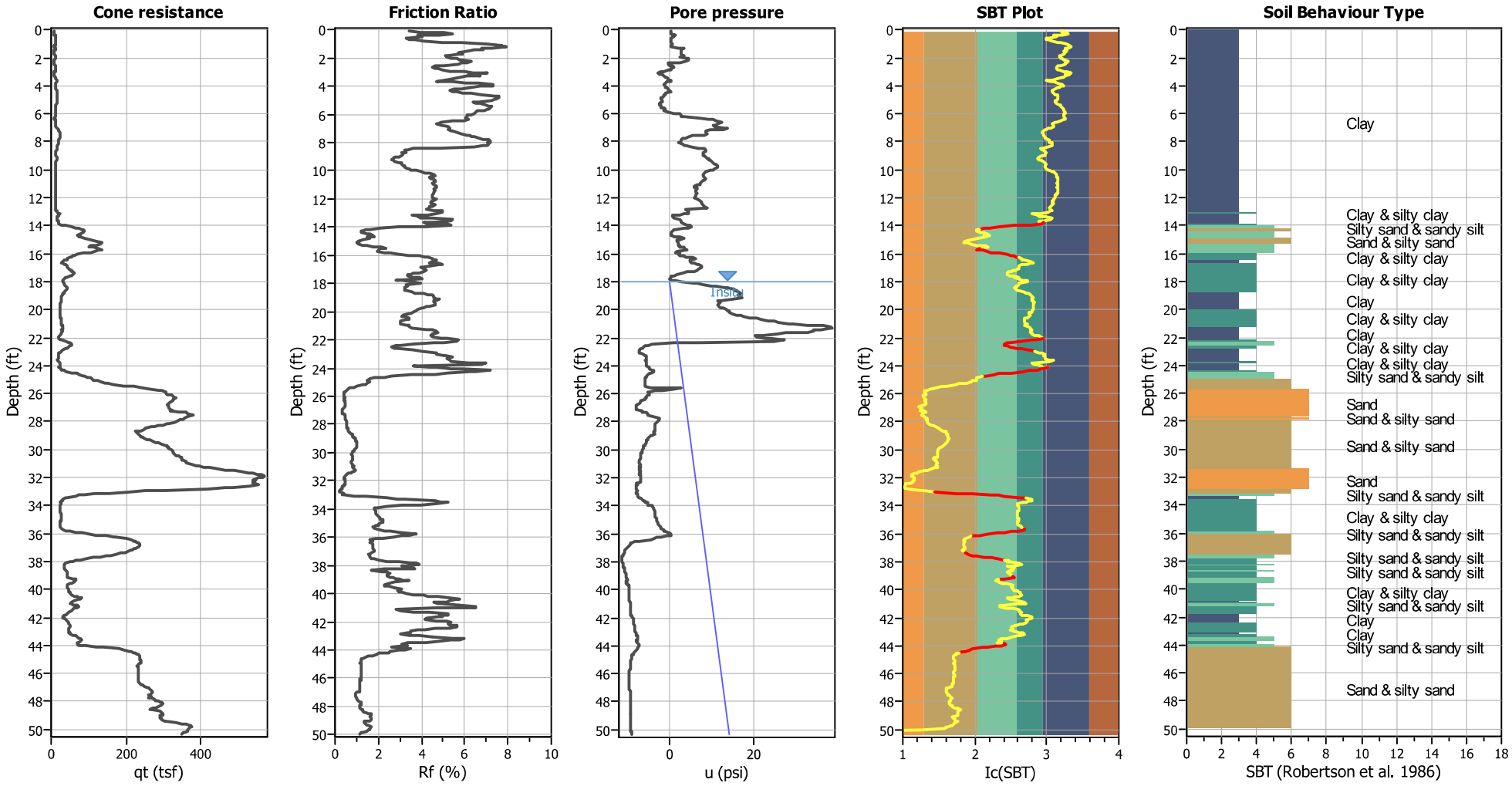



Zone $A_1$: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone $A_2$: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction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

# CPT basic interpretation plots



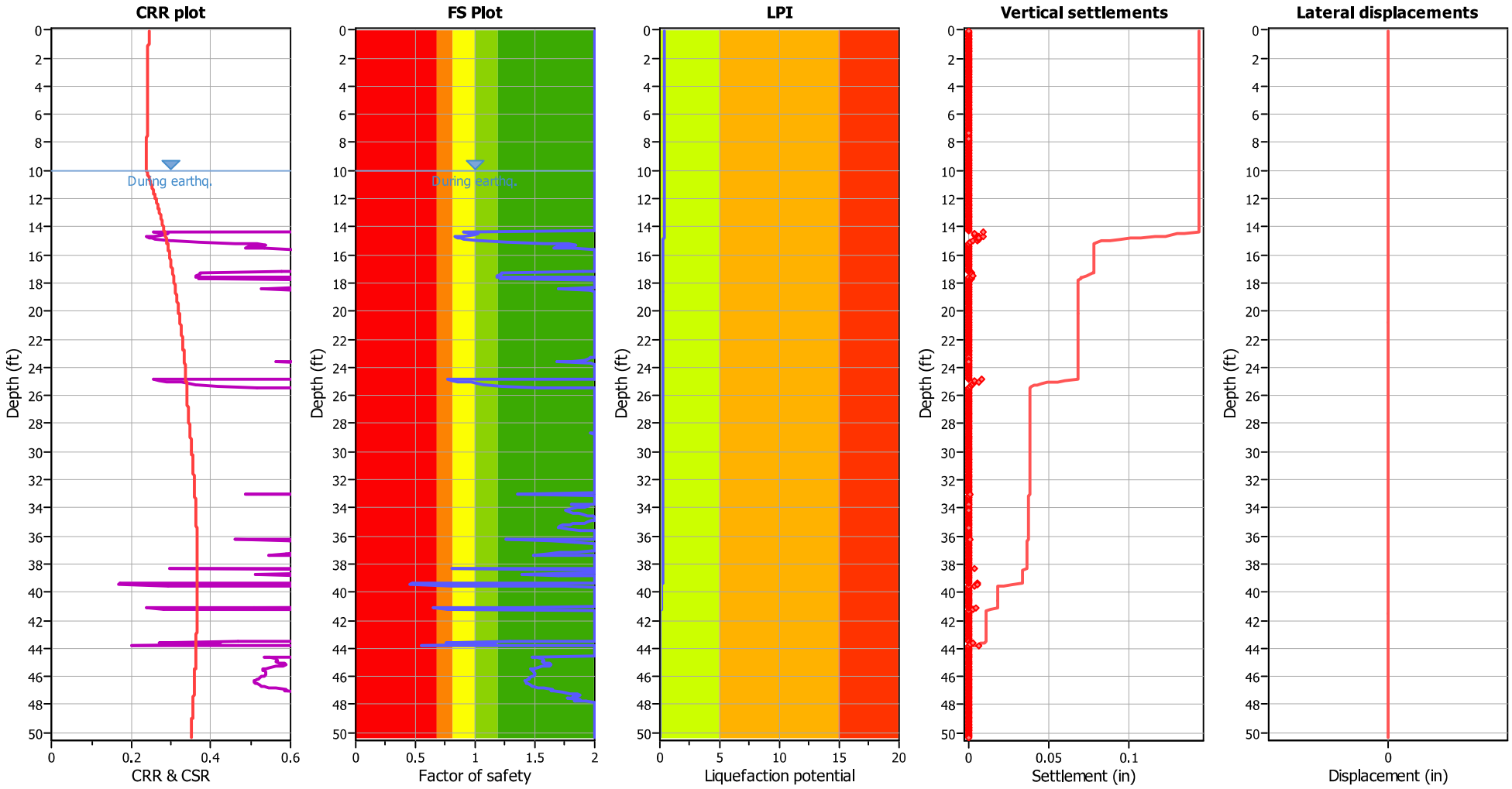

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

**SBT legend**

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

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

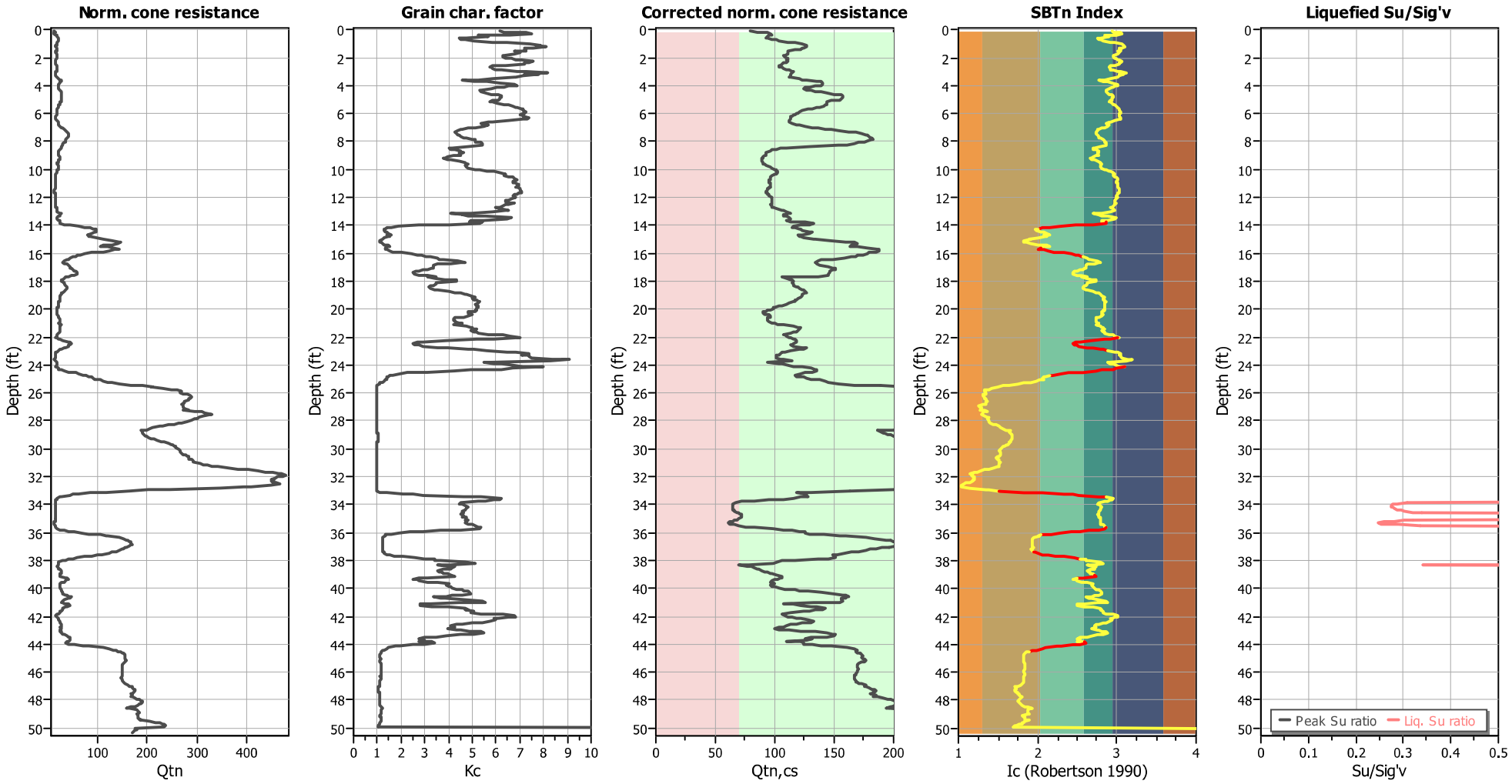
**F.S. color scheme**

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

**LPI color scheme**

- Very high risk
- High risk
- Low risk

## Check for strength loss plots (Robertson (2010))




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

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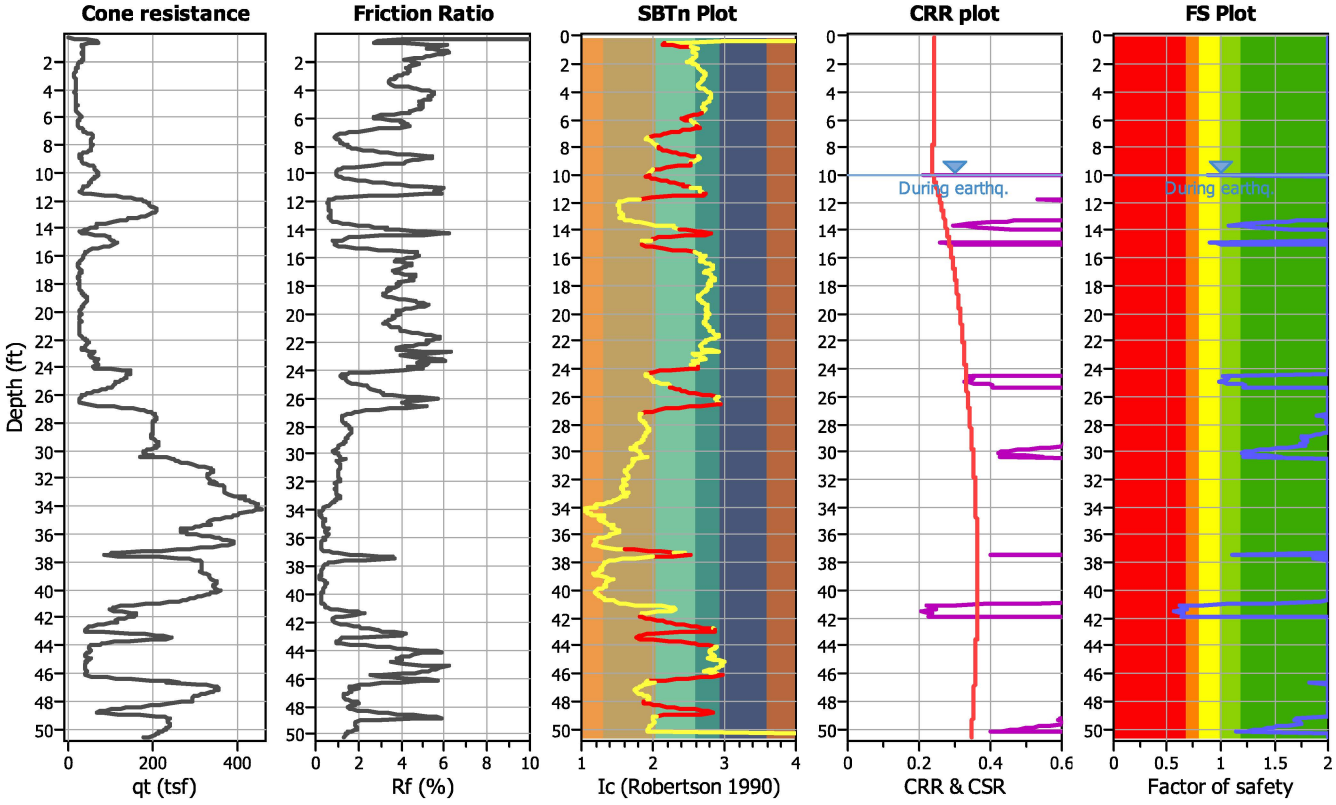
# LIQUEFACTION ANALYSIS REPORT

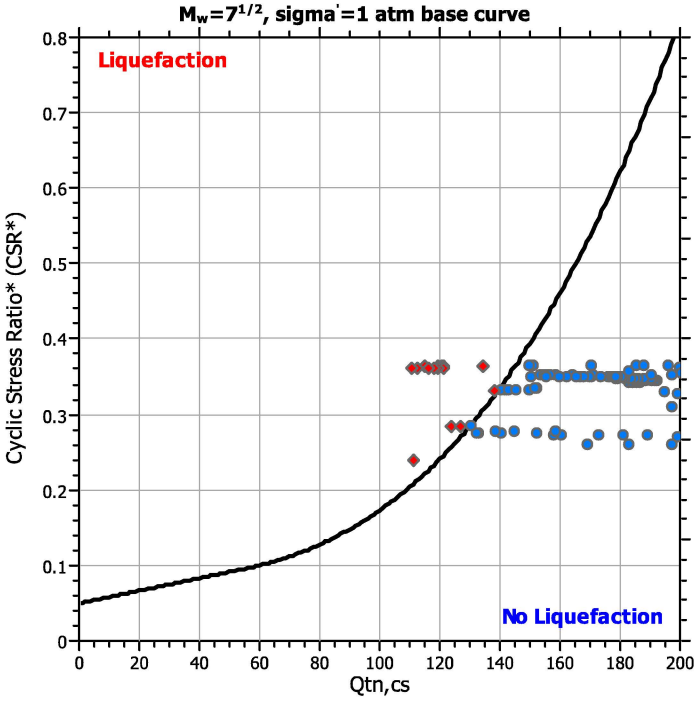
**Project title : EF International Language Campus** **Location : 3150 Bear St., Costa Mesa, CA**

