COUGHLINPORTERLUNDEEN
STRUCTURAL CIVIL SEISMIC ENGINEERING

ENGINEERING REPORT

Stormwater Drainage Report

Snohomish Regional Fire and Rescue – Station 32
Monroe, WA
August 2025

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Snohomish Regional Fire and Rescue

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Stormwater Drainage Report

Snohomish Regional Fire and Rescue – Station 32

Coughlin Porter Lundeen

Project No. C24017

August 2025

Table of Contents

I. Project Overview 3

General Description 3

Pre-developed Site Conditions 3

Post-Developed Site Conditions 4

II. Minimum Requirements 4

MR1 – Preparation of Stormwater Site Plans 4

MR2 – Construction Stormwater Pollution Prevention Plan 4

MR3 – Source Control of Pollution 5

MR4 – Preservation of Natural Drainage Systems and Outfalls 5

MR5 – On-site Stormwater Management 5

MR6 – Runoff Treatment 6

MR7 – Flow Control 6

MR8 – Wetland Protection 6

MR9 – Operation and Maintenance 6

III. Off-Site Analysis 7

Field Inspection 7

Drainage System Descriptions 7

Upstream Analysis 7

Downstream Analysis 7

IV. Flow Control and Water Quality Facility Analysis and Design 7

Existing Site Hydrology 7

Developed Site Hydrology 8

Flow Control 9

Water Quality 9

Appendices 10

I. Project Overview

General Description

This Storm Drainage Report was prepared in accordance with the 2019 Department of Ecology Stormwater Management Manual for Western Washington (SWMM). The proposed project is the development of a new fire station for Snohomish Regional Fire and Rescue (SRFR) Station 32, located in the City of Monroe, Washington.

The site is located at 19959 Oaks Street, Monroe WA 98272 in the NW corner of Section 6, Township 27 N, Range 7 E, Willamette Meridian. The project area is 1.5 acres, with a total property area of 2.1 acres.

The project is located within Woods Creek Watershed basin. The site is bound by Woods Creek Road to the northwest, Oaks Street to the south, and private property along the northeast border. Along the northeast boundary is an open drainage ditch, which conveys off-site stormwater runoff from the north to a piped system maintained by the City of Monroe at the southeast corner of the site. Mapped wetlands exist in the northern portion of the site and are protected by a 50-foot buffer per the project's critical areas report.

Pre-developed Site Conditions

The existing site consists primarily of an undeveloped grass field with some gravel staging areas used for trailers and overgrown blackberry bushes. The existing site drains generally toward the southeast, discharging to the existing roadside ditch. There are no existing building structures on site.

A geotechnical investigation and report titled *Geotechnical Engineering Report, Proposed Fire Station #32 19959 Oaks Street Monroe, Washington Snohomish County Parcel #27070600200300* was prepared by Otto Rosenau & Associates, Inc. in April 2025. Subsurface conditions generally consisted of fill, alluvium, and Olympia Beds (Snoqualmie and Skykomish River provenance). Fill was encountered near the surface at every boring location varying from 2 to 5 feet in depth. The fill materials were generally loose to medium dense sands with varying amounts of silt, gravel and cobbles. The alluvium was encountered up to depths of 26 feet below grade, observed to have a soft to medium stiffness, and consisted of interbedded silts, clays, sands, gravels, and some peat. Beyond 26 feet in depth, dense to very dense sands and gravels were encountered classified as non-glacial deposits from the Olympia Beds of Snoqualmie and Skykomish River.

Groundwater was observed during the geotechnical exploration at roughly 6 feet below grade. Additionally, a pressurized artesian aquifer was identified at approximately 21 feet below grade traveling north-south through the site.

A critical areas report titled *Aquatic Resources Report, Snohomish Regional Fire & Rescue Vacant Parcel No. 27070600200300 Monroe, Washington* was prepared by Haley Aldrich in February 2025. The report identifies Wetland 1 in the northern portion of the site as Category IV, requiring a 50-foot buffer. This wetland is upstream of the project discharge point so the project will not have an impact on the wetland's hydrology. Additionally, this

report identifies a 400-foot-long stormwater ditch along the northeast boundary. The project will use this stormwater ditch to discharge the site runoff after it flows through water treatment and flow control facilities.

Post-Developed Site Conditions

Site improvements will include the construction of a new fire station building, associated access drives, parking lot, sidewalks, and landscaping. The project will result in 0.76 acres of new impervious area and 0.74 acres of replaced pervious area for a total disturbed area of 1.5 acres.

Site work is anticipated to include the installation of new below grade utilities, site grading and paving. New utility systems on the site will include water, sanitary sewer, stormwater drainage, power, communication, and gas. The frontage improvements along Oaks Street will include a 45-foot dedication to the City of Monroe so they can widen and improve the roadway with a future City project based on future funding. The SRFR Station 32 project proposes to build the 10-foot sidewalk along the new proposed right-of-way and will coordinate with the City developing Oaks Street build out.

Stormwater from impervious areas will be collected by catch basins and roof downspouts. Pollution-generating surfaces will be treated through either bioretention facilities or a water quality unit prior to discharge. All flows will be routed to the existing drainage ditch in the southeast corner, which ultimately conveys stormwater to the City-maintained storm system.

II. Minimum Requirements

The 2019 DOE SWMMWW outlines nine minimum requirements in section I-3 that must be addressed prior to permit approval. For this project, all minimum requirements will be applied to new impervious surfaces based on our analysis of the "Flow Charts for Determining Requirements for New and Redevelopments" (See Appendix A, **Figure 6** for Flow Chart for New Development from Volume I Chapter 3 of the DOE SWMMWW).
A summary of each of these minimum requirements, and the approach this project will take to address those requirements, are listed below.

MR1 – Preparation of Stormwater Site Plans

Stormwater site plans and reports addressing all applicable minimum requirements are prepared by a licensed civil engineer as part of the Site Development Permit.

MR2 – Construction Stormwater Pollution Prevention Plan

A Construction Storm Water Pollution Prevention Plan (SWPPP) will be prepared and included with the Site Development Permit documents. Construction BMPs will be implemented to prevent erosion, sedimentation, and pollutant discharges during construction.

MR3 – Source Control of Pollution

Permanent source control BMPs will be implemented, including labeling of storm drain inlets, roof downspout discharges away from PGIS areas, and landscaping BMPs per the DOE manual. Runoff from surface level pollution generating impervious surfaces (PGIS) and pollution generating pervious surfaces (PGPS) will be treated prior to discharge into the public storm system. Source control BMPs will be selected, designed, and maintained in accordance with the DOE Manual. These include the following:

- S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems
- S421 BMPs for Parking and Storage of Vehicles and Equipment
- S411 BMPs for Landscaping and Lawn/Vegetation Management
- S435 BMPs for Pesticide and an Integrated Pest management Program
- S442 BMPs for Labeling Storm Drain inlets on Your Property
- S443 BMPs for Fertilizer Application
- S450 BMPs for irrigation

MR4 – Preservation of Natural Drainage Systems and Outfalls

The proposed development will match and maintain the existing drainage pattern to the stormwater ditch along the northeastern border.

MR5 – On-site Stormwater Management

LID BMPs have been evaluated per SWMM flow charts – **Figure 7 and Figure 8 in Appendix A**. Bioretention will be provided for pollution-generating surfaces where feasible. Compost-amended soils will be used in all new landscaped areas. Roof infiltration is not feasible due to limited infiltration capacity of native soils.

- **Surface Type: Lawn and Landscape Area:**
    - **BMP T5.13 Post-Construction Soil Quality and Depth:** All new landscaping will include 8" of compost amended soil.
- **Surface Type: Roofs:**
    - **BMP T5.30 Full Dispersion:** Dispersion is infeasible as the future buildings and site improvements do not allow sufficient space on site to provide a dispersion area.
    - **BMP T5.10A: Downspout Full Infiltration:** Full infiltration is not feasible because soils on site are not compatible with infiltration, per the geotechnical report.
    - **BMP T7.30: Bioretention:** Due to the wetland buffer setback, there is insufficient landscaped space around the building to provide bioretention for roof downspouts.
    - **BMP T5.30 Downspout Dispersion:** Downspout Dispersion is infeasible because there is a not a sufficient flow path due to the wetland buffer setback.

    - **BMP T5.15 Perforated Stub-out Connections:** Perforated stub-out connections are infeasible as the downspouts are located adjacent to paved surfaces and the wetland buffer that make maintenance of perforated stub-out connections infeasible.

- **Surface Type: Other Hard Surfaces:**
    - **BMP T5.30 Full Dispersion:** Dispersion is infeasible as the future building and site improvements do not allow sufficient space on site to provide a dispersion area.
    - **BMP T5.15 Permeable Pavements:** Based on a geotechnical analysis, the native soils have negligible infiltration capacity, making permeable pavements infeasible.
    - **BMP T7.30: Bioretention:** Non-infiltrative bioretention will be used adjacent to the parking lot and the apparatus bay drive to treat runoff from the onsite pollution generating areas.

MR6 – Runoff Treatment

The project creates more than 5,000 SF of pollution generating impervious surfaces (PGIS), requiring water quality treatment according to Section I-3.4.6 of the SWMM. The PGIS areas onsite include access drives and a parking lot for a total of 12,632 square feet (0.29 acres). Runoff from the PGIS will be directed to either bioretention facilities or a water quality unit prior to discharging into the municipal drainage system.

MR7 – Flow Control

The project creates more than 10,000 SF of impervious area and therefore per Section I-3.4.7 of the SWMM must provide flow control to match pre-developed forested conditions. The fully developed site will include a new building, driveway, and sidewalk with a total impervious area of approximately 33,106 square feet (0.76 acres). A detention system with controlled release to the stormwater ditch is proposed. Flow control will be sized using WWHM modeling per DOE performance criteria standards.

MR8 – Wetland Protection

Wetlands are present in the northern corner of the site. A 50-ft buffer has been established per the critical areas report. All proposed development and stormwater facilities are located outside of the wetland and buffer.

MR9 – Operation and Maintenance

An Operations and Maintenance (O&M) Manual will be provided in Appendix C at a later date. The manual will outline inspection and maintenance responsibilities for all stormwater facilities to ensure long-term functionality.

III. Off-Site Analysis

Field Inspection

Site visits have been made to gather information including a Level 1 Downstream Analysis. No drainage problems were observed onsite. Please refer to downstream analysis below for more information.

Drainage System Descriptions

The site currently drains northeast into the existing ditch, which conveys runoff east to the City of Monroe storm system in Oaks Street.

Upstream Analysis

Runoff from Woods Creek Road and adjacent properties north of the site drain into the storm ditch on the east site of Woods Creek Road, within Snohomish County stormwater jurisdiction into the northern area of the proposed site where a designated wetland sits. Runoff then flows along the northeastern border to the east side of the site where it enters a closed storm pipe maintained by the City of Monroe.

Downstream Analysis

The project is located within Woods Creek Watershed basin. The site's storm ditch conveys runoff to the City's piped storm system at the southeast corner of the site and into 36-inch concrete pipe that conveys runoff southeast where it daylights and joins into Woods Creek. Woods Creek flows south and west and eventually joins the Skykomish River. The City system has adequate capacity to receive project flows, as documented in coordination with the City of Monroe standards.

IV. Flow Control and Water Quality Facility Analysis and Design

Existing Site Hydrology

The pre-developed condition is predominantly grass field with gravel staging. For modeling, this is assumed equivalent to pasture/grass cover.

Table 1 – Existing On-site Area

Area Type	**Area**
Units	*Square Feet (Acres)*
PGIS	6,970 (0.16)
NPGIS	20,909 (0.48)
Roof	0 (0)
Pervious	59,677 (1.37)
Total	**87,556 (2.01)**

Table 2 – Existing ROW Area

Area Type	**Area**
Units	*Square Feet (Acres)*
PGIS	0 (0)
NPGIS	2,614 (0.06)
Roof	0 (0)
Pervious	1,307 (0.03)
Total	**3,921 (0.09)**

Developed Site Hydrology

Post-developed conditions include 0.76 acres of new impervious (PGIS + roof + sidewalk) and 0.74 acres of pervious area. Runoff from roofs and paved surfaces will be routed to bioretention and detention prior to discharge.

Area Type	**Discharge to Chambers**	**Discharge to Bioretention**	**Bypass**	**Total Area**
Units	*Square Feet (Acres)*	*Square Feet (Acres)*	*Square Feet (Acres)*	*Square Feet (Acres)*
PGIS	12,632 (0.29)	12,632 (0.29)	3,049 (0.07)	**15,683 (0.36)**
NPGIS	1,742 (0.04)	0 (0)	3,920 (0.09)	**5,662 (0.13)**
Roof (NPGIS)	11,761 (0.27)	0	0	**11,761 (0.27)**
Pervious	32,234 (0.74)	0 (0)	1,307 (0.03)	**32,234 (0.74)**
Total	**58,369 (1.34)**	**12,632 (0.29)**	**8,276 (0.19)**	**65,340 (1.5)**

Flow Control

Per DOE Minimum Requirement #7, flow control will be provided using a detention system sized to meet the forested condition standard. The detention facility will provide live storage capacity as required by WWHM.

Water Quality

Per DOE Minimum Requirement #6, all PGIS runoff will receive treatment prior to discharge. Bioretention facilities or a water quality unit will be installed to provide water quality treatment per Ecology-approved design.

Appendices

Appendix A – Supporting Figures

- **Figure 1** – Vicinity Map
- **Figure 2** – Existing Conditions Map
- **Figure 3** – Proposed Conditions Map
- **Figure 4a** – Monroe Critical Areas Map – Streams and Wetlands
- **Figure 4b** – Monroe Critical Areas Map – Floodplain
- **Figure 4c** – Monroe Critical Areas Map – Environmental Designations
- **Figure 5a** – Monroe City Stormwater Drainage Basins Map
- **Figure 5b** – Monroe City Stormwater Systems Map
- **Figure 6** – Flow Chart for New Development
- **Figure 7** – Flow Chart for MR#5 Requirements
- **Figure 8** – Flow Chart for Runoff Treatment BMP Selection
- **Figure 9** – Upstream Analysis Map
- **Figure 10** – Downstream Analysis Map
- **Figure 11** – NCRS Soil Map

Appendix B – Flow Control Calculations

Appendix C – Operations and Maintenance Manual (provided with next submittal)

Appendix D – Geotechnical Report

Appendix E – Critical Areas Report

FIGURE 1

VICINITY MAP

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Project:	Snohomish Regional Fire and Rescue Station 32	Designed By: JSS	Date: 8/25/2025
Project No:	C24017	Client: SRFR	Checked By:
			Sheet:

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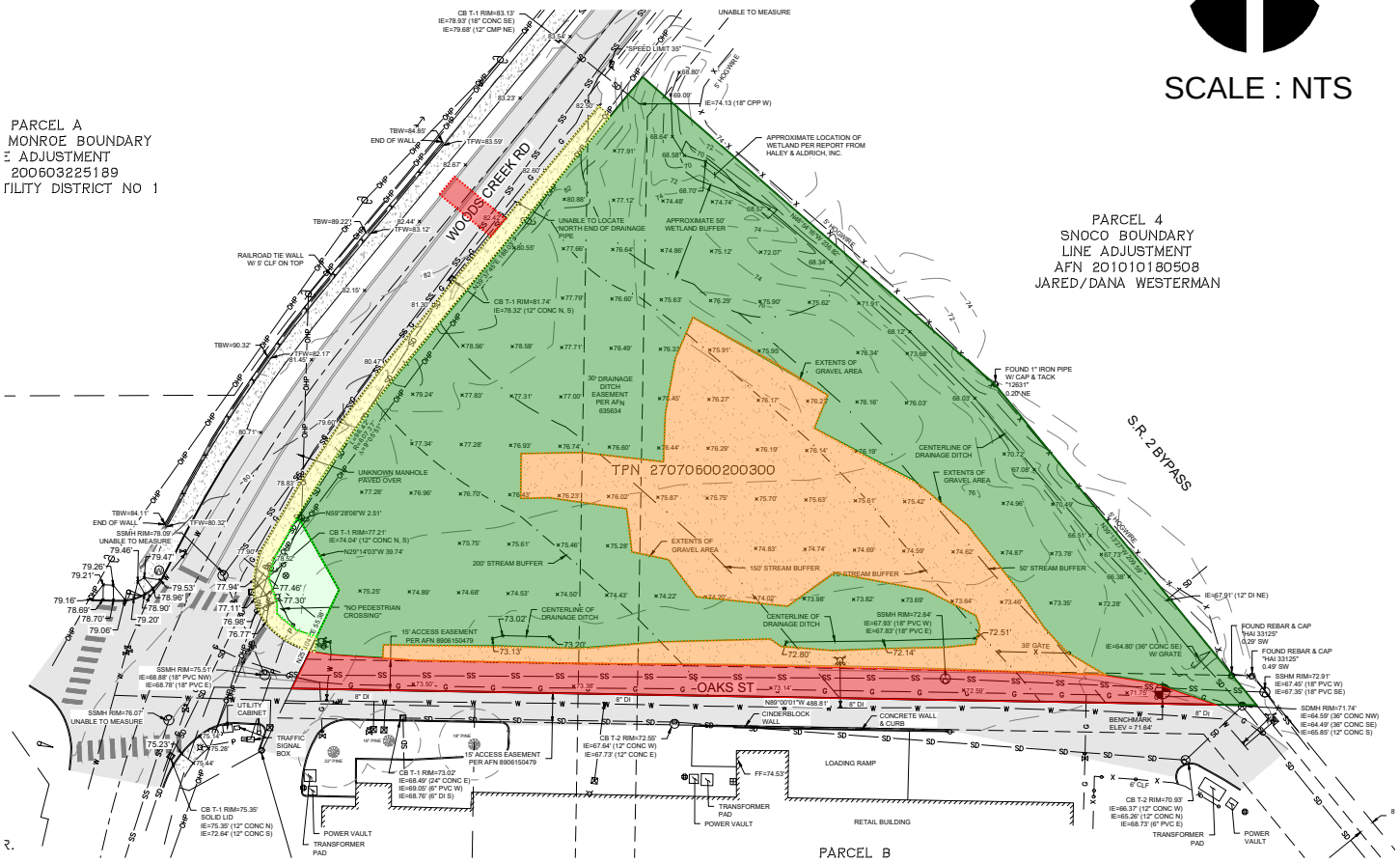

Legend		
Description	Quantity	Unit
OFFSITE IMPERVIOUS	0.06	ac
OFFSITE PERVIOUS	0.03	ac
ONSITE IMPERVIOUS	0.48	ac
ONSITE PERVIOUS	1.37	ac
ONSITE PGIS	0.16	ac