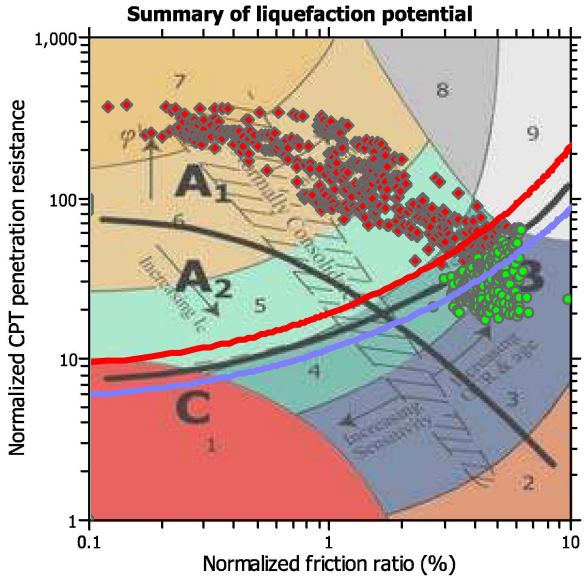
**CPT file : CPT-4**

**Input parameters and analysis data**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | G.W.T. (in-situ): | 18.00 ft | Use fill: | No | Clay like behavior applied: | All soils |
| Fines correction method: | Robertson (2009) | G.W.T. (earthq.): | 10.00 ft | Fill height: | N/A | | |
| Points to test: | Based on Ic value | Average results interval: | 1 | Fill weight: | N/A | Limit depth applied: | No |
| Earthquake magnitude $M_w$: | 6.50 | Ic cut-off value: | 2.60 | Trans. detect. applied: | Yes | Limit depth: | N/A |
| Peak ground acceleration: | 0.54 | Unit weight calculation: | Based on SBT | $K_\sigma$ applied: | Yes | MSF method: | Method based |

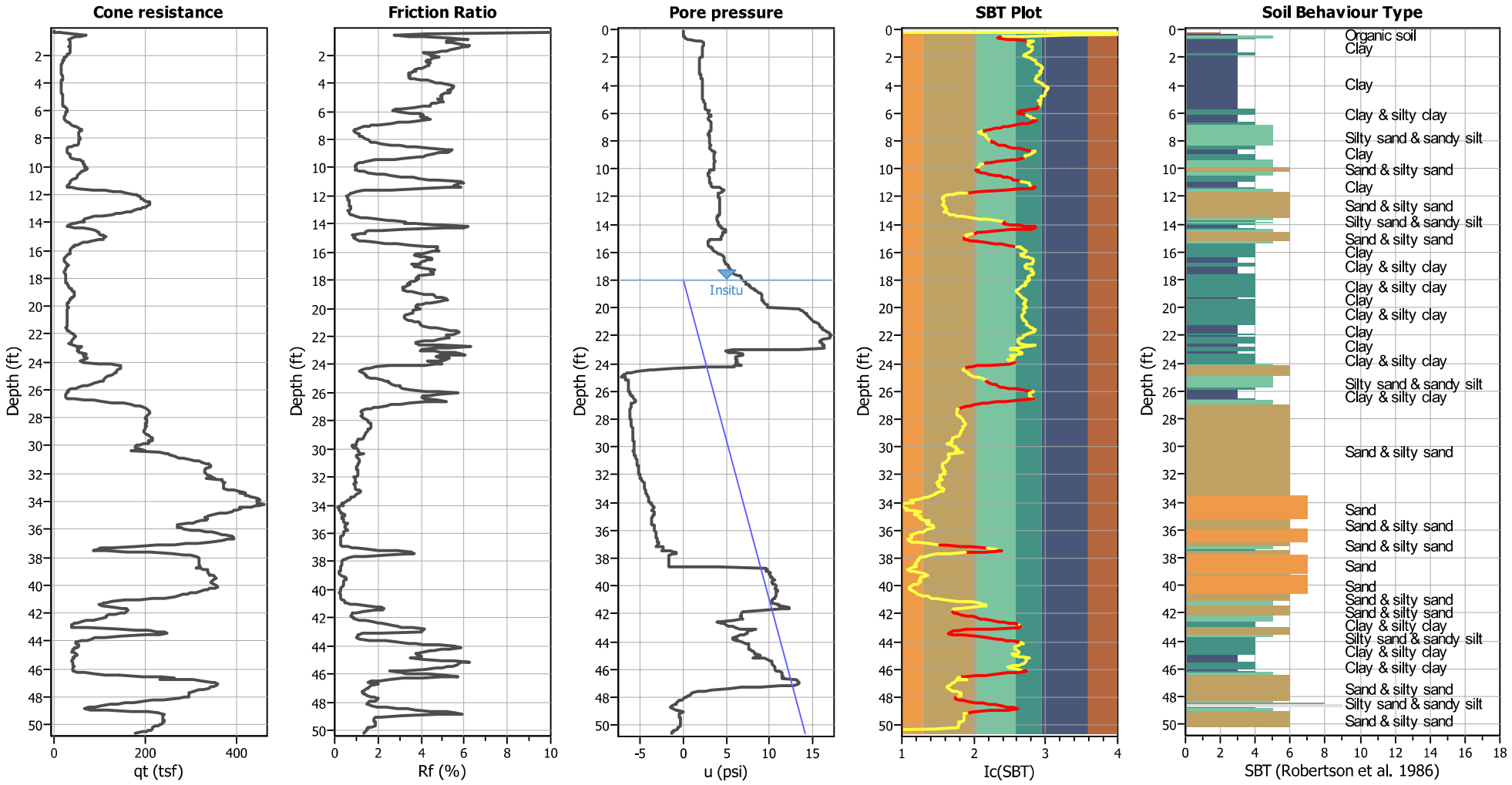



Zone $A_1$: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone $A_2$: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction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

# CPT basic interpretation plots



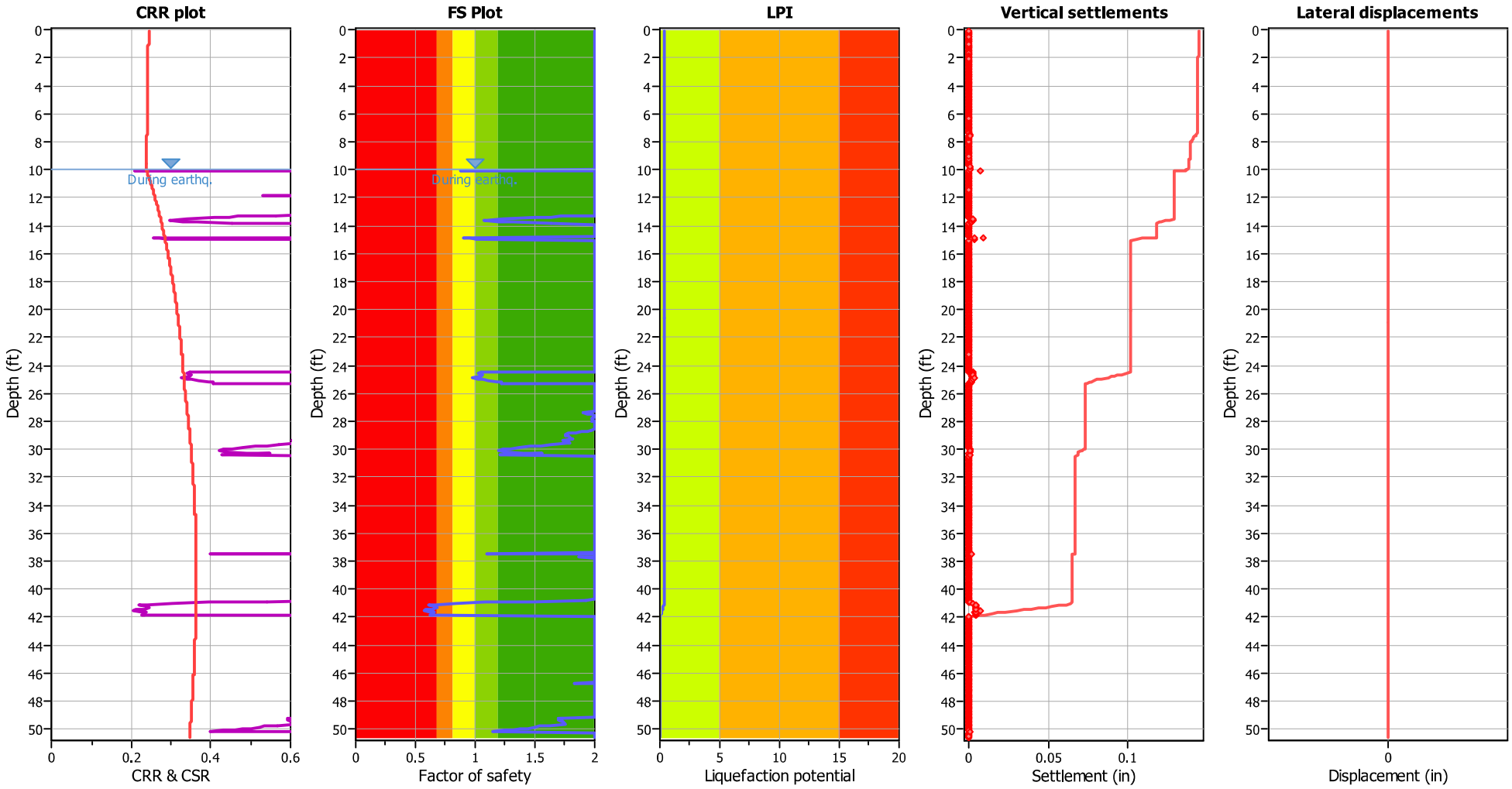

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

**SBT legend**

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

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

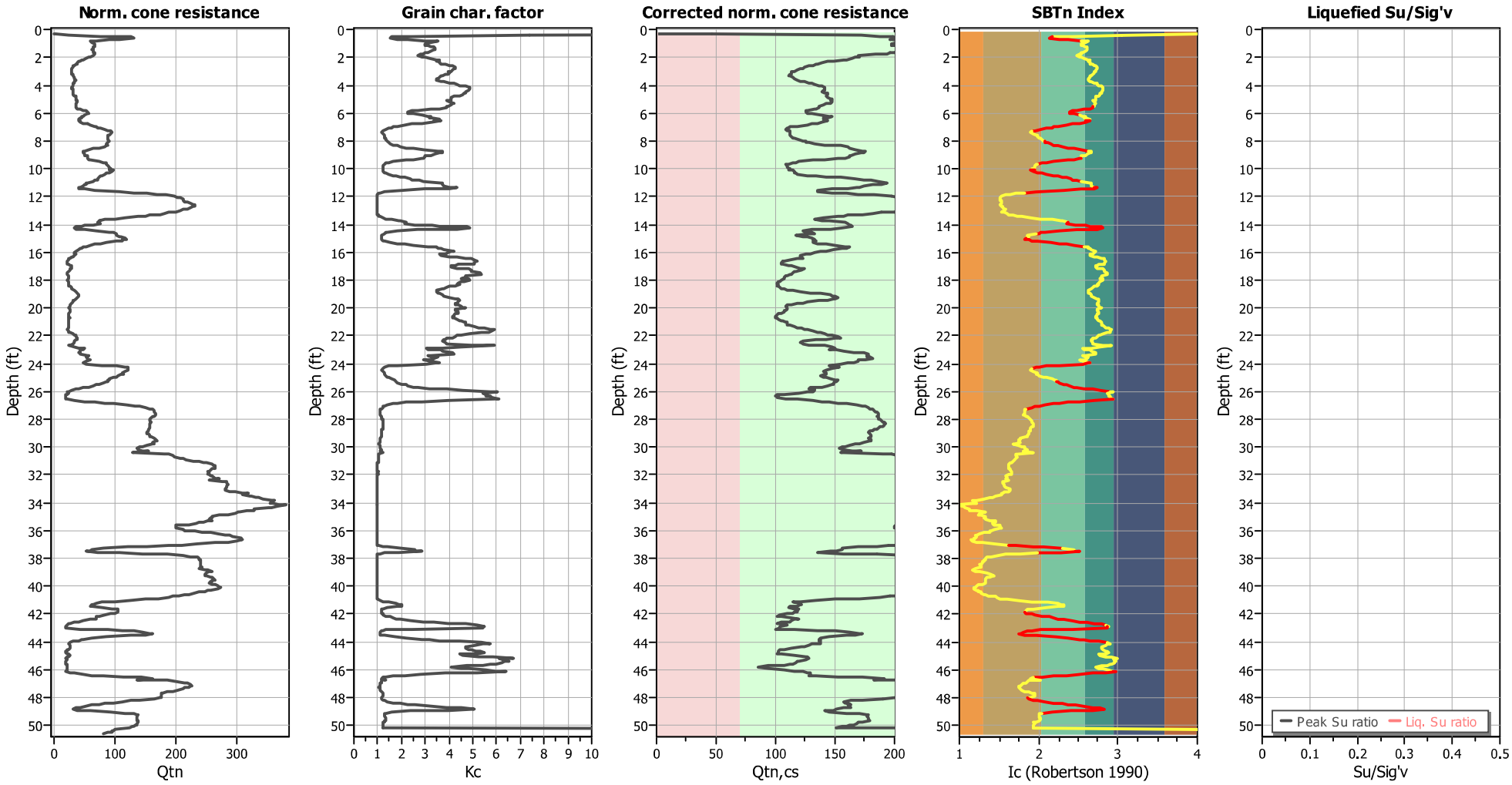
**F.S. color scheme**

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

**LPI color scheme**

- Very high risk
- High risk
- Low risk

## Check for strength loss plots (Robertson (2010))




### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | Robertson (2009) | Depth to water table (erthq.): | 10.00 ft | Fill weight: | N/A |
| Fines correction method: | Robertson (2009) | Average results interval: | 1 | Transition detect. applied: | Yes |
| Points to test: | Based on Ic value | Ic cut-off value: | 2.60 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.50 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | All soils |
| Peak ground acceleration: | 0.54 | Use fill: | No | Limit depth applied: | No |
| Depth to water table (insitu): | 18.00 ft | Fill height: | N/A | Limit depth: | N/A |

# Appendix G

# APPENDIX G

# GENERAL EARTHWORK AND GRADING SPECIFICATIONS

## 1.0 GENERAL

**1.1** **Intent:** These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these general Specifications. Observations of the earthwork by the project Geotechnical Consultant during grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

**1.2** **Geotechnical Consultant:** Prior to commencement of work, the project owner shall employ a geotechnical consultant. The geotechnical consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all keyway bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of subgrade and fill materials and perform adequate relative compaction testing of fill to determine the attained level of compaction and assess if, in their opinion, if the work was performed in substantial compliance

with the geotechnical report(s) and these specifications. The Geotechnical Consultant shall provide test results to the owner on a routine and frequent basis.

**1.3 The Earthwork Contractor:** The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with applicable grading codes, the project plans, and these specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork planned for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are corrected.

## 2.0 PREPARATION OF FILL AREAS

**2.1 Clearing and Grubbing:** Areas to be excavated and filled shall be cleared and grubbed. Vegetation, such as brush, grass, roots, and other deleterious material, man-made structures, and similar debris shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant. Borrow areas shall be cleared and grubbed to the extent necessary to provide a suitable fill material.