TOTAL AREA = 2.1 ACRES

TOTAL DISTURBED AREA = 1.5 ACRES

FIGURE 2

EXISTING CONDITIONS MAP

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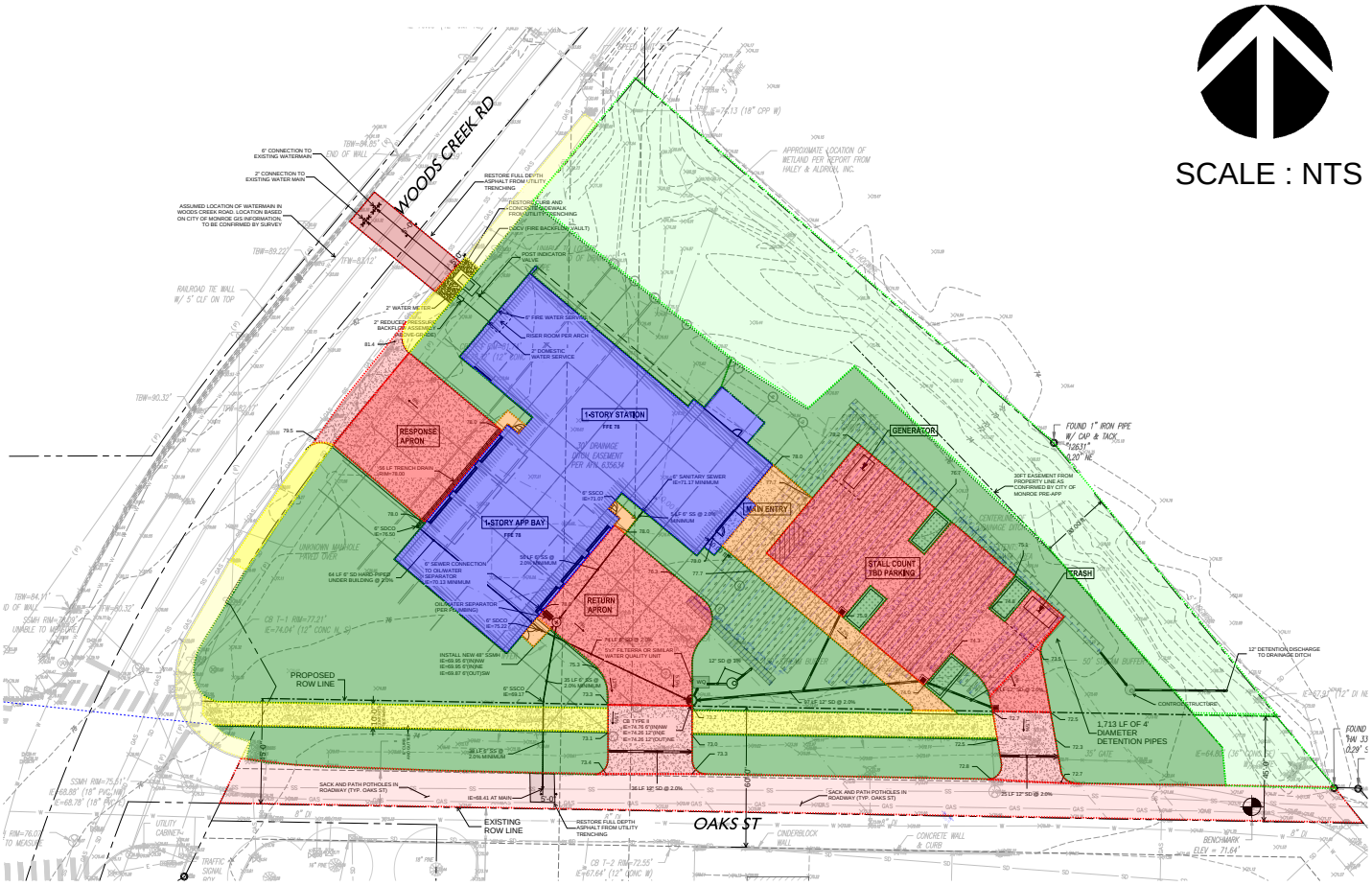
SCALE : NTS



Legend

Description	Quantity	Unit
EX IMPERVIOUS (NOT MODIFIED)	0.03	ac
EX OFFSITE PERVIOUS (NOT MODIFIED)	0.03	ac
EX PERVIOUS (NOT MODIFIED)	0.38	ac
EX PGIS (NOT MODIFIED)	0.17	ac
IMPERVIOUS	0.04	ac
OFFSITE IMPERVIOUS	0.09	ac
OFFSITE PGIS	0.07	ac
PERVIOUS	0.74	ac
PGIS	0.29	ac
ROOF	0.27	ac

TOTAL AREA = 2.1 ACRES

TOTAL DISTURBED AREA = 1.5 ACRES

FIGURE 3

PROPOSED CONDITIONS MAP

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Project: Snohomish Regional Fire and Rescue Station 32
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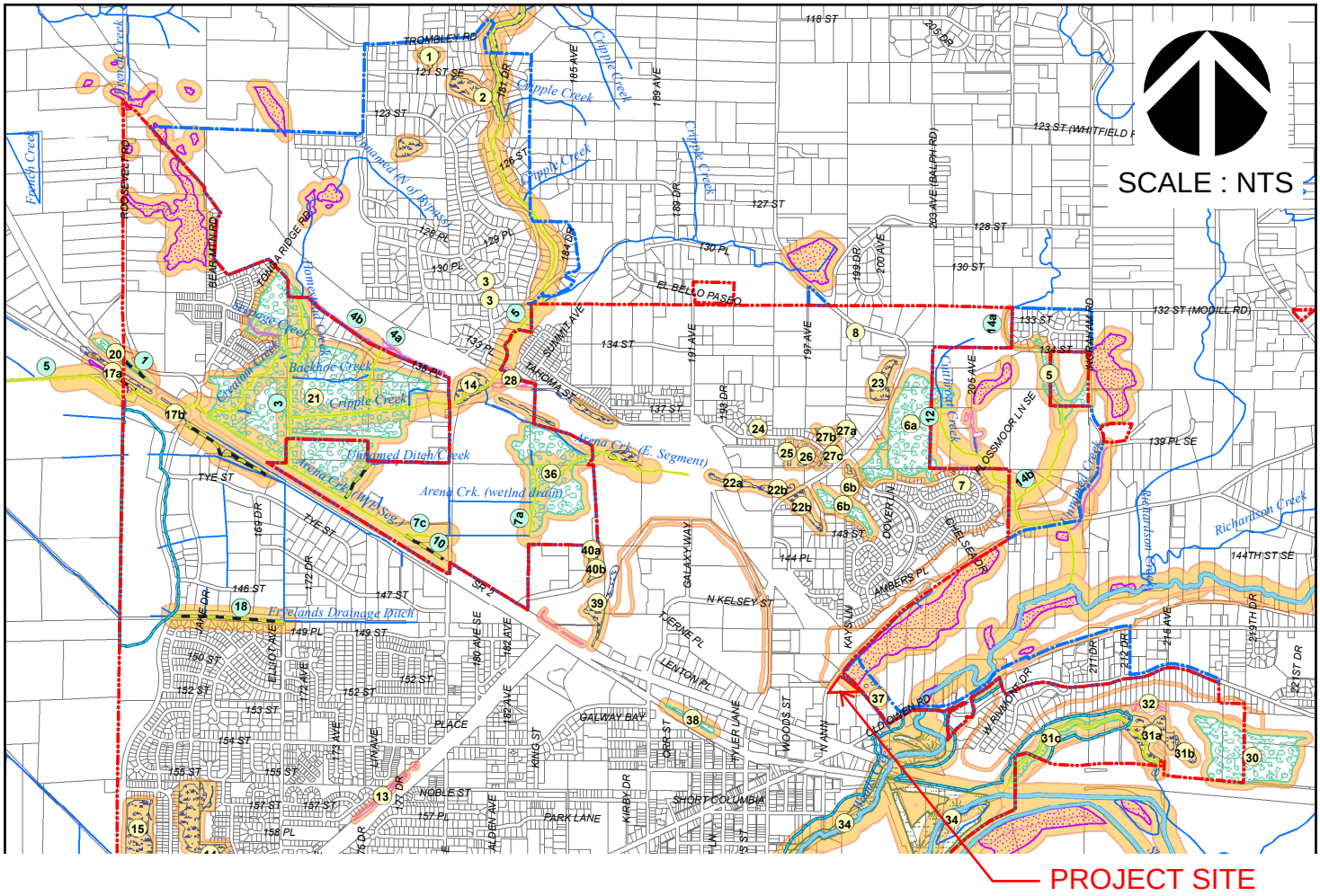
SCALE : NTS
PROJECT SITE
Cripple Creek
Backhoe Creek
Gunsmoke Creek
Gunsmoke Creek Tributary
Gunsmoke Creek Tributary 2
Gunsmoke Creek Tributary 3
Gunsmoke Creek Tributary 4
Gunsmoke Creek Tributary 5
Gunsmoke Creek Tributary 6
Gunsmoke Creek Tributary 7
Gunsmoke Creek Tributary 8
Gunsmoke Creek Tributary 9
Gunsmoke Creek Tributary 10
Gunsmoke Creek Tributary 11
Gunsmoke Creek Tributary

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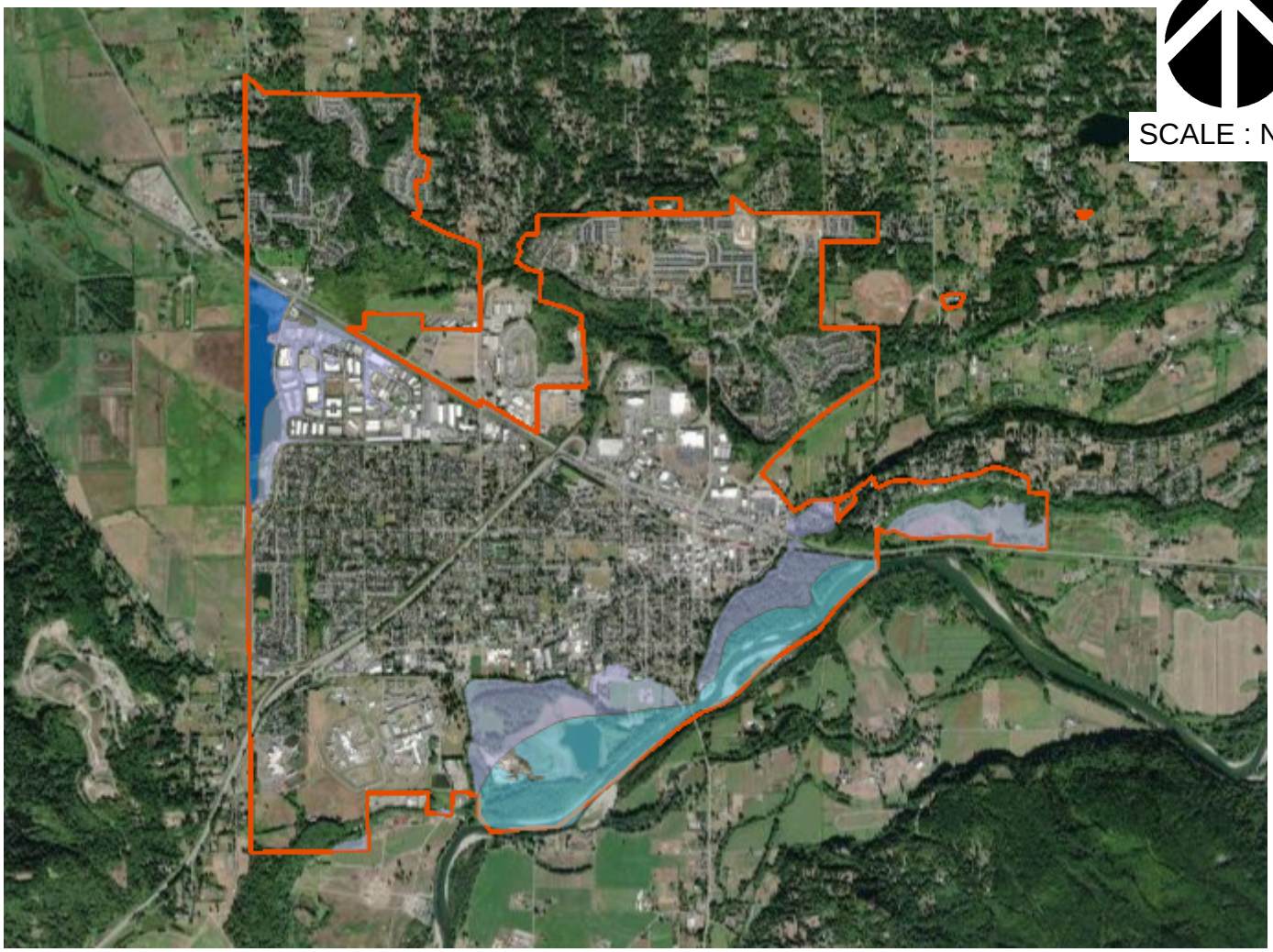

City of Monroe Floodplain Map

Flood Plains In Monroe

AE, no subtype specified

FLD_ZONE,ZONE_SUBTY

AE,

A

FLD_ZONE,ZONE_SUBTY

A,

AE, Density Fringe

FLD_ZONE,ZONE_SUBTY

AE,DENSITY FRINGE AREA

AE, Floodway

FLD_ZONE,ZONE_SUBTY

AE,FLOODWAY

City Limits

City Limits

FIGURE 4B

FLOODPLAIN MAP

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Project: Snohomish Regional Fire and Rescue Station 32

Designed By: JSS Date: 8/25/2025

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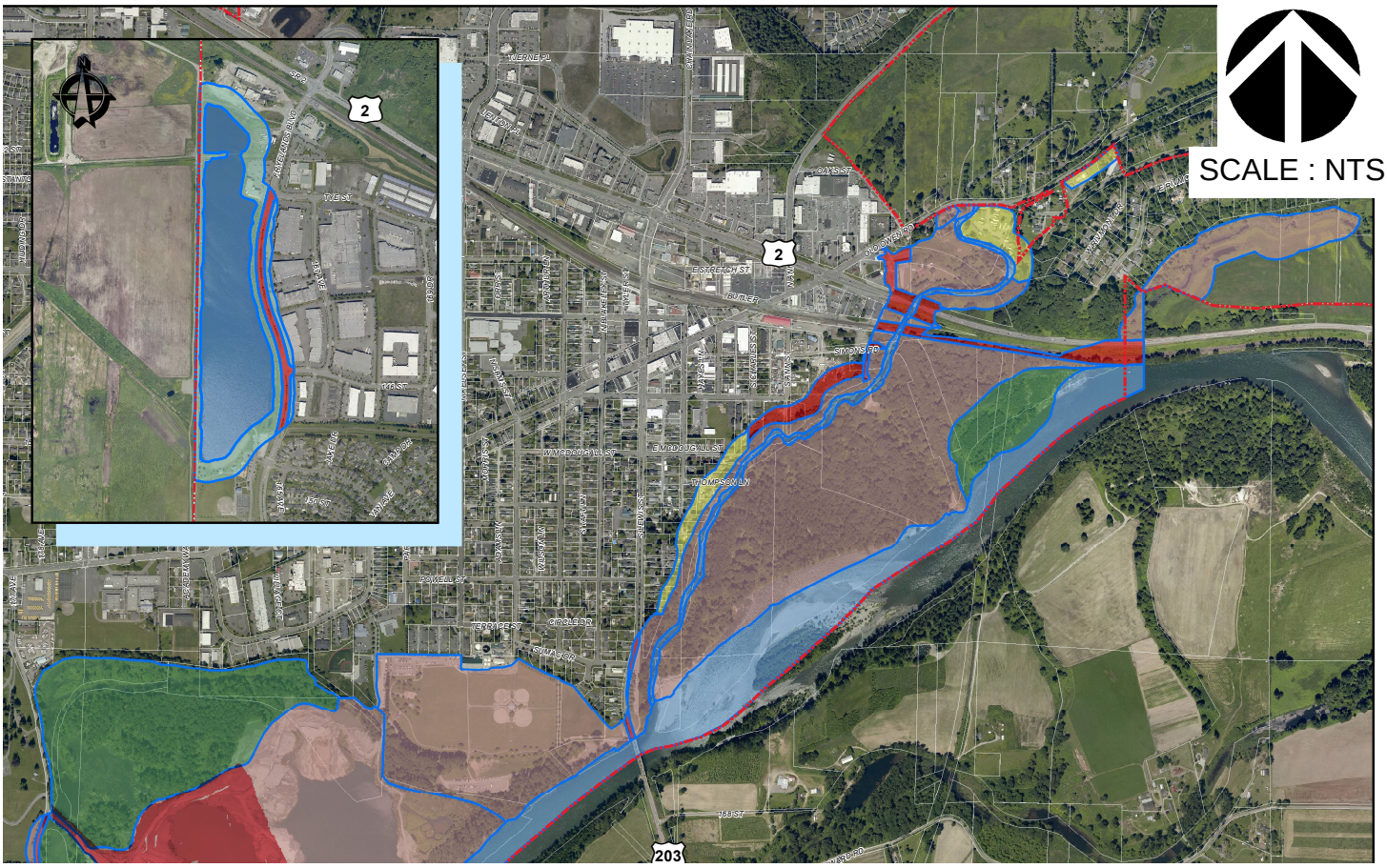

City of Monroe Shoreline Environment Designations

MONROE
WASHINGTON

Boundaries

- Monroe City Limits
- Shoreline Boundary

Shoreline Designations

ZONE

- (A) - Aquatic
- (HI) - High Intensity
- (N) - Natural
- (SR) - Shoreline Residential
- (TSW) - Tye Stormwater Facility
- (UC) - Urban Conservancy

Shoreline jurisdiction boundaries depicted on this map are approximate. They have not been formally delineated or surveyed and are intended for planning purposes only. Additional site-specific evaluation may be needed to confirm/verify information shown on this map.

Map data shown is the property of the City of Monroe. Inaccuracies may exist. The City of Monroe implies no warranties or guaranties regarding any aspect of data depiction. No real estate decisions are to be made using this map. Please contact the City of Monroe Community Development Department to verify the designation(s).