Concrete fragments that are free of reinforcing street may be placed in fills, provided they are placed in accordance with Section 3 and 4. Earth fill material

shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent organic matter. Nesting of organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, etc.) have chemical constituents that are considered hazardous waste. As such, the indiscriminate dumping or spillage of such fluids may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

The Geotechnical Consultant shall not be responsible for the identification or analysis of potentially hazardous materials; however, if observations, odors, or soil discoloration are suspect, the Geotechnical Consultant may request from the owner the termination of grading operations until such materials are deemed not hazardous as defined by applicable laws and regulations.

**2.2** **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 the survey control for determining elevations of processed areas, keys, and benches.

**2.3** **Processing:** Ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Ground that is not satisfactory shall be removed/overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction. After scarification, the surface should be moisture conditioned, as necessary, to achieve the proper moisture content and compacted in accordance with Section 4 of these specifications.

**2.4** **Overexcavation:** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured, or otherwise unsuitable ground shall be overexcavated to competent ground as recommended by the Geotechnical Consultant during grading.

**2.5** **Benching:** Fills to be placed on ground sloping steeper than 5H:1V (horizontal to vertical units) shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for fill placement.

## 3.0 FILL MATERIAL

**3.1** **General:** Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. 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.

**3.2** **Oversize:** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or other underground construction.

**3.3** **Import:** If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1 and/or requirements defined in the project geotechnical report(s). The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before import begins so that suitability can be determined, and appropriate laboratory tests performed.

## 4.0 FILL PLACEMENT AND COMPACTION

**4.1** **Fill Layers:** Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

**4.2** **Fill 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 over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with ASTM International (ASTM Test Method D1557).

**4.3** **Compaction of Fill:** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction and uniformity.

**Compaction of Fill Slopes:** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

**4.4** **Compaction Testing:** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

**4.5** **Frequency of Compaction Testing:** Tests shall be taken at intervals required by the governing agency and as deemed necessary by the Geotechnical Consultant in order to adequately qualify the fill material. In general, it should be anticipated that tests will be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill, unless recommended otherwise by the Geotechnical Consultant. In addition, test(s) shall be taken on slope faces and/or each 10 feet of vertical height of slope as deemed necessary by the Geotechnical Consultant. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

**4.6** **Compaction Test Locations:** The Geotechnical Consultant shall document the approximate elevation and location of each compaction test. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided. Alternatively, GPS units may be used to determine the approximate location/coordinates of the field density tests.

## 5.0 SUBDRAIN INSTALLATION

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and standard details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys. The Contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The Contractor is responsible for the performance of subdrains.

## 6.0 EXCAVATION

Excavations, including over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical report(s) and plans are estimates. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

## 7.0 TRENCH BACKFILLS

**7.1** Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

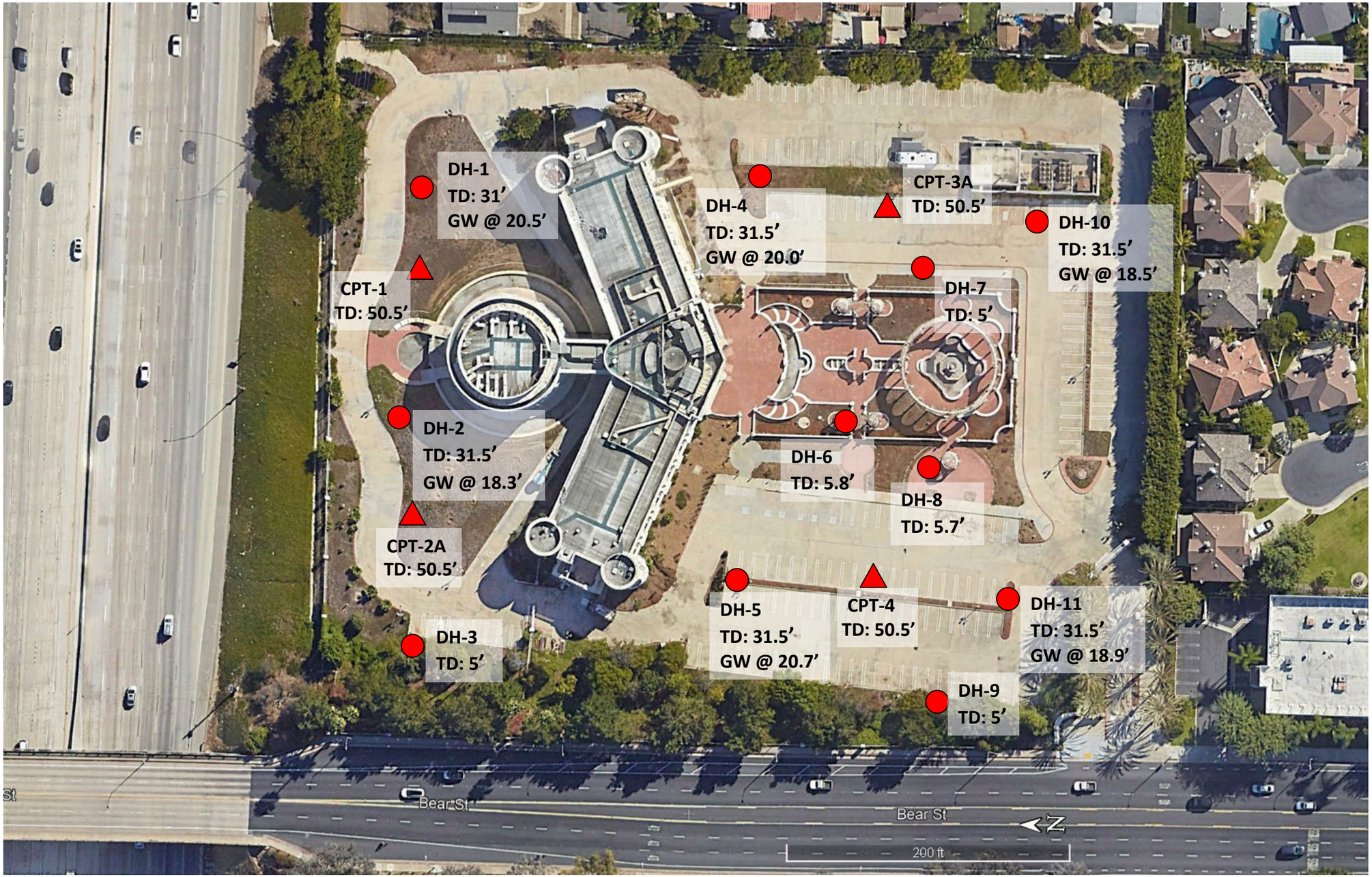
**7.2** Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum 90 percent of maximum from 1 foot above the top of the conduit to the surface, except in traveled ways (see Section 7.6 below).

**7.3** Jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

**7.4** Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill, unless required differently by the governing agency or the Geotechnical Consultant.

**7.5** Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

**7.6** Trench backfill in the upper foot measured from finish grade within existing or future traveled way, shoulder, and other paved areas (or areas to receive pavement) should be placed to a minimum 95 percent relative compaction.




## Legend

**DH-11**
**TD: 31.5**
**GW @ 18.9’**

Approximate Hollow Stem Auger Boring/Percolation Test Location by others (GMU, 2019), Showing Total Depth and Depth to Groundwater in Feet.

**CPT-4**
**TD: 50.5’**

Cone Penetrometer Test Location by others (GMU, 2019), Showing Total Depth in Feet.

# BORING LOCATION MAP

Meritage Homes
Proposed Residential Development
1350 Bear Street
Costa Mesa, California

Project Number: 23150-01
Date: January 5, 2024
Plate 1

S A

# Attachment E: Educational Materials

# The Pollution Solution

Several residential activities can result in water pollution. Among these activities are car washing and hosing off driveways and sidewalks. Both activities can waste water and result in excess runoff. Water conservation methods described in this pamphlet can prevent considerable amounts of runoff and conserve water. By taking your car to a commercial car wash and by sweeping driveways and sidewalks, you can further prevent the transport of pollutants to Orange County waterways. Here are some of the common pollutants for which you can be part of the solution:

### 1 Pesticides and Fertilizer

- **Pollution:** The same pesticides that are designed to be toxic to pests can have an equally lethal impact on our marine life. The same fertilizer that promotes plant growth in lawns and gardens can also create nuisance algae blooms, which remove oxygen from the water and clog waterways when it decomposes.
- **Solution:** Never use pesticides or fertilizer within 48 hours of an anticipated rainstorm. Use only as much as is directed on the label and keep it off driveways and sidewalks.

### 2 Dirt and Sediment

- **Pollution:** Dirt or sediment can impede the flow of the stormwater and negatively impact stream habitat as it travels through waterways and deposits downstream. Pollutants can attach to sediment, which can then be transported through our waterways.
- **Solution:** Protect dirt stockpiles by covering them with tarps or secure plastic sheets to prevent wind or rain from allowing dirt or sediment to enter the storm drain system.

### 3 Metals

- **Pollution:** Metals and other toxins present in car wash water can harm important plankton, which forms the base of the aquatic food chain.
- **Solution:** Take your car to a commercial car wash where the wash water is captured and treated at a local wastewater treatment plant.

***DID YOU KNOW?***

***Did you know that most of the pollution found in our waterways is not from a single source, but from a "non-point" source meaning the accumulation of pollution from residents and businesses throughout the community***

### 4 Pet Waste

- **Pollution:** Pet waste carries bacteria through our watersheds and eventually will be washed out to the ocean. This can pose a health risk to swimmers and surfers.
- **Solution:** Pick up after your pets!

### 5 Trash and Debris

- **Pollution:** Trash and debris can enter waterways by wind, littering and careless maintenance of trash receptacles. Street sweeping collects some of this trash; however, much of what isn't captured ends up in our storm drain system where it flows untreated out to the ocean.
- **Solution:** Don't litter and make sure trash containers are properly covered. It is far more expensive to clean up the litter and trash that ends up in our waterways than it is to prevent it in the first place. Come out to one of Orange County's many locations for Coastal and Inner-Coastal Cleanup Day, which is held in September.

### 6 Motor Oil / Vehicle Fluids

- **Pollution:** Oil and petroleum products from our vehicles are toxic to people, wildlife and plants.
- **Solution:** Fix any leaks from your vehicle and keep the maintenance up on your car. Use absorbent material such as cat litter on oil spills, then sweep it up and dispose of it in the trash. Recycle used motor oil at a local Household Hazardous Waste Collection Center.

## A TEAM EFFORT

The Orange County Stormwater Program has teamed with the Municipal Water District of Orange County (MWDOC) and the University of California Cooperative Extension Program (UCCE) to develop this pamphlet.

Low Impact Development (LID) and sustainable water use prevents water pollution and conserves water for drinking and reuse. Reducing your water use and the amount of water flowing from your home protects the environment and saves you money.

## Thank you for making water protection a priority!

For more information, please visit
www.ocwatersheds.com/publiced/

www.mwdoc.com

www.uccemg.com


To report a spill, call the Orange County 24-Hour Water Pollution Prevention Reporting Hotline at 1-877-89-SPILL \(1-877-897-7455)

**Special Thanks to**
The City of Los Angeles Stormwater Program for the use of its artwork

The Metropolitan Water District of Southern California for the use of the California-Friendly Plant and Native Habitat photos

# Homeowners Guide for Sustainable Water Use

**Low Impact Development, Water Conservation & Pollution Prevention**

The Ocean Begins at Your Front Door

# RUNOFF, RAINWATER AND REUSE

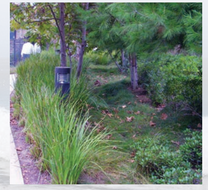
## Where Does Water Runoff Go?

Stormwater, or water from rainfall events, and runoff from outdoor water use such as sprinklers and hoses flows from homes directly into catch basins and the storm drain system. After entering the storm drain, the water flows untreated into streams, rivers, bays and ultimately the Pacific Ocean. Runoff can come from lawns, gardens, driveways, sidewalks and roofs. As it flows over hard, impervious surfaces, it picks up pollutants. Some pollutants carried by the water runoff include trash, pet waste, pesticides, fertilizer, motor oil and more.

## Water Conservation

Pollution not only impairs the water quality for habitat and recreation, it can also reduce the water available for reuse. Runoff allowed to soak into the ground is cleaned as it percolates through the soil, replenishing depleted groundwater supplies. Groundwater provides at least 50% of the total water for drinking and other indoor household activities in north and central Orange County. When land is covered with roads, parking lots, homes, etc., there is less land to take in the water and more hard surfaces over which the water can flow.

In Orange County, 60-70% of water used by residents and businesses goes to irrigation and other outdoor uses. Reusing rainwater to irrigate our lawn not only reduces the impact of water pollution from runoff, but it also is a great way to conserve our precious water resources and replenish our groundwater basin.



### What is Low Impact Development (LID)?

Low Impact Development (LID) is a method of development that seeks to maintain the natural hydrologic character of an area. LID provides a more sustainable and pollution-preventative approach to water management.

New water quality regulations require implementation of LID in larger new developments and encourage implementation of LID and other sustainable practices in existing residential areas. Implementing modifications to your lawn or garden can reduce pollution in our environment, conserve water and reduce your water bill.

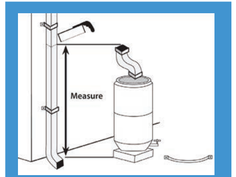
Permeable pavement allows water runoff to infiltrate through the soil and prevents most pollutants from reaching the storm drain system.

# OPTIONS FOR RAINWATER HARVESTING AND REUSE

Rainwater harvesting is a great way to save money, prevent pollution and reduce potable water use. To harvest your rainwater, simply redirect the runoff from roofs and downspouts to rain barrels. Rain gardens are another option; these reduce runoff as well as encourage infiltration.

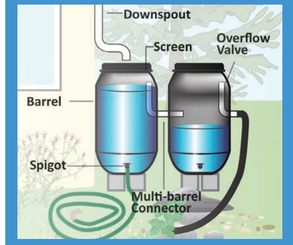
## Downspout Disconnection/Redirection

Disconnecting downspouts from pipes running to the gutter prevents runoff from transporting pollutants to the storm drain. Once disconnected, downspouts can be redirected to rain gardens or other vegetated areas, or be connected to a rain barrel.

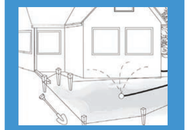



## Rain Barrels

Rain barrels capture rainwater flow from roofs for reuse in landscape irrigation. Capacity of rain barrels needed for your home will depend on the amount of roof area and rainfall received. When purchasing your rain barrel, make sure it includes a screen, a spigot to siphon water for use, an overflow tube to allow for excess water to run out and a connector if you wish to connect multiple barrels to add capacity of water storage.



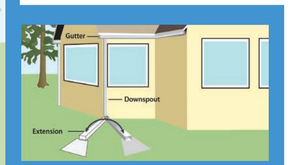

Mosquito growth prevention is very important when installing a rain barrel. The best way to prevent mosquito breeding is to eliminate entry points by ensuring all openings are sealed tightly. If these methods are unsuccessful, products are available to kill mosquito larvae, but that are harmless to animals and humans. Regular application of these products is essential. Please visit the Orange County Vector Control website for more information at www.ocvcd.org/mosquitoes3.php.



## Rain Gardens

Rain gardens allow runoff to be directed from your roof downspout into a landscaped area. Vegetation and rocks in the garden will slow the flow of water to allow for infiltration into the soil. Plants and soil particles will absorb pollutants from the roof runoff. By utilizing a native plant palate, rain gardens can be maintained all year with minimal additional irrigation. These plants are adapted to the semi-arid climate of Southern California, require less water and can reduce your water bill.

Before modifying your yard to install a rain garden, please consult your local building and/or planning departments to ensure your garden plan follows pertinent building codes and ordinances. Besides codes and ordinances, some home owner associations also have guidelines for yard modifications. If your property is in hill areas or includes engineered slopes, please seek professional advice before proceeding with changes.