Project: Shoreline Environment Designations
N:\GIS\Departments\CD\Shorelines\Shoreline Environment Designations (June 2019).mxd
Source: City of Monroe 2019; Snohomish County 2015, Watershed Company 2002; FEMA 2006
Revised: 06-01-19
Author: AM

FIGURE 4C
ENVIRONMENTAL DESIGNATIONS

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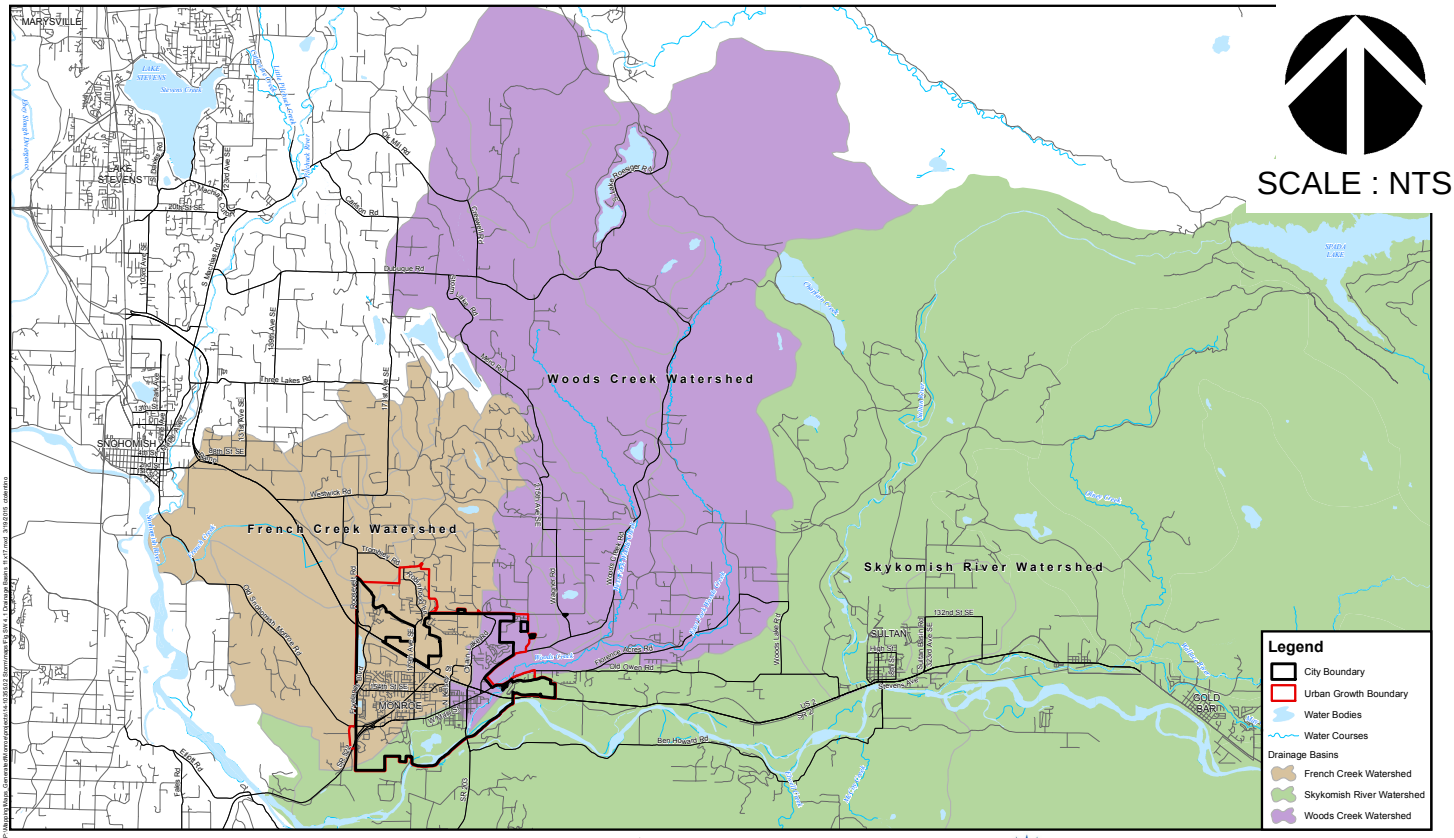

SCALE : NTS

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Snohomish County base data 2014
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MONROE WASHINGTON

Stormwater Drainage Basins
Utility Systems Plan - Stormwater
City of Monroe, Washington
March 2014

Figure
SW 4.1

FIGURE 5A

CITY STORWATER DRAINAGE BASINS MAP

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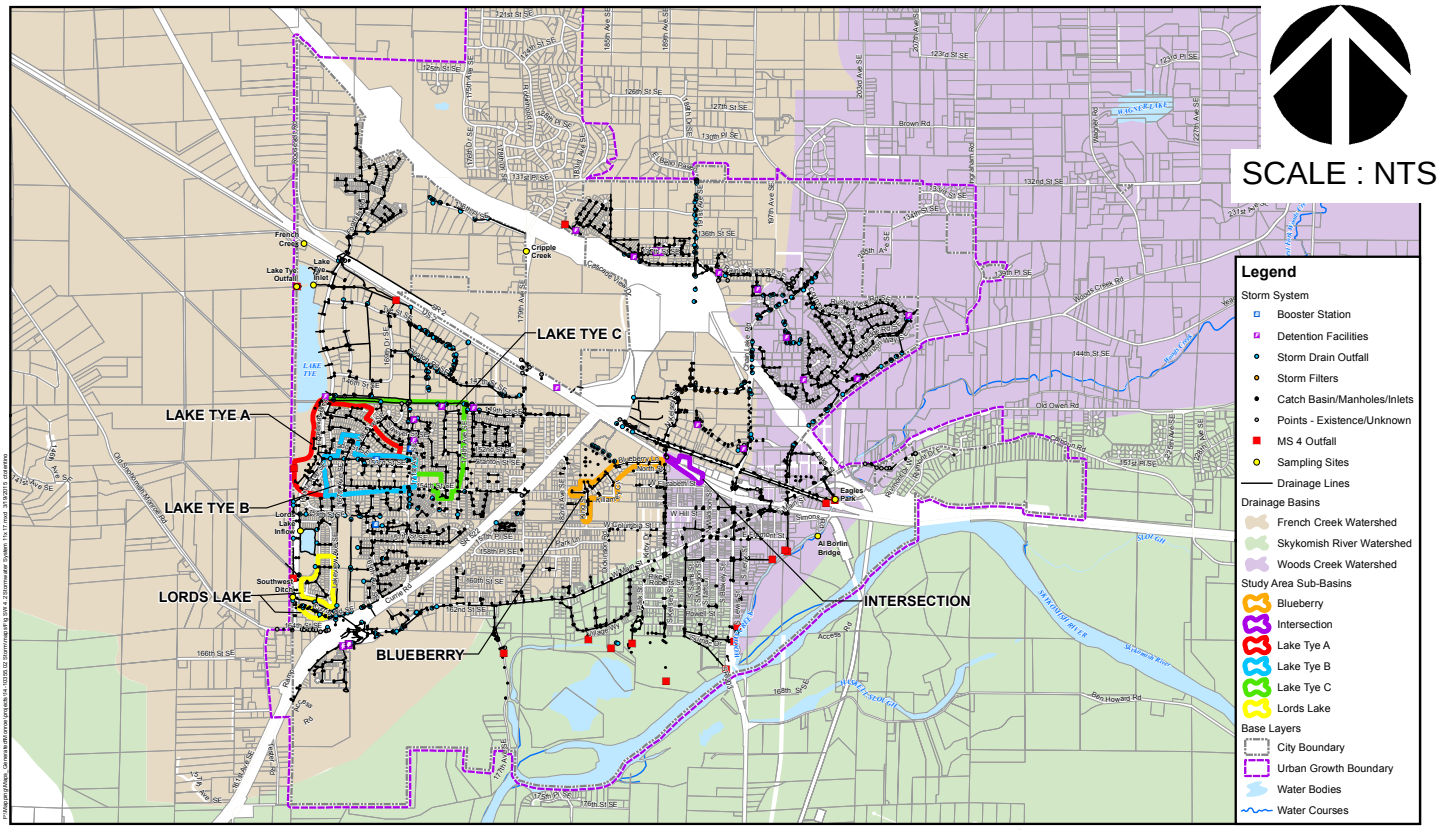

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Stormwater System: City of Monroe 2014

Snohomish County base data 2014
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MONROE WASHINGTON

Stormwater System
Utility Systems Plan - Stormwater
City of Monroe, Washington
March 2015

Figure
SW 4.2

FIGURE 5B

CITY STORMWATER SYSTEMS MAP

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Figure I-3.1: Flow Chart for Determining Requirements for New Development

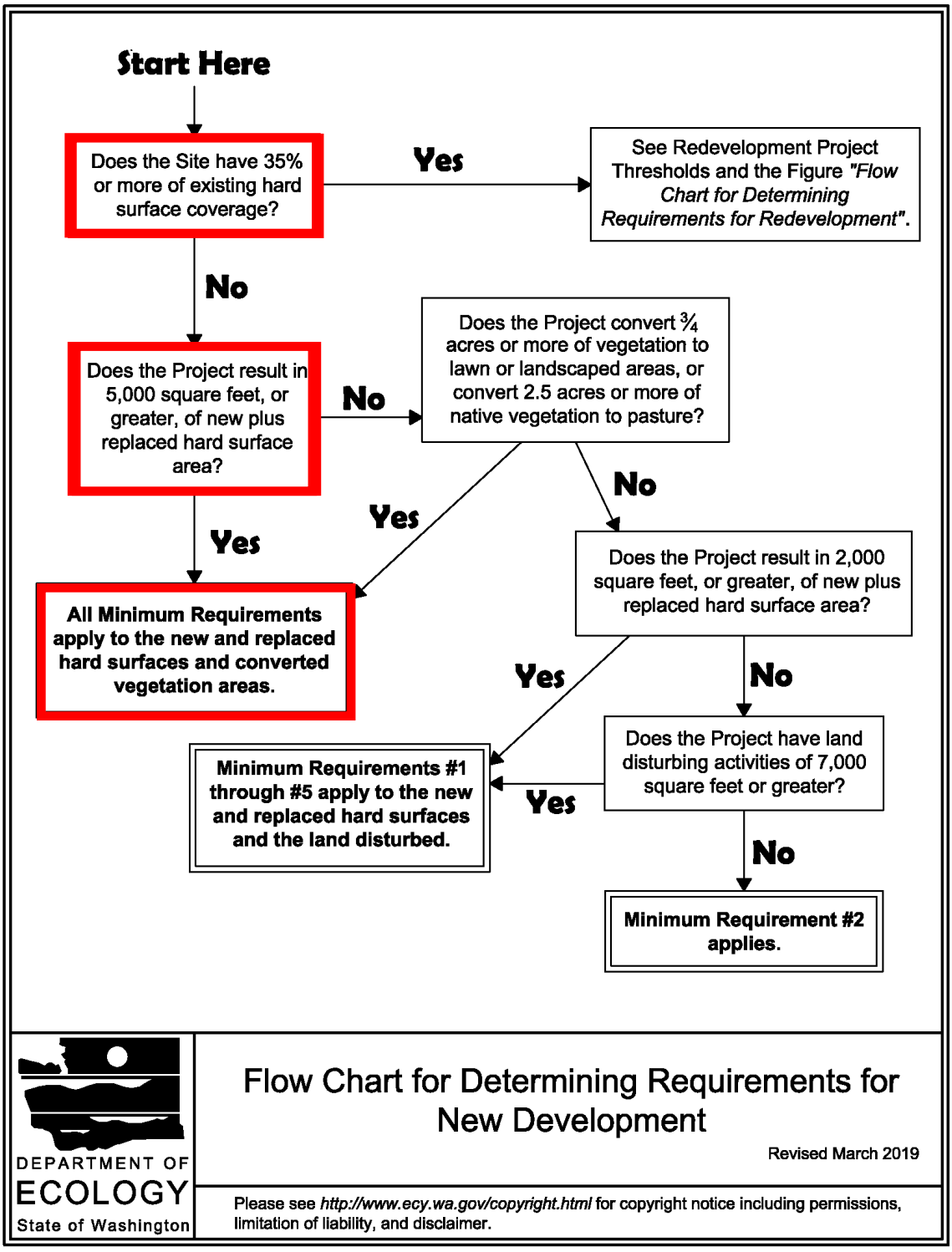

FIGURE 6

FLOW CHART FOR NEW DEVELOPMENT

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Figure I-3.3: Flow Chart for Determining MR #5 Requirements

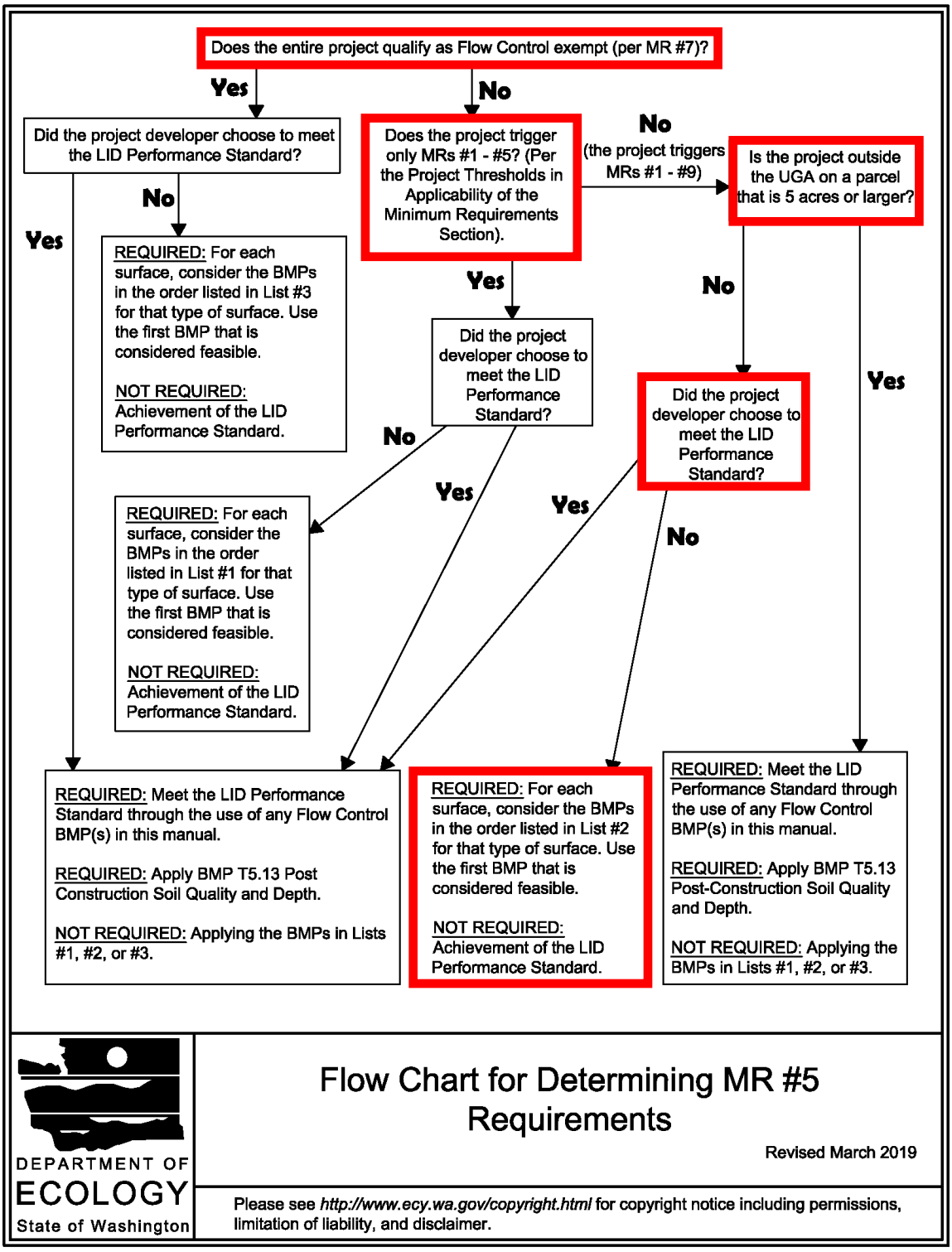

FIGURE 7

FLOW CHART FOR MR#5 REQUIREMENTS

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Figure III-1.1: Runoff Treatment BMP Selection Flow Chart

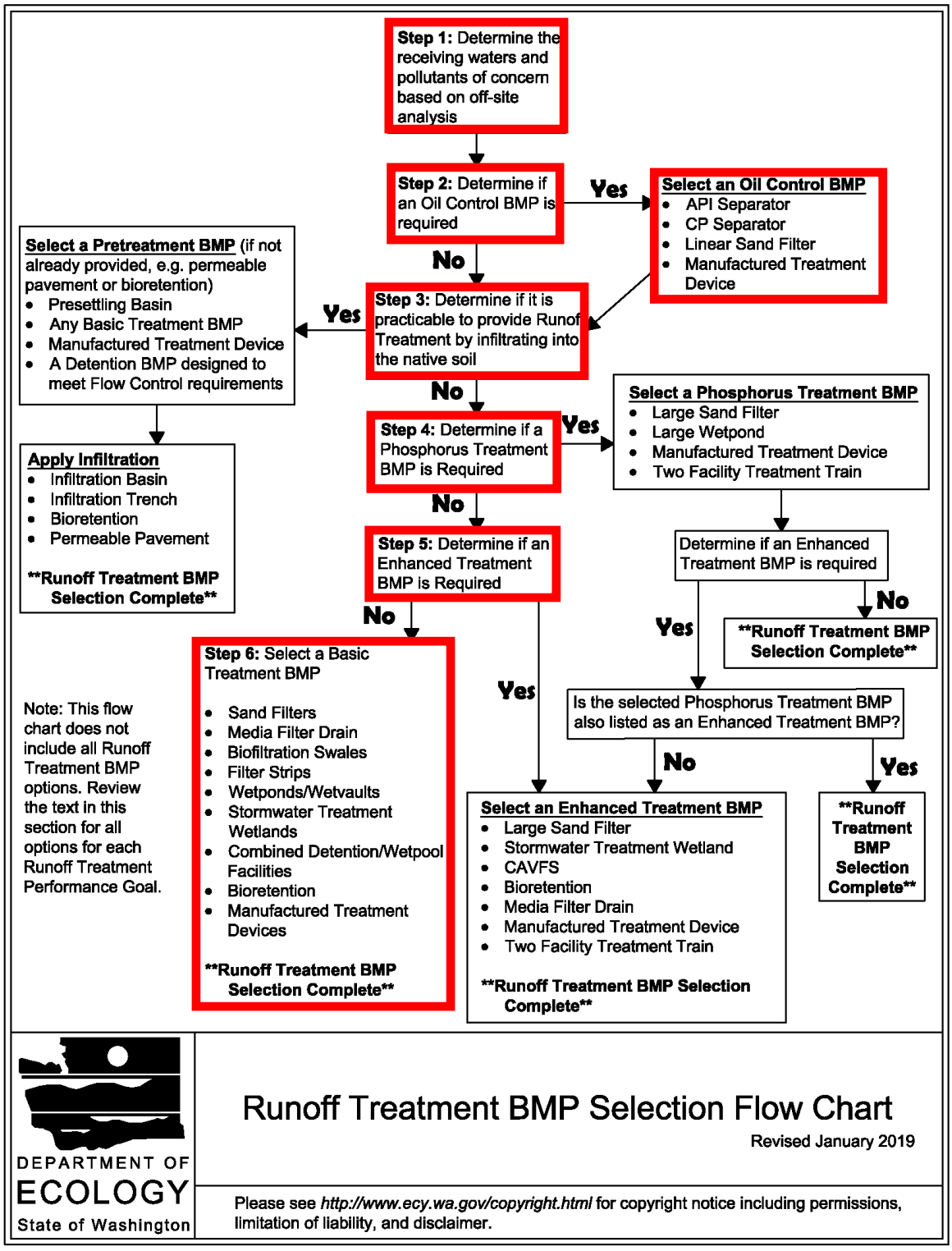

FIGURE 8

FLOW CHART FOR RUNOFF TREATMENT BMP SELECTION

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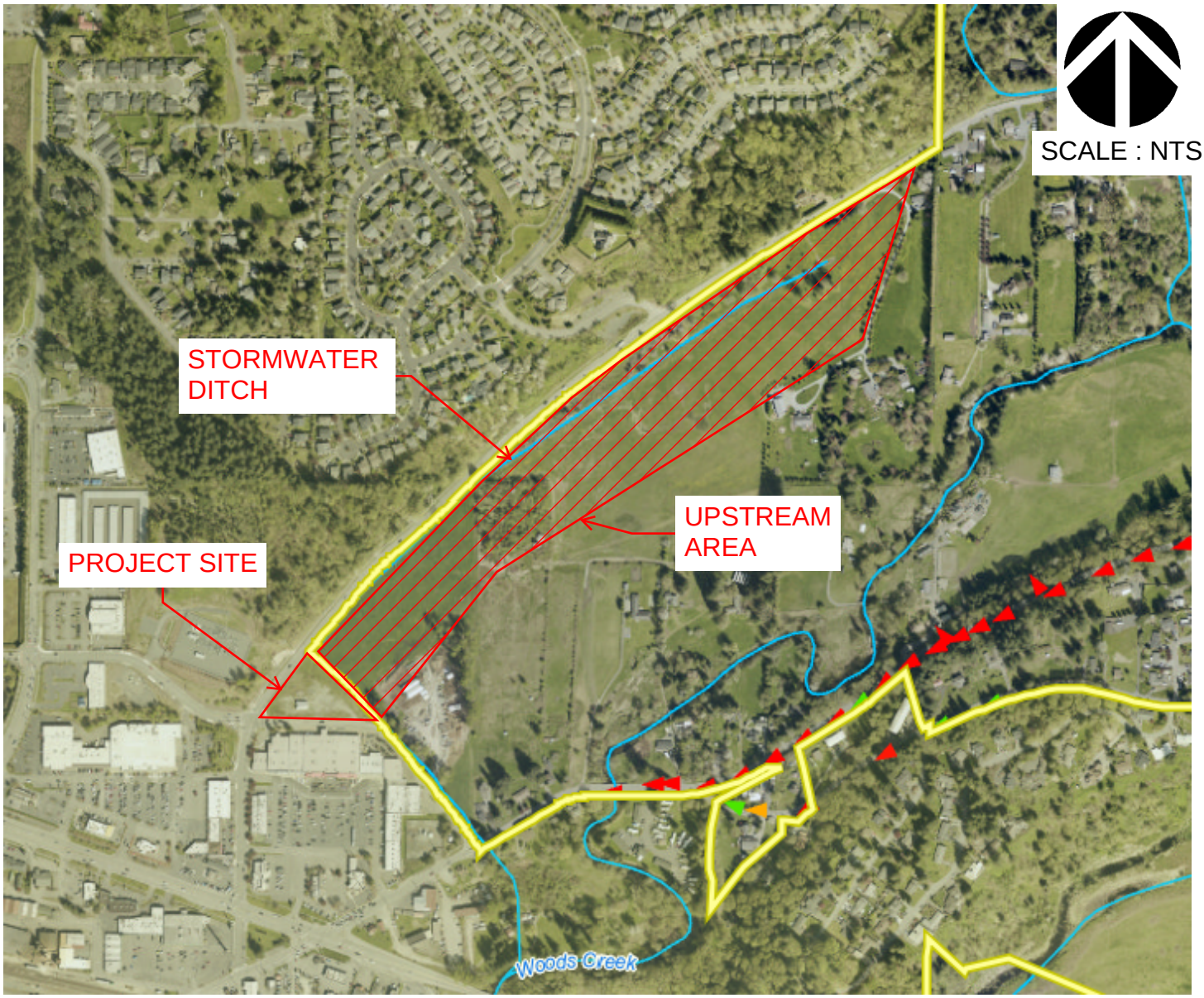

FIGURE 9

UPSTREAM ANALYSIS MAP

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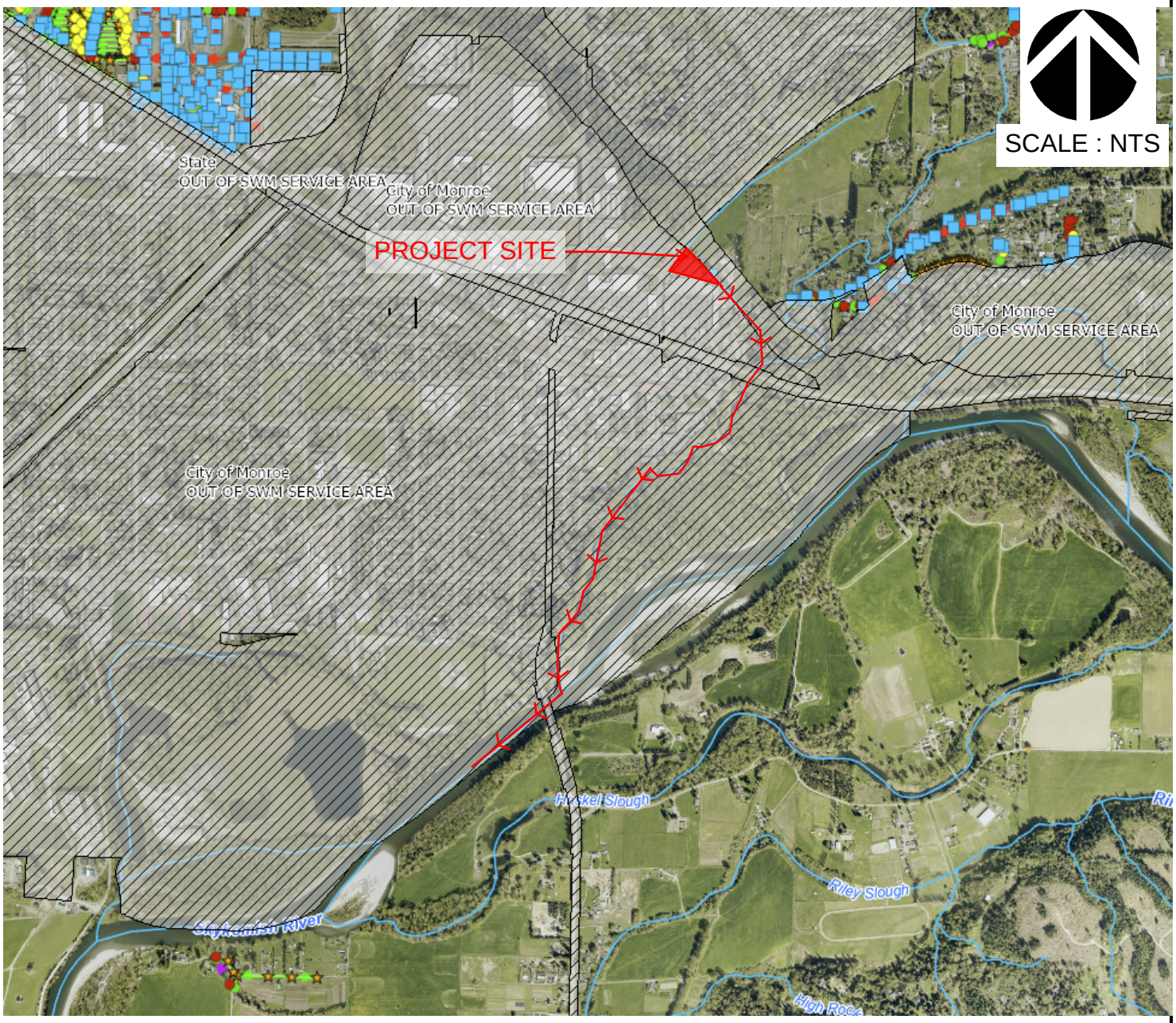

FIGURE 10

DOWNSTREAM ANALYSIS MAP

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FIGURE 11
NCRS SOIL MAP

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Project No: C24017
Client: SRFR
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Sheet:

APPENDIX B
FLOW CONTROL CALCULATIONS

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 2025-06-22 FS 32_4' depth

Site Name:	FS 32
Site Address:	Oaks St & Woods Creek Rd
City:	Monroe
Report Date:	8/25/2025
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	Hourly
Precip Scale:	1.200
Version Date:	2024/10/15
Version:	4.3.1

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.5
Pervious Total	1.5
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.5

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	0.74
Pervious Total	0.74

Impervious Land Use	acre
ROADS FLAT	0.36
ROOF TOPS FLAT	0.27
SIDEWALKS FLAT	0.13
Impervious Total	0.76
Basin Total	1.5

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

Tank 1	Tank 1

Routing Elements
Predeveloped Routing

Mitigated Routing

Tank 1

Dimensions
Depth: 4 ft.
Tank Type: Circular
Diameter: 4 ft.
Length: 1900 ft.
Discharge Structure
Riser Height: 3 ft.
Riser Diameter: 24 in.
Orifice 1 Diameter: 0.703 in. Elevation:0 ft.
Orifice 2 Diameter: 1.000 in. Elevation:2 ft.
Orifice 3 Diameter: 0.844 in. Elevation:2.75 ft.
Element Outlets:
Outlet 1 Outlet 2
Outlet Flows To:

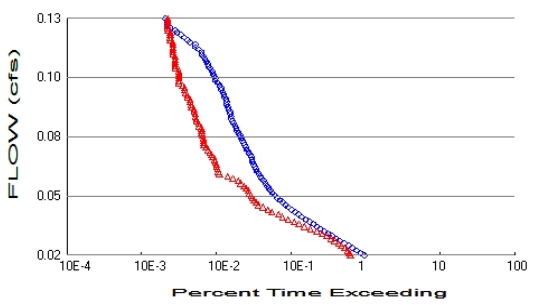
Tank Hydraulic Table

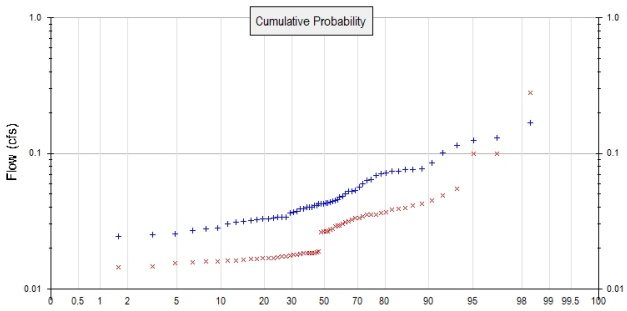
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000	0.000	0.000	0.000
0.0444	0.036	0.001	0.002	0.000
0.0889	0.051	0.003	0.004	0.000
0.1333	0.062	0.005	0.004	0.000
0.1778	0.071	0.008	0.005	0.000
0.2222	0.079	0.012	0.006	0.000
0.2667	0.087	0.015	0.006	0.000
0.3111	0.093	0.019	0.007	0.000
0.3556	0.099	0.024	0.008	0.000
0.4000	0.104	0.028	0.008	0.000
0.4444	0.109	0.033	0.008	0.000
0.4889	0.114	0.038	0.009	0.000
0.5333	0.118	0.043	0.009	0.000
0.5778	0.122	0.048	0.010	0.000
0.6222	0.126	0.054	0.010	0.000
0.6667	0.130	0.060	0.011	0.000
0.7111	0.133	0.065	0.011	0.000
0.7556	0.136	0.071	0.011	0.000
0.8000	0.139	0.078	0.012	0.000
0.8444	0.142	0.084	0.012	0.000
0.8889	0.145	0.090	0.012	0.000
0.9333	0.147	0.097	0.013	0.000
0.9778	0.150	0.103	0.013	0.000
1.0222	0.152	0.110	0.013	0.000
1.0667	0.154	0.117	0.013	0.000
1.1111	0.156	0.124	0.014	0.000
1.1556	0.158	0.131	0.014	0.000
1.2000	0.159	0.138	0.014	0.000
1.2444	0.161	0.145	0.015	0.000
1.2889	0.163	0.152	0.015	0.000
1.3333	0.164	0.159	0.015	0.000
1.3778	0.165	0.167	0.015	0.000
1.4222	0.167	0.174	0.016	0.000
1.4667	0.168	0.182	0.016	0.000
1.5111	0.169	0.189	0.016	0.000

1.5556	0.170	0.197	0.016	0.000
1.6000	0.170	0.204	0.017	0.000
1.6444	0.171	0.212	0.017	0.000
1.6889	0.172	0.220	0.017	0.000
1.7333	0.172	0.227	0.017	0.000
1.7778	0.173	0.235	0.017	0.000
1.8222	0.173	0.243	0.018	0.000
1.8667	0.174	0.250	0.018	0.000
1.9111	0.174	0.258	0.018	0.000
1.9556	0.174	0.266	0.018	0.000
2.0000	0.174	0.274	0.019	0.000
2.0444	0.174	0.281	0.024	0.000
2.0889	0.174	0.289	0.027	0.000
2.1333	0.174	0.297	0.029	0.000
2.1778	0.173	0.305	0.031	0.000
2.2222	0.173	0.312	0.032	0.000
2.2667	0.172	0.320	0.034	0.000
2.3111	0.172	0.328	0.035	0.000
2.3556	0.171	0.335	0.036	0.000
2.4000	0.170	0.343	0.037	0.000
2.4444	0.170	0.351	0.039	0.000
2.4889	0.169	0.358	0.040	0.000
2.5333	0.168	0.366	0.041	0.000
2.5778	0.167	0.373	0.042	0.000
2.6222	0.165	0.380	0.043	0.000
2.6667	0.164	0.388	0.044	0.000
2.7111	0.163	0.395	0.045	0.000
2.7556	0.161	0.402	0.047	0.000
2.8000	0.159	0.409	0.051	0.000
2.8444	0.158	0.416	0.053	0.000
2.8889	0.156	0.423	0.055	0.000
2.9333	0.154	0.430	0.057	0.000
2.9778	0.152	0.437	0.059	0.000
3.0222	0.150	0.444	0.131	0.000
3.0667	0.147	0.450	0.427	0.000
3.1111	0.145	0.457	0.848	0.000
3.1556	0.142	0.463	1.363	0.000
3.2000	0.139	0.470	1.953	0.000
3.2444	0.136	0.476	2.605	0.000
3.2889	0.133	0.482	3.308	0.000
3.3333	0.130	0.488	4.049	0.000
3.3778	0.126	0.493	4.817	0.000
3.4222	0.122	0.499	5.598	0.000
3.4667	0.118	0.504	6.381	0.000
3.5111	0.114	0.509	7.153	0.000
3.5556	0.109	0.514	7.903	0.000
3.6000	0.104	0.519	8.617	0.000
3.6444	0.099	0.524	9.287	0.000
3.6889	0.093	0.528	9.903	0.000
3.7333	0.087	0.532	10.45	0.000
3.7778	0.079	0.536	10.94	0.000
3.8222	0.071	0.539	11.37	0.000
3.8667	0.062	0.542	11.73	0.000
3.9111	0.051	0.545	12.04	0.000
3.9556	0.036	0.547	12.31	0.000
4.0000	0.000	0.548	12.55	0.000
4.0444	0.000	0.000	12.96	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.5
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.74
Total Impervious Area: 0.76

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.045434
5 year	0.068498
10 year	0.085671
25 year	0.109512
50 year	0.128832
100 year	0.149493

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.02429
5 year	0.039993
10 year	0.054221
25 year	0.077649
50 year	0.099851
100 year	0.126877

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.027	0.017
1950	0.076	0.029
1951	0.032	0.017
1952	0.034	0.017
1953	0.043	0.016
1954	0.071	0.018
1955	0.074	0.041
1956	0.053	0.042
1957	0.077	0.032
1958	0.070	0.018

1959	0.045	0.019
1960	0.043	0.027
1961	0.048	0.039
1962	0.064	0.016
1963	0.100	0.018
1964	0.041	0.015
1965	0.041	0.027
1966	0.024	0.017
1967	0.053	0.017
1968	0.060	0.027
1969	0.076	0.018
1970	0.033	0.017
1971	0.048	0.045
1972	0.040	0.018
1973	0.033	0.033
1974	0.040	0.026
1975	0.032	0.016
1976	0.031	0.019
1977	0.028	0.016
1978	0.034	0.016
1979	0.115	0.017
1980	0.036	0.017
1981	0.040	0.016
1982	0.039	0.032
1983	0.042	0.018
1984	0.045	0.049
1985	0.056	0.039
1986	0.129	0.099
1987	0.063	0.055
1988	0.031	0.034
1989	0.050	0.016
1990	0.043	0.031
1991	0.044	0.028
1992	0.037	0.029
1993	0.025	0.014
1994	0.028	0.030
1995	0.043	0.037
1996	0.073	0.035
1997	0.167	0.280
1998	0.030	0.018
1999	0.039	0.027
2000	0.025	0.038
2001	0.010	0.013
2002	0.043	0.035
2003	0.033	0.018
2004	0.052	0.033
2005	0.038	0.018
2006	0.085	0.035
2007	0.069	0.036
2008	0.125	0.100
2009	0.034	0.029

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1674	0.2800
2	0.1293	0.0996
3	0.1251	0.0989

4	0.1147	0.0547
5	0.1003	0.0487
6	0.0855	0.0447
7	0.0769	0.0421
8	0.0762	0.0415
9	0.0757	0.0394
10	0.0741	0.0391
11	0.0734	0.0385
12	0.0713	0.0368
13	0.0705	0.0364
14	0.0687	0.0353
15	0.0642	0.0353
16	0.0631	0.0352
17	0.0600	0.0342
18	0.0562	0.0334
19	0.0529	0.0334
20	0.0528	0.0325
21	0.0524	0.0316
22	0.0504	0.0311
23	0.0479	0.0300
24	0.0478	0.0293
25	0.0454	0.0292
26	0.0447	0.0290
27	0.0443	0.0278
28	0.0434	0.0275
29	0.0431	0.0267
30	0.0430	0.0266
31	0.0426	0.0265
32	0.0425	0.0262
33	0.0423	0.0189
34	0.0412	0.0188
35	0.0411	0.0184
36	0.0402	0.0183
37	0.0401	0.0183
38	0.0401	0.0182
39	0.0390	0.0182
40	0.0387	0.0181
41	0.0375	0.0179
42	0.0370	0.0179
43	0.0362	0.0177
44	0.0340	0.0173
45	0.0340	0.0173
46	0.0337	0.0172
47	0.0332	0.0169
48	0.0331	0.0168
49	0.0328	0.0168
50	0.0323	0.0167
51	0.0321	0.0166
52	0.0313	0.0165
53	0.0310	0.0162
54	0.0301	0.0162
55	0.0280	0.0160
56	0.0278	0.0160
57	0.0269	0.0158
58	0.0253	0.0156
59	0.0250	0.0147
60	0.0243	0.0144
61	0.0102	0.0133