For information on how to disconnect a downspout or to install and maintain a rain barrel or rain garden at your home, please see the Los Angeles Rainwater Harvesting Program, A Homeowner's "How-To" Guide, November 2009 at www.larainwaterharvesting.org/

# OTHER WATER CONSERVATION AND POLLUTION PREVENTION TECHNIQUES

## Native Vegetation and Maintenance

"California Friendly" plants or native vegetation can significantly reduce water use. These plants often require far less fertilizers and pesticides, which are two significant pollutants found in Orange County waterways. Replacing water "thirsty" plants and grass types with water efficient natives is a great way to save water and reduce the need for potentially harmful pesticides and fertilizer.

Please see the California Friendly Garden Guide produced by the Metropolitan Water District of Southern California and associated Southern California Water Agencies for a catalog of California friendly plants and other garden resources at www.bewaterwise.com/Gardensoft.

## Weed Free Yards

Weeds are water thieves. They often reproduce quickly and rob your yard of both water and nutrients. Weed your yard by hand if possible. If you use herbicides to control the weeds, use only the amount recommended on the label and never use it if rain is forecast within the next 48 hours.

## Soil Amendments

Soil amendments such as green waste (e.g. grass clippings, compost, etc.) can be a significant source of nutrients and can help keep the soil near the roots of plants moist. However, they can cause algal booms if they get into our waterways, which reduces the amount of oxygen in the water and impacts most aquatic organisms. It is important to apply soil amendments more than 48 hours prior to predicted rainfall.

# IRRIGATE EFFICIENTLY

Water runoff from sprinklers left on too long will carry pollutants into our waterways.

## Smart Irrigation Controllers

Smart Irrigation Controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy or too cold, the smart irrigation control sprinklers will automatically shut off.

Check with your local water agency for available rebates on irrigation controllers and smart timers.

- Aim your sprinklers at your lawn, not the sidewalk – By simply adjusting the direction of your sprinklers you can save water, prevent water pollution from runoff, keep your lawn healthy and save money.
- **Set a timer for your sprinklers** – lawns absorb the water they need to stay healthy within a few minutes of turning on the sprinklers. Time your sprinklers; when water begins running off your lawn, you can turn them off. Your timer can be set to water your lawn for this duration every time.
- **Water at Sunrise** – Watering early in the morning will reduce water loss due to evaporation. Additionally, winds tend to die down in the early morning so the water will get to the lawn as intended.
- **Water by hand** – Instead of using sprinklers, consider watering your yard by hand. Hand-watering ensures that all plants get the proper amount of water and you will prevent any water runoff, which wastes water and carries pollutants into our waterways.
- **Fix leaks** - Nationwide, households waste one trillion gallons of water a year to leaks – that is enough water to serve the entire state of Texas for a year. If your garden hose is leaking, replace the nylon or rubber hose washer and ensure a tight connection. Fix broken sprinklers immediately.

*Do your part to prevent water pollution in our creeks, rivers, bays and ocean.*

Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common household activities can lead to water pollution if you're not careful.

*Remember the Water in Your Storm Drain is Not Treated BEFORE It Enters Our Waterways*

Litter, oil, chemicals and other substances that are left on your yard or driveway can be blown or washed into storm drains that flow to the ocean. Over-watering your lawn and washing your car can also flush materials into the storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated.

You would never pour soap, fertilizers or oil into the ocean, so don't let them enter streets, gutters or storm drains. Follow the easy tips in this brochure to help prevent water pollution.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while performing everyday household activities. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

GENUINE RECYCLED PAPER
50% PRE-CONSUMER AND 15% POST-CONSUMER

RECYCLE USED OIL

Help Prevent Ocean Pollution:

# Household Tips

**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

# Pollution Prevention

## *Household Activities*

- **Do not rinse spills with water!** Sweep outdoor spills and dispose of in the trash. For wet spills like oil, apply cat litter or another absorbent material, then sweep and bring to a household hazardous waste collection center (HHWCC).
- Securely cover trash cans.
- Take household hazardous waste to a household hazardous waste collection center.
- Store household hazardous waste in closed, labeled containers inside or under a cover.
- Do not hose down your driveway, sidewalk or patio. Sweep up debris and dispose of in trash.
- Always pick up after your pet. Flush waste down the toilet or dispose of in the trash.
- Bathe pets indoors or have them professionally groomed.

## *Household Hazardous Wastes include:*

- ▲ **Batteries**
- ▲ **Paint thinners, paint strippers and removers**
- ▲ **Adhesives**
- ▲ **Drain openers**
- ▲ **Oven cleaners**
- ▲ **Wood and metal cleaners and polishes**
- ▲ **Herbicides and pesticides**
- ▲ **Fungicides/wood preservatives**
- ▲ **Automotive fluids and products**
- ▲ **Grease and rust solvents**
- ▲ **Thermometers and other products containing mercury**
- ▲ **Fluorescent lamps**
- ▲ **Cathode ray tubes, e.g. TVs, computer monitors**
- ▲ **Pool and spa chemicals**

## *Gardening Activities*

- Follow directions on pesticides and fertilizers, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Water your lawn and garden by hand to control the amount of water you use. Set irrigation systems to reflect seasonal water needs. If water flows off your yard and onto your driveway or sidewalk, your system is over-watering.
- Mulch clippings or leave them on the lawn. If necessary, dispose in a green waste container.
- Cultivate your garden often to control weeds.

## *Washing and Maintaining Your Car*

- Take your car to a commercial car wash whenever possible.
- Choose soaps, cleaners, or detergents labeled "non-toxic," "phosphate free" or "biodegradable." Vegetable and citrus-based products are typically safest for the environment, **but even these should not be allowed into the storm drain.**
- Shake floor mats into a trash can or vacuum to clean.
- Do not use acid-based wheel cleaners and "hose off" engine degreasers at home. They can be used at a commercial facility, which can properly process the washwater.
- **Do not dump washwater onto your driveway, sidewalk, street, gutter or storm drain.** Excess washwater should be disposed of in the sanitary sewers (through a sink, or toilet) or onto an absorbent surface like your lawn.
- Use a nozzle to turn off water when not actively washing down automobile.
- Monitor vehicles for leaks and place pans under leaks. Keep your car well maintained to stop and prevent leaks.
- Use cat litter or other absorbents and sweep to remove any materials deposited by vehicles. Contain sweepings and dispose of at a HHWCC.
- Perform automobile repair and maintenance under a covered area and use drip pans or plastic sheeting to keep spills and waste material from reaching storm drains.
- **Never pour oil or antifreeze in the street, gutter or storm drains.** Recycle these substances at a service station, HHWCC, or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.ciwmb.ca.gov/UsedOil.

*For locations and hours of Household Hazardous Waste Collection Centers in Anaheim, Huntington Beach, Irvine and San Juan Capistrano, call (714)834-6752 or visit www.oclandfills.com.*

***Do your part to prevent water pollution in our creeks, rivers, bays and ocean.***

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of household hazardous waste can lead to water pollution. Batteries, electronics, paint, oil, gardening chemicals, cleaners and other hazardous materials cannot be thrown in the trash. They also must never be poured or thrown into yards, sidewalks, driveways, gutters or streets. Rain or other water could wash the materials into the storm drain and eventually into our waterways and the ocean. In addition, hazardous waste must not be poured in the sanitary sewers (sinks and toilets).

***NEVER DISPOSE OF HOUSEHOLD HAZARDOUS WASTE IN THE TRASH, STREET, GUTTER, STORM DRAIN OR SEWER.***

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL** (1-877-897-7455) or visit **www.ocwatersheds.com**

**To Report Illegal Dumping of Household Hazardous Waste call 1-800-69-TOXIC**

To report a spill, call the **Orange County 24-Hour Water Pollution Problem Reporting Hotline 1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

RECYCLE USED OIL

Printed on Recycled Paper

Help Prevent Ocean Pollution:

# Proper Disposal of Household Hazardous Waste

**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

**ORANGE COUNTY**

# Pollution Prevention

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be "household hazardous waste" or "HHW." HHW can be found throughout your home, including the bathroom, kitchen, laundry room and garage.

*WHEN POSSIBLE, USE NON-HAZARDOUS OR LESS-HAZARDOUS PRODUCTS.*

Disposal of HHW down the drain, on the ground, into storm drains, or in the trash is illegal and unsafe.

Proper disposal of HHW is actually easy. Simply drop them off at a Household Hazardous Waste Collection Center (HHWCC) for free disposal and recycling. Many materials including anti-freeze, latex-based paint, motor oil and batteries can be recycled. Some centers have a "Stop & Swap" program that lets you take partially used home, garden, and automobile products free of charge. There are four HHWCCs in Orange County:

**Anaheim**:.....1071 N. Blue Gum St
**Huntington Beach**:.....17121 Nichols St
**Irvine**:..... 6411 Oak Canyon
**San Juan Capistrano**:... 32250 La Pata Ave

Centers are open Tuesday-Saturday, 9 a.m.-3 p.m. Centers are closed on rainy days and major holidays. For more information, call **(714) 834-6752** or visit **www.oclandfills.com.**

## *Common household hazardous wastes*

- Batteries
- Paint and paint products
- Adhesives
- Drain openers
- Household cleaning products
- Wood and metal cleaners and polishes
- Pesticides
- Fungicides/wood preservatives
- Automotive products (antifreeze, motor oil, fluids)
- Grease and rust solvents
- Fluorescent lamps
- Mercury (thermometers & thermostats)
- All forms of electronic waste including computers and microwaves
- Pool & spa chemicals
- Cleaners
- Medications
- Propane (camping & BBQ)
- Mercury-containing lamps
- Television & monitors (CRTs, flatscreens)

## *Tips for household hazardous waste*

- Never dispose of HHW in the trash, street, gutter, storm drain or sewer.
- Keep these materials in closed, labeled containers and store materials indoors or under a cover.
- When possible, use non-hazardous products.
- Reuse products whenever possible or share with family and friends.
- Purchase only as much of a product as you'll need. Empty containers may be disposed of in the trash.
- HHW can be harmful to humans, pets and the environment. Report emergencies to 911.

***Did you know that just one quart of oil can pollute 250,000 gallons of water?***

A clean ocean and healthy creeks, rivers, bays and beaches are important to Orange County. However, not properly disposing of used oil can lead to water pollution. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering the ocean. Help prevent water pollution by taking your used oil to a used oil collection center.

Included in this brochure is a list of locations that will accept up to five gallons of used motor oil at no cost. Many also accept used oil filters. Please contact the facility before delivering your used oil. This listing of companies is for your reference and does not constitute a recommendation or endorsement of the company.

Please note that used oil filters may not be disposed of with regular household trash. They must be taken to a household hazardous waste collection or recycling center in Anaheim, Huntington Beach, Irvine or San Juan Capistrano. For information about these centers, visit www.oclandfills.com.

Please do not mix your oil with other substances!

For more information, please call the Orange County Stormwater Program at 1-877-89-SPILL (1-877-897-7455) or visit www.watersheds.com.

For information about the proper disposal of household hazardous waste, call the Household Waste Hotline at (714) 834-6752 or visit www.oclandfills.com.

RECYCLE USED OIL

For additional information about the nearest oil recycling center, call the Used Oil Program at 1-800-CLEANUP or visit www.cleanup.org.

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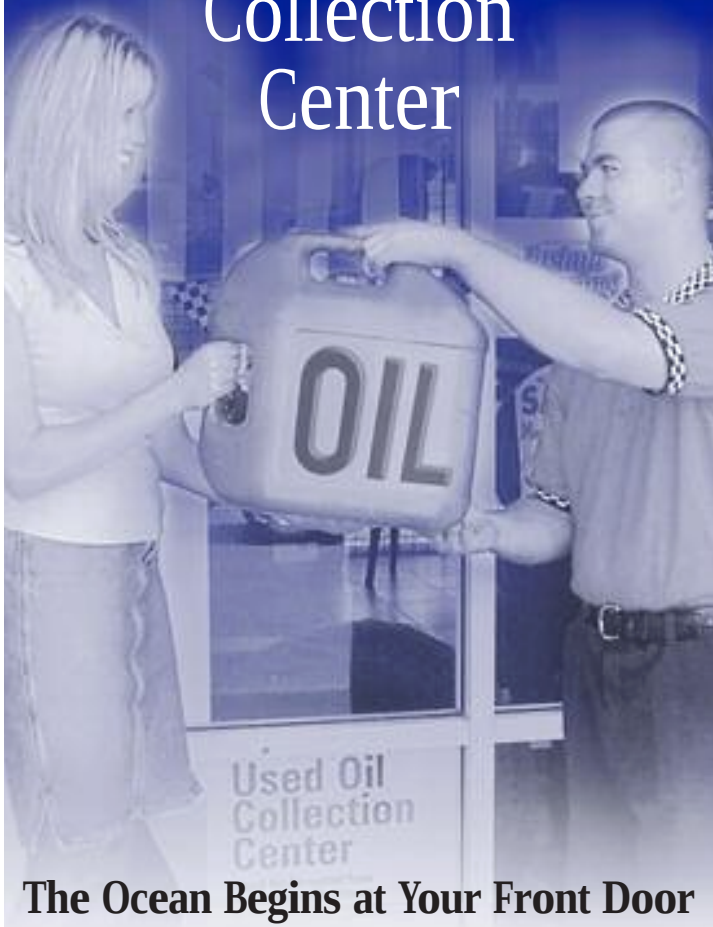
# Help Prevent Ocean Pollution:

# Recycle at Your Local Used Oil Collection Center




**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

NORTH COUNTY

# Used Oil Collection Centers

## *Anaheim*

**All Seasons Tire and Auto Center, Inc.**
817 S Brookhurst St., Anaheim, CA 92804
(714)772-6090( )
CIWMB#: 30-C-03177

**AutoZone #3317**
423 N Anaheim Blvd., Anaheim, CA 92805
(714)776-0787( )
CIWMB#: 30-C-05263

**AutoZone #5226**
2145 W Lincoln Ave., Anaheim, CA 92801
(714)533-6599( )
CIWMB#: 30-C-04604

**Bedard Automotive**
3601 E Miraloma Ave., Anaheim, CA 92806
(714)528-1380( )
CIWMB#: 30-C-02205

**Classic Chevrolet**
1001 Weir Canyon Rd., Anaheim, CA 92807
(714)283-5400( )
CIWMB#: 30-C-05223

**Econo Lube N' Tune #4**
3201 W Lincoln Ave., Anaheim, CA 92801
(714)821-0128( )
CIWMB#: 30-C-01485

**EZ Lube Inc - Savi Ranch #43**
985 N Weir Canyon Rd., Anaheim, CA 92807
(714)556-1312( )
CIWMB#: 30-C-06011

**Firestone Store #71C7**
1200 S Magnolia Ave., Anaheim, CA 92804
(949)598-5520( )
CIWMB#: 30-C-05743

**Great Western Lube Express**
125 N Brookhurst St., Anaheim, CA 92801
(714)254-1300( )
CIWMB#: 30-C-05542

**HR Pro Auto Service Center**
3180 W Lincoln Ave., Anaheim, CA 92801
(714)761-4343( )
CIWMB#: 30-C-05927

**Ira Newman Automotive Services**
1507 N State College Blvd., Anaheim, CA 92806
(714)635-2392( )
CIWMB#: 30-C-01482

**Jiffy Lube #1028**
2400 W Ball Rd., Anaheim, CA 92804
(714)761-5211( )
CIWMB#: 30-C-00870

**Jiffy Lube #1903**
2505 E Lincoln Ave., Anaheim, CA 92806
(714)772-4000( )
CIWMB#: 30-C-05511

**Jiffy Lube #2340**
2181 W Lincoln Ave., Anaheim, CA 92801
(714)533-1000( )
CIWMB#: 30-C-04647

**Kragen Auto Parts #1303**
1088 N State College Blvd., Anaheim, CA 92806
(714)956-7351( )
CIWMB#: 30-C-03438

**Kragen Auto Parts #1399**
2245 W Ball Rd., Anaheim, CA 92804
(714)490-1274( )
CIWMB#: 30-C-04094

**Kragen Auto Parts #1565**
2072 Lincoln Ave., Anaheim, CA 92806
(714)502-6992( )
CIWMB#: 30-C-04078

**Kragen Auto Parts #1582**
3420 W Lincoln Ave., Anaheim, CA 92801
(714)828-7977( )
CIWMB#: 30-C-04103

**Pep Boys #613**
10912 Katella Ave., Anaheim, CA 92804
(714)638-0863( )
CIWMB#: 30-C-01756

**Pep Boys #663**
3030 W Lincoln Anaheim, CA 92801
(714)826-4810( )
CIWMB#: 30-C-03417

**Pep Boys #809**
8205 E Santa Ana Cyn Rd., Anaheim, CA 92808
(714)974-0105( )
CIWMB#: 30-C-03443

**Pick Your Part**
1235 S Beach Blvd., Anaheim, CA 92804
(714)527-1645( )
CIWMB#: 30-C-03744

**PK Auto Performance**
3106 W. Lincoln Ave., Anaheim, CA 92801
(714)826-2141( )
CIWMB#: 30-C-05628

**Quick Change Lube and Oil**
2731 W Lincoln Ave., Anaheim, CA 92801
(714)821-4464( )
CIWMB#: 30-C-04363

**Saturn of Anaheim**
1380 S Auto Center Dr., Anaheim, CA 92806
(714)648-2444( )
CIWMB#: 30-C-06332

**Sun Tech Auto Service**
105 S State College Blvd., Anaheim, CA 92806
(714)956-1389( )
CIWMB#: 30-C-06455

**Vonic Truck Services**
515 S Rose St., Anaheim, CA 92805
(714)533-3333( )
CIWMB#: 30-C-01142

## *Anaheim Hills*

**Anaheim Hills Car Wash & Lube**
5810 E La Palma Ave., Anaheim Hills, CA 92807
(714)777-6605( )
CIWMB#: 30-C-01387

## *Brea*

**Firestone Store #27A9**
891 E Imperial Hwy., Brea, CA 92821
(714)529-8404( )
CIWMB#: 30-C-01221

**Oil Can Henry's**
230 N Brea Blvd., Brea, CA 92821
(714)990-1900( )
CIWMB#: 30-C-04273

## *Buena Park*

**Firestone Store #71F7**
6011 Orangethorpe Buena Park, CA 90620
(714)670-7912( )
CIWMB#: 30-C-01218

**Firestone Store #71T8**
8600 Beach Blvd., Buena Park, CA 90620
(714)827-5300( )
CIWMB#: 30-C-02121

**Kragen Auto Parts #1204**
5303 Beach Blvd., Buena Park, CA 90621
(714)994-1320( )
CIWMB#: 30-C-02623

## *Cypress*

**AutoZone #5521**
5471 Lincoln Ave., Cypress, CA 90630
(714)995-4644( )
CIWMB#: 30-C-00836

**Big O Tires**
6052 Cerritos Ave., Cypress, CA 90630
(714)826-6334( )
CIWMB#: 30-C-04245

**Econo Lube N' Tune #213**
5497 Cerritos Ave., Cypress, CA 90630
(714)761-0456( )
CIWMB#: 30-C-06240

**Jiffy Lube #851**
4942 Lincoln Ave., Cypress, CA 90630
(626)965-9689( )
CIWMB#: 30-C-06182

**M & N Coastline Auto & Tire Service**
4005 Ball Rd., Cypress, CA 90630
(714)826-1001( )
CIWMB#: 30-C-04387

**Masterlube #103**
5904 Lincoln Cypress, CA 90630
(714)826-2323( )
CIWMB#: 30-C-01071

**Masterlube #104**
5971 Ball Rd., Cypress, CA 90630
(714)220-1555( )
CIWMB#: 30-C-04682

**Metric Motors of Cypress**
6042 Cerritos Ave., Cypress, CA 90630
(714)821-4702( )
CIWMB#: 30-C-05157

## *Fullerton*

**AutoZone #2898**
146 N. Raymond Ave., Fullerton, CA 92831
(714)870-9772( )
CIWMB#: 30-C-04488

**AutoZone #5522**
1801 Orangethorpe W. Fullerton, CA 92833
(714)870-8286( )
CIWMB#: 30-C-06062

**AutoZone #5523**
102 N Euclid Fullerton, CA 92832
(714)870-8286( )
CIWMB#: 30-C-04755

**EZ Lube #17**
4002 N Harbor Blvd., Fullerton, CA 92835
(714)871-9980( )
CIWMB#: 30-C-03741

**Firestone Store #27EH**
1933 N Placentia Ave., Fullerton, CA 92831
(714)993-7100( )
CIWMB#: 30-C-02122

**Fox Service Center**
1018 W Orangethorpe Fullerton, CA 92833
(714)879-1430( )
CIWMB#: 30-C-02318

**Fullerton College Automotive Technology**
321 E Chapman Ave., Fullerton, CA 92832
(714)992-7275( )
CIWMB#: 30-C-03165

**Kragen Auto Parts #0731**
2978 Yorba Linda Fullerton, CA 92831
(714)996-4780( )
CIWMB#: 30-C-02628

**Kragen Auto Parts #4133**
904 W Orangethorpe Ave., Fullerton, CA 92832
(714)526-3570( )
CIWMB#: 30-C-06256

**Pep Boys #642**
1530 S Harbor Blvd., Fullerton, CA 92832
(714)870-0700( )
CIWMB#: 30-C-01755

**Sunnyside 76 Car Care Center**
2701 N Brea Blvd., Fullerton, CA 92835
(714)256-0773( )
CIWMB#: 30-C-01381

## *Garden Grove*

**76 Pro Lube Plus**
9001 Trask Ave., Garden Grove, CA 92844
(714)393-0590( )
CIWMB#: 30-C-05276

**AutoZone #5527**
13190 Harbor Blvd., Garden Grove, CA 92843
(714)636-5665( )
CIWMB#: 30-C-04760

**David Murray Shell**
12571 Vly View St., Garden Grove, CA 92845
(714)898-0170( )
CIWMB#: 30-C-00547

**Express Lube & Wash**
8100 Lampson Ave., Garden Grove, CA 92841
(909)316-8261( )
CIWMB#: 30-C-06544

**Firestone Store #7180**
10081 Chapman Ave., Garden Grove, CA 92840
(714)530-4630( )
CIWMB#: 30-C-01224

**Firestone Store #71W3**
13961 Brookhurst St., Garden Grove, CA 92843
(714)590-2741( )
CIWMB#: 30-C-03690

**Jiffy Lube #1991**
13970 Harbor Blvd., Garden Grove, CA 92843
(714)554-0610( )
CIWMB#: 30-C-05400

**Kragen Auto Parts #1251**
13933 N Harbor Blvd., Garden Grove, CA 92843
(714)554-3780( )
CIWMB#: 30-C-02663

**Kragen Auto Parts #1555**
9851 Chapman Ave., Garden Grove, CA 92841
(714)741-8030( )
CIWMB#: 30-C-04079

**Nissan of Grarden Grove**
9670 Trask Ave., Garden Grove, CA 92884
(714)537-0900( )
CIWMB#: 30-C-06553

**Toyota of Garden Grove**
9444 Trask Ave., Garden Grove, CA 92844
(714)895-5595( )
CIWMB#: 30-C-06555

## *La Habra*

**AutoZone #5532**
1200 W Imperial Hwy., La Habra, CA 90631
(562)694-5337( )
CIWMB#: 30-C-04784

**Burch Ford**
201 N Harbor Blvd., La Habra, CA 90631
(562)691-3225( )
CIWMB#: 30-C-05179

**Firestone Store #2736**
1071 S Beach Blvd., La Habra, CA 90631
(562)691-1731( )
CIWMB#: 30-C-01169

**Kragen Auto Parts #1569**
1621 W Whittier Blvd., La Habra, CA 90631
(562)905-2538( )
CIWMB#: 30-C-04076

**Pep Boys #997**
125 W Imperial Hwy., La Habra, CA 90631
(714)447-0601( )
CIWMB#: 30-C-04026

**SpeeDee Oil Change & Tune-Up**
1580 W Imperial Hwy., La Habra, CA 90631
(562)697-3513( )

## *Los Alamitos*

**Jiffy Lube #1740**
3311 Katella Ave., Los Alamitos, CA 90720
(562)596-1827( )
CIWMB#: 30-C-03529

## *Midway City*

**Bolsa Transmission**
8331 Bolsa Ave., Midway City, CA 92655
(714)799-6158( )
CIWMB#: 30-C-05768

## *Placentia*

**Advanced Auto & Diesel**
144 S Bradford Placentia, CA 92870
(714)996-8222( )
CIWMB#: 30-C-06242

**Castner's Auto Service**
214 S. Bradford Ave., Placentia, CA 92870
(714)528-1311( )
CIWMB#: 30-C-06452

**Econo Lube N' Tune**
100 W Chapman Ave., Placentia, CA 92870
(714)524-0424( )
CIWMB#: 30-C-06454

**Fairway Ford**
1350 E Yorba Linda Blvd., Placentia, CA 92870
(714)524-1200( )
CIWMB#: 30-C-01863

## *Seal Beach*

**M & N Coastline Auto & Tire Service**
12239 Seal Beach Blvd., Seal Beach, CA 90740
(714)826-1001( )
CIWMB#: 30-C-04433

**Seal Beach Chevron**
12541 Seal Beach Blvd., Seal Beach, CA 90740
(949)495-0774(14 )
CIWMB#: 30-C-06425

## *Stanton*

**AutoZone #2806**
11320 Beach Blvd., Stanton, CA 90680
(714)895-7665( )
CIWMB#: 30-C-04563

**Joe's Auto Clinic**
11763 Beach Blvd., Stanton, CA 90680
(714)891-7715( )
CIWMB#: 30-C-03253

**Kragen Auto Parts #1742**
11951 Beach Blvd., Stanton, CA 90680
(714)799-7574( )
CIWMB#: 30-C-05231

**Scher Tire #20**
7000 Katella Ave., Stanton, CA 90680
(714)892-9924( )
CIWMB#: 30-C-05907

**USA 10 Minute Oil Change**
8100 Lampson Ave., Stanton, CA 92841
(714)373-4432( )
CIWMB#: 30-C-05909

## *Westminster*

**AutoZone #5543**
6611 Westminster Blvd., Westminster, CA 92683
(714)898-2898( )
CIWMB#: 30-C-04964

**AutoZone #5544**
8481 Westminster Blvd., Westminster, CA 92683
(714)891-3511( )
CIWMB#: 30-C-04966

**City of Westminster Corporate Yard**
14381 Olive St., Westminster, CA 92683
(714)895-2876(292 )
CIWMB#: 30-C-02008

**Honda World**
13600 Beach Blvd., Westminster, CA 92683
(714)890-8900( )
CIWMB#: 30-C-03639

**Jiffy Lube #1579**
6011 Westminster Blvd., Westminster, CA 92683
(714)899-2727( )
CIWMB#: 30-C-02745

**John's Brake & Auto Repair**
13050 Hoover St., Westminster, CA 92683
(714)379-2088( )
CIWMB#: 30-C-05617

**Kragen Auto Parts #0762**
6562 Westminster Blvd., Westminster, CA 92683
(714)898-0810( )
CIWMB#: 30-C-02590

**Midway City Sanitary District**
14451 Cedarwood St., Westminster, CA 92683
(714)893-3553( )
CIWMB#: 30-C-01626

**Pep Boys #653**
15221 Beach Blvd., Westminster, CA 92683
(714)893-8544( )
CIWMB#: 30-C-03415

## *Yorba Linda*

**AutoZone #5545**
18528 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)970-8933( )
CIWMB#: 30-C-04971

**Econo Lube N' Tune**
22270 La Palma Ave., Yorba Linda, CA 92887
(714)692-8394( )
CIWMB#: 30-C-06513

**EZ Lube Inc. #41**
17511 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)556-1312( )
CIWMB#: 30-C-05739

**Firestone Store #27T3**
18500 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)779-1966( )
CIWMB#: 30-C-01222

**Jiffy Lube #1532**
16751 Yorba Linda Blvd., Yorba Linda, CA 92886
(714)528-2800( )
CIWMB#: 30-C-03777

**Mike Schultz Import Service**
4832 Eureka Ave., Yorba Linda, CA 92886
(714)528-4411( )
CIWMB#: 30-C-04313

*This information was provided by the County of Orange Integrated Waste Management Department and the California Integrated Waste Management Board (CIWMB).*

# Tips for Pest Control

## *Key Steps to Follow:*

### *Step 1:* **Correctly identify the pest (insect, weed, rodent, or disease) and verify that it is actually causing the problem.**

Three life stages of the common lady beetle, a beneficial insect.

This is important because beneficial insects are often mistaken for pests and sprayed with pesticides needlessly.

Consult with a Certified Nursery Professional at a local nursery or garden center or send a sample of the pest to the Orange County Agricultural Commissioner's Office.

Determine if the pest is still present – even though you see damage, the pest may have left.

### *Step 2:* **Determine how many pests are present and causing damage.**

Small pest populations may be controlled more safely using non-pesticide techniques. These include removing food sources, washing off leaves with a strong stream of water, blocking entry into the home using caulking and replacing problem plants with ones less susceptible to pests.

Integrated Pest Management (IPM) usually combines several least toxic pest control methods for long-term prevention and management of pest problems without harming you, your family, or the environment.

UC CE University of California Cooperative Extension

### *Step 3:* **If a pesticide must be used, choose the least toxic chemical.**

Obtain information on the least toxic pesticides that are effective at controlling the target pest from the UC Statewide Integrated Pest Management (IPM) Program's Web site at www.ipm.ucdavis.edu.

Seek out the assistance of a Certified Nursery Professional at a local nursery or garden center when selecting a pesticide. Purchase the smallest amount of pesticide available.

Apply the pesticide to the pest during its most vulnerable life stage. This information can be found on the pesticide label.

### *Step 4:* **Wear appropriate protective clothing.**

Follow pesticide labels regarding specific types of protective equipment you should wear. Protective clothing should always be washed separately from other clothing.

### *Step 5:* **Continuously monitor external conditions when applying pesticides such as weather, irrigation, and the presence of children and animals.**

Never apply pesticides when rain is predicted within the next 48 hours. Also, do not water after applying pesticides unless the directions say it is necessary.

Apply pesticides when the air is still; breezy conditions may cause the spray or dust to drift away from your targeted area.

In case of an emergency call 911 and/or the regional poison control number at (714) 634-5988 or (800) 544-4404 (CA only).

For general questions you may also visit www.calpoison.org.

### *Step 6:* **In the event of accidental spills, sweep up or use an absorbent agent to remove any excess pesticides. Avoid the use of water.**

Be prepared. Have a broom, dust pan, or dry absorbent material, such as cat litter, newspapers or paper towels, ready to assist in cleaning up spills.

Contain and clean up the spill right away. Place contaminated materials in a doubled plastic bag. All materials used to clean up the spill should be properly disposed of according to your local Household Hazardous Waste Disposal site.

### *Step 7:* **Properly store and dispose of unused pesticides.**

Purchase Ready-To-Use (RTU) products to avoid storing large concentrated quantities of pesticides.

Store unused chemicals in a locked cabinet.

Unused pesticide chemicals may be disposed of at a Household Hazardous Waste Collection Center.

Empty pesticide containers should be triple rinsed prior to disposing of them in the trash.

**Household Hazardous Waste Collection Center**
**(714) 834-6752**
**www.oclandfills.com**

PROJECT Pollution PREVENTION

# Sewage Spill Regulatory Requirements

Allowing sewage to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up efforts.

Here are the pertinent codes, fines, and agency contact information that apply.

### Orange County Stormwater Program
24 Hour Water Pollution Reporting Hotline
**1-877-89-SPILL** (1-877-897-7455)

- County and city water quality ordinances prohibit discharges containing pollutants.

### Orange County Health Care Agency Environmental Health
(714) 433-6419

**California Health and Safety Code,** Sections 5410-5416

- No person shall discharge raw or treated sewage or other waste in a manner that results in contamination, pollution or a nuisance.
- Any person who causes or permits a sewage discharge to any state waters:
  - must immediately notify the local health agency of the discharge.
  - shall reimburse the local health agency for services that protect the public's health and safety (water-contact receiving waters).
  - who fails to provide the required notice to the local health agency is guilty of a misdemeanor and shall be punished by a fine (between $500–$1,000) and/or imprisonment for less than one year.