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0227	5227	3386	64	Pass
0.0238	4628	3244	70	Pass
0.0249	4066	3078	75	Pass
0.0259	3582	2795	78	Pass
0.0270	3167	2534	80	Pass
0.0281	2799	2322	82	Pass
0.0291	2448	2088	85	Pass
0.0302	2153	1858	86	Pass
0.0313	1915	1631	85	Pass
0.0324	1682	1405	83	Pass
0.0334	1482	1193	80	Pass
0.0345	1327	981	73	Pass
0.0356	1198	820	68	Pass
0.0367	1075	692	64	Pass
0.0377	964	593	61	Pass
0.0388	844	495	58	Pass
0.0399	746	417	55	Pass
0.0409	672	366	54	Pass
0.0420	614	298	48	Pass
0.0431	548	264	48	Pass
0.0442	498	228	45	Pass
0.0452	456	197	43	Pass
0.0463	414	184	44	Pass
0.0474	385	172	44	Pass
0.0484	353	163	46	Pass
0.0495	326	157	48	Pass
0.0506	307	151	49	Pass
0.0517	286	144	50	Pass
0.0527	271	134	49	Pass
0.0538	258	126	48	Pass
0.0549	244	114	46	Pass
0.0559	231	105	45	Pass
0.0570	216	90	41	Pass
0.0581	210	76	36	Pass
0.0592	199	59	29	Pass
0.0602	189	57	30	Pass
0.0613	182	56	30	Pass
0.0624	177	54	30	Pass
0.0634	171	54	31	Pass
0.0645	165	52	31	Pass
0.0656	161	51	31	Pass
0.0667	157	48	30	Pass
0.0677	154	46	29	Pass
0.0688	146	44	30	Pass
0.0699	137	42	30	Pass
0.0710	133	39	29	Pass
0.0720	130	36	27	Pass
0.0731	125	36	28	Pass
0.0742	121	36	29	Pass
0.0752	117	36	30	Pass
0.0763	112	35	31	Pass
0.0774	107	34	31	Pass
0.0785	102	34	33	Pass

0.0795	99	34	34	Pass
0.0806	96	32	33	Pass
0.0817	92	31	33	Pass
0.0827	89	29	32	Pass
0.0838	86	29	33	Pass
0.0849	86	28	32	Pass
0.0860	82	28	34	Pass
0.0870	82	27	32	Pass
0.0881	78	27	34	Pass
0.0892	77	25	32	Pass
0.0902	75	25	33	Pass
0.0913	74	24	32	Pass
0.0924	73	24	32	Pass
0.0935	70	22	31	Pass
0.0945	68	22	32	Pass
0.0956	66	21	31	Pass
0.0967	63	20	31	Pass
0.0977	62	20	32	Pass
0.0988	59	19	32	Pass
0.0999	56	17	30	Pass
0.1010	53	17	32	Pass
0.1020	53	17	32	Pass
0.1031	50	17	34	Pass
0.1042	48	17	35	Pass
0.1053	47	17	36	Pass
0.1063	44	15	34	Pass
0.1074	42	15	35	Pass
0.1085	41	15	36	Pass
0.1095	40	15	37	Pass
0.1106	38	15	39	Pass
0.1117	36	15	41	Pass
0.1128	34	14	41	Pass
0.1138	34	14	41	Pass
0.1149	31	14	45	Pass
0.1160	28	14	50	Pass
0.1170	28	14	50	Pass
0.1181	24	14	58	Pass
0.1192	22	13	59	Pass
0.1203	20	13	65	Pass
0.1213	18	13	72	Pass
0.1224	16	13	81	Pass
0.1235	15	12	80	Pass
0.1245	13	12	92	Pass
0.1256	12	12	100	Pass
0.1267	12	12	100	Pass
0.1278	12	12	100	Pass
0.1288	11	12	109	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

Model Default Modifications

Total of 0 changes have been made.

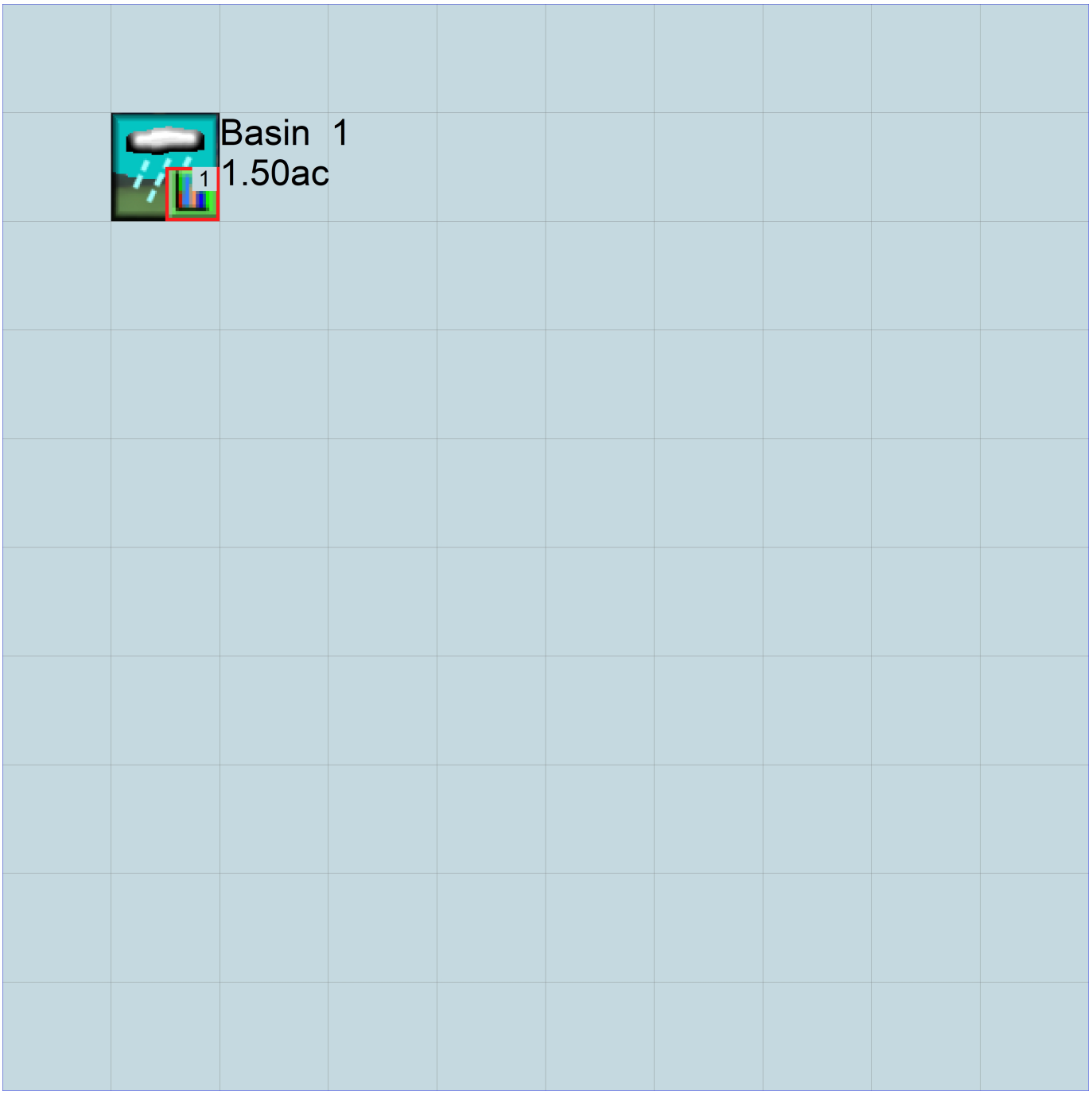
PERLND Changes

No PERLND changes have been made.

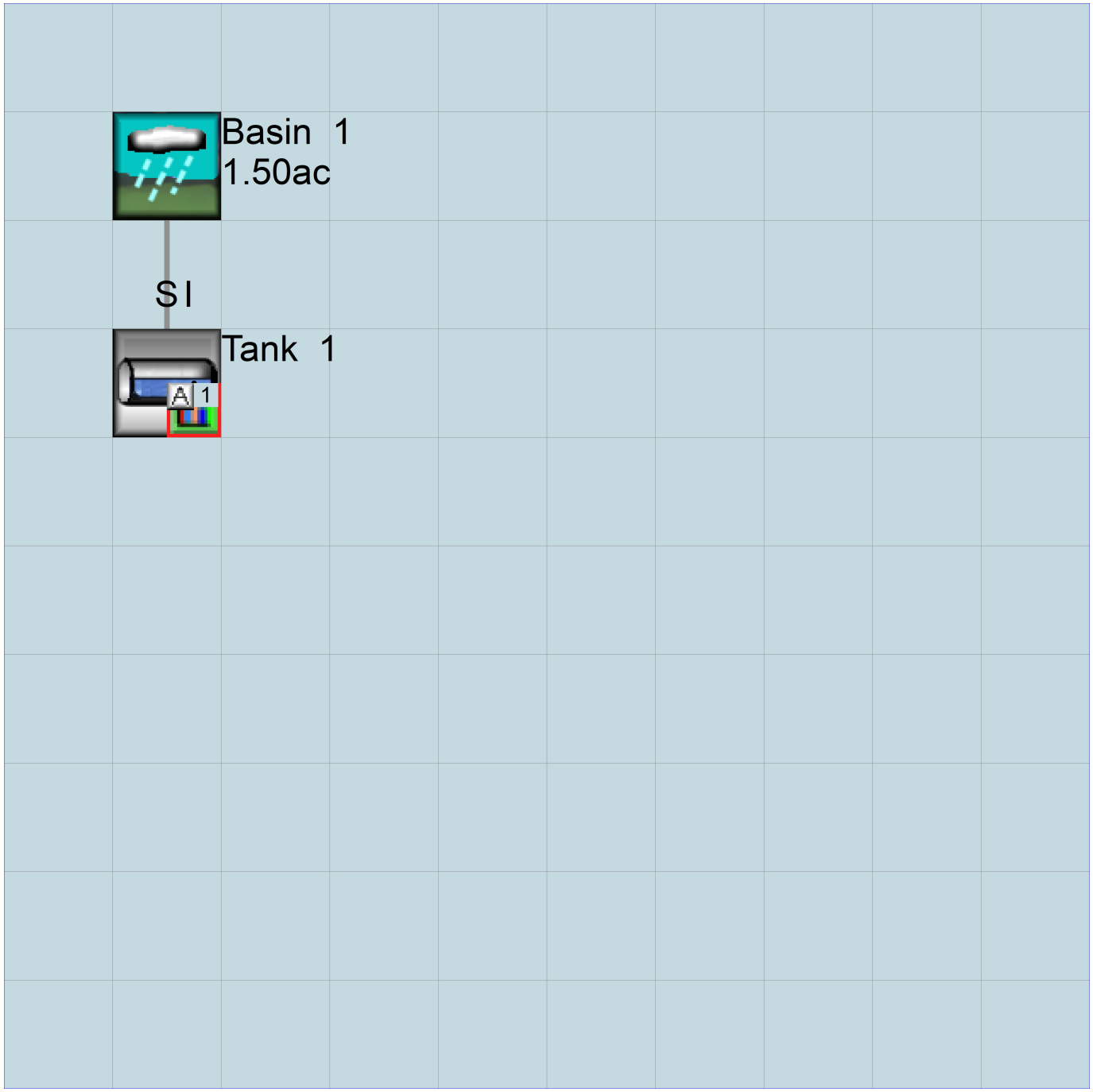
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   2025-06-22 FS 32_4' depth.wdm
MESSU       25   Pre2025-06-22 FS 32_4' depth.MES
            27   Pre2025-06-22 FS 32_4' depth.L61
            28   Pre2025-06-22 FS 32_4' depth.L62
            30   POC2025-06-22 FS 32_4' depth1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   10         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   10         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   10         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   10              0       4.5      0.08       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10           0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   10             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  10                        1.5     COPY   501     12
PERLND  10                        1.5     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *      *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                     ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><---><---><---><---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2       SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2       SUM  IMPLND   1 999 EXTNL  PREC
```

```
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   2025-06-22 FS 32_4' depth.wdm
MESSU       25   Mit2025-06-22 FS 32_4' depth.MES
            27   Mit2025-06-22 FS 32_4' depth.L61
            28   Mit2025-06-22 FS 32_4' depth.L62
            30   POC2025-06-22 FS 32_4' depth1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      16
      IMPLND       1
      IMPLND       4
      IMPLND       8
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Tank  1                     MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   16     C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
```

```
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   16              0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16           0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
```

```
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >       IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >       IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  16                       0.74     RCHRES   1      2
PERLND  16                       0.74     RCHRES   1      3
IMPLND   1                       0.36     RCHRES   1      5
IMPLND   4                       0.27     RCHRES   1      5
IMPLND   8                       0.13     RCHRES   1      5

******Routing******
PERLND  16                       0.74     COPY     1     12
IMPLND   1                       0.36     COPY     1     15
IMPLND   4                       0.27     COPY     1     15
IMPLND   8                       0.13     COPY     1     15
PERLND  16                       0.74     COPY     1     13
RCHRES   1                          1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                        in  out                             ***
    1     Tank  1                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
```

```
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1               1      0.36       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.000000  0.000000  0.000000
  0.044444  0.036577  0.001086  0.002828
  0.088889  0.051436  0.003062  0.004000
  0.133333  0.062637  0.005606  0.004898
  0.177778  0.071911  0.008601  0.005656
  0.222222  0.079930  0.011980  0.006324
  0.266667  0.087042  0.015693  0.006928
  0.311111  0.093455  0.019706  0.007483
  0.355556  0.099304  0.023992  0.007999
  0.400000  0.104683  0.028526  0.008484
  0.444444  0.109663  0.033291  0.008943
  0.488889  0.114294  0.038269  0.009380
  0.533333  0.118618  0.043446  0.009797
  0.577778  0.122668  0.048809  0.010197
  0.622222  0.126469  0.054346  0.010582
  0.666667  0.130044  0.060047  0.010953
  0.711111  0.133410  0.065902  0.011313
  0.755556  0.136584  0.071903  0.011661
  0.800000  0.139578  0.078040  0.011999
  0.844444  0.142403  0.084307  0.012328
  0.888889  0.145070  0.090696  0.012648
  0.933333  0.147587  0.097200  0.012960
  0.977778  0.149961  0.103813  0.013265
  1.022222  0.152200  0.110528  0.013563
  1.066667  0.154309  0.117340  0.013855
  1.111111  0.156293  0.124243  0.014141
  1.155556  0.158158  0.131231  0.014421
  1.200000  0.159906  0.138299  0.014695
  1.244444  0.161543  0.145443  0.014965
  1.288889  0.163071  0.152657  0.015230
  1.333333  0.164494  0.159937  0.015490
  1.377778  0.165814  0.167277  0.015746
```

```
  1.422222  0.167033  0.174674  0.015998
  1.466667  0.168154  0.182123  0.016246
  1.511111  0.169179  0.189620  0.016491
  1.555556  0.170110  0.197160  0.016732
  1.600000  0.170947  0.204739  0.016969
  1.644444  0.171693  0.212354  0.017203
  1.688889  0.172348  0.219999  0.017434
  1.733333  0.172914  0.227672  0.017662
  1.777778  0.173392  0.235368  0.017887
  1.822222  0.173781  0.243084  0.018109
  1.866667  0.174084  0.250814  0.018328
  1.911111  0.174300  0.258556  0.018545
  1.955556  0.174429  0.266306  0.018760
  2.000000  0.174472  0.274060  0.018972
  2.044444  0.174429  0.281814  0.024902
  2.088889  0.174300  0.289564  0.027479
  2.133333  0.174084  0.297306  0.029503
  2.177778  0.173781  0.305036  0.031239
  2.222222  0.173392  0.312752  0.032790
  2.266667  0.172914  0.320448  0.034210
  2.311111  0.172348  0.328120  0.035530
  2.355556  0.171693  0.335766  0.036770
  2.400000  0.170947  0.343381  0.037945
  2.444444  0.170110  0.350960  0.039065
  2.488889  0.169179  0.358500  0.040138
  2.533333  0.168154  0.365997  0.041170
  2.577778  0.167033  0.373446  0.042166
  2.622222  0.165814  0.380843  0.043129
  2.666667  0.164494  0.388183  0.044064
  2.711111  0.163071  0.395463  0.044972
  2.755556  0.161543  0.402677  0.047297
  2.800000  0.159906  0.409821  0.051040
  2.844444  0.158158  0.416889  0.053500
  2.888889  0.156293  0.423877  0.055587
  2.933333  0.154309  0.430780  0.057466
  2.977778  0.152200  0.437592  0.059204
  3.022222  0.149961  0.444307  0.131168
  3.066667  0.147587  0.450920  0.427485
  3.111111  0.145070  0.457424  0.848646
  3.155556  0.142403  0.463813  1.363126
  3.200000  0.139578  0.470079  1.953362
  3.244444  0.136584  0.476217  2.605916
  3.288889  0.133410  0.482218  3.308678
  3.333333  0.130044  0.488073  4.049795
  3.377778  0.126469  0.493774  4.817246
  3.422222  0.122668  0.499311  5.598738
  3.466667  0.118618  0.504674  6.381790
  3.511111  0.114294  0.509851  7.153940
  3.555556  0.109663  0.514829  7.903032
  3.600000  0.104683  0.519594  8.617587
  3.644444  0.099304  0.524128  9.287217
  3.688889  0.093455  0.528414  9.903098
  3.733333  0.087042  0.532427  10.45848
  3.777778  0.079930  0.536140  10.94926
  3.822222  0.071911  0.539518  11.37451
  3.866667  0.062637  0.542514  11.73720
  3.911111  0.051436  0.545058  12.04474
  3.955556  0.036577  0.547034  12.30976
  4.000000  0.001000  0.548120  12.55075
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2       SUM  PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2       SUM  IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
```

```
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     12.1      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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GEOTECHNICAL ENGINEERING REPORT

PROPOSED FIRE STATION # 32
19959 OAKS STREET
MONROE, WASHINGTON
SNOHOMISH COUNTY PARCEL
27070600200300

PREPARED FOR
SNOHOMISH COUNTY REGIONAL FIRE & RESCUE
C/O OAC SERVICES, INC.

BY:
OTTO ROSENAU & ASSOCIATES, INC.
ORA JOB NO. 24-0267, REPORT NO. 1

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April 29, 2025

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2200 1st Avenue S
Seattle, WA 98134

Re: **GEOTECHNICAL ENGINEERING REPORT**
PROPOSED FIRE STATION # 32
19959 OAKS STREET
MONROE, WASHINGTON
SNOHOMISH COUNTY PARCEL # 27070600200300

ORA Project Number: 24-0267

Dear Mr. Bailey (OAC Services),

We are pleased to provide this for the proposed Fire Station # 32 located at 19959 Oaks Street in Monroe, Washington. Based on our findings from the subsurface explorations and our analyses, we anticipate that the site can be satisfactorily developed, but that the presence of shallow groundwater, potentially liquefiable soils, and near-surface, highly compressible soils will require mitigation of those conditions to be performed. Based on discussions with the design team and contractors, we understand that the preferred mitigation option is to perform ground improvement at the location of the proposed fire station to stabilize the soils and allow for the use of the conventional spread foundation elements. Additional explorations were completed at the site to support this design approach.

It is our opinion that the construction of the proposed new fire station will not have any adverse impact on the adjacent properties, provided that the recommendations as presented in this report are implemented in their entirety and under the supervision of an ORA representative during construction.
If you have any questions or if we may be of additional service, please contact us.