### Regional Water Quality Control Board
**Santa Ana Region** (951) 782-4130
**San Diego Region** (858) 467-2952

- Requires the prevention, mitigation, response to and reporting of sewage spills.

### California Office of Emergency Services
(800) 852-7550

**California Water Code,** Article 4, Chapter 4, Sections 13268-13271
**California Code of Regulations,** Title 23, Division 3, Chapter 9.2, Article 2, Sections 2250-2260

- Any person who causes or permits sewage in excess of 1,000 gallons to be discharged to state waters **shall immediately notify the Office of Emergency Services.**
- Any person who fails to provide the notice required by this section is **guilty of a misdemeanor** and shall be punished by a fine (less than $20,000) and/or imprisonment for not more than one year.

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# Sewage Spill
## Reference Guide

## *Your Responsibilities as a Private Property Owner*

**Residences**
**Businesses**
**Homeowner/Condominium Associations**
**Federal and State Complexes**
**Military Facilities**

Orange County Sanitation District

Health Care Agency
Environmental Health

PROJECT Pollution PREVENTION
www.ocwatersheds.com

**This brochure was designed courtesy of the Orange County Sanitation District (OCSD). For additional information, call (714) 962-2411, or visit their website at www.ocsd.com**

# What is a Sewage Spill?

Sewage spills occur when the wastewater being transported via underground pipes overflows through a manhole, cleanout or broken pipe. Sewage spills can cause health hazards, damage to homes and businesses, and threaten the environment, local waterways and beaches.

## Common Causes of Sewage Spills

**Grease** builds up inside and eventually blocks sewer pipes. Grease gets into the sewer from food establishments, household drains, as well as from poorly maintained commercial grease traps and interceptors.

**Structure problems** caused by tree roots in the lines, broken/cracked pipes, missing or broken cleanout caps or undersized sewers can cause blockages.

**Infiltration and inflow (I/I)** impacts pipe capacity and is caused when groundwater or rainwater enters the sewer system through pipe defects and illegal connections.

## You Are Responsible for a Sewage Spill Caused by a Blockage or Break in Your Sewer Lines!

Time is of the essence in dealing with sewage spills. You are required to **immediately**:

**Control and minimize the spill.** Keep spills contained on private property and out of gutters, storm drains and public waterways by shutting off or not using the water.

**Use sandbags, dirt and/or plastic sheeting** to prevent sewage from entering the storm drain system.

**Clear the sewer blockage.** Always wear gloves and wash your hands. It is recommended that a plumbing professional be called for clearing blockages and making necessary repairs.

**Always notify your city sewer/public works department or public sewer district of sewage spills.** If the spill enters the storm drains also notify the Health Care Agency. In addition, if it exceeds 1,000 gallons notify the Office of Emergency Services. Refer to the numbers listed in this brochure.

Overflowing cleanout pipe located on private property

## You Could Be Liable

Allowing sewage from your home, business or property to discharge to a gutter or storm drain may subject you to penalties and/or out-of-pocket costs to reimburse cities or public agencies for clean-up and enforcement efforts. See Regulatory Codes & Fines section for pertinent codes and fines that apply.

## What to Look For

Sewage spills can be a very noticeable gushing of water from a manhole or a slow water leak that may take time to be noticed. Don't dismiss unaccounted-for wet areas.

Look for:

- Drain backups inside the building.
- Wet ground and water leaking around manhole lids onto your street.
- Leaking water from cleanouts or outside drains.
- Unusual odorous wet areas: sidewalks, external walls or ground/landscape around a building.

## Caution

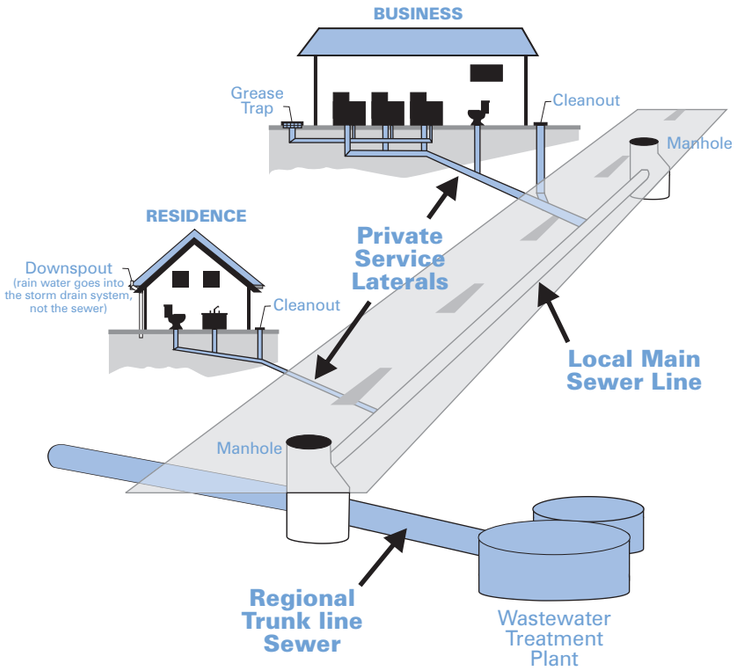
Keep people and pets away from the affected area. Untreated sewage has high levels of disease-causing viruses and bacteria. Call your local health care agency listed on the back for more information.

**If You See a Sewage Spill Occurring, Notify Your City Sewer/Public Works Department or Public Sewer District IMMEDIATELY!**

# How a Sewer System Works

A property owner's sewer pipes are called service laterals and are connected to larger local main and regional trunk lines. Service laterals run from the connection at the home to the connection with the public sewer (including the area under the street). These laterals are the responsibility of the property owner and must be maintained by the property owner. Many city agencies have adopted ordinances requiring maintenance of service laterals. Check with your city sewer/local public works department for more information.

Operation and maintenance of **local and regional sewer lines** are the responsibility of the city sewer/public works departments and public sewer districts.




## How You Can Prevent Sewage Spills

1. **Never put grease down garbage disposals, drains or toilets.**
2. **Perform periodic cleaning to eliminate grease, debris and roots in your service laterals.**
3. **Repair any structural problems in your sewer system and eliminate any rainwater infiltration/inflow leaks into your service laterals.**


# Preventing Grease Blockages

The drain is not a dump! Recycle or dispose of grease properly and never pour grease down the drain.

Homeowners should mix fats, oils and grease with absorbent waste materials such as paper, coffee grounds, or kitty litter and place it in the trash. Wipe food scraps from plates and pans and dump them in the trash.

Restaurants and commercial food service establishments should always use "Kitchen Best Management Practices." These include:

- Collecting all cooking grease and liquid oil from pots, pans and fryers in covered grease containers for recycling.
- Scraping or dry-wiping excess food and grease from dishes, pots, pans and fryers into the trash.
- Installing drain screens on all kitchen drains.
- Having spill kits readily available for cleaning up spills.
- Properly maintaining grease traps or interceptors by having them serviced regularly. Check your local city codes.

# Orange County Agency Responsibilites

- **City Sewer/Public Works Departments—** Responsible for protecting city property and streets, the local storm drain system, sewage collection system and other public areas.
- **Public Sewer/Sanitation District—** Responsible for collecting, treating and disposing of wastewater.
- **County of Orange Health Care Agency—** Responsible for protecting public health by closing ocean/bay waters and may close food-service businesses if a spill poses a threat to public health.
- **Regional Water Quality Control Boards—** Responsible for protecting State waters.
- **Orange County Stormwater Program—** Responsible for preventing harmful pollutants from being discharged or washed by stormwater runoff into the municipal storm drain system, creeks, bays and the ocean.

## You Could Be Liable for Not Protecting the Environment

Local and state agencies have legal jurisdiction and enforcement authority to ensure that sewage spills are remedied.

They may respond and assist with containment, relieving pipe blockages, and/or clean-up of the sewage spill, especially if the spill is flowing into storm drains or onto public property.

**A property owner may be charged for costs incurred by these agencies responding to spills from private properties.**

# Report Sewage Spills!

### City Sewer/Public Works Departments

| | |
|---|---|
| Aliso Viejo | (949) 425-2500 |
| Anaheim | (714) 765-6860 |
| Brea | (714) 990-7691 |
| Buena Park | (714) 562-3655 |
| Costa Mesa | (949) 645-8400 |
| Cypress | (714) 229-6760 |
| Dana Point | (949) 248-3562 |
| Fountain Valley | (714) 593-4600 |
| Fullerton | (714) 738-6897 |
| Garden Grove | (714) 741-5375 |
| Huntington Beach | (714) 536-5921 |
| Irvine | (949) 453-5300 |
| Laguna Beach | (949) 497-0765 |
| Laguna Hills | (949) 707-2650 |
| Laguna Niguel | (949) 362-4337 |
| Laguna Woods | (949) 639-0500 |
| La Habra | (562) 905-9792 |
| Lake Forest | (949) 461-3480 |
| La Palma | (714) 690-3310 |
| Los Alamitos | (562) 431-3538 |
| Mission Viejo | (949) 831-2500 |
| Newport Beach | (949) 644-3011 |
| Orange | (714) 532-6480 |
| Orange County | (714) 567-6363 |
| Placentia | (714) 993-8245 |
| Rancho Santa Margarita | (949) 635-1800 |
| San Clemente | (949) 366-1553 |
| San Juan Capistrano | (949) 443-6363 |
| Santa Ana | (714) 647-3380 |
| Seal Beach | (562) 431-2527 |
| Stanton | (714) 379-9222 |
| Tustin | (714) 962-2411 |
| Villa Park | (714) 998-1500 |
| Westminster | (714) 893-3553 |
| Yorba Linda | (714) 961-7170 |

### Public Sewer/Water Districts

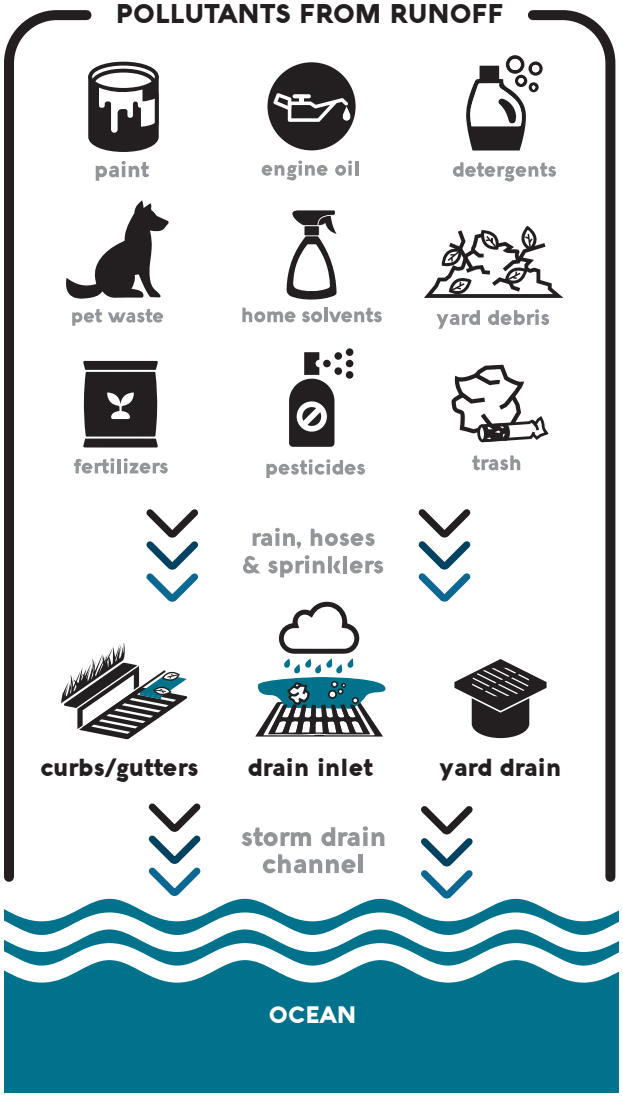
| | |
|---|---|
| Costa Mesa Sanitary District | (714) 393-4433/ (949) 645-8400 |
| El Toro Water District | (949) 837-0660 |
| Emerald Bay Service District | (949) 494-8571 |
| Garden Grove Sanitary District | (714) 741-5375 |
| Irvine Ranch Water District | (949) 453-5300 |
| Los Alamitos/Rossmoor Sewer District | (562) 431-2223 |
| Midway City Sanitary District (Westminster) | (714) 893-3553 |
| Moulton Niguel Water District | (949) 831-2500 |
| Orange County Sanitation District | (714) 962-2411 |
| Santa Margarita Water District | (949) 459-6420 |
| South Coast Water District | (949) 499-4555 |
| South Orange County Wastewater Authority | (949) 234-5400 |
| Sunset Beach Sanitary District | (562) 493-9932 |
| Trabuco Canyon Sanitary District | (949) 858-0277 |
| Yorba Linda Water District | (714) 777-3018 |

### Other Agencies

| | |
|---|---|
| Orange County Health Care Agency | (714) 433-6419 |
| Office of Emergency Services | (800) 852-7550 |

# What Common Pollutants are Found in Runoff?

Common runoff pollutants include trash, pet waste, yard debris, fertilizer, pesticides, engine oil, paint, home solvents, and detergents. Continue reading to learn how these pollutants affect our water resources and what you can do to help.




# Who is $H_2OC$?

$H_2OC$ is YOU! $H_2OC$ is also a cooperative stormwater program which includes all 34 cities in Orange County, the County of Orange, and Orange County Flood Control District. Clean and healthy beaches, creeks, rivers, bays, wetlands, and ocean are important to Orange County. $H_2OC$ provides resources to residents and businesses to prevent water pollution and encourage personal action by working with communities to prevent polluted runoff from entering our waterways. Join us at H2OC.org to learn more about how you can protect local waterways and be the solution to runoff pollution!

# Visit

H2OC.org to learn more about runoff, water pollution, and what you can do to protect our water resources!

# Contact

24-Hour Pollution Reporting Hotline:
(877) 89-SPILL (77455)
24-Hour Reporting Website:
myOCeServices.ocgov.com

*For more information on household hazardous waste centers go to www.oclandfills.com/hazardous or call (714) 834-4000

**UCCE Master Gardeners: ucceocmghotline@ucanr.edu
mgorange.ucanr.edu/Gardening_Hotline/

# YOU ARE THE SOLUTION TO RUNOFF POLLUTION

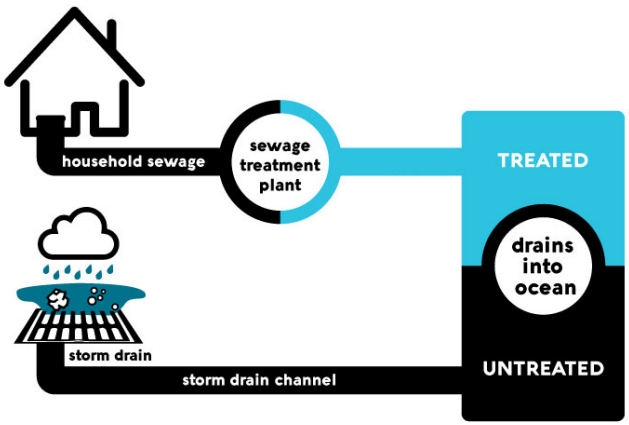
$H_2OC$ STORMWATER PROGRAM

# What is Runoff?

Runoff is water from rain and outdoor water use that drains from roofs, driveways, sidewalks, and other surfaces, which does not soak into the ground. As runoff flows over surfaces it will pick up and carry pollutants it encounters, many of which come from waste we produce or mishandle. In Orange County, runoff is captured by storm drains where it flows untreated to the ocean.

# Water that flows into storm drains is NOT TREATED

Runoff from homes and businesses may contain pollutants that have harmful effects on downstream creeks, rivers, bays, and ocean. Unlike household sewage, this water is not treated and can negatively impact recreational use, wildlife habitat, and even human health.




## TRASH

If trash such as cigarette butts, straws, cups, and other debris enter our waterways, it can create water flow problems and contaminate aquatic habitats. Always properly dispose of waste and recyclables and secure your trash can lid to prevent trash from being released into the environment.

## ENGINE OIL

If engine oil enters our waterways, aquatic animals and plants can be negatively affected. It is important to repair leaking vehicles as soon as possible. Clean affected areas utilizing absorbents available at auto and home supply stores. Be sure to follow manufacturer's directions for proper use and disposal of absorbent. Used engine oil can be disposed at a Household Hazardous Waste Center (HHWC*) or where oil was purchased.

## PET WASTE

Pet waste is a threat to human and environmental health because it contains harmful bacteria and pathogens. Being a responsible pet owner means picking up after your pet on walks and in your yard, especially before it rains.

## YARD DEBRIS

If yard debris reaches local waterways, it can obstruct stormwater flow, clog storm drains, and cause other problems like flooding and erosion. Be sure to collect all debris when doing yard work and properly dispose of it in a green waste bin, or better yet, compost it.

## FERTILIZER

If improperly applied, fertilizers can enter our waterways and cause ecological problems. For proper application, follow the manufacturer's instructions and stop applying fertilizers 48 hours before a forecasted rain event.

## PESTICIDES

If pesticides, which include herbicides, insecticides, fungicides, and rodenticides, enter our waterways, they can be dangerous to human health and aquatic life. Be sure to limit pesticide use by using nonchemical methods or least-toxic pesticides whenever possible and contact the University of California Cooperative Extension (UCCE) Master Gardeners** with any questions. To properly apply pesticides, follow the manufacturer's instructions and stop applying 48 hours before a forecasted rain event.

## PAINT

Paints, and related materials, contain a wide range of chemicals. These products should never be put in storm drains, sewers or septic systems. Instead, dispose of unused paint at your local HHWC*.

## DETERGENTS

If phosphorus from detergents enters our waterways, it can cause ecological problems, including fish kills. Additionally, detergents can remove the protective mucous layer from fish, leaving them susceptible to disease. When using detergents for outdoor cleaning projects, do not allow wash water to reach the storm drain system.

## HOME SOLVENTS

Many common household cleaning products contain harmful chemicals which are toxic and volatile. If not used and disposed of properly, these chemicals enter our waterways and pose a threat to both human and aquatic life. Always follow the manufacturer's instructions and dispose of the material at your local HHWC*.

**Clean beaches and healthy creeks, rivers, bays, and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Washwater, oil and residue from car washing should not flow into the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never dump soap, oil or dirty water into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL**
**(1-877-897-7455)**
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour**
**Water Pollution Problem**
**Reporting Hotline**
at **1-877-89-SPILL**
**(1-877-897-7455)**

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information about how you can keep soap, oil and washwater from car wash activities from entering the storm drain system. If you have other suggestions, please contact your city's stormwater representative or call the Orange County Stormwater Program.

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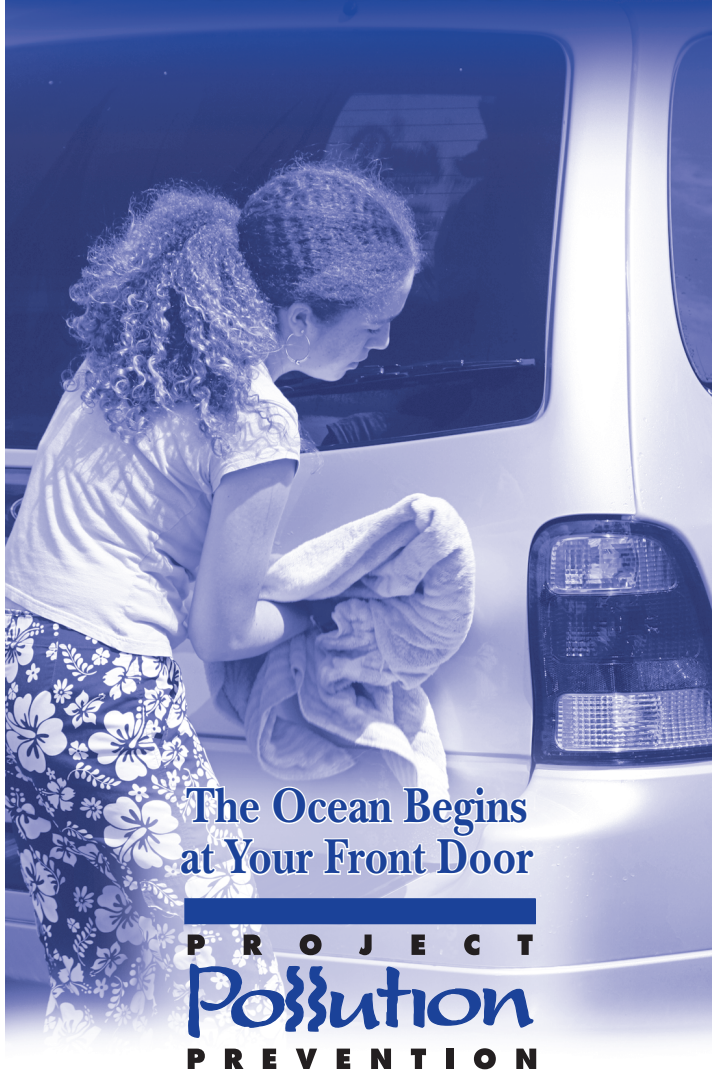
Help Prevent Ocean Pollution:

# Tips for Car Wash Fund-Raisers



**The Ocean Begins at Your Front Door**

PROJECT Pollution PREVENTION

# Tips for Car Wash Fund-Raisers

## *Before beginning your car wash fund-raiser*

- Partner with a professional car wash and avoid the pollution that parking lot car washes can produce.

- Hold a meeting with all participants to explain the proper procedures that should be followed when washing cars.
- Remove all trash and debris from the car washing area.
- Select only soaps, cleaners or detergents labeled "non-toxic," "phosphate-free," or "biodegradable." The safest products for the environment are vegetable-based or citrus-based soaps. However, even these soaps can be toxic for the environment, so never let any products enter the street, gutter or storm drain.
- Do not use acid based wheel cleaners or engine degreasers.
- Select a site where the washwater can soak into grass, gravel, or be diverted to nearby landscaping. This will allow the washwater to filter through the vegetation and/or soil instead of flowing directly into a storm drain.
- Divert the washwater to an area where the water can pool and evaporate throughout the day, or arrange to dispose of the washwater down a sanitary sewer drain. For details, refer to Factsheet *IC24 Wastewater Disposal Guidelines located* at **www.ocwatersheds.com/StormWater/documents_bmp_existing_development.asp#res**
- If there is a storm drain on-site, block it with sandbags. At the end of the day, dispose of the sandbags by dumping the contents in an authorized landscaped area.

## *During the fund-raiser*

- Never let any trash or washwater enter the street, gutter or storm drain.
- Shake car mats in a trash can or vacuum them. Do not shake dirt from car mats directly onto the ground.
- Use a bucket of soapy water to re-soap rags or sponges throughout the day rather than adding soap directly to them.
- Wring sponges and washrags into buckets, not the ground.
- Conserve water by using a spray nozzle with an automatic shut-off. Turn off the water or kink the hose when not in use.
- Always empty buckets into the sanitary sewer system (e.g. sinks or toilets) or a landscaped area rather than pouring the water on concrete or asphalt.

## *After the fund-raiser*

- Remember to clean up. Have a volunteer walk the perimeter of the site to pick up trash and debris and dispose of it properly.

PROJECT Pollution PREVENTION

**Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Home improvement projects and work sites must be maintained to ensure that building materials do not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never dump building materials into the ocean, so don't let them enter the storm drains. Follow these tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour**
**Water Pollution Problem**
**Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while performing home improvement projects. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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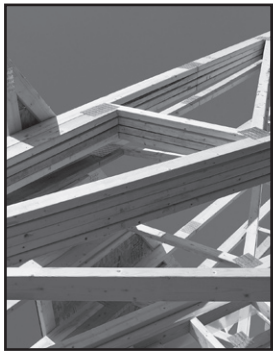
# Help Prevent Ocean Pollution:

# Tips for Home Improvement Projects

# Tips for Home Improvement Projects

Home improvement projects can cause significant damage to the environment. Whether you hire a contractor or work on the house yourself, it is important to follow these simple tips while renovating, remodeling or improving your home:

## General Construction



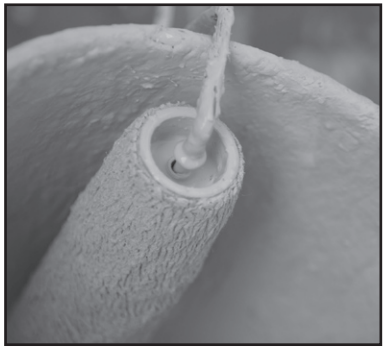
- Schedule projects for dry weather.
- Keep all construction debris away from the street, gutter and storm drain.
- Store materials under cover with temporary roofs or plastic sheets to eliminate or reduce the possibility that rainfall, runoff or wind will carry materials from the project site to the street, storm drain or adjacent properties.

## Building Materials

- Never hose materials into a street, gutter or storm drain.
- Exposed piles of construction material should not be stored on the street or sidewalk.
- Minimize waste by ordering only the amount of materials needed to complete the job.
- Do not mix more fresh concrete than is needed for each project.
- Wash concrete mixers and equipment in a designated washout area where the water can flow into a containment area or onto dirt.
- Dispose of small amounts of dry excess materials in the trash. Powdery waste, such as dry concrete, must be properly contained within a box or bag prior to disposal. Call your local trash hauler for weight and size limits.

## Paint

- Measure the room or object to be painted, then buy only the amount needed.
- Place the lid on firmly and store the paint can upside-down in a dry location away from the elements.
- Tools such as brushes, buckets and rags should never be washed where excess water can drain into the street, gutter or storm drain. All tools should be rinsed in a sink connected to the sanitary sewer.
- When disposing of paint, never put wet paint in the trash.
- Dispose of water-based paint by removing the lid and letting it dry in the can. Large amounts must be taken to a Household Hazardous Waste Collection Center (HHWCC).



- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.
- For HHWCC locations and hours, call **(714) 834-6752** or visit **www.oclandfills.com**.

## Erosion Control

- Schedule grading and excavation projects for dry weather.
- When temporarily removing soil, pile it in a contained, covered area where it cannot spill into the street, or obtain the required temporary encroachment or street closure permit and follow the conditions instructed by the permit.
- When permanently removing large quantities of soil, a disposal location must be found prior to excavation. Numerous businesses are available to handle disposal needs. For disposal options, visit **www.ciwmb.ca.gov/SWIS**.
- Prevent erosion by planting fast-growing annual and perennial grasses. They will shield and bind the soil.

## Recycle

- Use a construction and demolition recycling company to recycle lumber, paper, cardboard, metals, masonry (bricks, concrete, etc.), carpet, plastic, pipes (plastic, metal and clay), drywall, rocks, dirt and green waste.

- For a listing of construction and demolition recycling locations in your area, visit **www.ciwmb.ca.gov/recycle.**

## Spills

- Clean up spills immediately by using an absorbent material such as cat litter, then sweep it up and dispose of it in the trash.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **1-877-897-7455** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

**Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Fertilizers, pesticides and other chemicals that are left on yards or driveways can be blown or washed into storm drains that flow to the ocean. Overwatering lawns can also send materials into storm drains. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never pour gardening products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

**UCCE Master Gardener Hotline:**
**(714) 708-1646**

To report a spill,
call the
**Orange County 24-Hour**
**Water Pollution Problem**
**Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while landscaping or gardening. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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Help Prevent Ocean Pollution:

# Tips for Landscape & Gardening

The Ocean Begins at Your Front Door

PROJECT Pollution PREVENTION

# Tips for Landscape & Gardening

Never allow gardening products or polluted water to enter the street, gutter or storm drain.

## *General Landscaping Tips*

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers, and pesticide applied to the landscape.

- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

## *Garden & Lawn Maintenance*

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Use slow-release fertilizers to minimize leaching, and use organic fertilizers.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.

- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting. For more information, visit **www.ipm.ucdavis.edu**.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Hazardous Waste Collection Center to be recycled. Locations are provided below.

**Household Hazardous Waste Collection Centers**

| | |
|---|---|
| **Anaheim:** | 1071 N. Blue Gum St. |
| **Huntington Beach:** | 17121 Nichols St. |
| **Irvine:** | 6411 Oak Canyon |
| **San Juan Capistrano:** | 32250 La Pata Ave. |

**For more information, call (714) 834-6752 or visit www.oclandfills.com**

**Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities can lead to water pollution if you're not careful. Pet waste and pet care products can be washed into the storm drains that flow to the ocean. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never put pet waste or pet care products into the ocean, so don't let them enter the storm drains. Follow these easy tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
**1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while caring for your pet. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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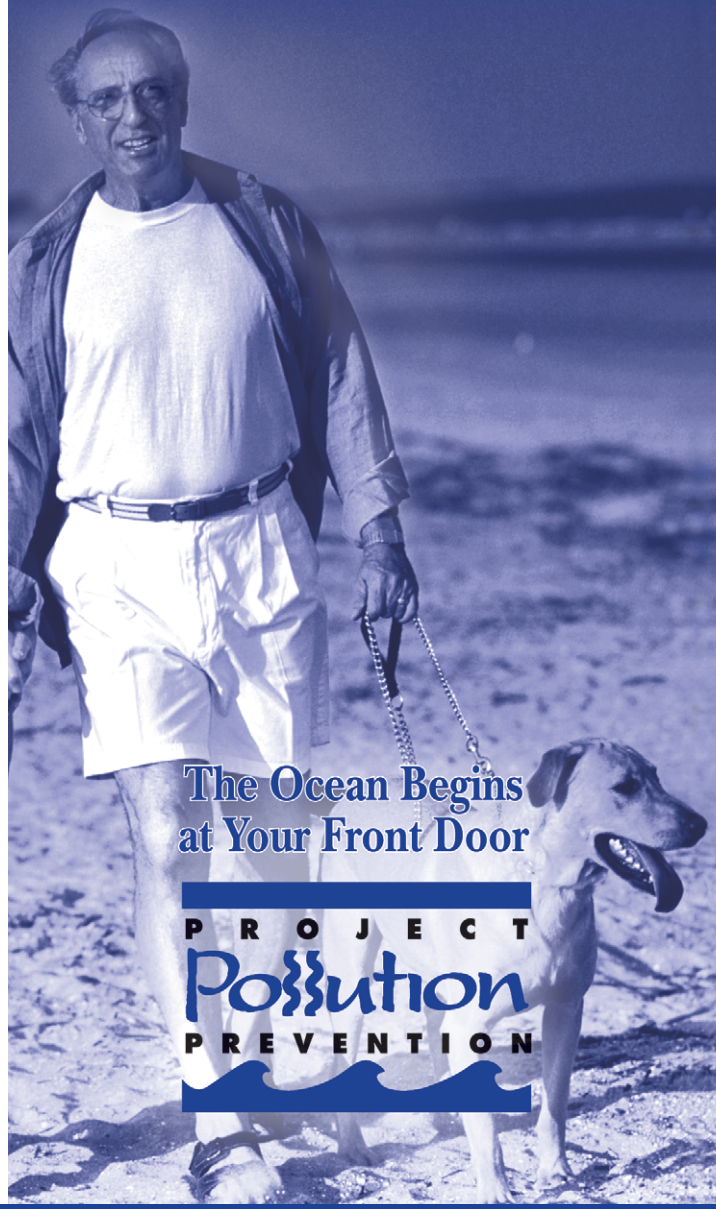
Help Prevent Ocean Pollution:

# Tips for Pet Care



# Tips for Pet Care

Never let any pet care products or washwater run off your yard and into the street, gutter or storm drain.

## *Washing Your Pets*

Even biodegradable soaps and shampoos can be harmful to marine life and the environment.

- If possible, bathe your pets indoors using less-toxic shampoos or have your pet professionally groomed. Follow instructions on the products and clean up spills.

- If you bathe your pet outside, wash it on your lawn or another absorbent/ permeable surface to keep the washwater from running into the street, gutter or storm drain.

## *Flea Control*

- Consider using oral or topical flea control products.