Sincerely,

Digitally signed by
Anthony G Coyne
Date: 2025.04.29
17:00:37 -07'00'

Anthony Coyne, P.E.
Senior Geotechnical Engineer

Scott Hoobler, PE
Geotechnical Engineer

TABLE OF CONTENTS

1. INTRODUCTION 1

2. PROJECT DESCRIPTION 1

3. SCOPE OF SERVICES 2

4. SURFACE CONDITIONS 2

5. SITE CHARACTERIZATION 3

6. SUBSURFACE CONDITIONS 4
- 6.1 FILL MATERIALS 7
- 6.2 ALLUVIUM 7
- 6.3 OLYMPIA BEDS, SNOQUALMIE AND SKYKOMISH RIVER PROVENANCE 7
- 6.4 GROUNDWATER CONDITION 7

7. LABORATORY TESTING 8

8. DISCUSSION 8

9. CONCLUSIONS AND RECOMMENDATIONS 8
- 9.1 GENERAL 8
- 9.2 SEISMIC CONSIDERATIONS 9
  - 9.2.1 Seismic Setting 9
  - 9.2.2 Seismic Design Parameters 9
  - 9.2.3 Liquefaction Hazard Evaluation 11
  - 9.2.4 Surface Rupture Hazard Evaluation 13
  - 9.2.5 Lateral Spread Hazard Evaluation 13
- 9.3 FOUNDATION SYSTEMS 13
  - 9.3.1 Fire Station and Critical Ancillary Structure Foundations 13
  - 9.3.2 Stormwater Detention Vault Foundation 14
  - 9.3.3 Site Retaining Wall Foundations (less than 4-foot wall height) 15
- 9.4 CONCRETE SLABS-ON-GRADE 15
- 9.5 BELOW-GRADE WALLS AND RETAINING WALLS 16
- 9.6 PAVEMENT DESIGN 17
- 9.7 EARTHWORK 18
  - 9.7.1 Foundation and Slab Subgrade Preparation 18
  - 9.7.2 Pavement Subgrade Preparation 18
  - 9.7.3 Wet Weather Grading Considerations 19
  - 9.7.4 Structural Fill – Material, Placement and Compaction 19
  - 9.7.5 Temporary Excavations 21
  - 9.7.5.1 Excavations for the Proposed Fire Station 21
  - 9.7.5.2 Temporary Excavations for the Proposed Stormwater Detention Vault 21
  - 9.7.5.3 Temporary Excavation Construction Monitoring 22
  - 9.7.6 Erosion and Sedimentation Control 22

9.8 DRAINAGE 23
9.8.1 Dewatering 23
9.8.2 Foundation Wall and Retaining Wall Drainage 23
9.8.3 Surface Drainage 23
10. REPORT LIMITATIONS 24
11. REFERENCES 24

REPORT FIGURES

Figure 1 - Vicinity Map
Figure 2 - Site Plan
Figure 3 - Geologic Map
Figure 4 – NEHRP Site Classification Map
Figure 5 – Liquefaction Susceptibility Map

APPENDIX A – EXPLORATIONS AND LABORATORY TESTING

Boring Log Notes A-1
Unified Soil Classification Chart A-3
Boring Logs for ORA Borings B-1 through B-7 ..... A-4
CPT Exploration Summary Report by ConeTec A-12

APPENDIX B – LABORATORY TESTING

Grain Size Analysis B-1
Liquid And Plastic Limit Determinations B-6

APPENDIX C – RESULTS OF GEOPHYSICAL (REMI) SURVEY

Report for REMI Survey at a proposed fire station in Monroe, WA by Global Geophysics (2024) C-1

APPENDIX D - SEISMIC DESIGN CRITERIA

ASCE 7-16 Hazards Report D-1
USGS Deaggregation Report D-4

APPENDIX E - LIQUEFACTION ANALYSIS

Combined Liquefaction Analysis Results for CPT-1 and CPT-2 ..... E-1

APPENDIX F - GROUNDWATER MONITORING DATA

Groundwater Monitoring Data at B-4 .....F-1

Groundwater Monitoring Data at B-5 .....F-2

Groundwater Monitoring Data at B-6 .....F-3

Groundwater Monitoring Data at B-7 .....F-4

GEOTECHNICAL ENGINEERING REPORT
PROPOSED FIRE STATION # 32
19959 OAKS STREET
MONROE, WASHINGTON
SNOHOMISH COUNTY PARCEL # 27070600200300

PREPARED FOR
SNOHOMISH COUNTY REGIONAL FIRE & RESCUE
C/O OAC SERVICES, INC.

BY OTTO ROSENAU & ASSOCIATES, INC.

APRIL 29, 2025

1. INTRODUCTION

This report presents the results of our geotechnical engineering services for the proposed Fire Station # 32 at 19959 Oaks Street in Monroe, Washington (Snohomish County Parcel # 27070600200300). The approximate location of the site is shown in Figure 1, Vicinity Map.

2. PROJECT DESCRIPTION

Snohomish County Regional Fire & Rescue is considering constructing a new fire station at a currently undeveloped lot in Monroe, Washington. The preliminary information provided to us indicates that the fire station will be about 7,500 square feet in size and will be located on the western side of the parcel. We further understand that the fire station will be set back about 50 feet south of a potential wetland that is located close to the north property line at the west side of the site.

The associated site improvements will likely include secure firefighter parking, separate visitor parking, and maneuvering space for emergency vehicles returning to the fire station with drive-thru bays. An exterior emergency generator will also likely be included as part of the project.

3. SCOPE OF SERVICES

ORA previously completed a preliminary site evaluation for this site and completed three borings (B-1 through B-3) using hollow-stem auger equipment to a maximum depth of 21.5 feet and two cone penetration tests (CPT-1 and CPT-2) to a maximum depth of 42 feet to evaluate the soil and groundwater conditions at the site in May 2024. Four additional explorations (B-4 through B-7) were completed using sonic drilling equipment on March 26 and 27, 2025, to depths ranging from 16.5 to 40 feet below the existing site grade. Groundwater level monitoring devices and data logging equipment were also installed at borings B-4 through B-7 to record the groundwater level and pressure data through time. The approximate locations of the completed borings, CPTs, and the ReMi geophysical investigation completed for this study are shown in Figure 2, Site Plan.

The scope of geotechnical engineering services for this study is to develop and provide the following information:

- A summary of the observed soil and groundwater conditions,
- An evaluation of the existing site conditions,
- A review of available geologic information,
- Completion of a geophysical evaluation using a geophysical survey (ReMi) to determine the measured shear-wave velocity sounding of the underlying soils,
- Evaluation of potential seismic hazards, including liquefaction, lateral spreading caused by liquefaction, and surface rupture.
- Suitable foundation systems with estimated settlements,
- Lateral earth pressures and friction coefficients,
- Recommendations for temporary cut slopes,
- Influence of groundwater on the proposed development, and
- Site preparation and earthwork.

4. SURFACE CONDITIONS

The project site is located on the east side of the City of Monroe in the Snohomish River / Skykomish River valleys. The project site consists of a single non-contiguous parcel with a combined size of approximately 2.16 acres. The larger portion of the parcel is located at the northeast corner of Woods Creek Road and Oaks Street, is approximately 2.02 acres in area, and is being considered for the location of Fire Station #32. The smaller detached portion of the parcel is located about 500 feet to the southeast, is about 0.14 acres in area, and is not being considered for development as part of this project.

The larger portion of the parcel being considered for development is roughly triangular and is located at the northeast corner of the intersection of Woods Creek Road and Oaks Street. A drainage ditch is

located along the northeast boundary of the parcel. The drainage ditch coincides with a mapped unclassified stream as described in the City of Monroe's Stream and Wetlands 11 x 17 inventory map. The unclassified stream drains to Woods Creek, which is located to the southeast of the site. Woods Creek drains to the Skykomish River, which is located to the south of the site. An unclassified wetland is located immediately northeast of the project site. The adjacent parcels located to the northeast and east of the subject property appear to be agricultural fields. A Snohomish County PUD power switching station is located on the west side of Woods Creek Road to the west of the site. An undeveloped wooded area is located on the west side of Woods Creek Road immediately north of the site. A commercial strip mall is located on the south side of Oaks Street to the south of the subject property.

The majority of the parcel gently slopes from west to east and from south to north. The site grades along the west property line range from about Elevation 77 to 78 feet (NAVD 88) from the intersection of Woods Creek Road and Oaks Street to the northwest property corner. The roadway embankment for Woods Creek Road is approximately 5 feet in height near the northwest corner of the property and rapidly tapers downward in height from the northwest property corner. The site grades along the south property line range from about Elevation 77 feet at the southwest property corner to about Elevation 72 feet at the southeast property corner.

Gravel surfacing has been placed across much of the site to facilitate the site's historical use as a parking area for trucks and trailers and as a storage yard for construction equipment and materials. The northeast side of the property appears to have been built up with up to 4 to 5 feet of fill to create an embankment along the northeast property line.

5. SITE CHARACTERIZATION

We reviewed the "Geologic Map of the Monroe 7.5-minute Quadrangle, King and Snohomish Counties, Washington (November 2011). The near-surface soils at the site are mapped as Alluvium (Qa), which typically consists of normally consolidated, river-deposited silts, clays, sands, and gravels. Deposits of Olympia beds Snoqualmie and Skykomish provenance (Qco), appear to underlie the near-surface Alluvium. Olympia Beds, Snoqualmie and Skykomish River provenance (Qco) are nonglacial deposits that generally consist of dense cohesionless sands, gravels, cobbles, and very stiff to hard silts and clays.

The project site is mapped by the Washington Department of Natural Resources (DNR) as having Moderate to High Liquefaction Susceptibility. Please see Figure 4 titled "Liquefaction Susceptibility" for an excerpt.

6. SUBSURFACE CONDITIONS

The subsurface soil and groundwater conditions were evaluated by completing 7 borings, 2 cone penetration tests (CPTs), and a ReMi geophysical evaluation at the site. The locations of the completed explorations are shown in the Site Plan, Figure 2.

Borings B-1, B-2, and B-3 were completed on May 21, 2024, to depths of 21.5 feet, 16.5 feet, and 16.5 feet, respectively. A pressurized, confined aquifer (artesian aquifer) was encountered during drilling at a depth of about 21 feet at boring B-1. Groundwater was observed to flow up from the boring hole onto the adjacent ground surface, and the hole was abandoned and sealed with difficulty. Borings B-2 and B-3 were drilled to a shallower depth to reduce the risk of penetrating into the artesian aquifer and the associated difficulty with sealing the hole after completion of drilling.

Borings B-4 through B-7 were completed on March 26 and 27, 2025, to a depth of 40 feet for boring B-4 and a depth of 16.5 feet for borings B-5 through B-7 using Sonic Drilling techniques on a track rig provided by Holt Services, Inc. The Sonic Drilling method utilizes a full-length pipe casing that is advanced using a high-frequency oscillating motion and rotation of the pipe casing while the boring is advanced. This allowed us to penetrate the confined aquifer at boring B-4 and to set a vibrating wire groundwater pressure monitoring device to determine the amount of groundwater pressure in the confined aquifer. 2-inch diameter standpipe piezometers were installed in borings B-5 through B-7. Groundwater pressure monitoring devices were also installed at borings B-5 through B-7 to evaluate the groundwater level fluctuations of the near-surface, unconfined aquifer. The groundwater pressure monitoring devices were connected to data logging equipment to record groundwater pressure variation through time. Plots of groundwater pressure in the confined aquifer at B-4 and plots of groundwater levels below the existing site grade are presented in Appendix G.

CPT testing was performed at two locations, CPT-1 and CPT-2 on May 28, 2024, to evaluate the soil and groundwater conditions at greater depths than could be accomplished by using conventional hollow stem auger drilling methods. Pore water dissipation testing was performed at both CPT locations. CPT-1 was completed as a Seismic CPT, which allowed shear wave velocity measurements to be collected as the CPT was advanced to assist in site characterization of the underlying soils for seismic design purposes. CPT-1 and CPT-2 were completed to depths of about 42 feet and 34.5 feet below the existing site grade, respectively, before encountering dense to very dense soils where refusal of the equipment was met and could not be advanced to greater depths. The CPT logs are presented in Appendix A.

Photo at Boring B-1 after withdrawal of the auger and before sealing off the boring hole on May 21, 2024. Please note the artesian groundwater flowing from the unsealed boring hole onto the adjacent ground surface.

Photo taken while drilling at Boring B-4 using Sonic Drilling technique on March 26, 2025.

Photo of CPT rig set up at the location of CPT-01 on May 28, 2024.

In general, the soils encountered at the site can be divided into three soil units – Fill, Alluvium, and Olympia beds, Snoqualmie and Skykomish River provenance. The following is a description of the characteristics of each soil unit encountered.

6.1 FILL MATERIALS

2 to 3.5 feet of undocumented, near-surface fill was encountered below the existing ground surface at each exploration location. We anticipate that the fill is likely up to 5 feet thick at the embankment along the northeast property line. The fill materials generally consisted of loose to medium dense sands with varying amounts of silt, gravel, and cobbles. The fill materials were generally in a moist to wet condition.

6.2 ALLUVIUM

Alluvium was present below the encountered upper fill materials and appeared to extend to a depth of about 23 to 26 feet below the existing site grade. The alluvium consisted of interbedded silts, clays, sands, gravels, and some peat. The silts and clays were observed to have a soft to medium stiff consistency. The sands and gravels varied in fines content and were observed to be in a loose to dense consistency.

6.3 OLYMPIA BEDS, SNOQUALMIE AND SKYKOMISH RIVER PROVENANCE

Based on the findings from the CPTs, we interpreted that the dense to very dense sands and gravels encountered below the Alluvium at depths of 23 to 26 feet below the site grade to be Olympia Beds, Snoqualmie and Skykomish River provenance (Qco). These deposits are Pleistocene age, nonglacial deposits that generally consist of dense cohesionless sands, gravels, cobbles, and very stiff to hard silts and clays.

6.4 GROUNDWATER CONDITION

Groundwater was observed during drilling of the explorations at a depth of about 6 feet below the existing site grade in the near-surface unconfined aquifer at the site. The groundwater pressure monitoring devices and standpipe piezometers that were installed at borings B-5 through B-7 in March and April 2025 indicate that the depth to groundwater varies between 4.5 to 7 feet below the existing site grade.

A pressurized, confined aquifer (artesian aquifer) was observed to be present at a depth of about 21 feet below the existing site grade while drilling at boring B-1 in May 2024. The confined aquifer was sufficiently pressurized to allow the groundwater to reach the ground surface and flow out of the drilled hole. Boring B-4, which was completed within 25 feet of boring B-1 in March 2025, did not encounter artesian groundwater flow to the ground surface at a depth of 20 feet, but did at a depth of 25 feet, groundwater was observed to be at the ground surface with minimal flow from the boring when the casing was at a depth of 30 feet. Due to the use of a continuous steel pipe casing during sonic drilling of boring B-4, we infer that the top of the confined aquifer is likely between depths of 21 and 25 feet, or that the thickness

of the confining silt/clay layer had become sufficiently thin during drilling at those depths to allow the pressurized water from the confined aquifer to break through the remaining silt/clay layer. A groundwater pressure monitoring device was installed at a depth of 30 feet and has shown that the groundwater pressure within the confined aquifer is equal to about a 30-foot of head of water during the month of April 2025.

Based on our observations of the monitored groundwater levels at borings B-5 through B-7 in the near-surface unconfined aquifer depth to groundwater decreases with decreasing amounts of precipitation. Similarly, we observed that the groundwater pressure at boring B-4 within the confined aquifer decreased slightly with decreasing amounts of precipitation. We anticipate that groundwater levels will fluctuate with precipitation and season and may affect the construction of the new fire station with regard to the recommended maximum depth of ground improvement and excavations for utilities and stormwater detention facilities.

7. LABORATORY TESTING

We completed grain size analyses and Atterberg Limit determinations on multiple samples and moisture content determinations on each sample collected from our borings. The result of the moisture content determinations is presented on the boring logs on pages A-4 to A-11 of Appendix A. The results of the grain size analyses and Atterberg Limit determinations are presented in Appendix B.

8. DISCUSSION

The engineering recommendations and advice presented in this report have been made in accordance with generally accepted geotechnical engineering practices in the area and are based on our understanding of the geology of the area and our experience with similar projects. Project conditions and design details often change during the design and revision process. In addition, subsurface conditions do not always match those that are anticipated. Therefore, if discrepancies are noticed, the geotechnical engineer should be contacted for review and possible revision of the recommendations presented.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 GENERAL

Based on our findings from the subsurface explorations and our analyses, we anticipate that the site can be developed as a new fire station, but the presence of potentially liquefiable soils and the compressible silt, clay and peat soils located beneath the site will require mitigation due to the risk of post-construction settlement and liquefaction-induced settlement. There is also a risk of significant lateral movement during a design-level seismic event due to liquefaction-induced lateral spread, which could affect the structure

and the ground surface at the site. See the recommendations for the deep foundation systems in the "Foundation Systems" section of this report for specific details.

9.2 SEISMIC CONSIDERATIONS

9.2.1 Seismic Setting

The project site is in the seismically active Puget Sound region. The seismicity of the area is derived from three primary sources.

- The Cascadia Subduction Zone (CSZ) – The CSZ is in the Pacific Ocean approximately 50 miles west coast of Washington State, where a deep trough has formed as the oceanic Juan de Fuca plate is being subducted beneath the North American continental plate. Earthquakes as great as magnitude 9 are capable of being generated at the CSZ. The last earthquake along the CSZ was an estimated M9 event in 1700 CE.
- The Benioff Zone – This seismic source is located deep beneath the North American Plate, where the oceanic Juan de Fuca plate is steeply diving into the Earth's mantle as it is being subducted. Earthquakes in the Benioff Zone are relatively frequent, with an estimated maximum magnitude of about 7. The M6.8 Nisqually earthquake in 2001 was a Benioff Zone event.
- Shallow crustal faults – There are several shallow crustal faults in the Puget Sound area, including the Seattle Fault Zone, the Tacoma Fault Zone, and the South Whidbey Fault Zone. These faults are all thrust faults, more generally called reverse faults, and are caused by compression of the crust in our region. These faults are also expected to be capable of generating an earthquake with a maximum of about magnitude 7. The most recent evidence of seismic deformation along the South Whidbey Fault zone occurred about 2,700 years ago.

9.2.2 Seismic Design Parameters

The seismic design of structures in the City of Monroe is governed by the requirements of the International Building Code (IBC). We understand that the project will be permitted under the provisions of the 2021 IBC and ASCE/SEI 7-16. These documents require that the soils underlying the site be assigned a Site Class based on the conditions that are present. A Refraction Microtremor (ReMi) survey was performed along the northeast side of the site on August 13, 2024, by Global Geophysics of Redmond, WA. The results of the ReMi geophysical survey indicate that a measured average characteristic site shear-wave velocity in the upper 100 feet of the soil profile below the ground surface, V_s100, is 828 feet per second. Based on the measured average shear wave velocity of the underlying soils, we recommend that the site soils be categorized as Site Class D for design purposes. The completed ReMi survey provided a shear wave velocity profile that extended to a depth of 200 feet below the site. The ReMi survey report prepared by Global Geophysics is included in Appendix C. Our subsurface investigations and preliminary analyses indicate that potentially liquefiable soils underlie the site, and as a result, a Site Class F could be assigned, which would require a site response analysis to be performed in accordance with Section 21.1 of ASCE 7. However, Section 20.3.1 of ASCE/SEI 7-16 states the following:

However, Section 20.3.1 of ASCE/SEI 7-16 states the following:

> *"Where any of the following conditions are satisfied, the site shall be classified as Site Class F and a site response analysis in accordance with Section 21.1 shall be performed.*
> 1. *Soil profile that includes soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils, quick and highly sensitive clays, and collapsible, weakly cemented soils.*
>
> ***EXCEPTION**: For structures that have fundamental periods of vibration equal to, or less than 0.5 s, site response analysis is not required to determine spectral accelerations for liquefiable soils. Rather, for the purpose of determining spectral accelerations only, a site class is permitted to be determined in accordance with Section 20.2 and the corresponding response spectrum determined from Section 11.4.*

We anticipate that the fundamental period of the proposed fire station structure will not exceed 0.5 seconds. As a result, a site response analysis may not be required for this project and the Site Class can be determined based on the criteria listed in Section 20.3 of ASCE/SEI 7-16, which permits Site Class to be determined by the Vs, or Shear Wave Velocity Profile method for the top 100 feet of the soil profile that underlies the site. Based on the results of the shear wave velocity profile from the ReMi survey (geophysical survey), the average shear wave velocity of 828 feet per second was measured in the upper 100 feet of the soil profile that underlies the site, which corresponds to Site Class D conditions based on our review. If the fundamental period of the proposed fire station structure exceeds 0.5 seconds, a site response analysis will be required, and we can provide a proposal to provide that information upon request. No additional subsurface information will be required to perform a site response analysis.

Risk-targeted Maximum Considered Earthquake (MCE_R) ground motion response accelerations for this are based on the maps in the IBC (Figures 1613.2.1(1) and 1613.2.1(2)) for 0.2-second and 1-second spectral response accelerations on a bedrock site. The values for S_S and S_1 are spectral accelerations (SRA) for a maximum considered earthquake event with a 2,475-year return period, or a 2 percent probability of exceedance in 50 years.

The seismic design values for use in the preliminary analyses in this report were obtained from the ASCE 7 Hazard Tool web tool. Please see the ASCE Hazard Tool Report on page D-1 of Appendix D. The input parameters used with this utility were the latitude and longitude for the project site (47.860741° N, 121.964541° W). The following table presents recommended values from the ASCE/SEI 7-16 "Minimum Design Loads for Buildings and Other Structures" for seismic design:

SEISMIC DESIGN PARAMETERS	
Risk Category	IV
Site Soil Class	D
PGA_M	0.544
S_S, g	1.144
S_1, g	0.402
S_{MS}, g	1.193
S_{M1}, g	N/A
S_{DS}, g	0.795
S_{D1}, g	N/A

9.2.3 Liquefaction Hazard Evaluation

The State of Washington Department of Natural Resources (DNR) has identified the project site as having a high liquefaction susceptibility. As a result, an evaluation of the potential impact of the liquefaction hazard must be performed.

Liquefaction may be defined as the sudden loss of strength of soil as the soil is subjected to rapid cyclic loading, such as during an earthquake. The mechanism that allows this to occur is that excess pore water pressures are generated between the soil particles. This excess pore water pressure reduces the frictional contact between the soil particles and reduces the shear strength of the soil. If the earthquake is of large magnitude and duration, the soil can begin to behave more like a liquid than a solid and "liquefy". For liquefaction to occur, several conditions must typically be present, these include the following:

- Saturated soil.
- Fine to medium sand matrix containing less than about 10 percent fines (soil that can pass a No. 200 sieve.
- Very loose to medium dense soil conditions. This is usually defined as soils that have N-values of 15 or less.

Based on the findings from the explorations completed at the project site, the site appears to be underlain by alluvium that consists of potentially liquefiable, interbedded, very loose to medium dense sands and gravels and soft to medium stiff silts. Groundwater levels appear to be approximately 6 feet below the existing site grade.

We completed a liquefaction analysis using the subsurface information collected from CPT-1 and CPT-2 which was completed at the site. The liquefaction analysis was completed in general accordance with

"Seed's Simplified Procedure" with the suggested modifications proposed by Seed, Youd, et al. in "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils" (Journal of Geotechnical and Geoenvironmental Engineering – October 2001). The analyses were completed using a ground acceleration equal to 0.54 g and a 7.1 magnitude event (free field condition). The ground acceleration used in the analysis is the site-modified PGA_M from the ASCE 7 Hazard Tool report for a 2,475-year event and assuming Site Class D conditions. The magnitude of the seismic event used in the analysis was the mode value for a 2,475-year event assuming Site Class D from the USGS Unified Hazard Tool Deaggregation, which is included in Appendix D. The analyses were performed using the CLiq version 3.5.3.10 software published by GeoLogismiki.

Based on the results of our analyses, the risk of liquefaction at the project during a strong design-level seismic event is moderate to high. The results are presented in Appendix E, and a summary of the estimated liquefaction-induced settlements based on each CPT exploration is as follows:

CPT Location	Estimated Liquefaction-Induced Settlement
CPT-1	~ 1.3 inches
CPT-2	~ 2.8 inches

When liquefaction occurs at a site, it typically does not result in widespread, uniform settlement. Instead, liquefaction-induced settlement tends to occur across non-uniform areas with varying amounts of settlement being observed. Varying amounts of settlement under the foundation elements of a structure can result in differential settlement. Differential settlement of soils under a foundation tends to induce more damage than uniform settlement if the foundation system is not designed to be able to resist differential settlement.

Based on the observed subsurface soil and groundwater conditions encountered at the site and our understanding of the geologic conditions present at the site, it is our opinion that the potential for the occurrence of liquefaction at the project site is moderate to high during an IBC design level seismic event.

Based on a review of known faults on the USGS Interactive Quaternary Faults Database, we observed that the project site is located about 2.6 miles northeast of the nearest trace of the South Whidbey Fault Zone (Fault ID # 572). The South Whidbey Fault Zone is a northwest-southeast trending reverse fault and is described as a Class A fault with an estimated slip rate of between 0.2 and 1.0 mm/yr.

Other inferred faults are described as being closer to the site in the Geologic Map of the Monroe Quadrangle, however, these faults are not well studied, and it is not clear if they have been active in the last 10,000 years. Only the mapped faults described in the USGS Interactive Quaternary Faults Database were considered in our evaluation of seismic hazards at this site.

9.2.4 Surface Rupture Hazard Evaluation

Surface rupture can occur during large seismic events on faults where the ground surface ruptures due to the movement of the fault. Given that the site is located about 2.6 miles away from the nearest known trace of the South Whidbey Fault Zone, it is our opinion that the risk of surface rupture at the project site is relatively low during the design life of the proposed fire station.

9.2.5 Lateral Spread Hazard Evaluation

Lateral spread can occur during strong seismic events when large blocks of non-liquefied surface soils and underlying liquefied soils move horizontally downslope at gently sloping locations or move towards a free face, such as along a shoreline or riverbank. A 5-foot-tall free face is present near the northeast property line, which corresponds with the location of a drainage ditch on the project site. The CPT-based CLiq liquefaction software used to perform the liquefaction analyses estimated that up to 1 to 2.5 feet of lateral spread was possible at the site during a design-level seismic event (Magnitude = 7.1, Site-Modified Peak Ground Acceleration, PGA_M = 0.54g) using the methodology presented by Bartlett and Youd (1995) and is based on the soil profile at our CPT-1 and CPT-2 explorations. Calculated values of lateral spread are based on regression analyses of historically observed seismically induced lateral spread events around the world under many different seismic conditions. The actual values of possible lateral spread should be considered to likely range from 50% to 200% of the calculated values.

We understand that the proposed ground improvement will strengthen the existing subsurface soils at the footprint of the proposed fire station and make them resistant to liquefaction and lateral spreading. We recommend that the zone of ground improvement extend beyond the footprint of the soil to reduce the risk of having any lateral spreading or slope failures in unimproved areas that could potentially undermine foundation elements. This is most important along the north side of the future fire station, where the free face of the open ditch is closest.

9.3 FOUNDATION SYSTEMS

9.3.1 Fire Station and Critical Ancillary Structure Foundations

We understand that a ground improvement contractor will be preparing a geotechnical design and drawings that will specify the details of the ground improvement. The ground improvement contractor will provide the allowable bearing capacity value that the new fire station's conventional spread foundation elements that bear on improved soil may be designed for. We also recommend that critical ancillary

structures, such as emergency generators, and site retaining walls greater than 4 feet in height be supported on improved soil.

Based on discussions with the ground improvement contractor, we understand that the proposed soil improvement will stabilize the potentially liquefiable and compressible soils at the location of the fire station by mixing the existing soil in place with Portland cement to strengthen the soil and eliminate the potential for collapse due to liquefaction and the risk of post-construction settlement related to the presence of peat at that location.

We recommend that all new foundation elements be embedded at a minimum of 18 inches below the final grade for frost protection.

9.3.2 Stormwater Detention Vault Foundation

Onsite infiltration of stormwater is not feasible at the project site due to the relatively shallow depth to groundwater and the presence of relatively impermeable near-surface silt and clay soils that underlie the site. As a result, we anticipate that a stormwater detention system will be needed for the project. The configuration and location of the detention system were not known at the time of issuance of this report. Compressible silts, clays are present to depths of 6 to 9 feet across the site. Potentially liquefiable soils are present below the near-surface compressible silt and clay soils. Observed groundwater levels at depths across the site ranging from about 4.5 to 7 feet below the existing site grades during early spring 2025.

We recommend that foundations for the new stormwater detention vault not bear directly on the compressible silt and clay soils or on potentially liquefiable soils for foundation support. The use of conventional foundation elements with overexcavations and structural backfill at the foundation and slab location may be a suitable alternative, but will need to be evaluated for feasibility by ORA once the configuration of the detention vault is determined. If the stormwater detention system were to be built using conventional foundation elements and slabs that bear on a zone of structural fill, an allowable bearing capacity on the order of 750 to 1,000 psf would likely be specified and post-construction settlement due to the underlying compressible silts and clays would likely be on the order of one to two inches. Furthermore, the detention vault would still be vulnerable to liquefaction-induced settlement and lateral spreading as described in Section 9.2 of this report.

We anticipate that an overexcavation and structural backfill would likely consist of 2- to 4-inch quarry spalls that extend at least two feet in depth below the bottom of the foundation elevation would be required to provide a stable base for foundation construction. The width of the overexcavation would additionally need to extend laterally an amount equal to the overexcavation depth beyond the edges of the footings. A nonwoven geotextile fabric such as Tencate Mirafi 140N, or an approved equivalent, would need to

fully surround the quarry spall backfill. This method would also require that the groundwater in this location be drawn down to at least 2 feet below the bottom of the excavation depth. The excavated material would likely not be suitable for reuse as structural fill around the perimeter of the stormwater vault, and imported granular backfill around the stormwater vault would be required.

A more resilient foundation alternative that would perform better during seismic events would be to provide ground improvement at this location, as is proposed for the fire station. If this method were utilized, the ground improvement contractor would provide recommendations for the allowable bearing capacity of new foundation elements that bear on improved soil.

9.3.3 Site Retaining Wall Foundations (less than 4-foot wall height)

Lightly loaded site retaining walls that have a wall height of 4 feet or less (measured from the top of the wall to the bottom of the foundation) do not require deep foundation elements or ground improvement for foundation support. The site retaining walls may be supported on a 12-inch deep overexcavation that is backfilled with a zone of imported Crushed Surfacing Top Course (CSTC). The width of the overexcavation would additionally need to extend laterally one foot beyond the edges of the footings. We recommend that an allowable bearing capacity of 1,500 psf be used for the design of retaining wall foundation elements that are supported as described above. The base of the overexcavation should be prepared per the recommendations presented in Section 9.6.1 Foundation and Slab Subgrade Preparation of this report.

Site retaining walls designed in this manner are still vulnerable to liquefaction-induced settlement and post-construction settlement due to the presence of highly compressible soils, but we understand that it is likely more cost-effective to remove and replace any poorly performing low retaining walls than to provide deep foundation support or ground improvement at those locations.

9.4 CONCRETE SLABS-ON-GRADE

We recommend that the concrete slabs on grade in the fire station be supported on a zone of ground-improved soil. We further recommend that a 6-inch-thick, free-draining, clean, crushed gravel base be provided as a capillary break. A robust vapor retarder, such as 10-mil polyethylene sheeting, shall be included beneath the slab to minimize the transmission of moisture through the concrete floor. A minimum, two-inch-thick layer of clean sand with less than 3 percent fines may be placed on top of the polyethylene sheeting to protect the sheeting and to enhance the curing of the concrete slabs. The sand must not be saturated at the time of concrete placement in order to enhance concrete curing. If slabs–on-grade are being planned for heated areas, a more robust vapor barrier should be utilized since the conditioned air in the heated areas will tend to draw moisture from the near-surface groundwater that is present beneath the site. ORA can provide recommendations for vapor barriers upon request.

Lightly loaded concrete slabs on grade at exterior or non-critical locations around the fire station may be conventionally supported on a zone of structural fill consisting of crushed surfacing top course that is at least 6 inches in thickness.

9.5 BELOW-GRADE WALLS AND RETAINING WALLS

The below-grade foundation walls for this project must be designed as retaining walls. Lateral earth pressures for the design of permanent retaining walls and temporary shoring walls with no hydrostatic pressures or other surcharge loads may be calculated using the following equivalent fluid densities in pounds per cubic foot (pcf):

Level Back Slope Condition Active (unrestrained):	
Compacted granular soils or native soils against wall	35 pcf.
Level Back Slope Condition Active (restrained):	
Compacted granular soils or native soils against wall	55 pcf.
Passive:	
Embedded Portions of Foundation Elements	270 pcf.
Hydrostatic Pressure on the portion of foundations below the groundwater table (triangular pressure distribution)	62.4 pcf

No factor of safety has been applied to the active pressure values listed above. A factor of safety of about 1.5 has been applied to the passive pressure value listed above. The geotechnical engineer should be contacted to determine appropriate lateral earth pressures for situations not described above.

Seismic earth pressures were estimated using the Mononobe-Okabe pseudo-static method. We recommend that seismic earth pressures be estimated using a rectangular pressure distribution equal to 15H, where H is the height of the retained soil behind the wall and applied to permanent retaining structures.

A total soil unit weight of 125 pounds per cubic foot should be used in the design of any permanent below-grade wall, retaining structures, or temporary shoring walls.

Passive resistance should be evaluated using an equivalent fluid pressure of 270 pounds per cubic foot (pcf) where foundation elements are cast on structural fill and backfilled on both sides with structural fill compacted to at least 95 percent of maximum dry density (MDD). This value of passive pressure includes

a factor of safety of 1.5. An allowable coefficient of friction between footings and bearing soils of 0.35 may be used to resist lateral foundation loads. This value includes a factor of safety of about 1.5.

9.6 PAVEMENT DESIGN

We recommend that a California Bearing Ratio (CBR) of 10 and a Modulus of Subgrade Reaction (k) of 150 pounds per cubic inch (pci) be used to model the existing subgrade conditions for the design of rigid and flexible pavements. We anticipate that the traffic on new asphalt pavements around the proposed Fire Station will consist of light passenger vehicles, and heavier emergency vehicles with occasional delivery trucks.

We recommend that the driveways and aprons leading to the vehicle bays and other traffic lanes for heavy emergency vehicles utilize a Heavy-Duty pavement section. The parking areas for light vehicles can utilize a lighter Standard-Duty pavement section. The following minimum acceptable pavement sections are recommended:

- **Heavy-Duty Asphalt Concrete Pavement Areas**: 4 inches of Hot Mix Asphalt (HMA) Class ½" over 8 inches of Crushed Surfacing Base Course (CSBC).
- **Heavy-Duty Portland Concrete Cement Pavement Areas**: 10 inches of Portland Concrete Cement pavement over 6 inches of Crushed Surfacing Base Course (CSBC).
- **Standard-Duty Asphalt Concrete Pavement Areas**: 3 inches of HMA Class ½" over 6 inches of Crushed Surfacing Base Course (CSBC).

The HMA Class ½" shall meet the requirements of "Section 5-04 Hot Mix Asphalt" of the 2025 edition of the WSDOT *Standard Specifications for Road, Bridge, and Municipal Construction*. Asphalt Treated Base (ATB) may be substituted for the crushed rock and shall meet the requirements of WSDOT *Local Agency General Provisions (GSP)* 4-06 Asphalt Treated Base" and WSDOT Standard Specification 9-03.6(3). HMA should be compacted to at least 91 percent of the maximum density as determined by the WSDOT FOP for AASHTO T 209 (rice density). ATB should be compacted to at least 80 percent of the maximum density as determined by the WSDOT FOP for AASHTO T 209 (rice density).

We further recommend the following precautions be taken during the placement of asphalt during adverse weather conditions:

- HMA should not be placed in the rain.
- All final lifts of HMA must be placed when the air temperature is 45 degrees and rising.
- ATB should not be placed when the air temperature is below 35 degrees.
- HMA should not be placed on frozen or ice-coated ground or subgrade.

9.7 EARTHWORK

The recommendations presented in this report are predicated on the fulfillment of the following earthwork recommendations.

9.7.1 Foundation and Slab Subgrade Preparation

All concrete slabs, undocumented fill, organic debris, and old topsoil must be removed from all foundation element locations and future slab-on-grade areas. If construction activities are to be performed during periods of wet weather, we recommend that the exposed foundation subgrade soils be protected with 4 to 6 inches of thoroughly compacted 1-1/4 inch minus crushed rock, quarry spalls, controlled density fill (CDF), or a rat slab of structural concrete. The exposed subgrade soil conditions should be verified by a representative of ORA to ensure that the soils are adequately prepared to provide the required support. Concrete slab-on-grade areas at interior locations in the fire station should be supported on at least 12 inches of structural fill.

Overexcavations to replace unsuitable soils present at the design bottom of foundation elevation may be backfilled with structural concrete, lean concrete, or Controlled Low Strength Material (CLSM) at locations where foundation elements have an allowable bearing capacity of 1,500 psf. The most commonly used CLSM in the Puget Sound area is typically referred to as Controlled Density Fill (CDF). Granular structural fill may also be used to backfill overexcavations at these locations. The overexcavations where granular backfill is used must be extended laterally a distance equal to the depth of the overexcavation beyond the edges of all future foundation elements. All granular structural fill for overexcavations must be backfilled as described in the Earthwork section of this report.

If construction activities are to be performed during periods of wet weather, we recommend that the exposed foundation subgrade soils be protected with 4 to 6 inches of thoroughly compacted 1-1/4 inch minus crushed rock, quarry spalls, controlled density fill (CDF), or a rat slab of structural concrete.