- If you use flea control products such as shampoos, sprays or collars, make sure to dispose of any unused products at a Household Hazardous Waste Collection Center. For location information, call **(714) 834-6752**.

## *Why You Should Pick Up After Your Pet*

It's the law! Every city has an ordinance requiring you to pick up after your pet. Besides being a nuisance, pet waste can lead to water pollution, even if you live inland. During rainfall, pet waste left outdoors can wash into storm drains. This waste flows directly into our waterways and the ocean where it can harm human health, marine life and the environment.

As it decomposes, pet waste demands a high level of oxygen from water. This decomposition can contribute to killing marine life by reducing the amount of dissolved oxygen available to them.

Have fun with your pets, but please be a responsible pet owner by taking care of them and the environment.

- Take a bag with you on walks to pick up after your pet.

- Dispose of the waste in the trash or in a toilet.

PROJECT Pollution PREVENTION

**Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, many common activities such as painting can lead to water pollution if you're not careful. Paint must be used, stored and disposed of properly to ensure that it does not enter the street, gutter or storm drain. Unlike water in sanitary sewers (from sinks and toilets), water in storm drains is not treated before entering our waterways.**

**You would never dump paint into the ocean, so don't let it enter the storm drains. Follow these easy tips to help prevent water pollution.**

For more information,
please call the
**Orange County Stormwater Program**
at **1-877-89-SPILL** (1-877-897-7455)
or visit
**www.ocwatersheds.com**

To report a spill,
call the
**Orange County 24-Hour Water Pollution Problem Reporting Hotline**
at **1-877-89-SPILL** (1-877-897-7455).

**For emergencies, dial 911.**

The tips contained in this brochure provide useful information to help prevent water pollution while using, storing and disposing of paint. If you have other suggestions, please contact your city's stormwater representatives or call the Orange County Stormwater Program.

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# Help Prevent Ocean Pollution:

# Tips for Projects Using Paint

# Tips for Projects Using Paint

Paint can cause significant damage to our environment. Whether you hire a contractor or do it yourself, it is important to follow these simple tips when purchasing, using, cleaning, storing and disposing of paint.

## *Purchasing Paint*

- Measure the room or object to be painted, then buy only the amount needed.
- Whenever possible, use water-based paint since it usually does not require hazardous solvents such as paint thinner for cleanup.

## *Painting*

- Use only one brush or roller per color of paint to reduce the amount of water needed for cleaning.
- Place open paint containers or trays on a stable surface and in a position that is unlikely to spill.
- Always use a tarp under the area or object being painted to collect paint drips and contain spills.

## *Cleaning*

- Never clean brushes or rinse paint containers in the street, gutter or storm drain.
- For oil-based products, use as much of the paint on the brushes as possible. Clean brushes with thinner. To reuse thinner, pour it through a fine filter (e.g. nylon, metal gauze or filter paper) to remove solids such as leftover traces of paint.
- For water-based products, use as much of the paint on the brushes as possible, then rinse in the sink.
- Collect all paint chips and dust. Chips and dust from marine paints or paints containing lead, mercury or tributyl tin are hazardous waste. Sweep up and dispose of at a Household Hazardous Waste Collection Center (HHWCC).

## *Storing Paint*

- Store paint in a dry location away from the elements.
- Store leftover water-based paint, oil-based paint and solvents separately in original or clearly marked containers.
- Avoid storing paint cans directly on cement floors. The bottom of the can will rust much faster on cement.
- Place the lid on firmly and store the paint can upside-down to prevent air from entering. This will keep the paint usable longer. Oil-based paint is usable for up to 15 years. Water-based paint remains usable for up to 10 years.

## *Alternatives to Disposal*

- Use excess paint to apply another coat, for touch-ups, or to paint a closet, garage, basement or attic.
- Give extra paint to friends or family. Extra paint can also be donated to a local theatre group, low-income housing program or school.
- Take extra paint to an exchange program such as the **"Stop & Swap"** that allows you to drop off or pick up partially used home care products free of charge. **"Stop & Swap"** programs are available at most HHWCCs.
- For HHWCC locations and hours, call **1-877-897-7455** or visit **www.oclandfills.com**.

## *Disposing of Paint*

- Never put wet paint in the trash.

### *For water-based paint:*

- If possible, brush the leftover paint on cardboard or newspaper. Otherwise, allow the paint to dry in the can with the lid off in a well-ventilated area protected from the elements, children and pets. Stirring the paint every few days will speed up the drying.
- Large quantities of extra paint should be taken to a HHWCC.
- Once dried, paint and painted surfaces may be disposed of in the trash. When setting a dried paint can out for trash collection, leave the lid off so the collector will see that the paint has dried.

### *For oil-based paint:*

- Oil-based paint is a household hazardous waste. All leftover paint should be taken to a HHWCC.

### *Aerosol paint:*

- Dispose of aerosol paint cans at a HHWCC.

## *Spills*

- Never hose down pavement or other impermeable surfaces where paint has spilled.
- Clean up spills immediately by using an absorbent material such as cat litter. Cat litter used to clean water-based paint spills can be disposed of in the trash. When cleaning oil-based paint spills with cat litter, it must be taken to a HHWCC.
- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at **1-877-897-7455** or visit **www.ocwatersheds.com** to fill out an incident reporting form.

PROJECT Pollution PREVENTION

# Tips for Protecting Your Watershed

## *My Watershed. Our Ocean.*

**Water + shed,** *noun: A region of land within which water flows down into a specified water body, such as a river, lake, sea, or ocean; a drainage basin or catchment basin.*

Orange County is comprised of 11 major watersheds into which most of our water flows, connecting all of Orange County to the Pacific Ocean.

As water from rain (stormwater) or sprinklers and hoses (urban runoff) runs down your driveway and into your neighborhood streets, sidewalks and gutters, it flows into storm drains that lead to waterways within your watershed. The waterways from other cities merge as they make their way through our watersheds until all the runoff water in Orange County meets at the Pacific Ocean. The water that reaches our ocean is not pure. As it flows through the watershed, it picks up pollutants such as litter, cigarette butts, fertilizer, pesticides, pet waste, motor oil and lawn clippings. Unlike water that enters the sewer (from sinks and toilets), water that enters the storm drain is not treated before it flows, ultimately, to the ocean.

Water quality can be improved by "Adopting Your Watershed." Through this effort, we are challenging citizens and organizations to join the Orange County Stormwater Program and others who are working to protect and restore our creeks, rivers, bays and ocean.

**There are many opportunities to get involved:**

- Appreciate your watershed - explore the creeks, trails and ocean and make observations about its conditions. If you see anything abnormal (such as dead fish, oil spills, leaking barrels, and other pollution) contact the Orange County 24-hour water pollution problem reporting hotline at 1.877.89.SPILL to report the problem.
- Research your watershed. Learn about what watershed you live in by visiting www.ocwatersheds.com.
- Find a watershed organization in your community and volunteer to help. If there are no active groups, consider starting your own.
- Visit EPA's Adopt Your Watershed's Catalog of Watershed Groups at www.epa.gov/adopt to locate groups in your community.
- Organize or join in a creek, river, bay or ocean cleanup event such as Coastal & Inner Coastal Cleanup Day that takes place the 3rd Saturday of every September. For more information visit www.coast4u.org.

**Follow these simple tips to protect the water quality of your watershed:**

- **Sweep up debris and dispose of it in the trash. Do not hose down driveways or sidewalks into the street or gutter.**
- **Use dry cleanup methods such as cat litter to absorb spills and sweep up residue.**
- **Set your irrigation systems to reflect seasonal water needs or use weather-based controllers. Inspect for runoff regularly.**
- **Cover trashcans securely.**
- **Take hazardous waste to a household hazardous waste collection center. (For example, paint, batteries and petroleum products)**
- **Pick up after your pet.**
- **Follow application and disposal directions for pesticides and fertilizers.**
- **If you wash your car at home, wash it on your lawn or divert the runoff onto a landscaped area. Consider taking your car to a commercial car wash, where the water is reclaimed or recycled.**
- **Keep your car well maintained.**
- **Never pour oil or antifreeze in the street, gutter or storm drain.**

Clean beaches and healthy creeks, rivers, bays and ocean are important to Orange County. However, not properly disposing of used oil is illegal and can lead to fines. If you pour or drain oil onto driveways, sidewalks or streets, it can be washed into the storm drain.

Help prevent water pollution by taking your used oil and oil filters to a used oil collection center. Most major automotive maintenance centers will accept up to five gallons of used motor oil at no cost. For a list of locations, please visit www.cleanup.org.

For more information, please call the **Orange County Stormwater Program** at **1-877-89-SPILL (1-877-897-7455)** or visit **www.ocwatersheds.com.**

For information about the proper disposal of household hazardous waste, call the **Household Waste Hotline** at **1-877-89-SPILL (1-877-897-7455)** or visit **www.oclandfills.com.**

For additional information about the nearest oil recycling center, call the **Used Oil Program** at **1-800-CLEANUP** or visit **www.cleanup.org.**

RECYCLE USED OIL

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Help Prevent Ocean Pollution:

# Tips for the Home Mechanic

PROJECT Pollution PREVENTION

**The Ocean Begins at Your Front Door**

# Tips for the Home Mechanic

WORK SITE

- Locate the storm drains on or near your property. Do not allow used oil or any materials to flow into these drains.

- Examine your home for sources of pollution.

- Perform automotive projects under cover and in a controlled area to prevent stormwater runoff.

- Sweep or vacuum your automotive workspace regularly

- Use a damp mop to clean work areas. Never hose down surfaces into the street, gutter or storm drain.

- Pour mop water into a sink or toilet. Never dispose of water in a parking lot, street, gutter or storm drain.

PREVENT LEAKS AND SPILLS

- Keep absorbent materials such as rags and/or cat litter in the work area
- Empty drip pans into a labeled, seal container before they are full
- Wipe up any spills or repair leaks as they happen. Don't let them sit.
- Place large pans under any wrecked cars until all fluids are drained.
- Promptly dispose of collected fluids into a hazardous waste drum or deliver them to an oil recycling center. Used oil recycling locations can be found at http://www.ochealthinfo.com/regulatory/usedoil.htm

CLEANING SPILLS

- Clean up spills immediately by using absorbent material such as rags, cat litter or sand. If the material spilled is hazardous, dispose of the rag, litter or sand in the same manner as hazardous waste. If the material spill is non-hazardous, dispose of it in the trash.

- Immediately report spills that have entered the street, gutter or storm drain to the County's 24-Hour Water Pollution Problem Reporting Hotline at 1-877-89-SPILL (1-877-897-7455) or visit www.ocwatersheds.com to fill out an incident report.

- Report emergencies to 911.

VEHICLE FLUID MANAGEMENT

- Vehicle fluids are hazardous waste and must be stored and disposed of in accordance with all local, state and federal laws.

- Designate an area to drain vehicle fluids away from storm drains and sanitary drains.

- When possible, drain vehicle fluids indoors or within covered areas, and only over floors that are constructed of a non-porous material such as concrete. Asphalt and dirt floors absorb spilled or leaked fluids, making the cleanup extremely difficult.

PROJECT Pollution PREVENTION

## Update Your Irrigation System and Landscape

**Switch to Rotating Sprinkler Nozzles:** Consider replacing your sprinkler heads with rotating sprinkler nozzles. Rotating nozzles water more uniformly and efficiently, significantly reducing your outdoor water use. Check with your local water agency for available rebates on rotating nozzles, irrigation controllers, and other water efficient devices.

**Get Smart:** Consider using smart irrigation controllers. Smart irrigation controllers have internal clocks as well as sensors that will turn off the sprinklers in response to environmental changes. If it is raining, too windy, or too cold, the smart irrigation controller will automatically shut off the sprinklers.

**Drip don't Douse:** Drip irrigation systems prevent runoff from carrying pollutants into the storm drain by watering only the targeted plants using low volumes of water.

**Reduce the Need:** Replace water "thirsty" plants and grass types with water efficient natives or OC Garden Friendly plants to save water and reduce the need for pesticides and fertilizer. Please see the California Friendly® Landscape Maintenance Guide produced by the Metropolitan Water District of Southern California** and associated Southern California Water Agencies for more information.

**Group Plants:** When adding to or redesigning your landscaping, plants that require similar watering needs can be planted together. Grouping plants with similar watering needs helps prevent unnecessary watering.

## Who is $H_2OC$?

**$H_2OC$ is YOU!** $H_2OC$ is also a cooperative stormwater program which includes all 34 cities in Orange County, the County of Orange, and Orange County Flood Control District (OCFCD). Clean and healthy beaches, creeks, rivers, bays, wetlands, and ocean are important to Orange County. $H_2OC$ provides resources to residents and businesses to prevent water pollution and encourage personal action by working with communities to prevent polluted runoff from entering our waterways.

## Join us

Visit **h2oc.org** to learn more about runoff, water pollution, and how you can be the solution to runoff pollution and protect our water resources!

## Contact

**24-Hour Pollution Reporting Hotline:**
1-877-89-SPILL (1-877-897-7455)

**24-Hour Reporting Website:**
myOCeServices.ocgov.com

*__University of California Master Gardeners of Orange County__
ucceocmghotline@ucanr.edu mgorange.ucanr.edu/Gardening_Hotline/

**__Visit bewaterwise.com to learn more__

# OVERWATERING IS OUT

## TIPS TO PREVENT IRRIGATION RUNOFF

$H_2OC$® STORMWATER PROGRAM

# What is Irrigation Runoff and How Does it Lead to Pollution?

Irrigation runoff is water flowing off landscaped areas, which can carry pollutants to our storm drains and waterways. It is usually the result of landscape overwatering, and mismanaged irrigation systems. Runoff can carry pesticides, fertilizers, pet waste, and other pollutants into our storm drains, which flow untreated to the ocean. Explore the tips below to find out how to prevent irrigation runoff.

## RUN YOUR SYSTEM

Run and observe your irrigation system through its entire cycle seasonally (twice a year) to look for leaks, misaligned sprinkler heads, and areas of ponding and/or runoff.

## WATER AT SUNRISE

Watering early in the morning before sunrise will reduce water loss due to evaporation. Wind also tends to die down in the early morning, so the water will irrigate the lawn as intended.

## WATER BY PLANT TYPE AND SEASON

Different types of grass and plants have differing water needs. This also changes throughout the year, with cooler months typically requiring less water than warmer months. Ask your landscape maintenance provider or contact the University of California Cooperative Extension Master Gardeners* for questions regarding landscape watering needs.

## HAND WATER PLANTS

Garden hoses with automatic shutoff nozzles can use less water than sprinkler irrigation systems. Hand watering also ensures only those areas that need water get it and prevents irrigation runoff. An easy alternative to sprinklers, hand watering can help keep our waterways clean!

# Know Your Irrigation System and Landscape:

## PROPER AIM

Adjust the direction of your sprinkler heads so water does not spray on sidewalks, driveways or roads. By simply adjusting the direction of your sprinklers, you can save water, prevent irrigation runoff, and keep your landscape healthy.

## FIX LEAKS

Broken or leaky sprinklers can waste thousands of gallons of water per month and significantly increase the amount of runoff from your yard. Repairing sprinklers can prevent runoff from entering our waterways and save you money.

## LEAST TOXIC FIRST

Limit pesticide use by using nonchemical methods, integrated pest management, or least-toxic pesticides whenever possible. Contact the University of California Cooperative Extension Master Gardeners* for alternative suggestions and related guidance.

## CYCLE AND SOAK

Running multiple, shorter cycles with an hour break in between allows the water to infiltrate into the ground so it does not run off.

## RAIN SKIP

Adjusting your watering schedule when it rains prevents unnecessary watering that can lead to runoff. Keep an eye on the weather forecast and skip your normal watering schedule before, during, and after a rain to help keep our waterways clean and your landscaping looking its best.

## SET A TIMER

Use an irrigation timer to minimize runoff and maximize water absorption. Water districts often provide irrigation schedules to determine the best water scheme for your yard. Contact your water provider for a weekly irrigation schedule.

## GIVE IT 48 HOURS

Prevent fertilizers and pesticides from entering our waterways by not watering your lawn 48 hours after application and stopping application 48 hours before a forecasted rain event.