9.7.2 Pavement Subgrade Preparation

Following the removal of the existing pavements, any underlying existing organic soils, woody debris, uncontrolled fill, and any other deleterious materials shall be removed. The exposed subgrade surface should then be thoroughly compacted to a firm and unyielding condition. A thorough proof roll of the exposed subgrade soils should then be performed using a fully loaded, single-unit dump truck to identify areas of soft subgrade soils. The proof roll shall be witnessed by an ORA geotechnical engineer or his representative. Areas of soft subgrade soil shall be removed and replaced with structural fill. The extent and depth of the overexcavations of unsuitable soils shall be determined by the ORA geotechnical engineer or his representative. All overexcavations shall be backfilled with structural fill consisting of Crushed Surfacing Base Course (CSBC).

If the areas of unsuitable soil are extensive or deep (greater than about 18 inches), the use of one of the following measures may be considered to limit the depths of overexcavation:

- Woven geotextile fabrics,
- Geogrids, or
- Using coarser backfill such as quarry spalls at the base of overexcavations with base course crushed rock at the upper portion of the overexcavation backfill.

ORA can provide suitable recommendations to address the remediation of areas with extensive or deep unsuitable subgrade soils once the extent is determined in the field.

The near-surface soils at the site are moisture-sensitive and easily disturbed during periods of wet weather. Pavement construction activities should take place during the drier summer months if possible to minimize the risk of subgrade disturbance during periods of wet weather.

9.7.3 Wet Weather Grading Considerations

The soils at the site are moisture-sensitive, and disturbance of these soils should be assumed to be a certainty during periods of wet weather and wetter times of the year if left exposed to the weather. Mass grading activities during extended periods of wet weather, and during the wet season (October 31st through March 31st) may not be possible without incurring significant expenses related to overexcavation and replacement of loose, wet soils, and re-working of previously graded areas. We recommend that the following measures be implemented during periods of wet weather.

- Protect exposed foundation subgrade soils with 4 to 6 inches of thoroughly compacted 1-1/4 inch minus crushed rock, quarry spalls, controlled density fill (CDF), or a rat slab of structural concrete.
- The earthwork contractor should shape and compact areas being worked on to shed water and prevent the creation of low areas that would allow water to accumulate and result in degradation of underlying and/or previously prepared soils.
- Construction traffic should be limited to defined routes or quarry spall-protected haul roads to minimize widespread disturbance.
- Cover stockpiled materials that are to be used as structural fill with securely fastened plastic sheeting.
- Use approved, imported sand and gravel materials as structural fill with low fines content.

9.7.4 Structural Fill – Material, Placement and Compaction

Suitable onsite sandy soils or imported, granular aggregates may be used as structural fill. Soils consisting of clay, silt, peat, or containing deleterious matter are generally not suitable for use as structural fill. All structural fill material and any onsite sandy soils should be evaluated and approved by

ORA before use as structural fill. During periods of wet weather, it is unlikely that the onsite soils will be suitable for use as structural fill. Any imported granular aggregates should contain less than 5 percent fines during periods of wet weather.

All fill and backfill materials used as structural fill should be placed in relatively horizontal loose lifts, not exceeding 10 inches in thickness, and compacted to at least 95 percent of the maximum dry density (MDD) as determined by the modified Proctor test (ASTM D1557). If manually operated equipment such as a jumping jack compactor is used, the thickness of each loose lift should be no greater than 6 inches. Light vibratory plate compactors are not suitable for the compaction of structural fill.

Structural fill should be compacted to 95 percent of MDD should additionally be moisture-conditioned to within three (3) percent of optimum moisture. Structural fill to be compacted to 90 percent of MDD should be moisture-conditioned to within six (6) percent of optimum moisture content. Placement of frozen soils or placement of soils on frozen ground should not be attempted.

The following table summarizes our recommendations for fill material and compaction requirements for various types of aggregates.

Intended Use	Specification	Compaction Requirements
Structural fill below foundation elements	Crushed Surfacing Top Course (WSDOT 9-03.9(3)), and suitable onsite sandy gravel soils during extended periods of dry weather	Each lift must be compacted to 95 percent of MDD per ASTM D1557 test procedure.
Fill behind below-grade walls (outside of the zone of wall drainage material)	Gravel Backfill for Walls (WSDOT 9-03.12(2))	Fill placed within 5 feet of below-grade walls or retaining walls shall be compacted with manually operated compaction equipment. Fill placed at depths greater than 2 feet below finish subgrade elevation compacted to 90 percent of MDD. Fill placed at depths within 2 feet of finish subgrade elevation must be compacted to 95 percent of MDD if the area will be supporting pavements or roadway.
Fill behind below-grade walls at the zone of wall drainage material	Gravel Backfill for Drains (WSDOT 9-03.12(4))	No compaction until at least 18 inches of cover is present above the perforated drain pipe. Each subsequent 12-inch lift

Intended Use	Specification	Compaction Requirements
		is lightly compacted using manual compaction equipment.
Capillary break Material below slabs-on-grade	Clean, 3/4-inch crushed rock	Each lift must be compacted to a firm and unyielding condition over the firm subgrade soils.

9.7.5 Temporary Excavations

9.7.5.1 Excavations for the Proposed Fire Station

We anticipate that maximum excavation depths for the proposed fire station will be on the order of 3 to 4 feet. We recommend that the inclination of temporary cut slopes be no greater than 1.5H:1V (horizontal to vertical) in the near-surface soils. However, the temporary cut slope inclinations will likely need to be flattened to 3H:1V or flatter during wetter times of the year or during extended periods of heavy precipitation when depths to groundwater will likely be on the order of 4.5 feet below the existing site grade. We recommend that water in the excavations be routed by ditches to gravel-filled, temporary sumps that will allow the water to be collected and discharged to discharge locations. We anticipate that the collected water will need to be detained to allow sedimentation to occur and to be treated, as needed, onsite in temporary storage tanks.

9.7.5.2 Temporary Excavations for the Proposed Stormwater Detention Vault

We understand that a stormwater detention vault will likely be needed for the project. We anticipate that a detention vault would likely require excavation depths ranging from 5 to 10 feet in depth. The measured depths to groundwater have been observed to range from about 4.5 feet to 7 feet in early Spring 2025. As a result, the excavation for a stormwater detention vault would likely require a robust dewatering system. We anticipate that dewatering well points will need to be installed around the outside of the excavation by a dewatering contractor to draw down the water to a level at least 2 feet below the design base of the excavation level to provide stability of the base of the excavation. Given that a wetland is located immediately to the north of the project site there is likely a steady source of surface water to that area and groundwater dewatering volumes could easily reach 100 to 300 gallons per minute (gpm) as dewatering initially begins depending on the depth and size of the excavation, and would likely stabilize to lower levels as dewatering continues. It would be imperative that the dewatering wells do not penetrate the underlying pressurized, confined aquifer. We recommend that an experienced dewatering contractor be retained to design and maintain the dewatering system for the project. The collected water from the dewatering system will need to be stored, treated, and discharged in accordance with local and state requirements.

We anticipate that any permanent detention vault would need to be designed to resist buoyancy forces. Buoyancy forces will increase with a greater depth of embedment below the groundwater table.

Resistance to buoyancy forces can be achieved by ensuring the self-weight of the empty detention system is greater than the buoyancy forces that are acting on it, or by providing anchors into the ground below it that provide sufficient resistance to the upward forces acting on the detention system. The upward buoyancy force exerted on an object is equal to the weight of the displaced volume of fluid. The proposed configuration of the detention is currently unknown. ORA can provide assistance in estimating buoyancy forces and other design parameters such as the design of sheet pile walls and detention vault hold-down anchors, as needed.

9.7.5.3 Temporary Excavation Construction Monitoring

An ORA representative should periodically evaluate the exposed soil conditions during construction to verify that the recommended temporary cut slope inclinations are appropriate for the conditions being encountered. In addition, the configuration for temporary cut slope inclinations may need to be modified during construction if site conditions change.

All temporary cut slopes and excavations must comply with the provisions of the Washington Administrative Code (WAC) Chapter 296-155, Part N, “Excavation, Trenching and Shoring.” The contractor performing the work has the primary responsibility for the protection of workers and adjacent improvements.

9.7.6 Erosion and Sedimentation Control

The migration of sediments from the site must be controlled in accordance with City of Monroe requirements. We recommend that the following minimum erosion control measures be employed at the site:

- Provide silt fencing around the construction area to delineate the construction limits. No construction or soil disturbance should take place outside of the construction limits.
- Stockpiled soil at the site should be kept to a minimum. Any stockpiled soils should be covered with carefully secured plastic sheeting.
- Catch basin socks should be installed in nearby catch basins located downhill from the work area that could be impacted by construction activities.
- All sediment and soil should be removed from adjacent pavements at the end of each day of construction activities.
- Periodic inspection of the adequacy and condition of the installed erosion control measures by a geotechnical engineer or an experienced representative assigned by the geotechnical engineer.

Additional erosion control measures may be required as construction progresses.

9.8 DRAINAGE

9.8.1 Dewatering

Based on our review of the proposed development and the relatively shallow depth of groundwater encountered in our explorations (4.5 feet below the existing site grade), groundwater may be encountered during the construction of the new fire station and installation of buried utilities. The shallowest depth to groundwater will likely be during the wet season and following periods of extended precipitation. If groundwater or seepage is encountered during construction, we anticipate that dewatering could be satisfactorily completed by routing water through ditches to a low spot or sump in the excavation. We recommend that the sump depths be set to the lower groundwater level to at least 2 feet below the base of the excavation elevation. If this proves to be insufficient, a dewatering system designed by an experienced dewatering contractor may be required.

Runoff water and groundwater collected in temporary excavations should be removed as soon as possible for storage and treatment before being discharged to a location approved by the City of Monroe and in accordance with local and state requirements.

9.8.2 Foundation Wall and Retaining Wall Drainage

Good drainage is considered critical to the performance of earth-supported structures such as foundations and retaining walls. Adequate drainage must be provided behind foundation walls and retaining walls for this project. We recommend that perimeter drains be installed near the base of all foundations. Foundation drains should, at a minimum, consist of a 4-inch diameter, perforated or slotted SDR 35, or Schedule 40 PVC pipe. The foundation drains should be surrounded by at least 6 inches of drainage material such as ¾" clean crushed rock. A 24-inch wide zone of free-draining, clean, crushed gravel should be placed at the back of all foundation walls, below-grade walls, and retaining structures to within 12 inches of the final grade. A nonwoven geotextile fabric filter fabric such as Mirafi 140N, or an approved equivalent, should fully surround the zone of free-draining gravel. In addition, an appropriate spray-applied, or roller-applied damp proofing or waterproofing membrane should be applied directly to the exterior side of all below-grade walls, the tops of footings, and along the sides to provide a continuous membrane.

9.8.3 Surface Drainage

Good surface drainage is an integral part of the performance of earth-supported structures such as foundations, retaining walls, and pavements. Therefore, construction grades and final site grades should be designed to prevent water from entering the foundations or gravel drains behind any retaining walls or from ponding on or next to pavements. Where pavement does not immediately abut structures, slopes, with an outfall of at least three (3) percent for a minimum distance of five (5) feet from exterior footings, should be provided. These slopes should be capped with relatively impervious soils to prevent infiltration of water into the foundation soils.

10. REPORT LIMITATIONS

The recommendations presented in this report are for the exclusive use of Snohomish Regional Fire and Rescue and other members of the design team for the proposed Fire Station #32 site at 19959 Oaks Street in Monroe, Washington. The recommendations are based on completed subsurface explorations and analyses. The recommendations of this report are not transferable to any other site. If there are any revisions to the plans, or if deviations from the subsurface conditions noted in this report are encountered during construction, Otto Rosenau & Associates, Inc. (ORA) should be notified immediately to determine whether changes to the design recommendations are required.

11. REFERENCES

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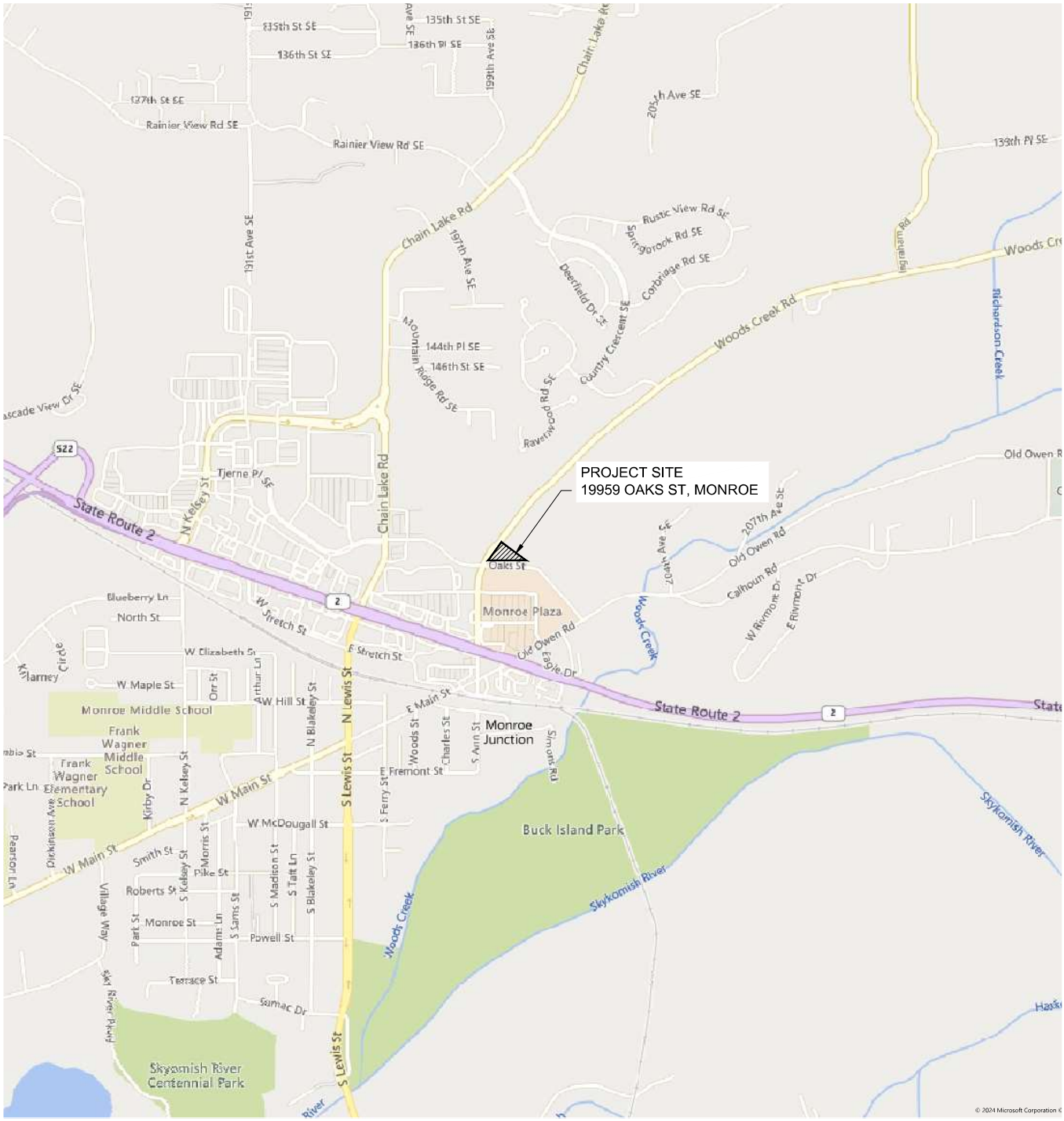
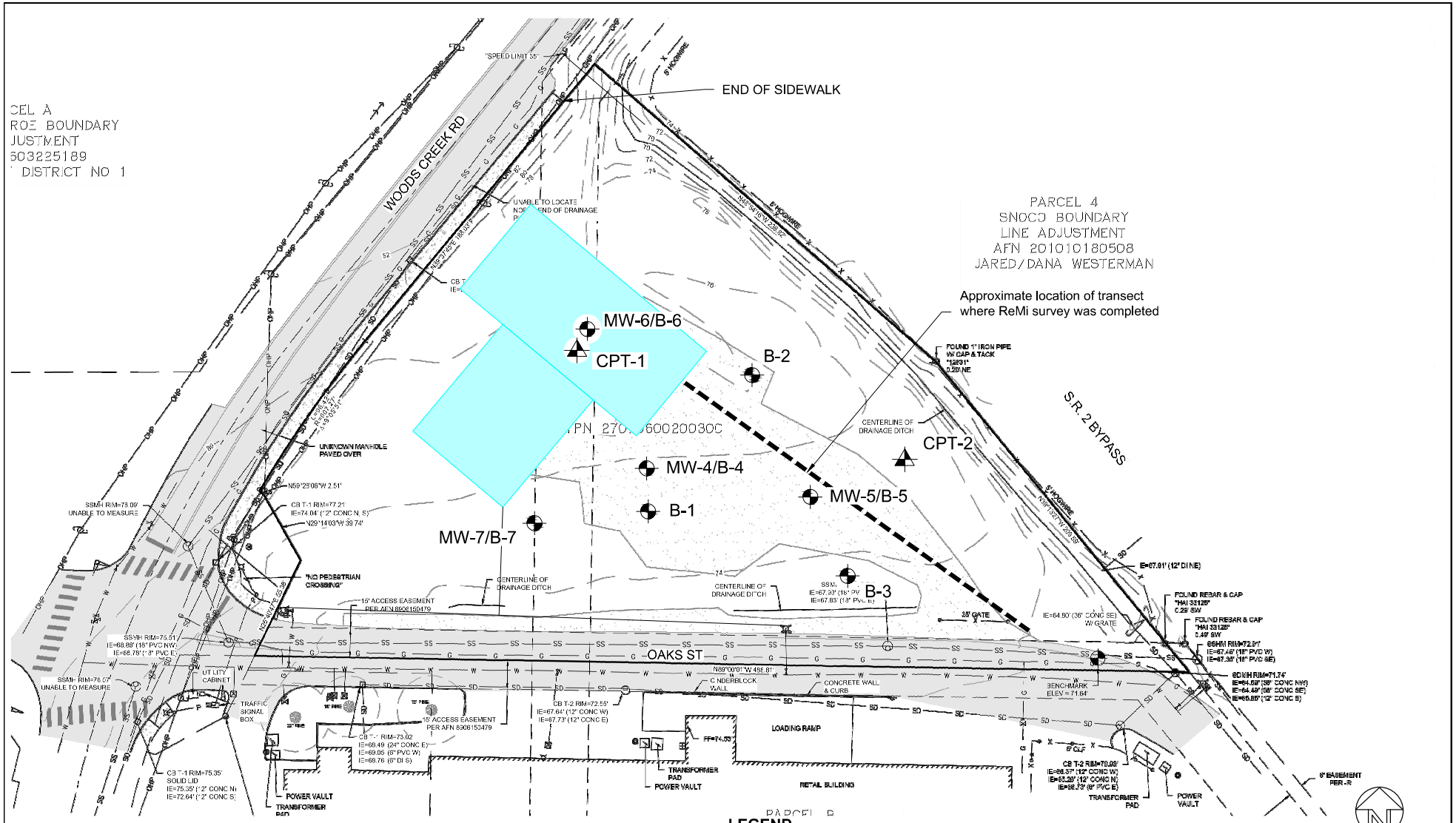


Reference: © 2024 Microsoft Corporation Tom Tom Mapping Service.

VICINITY MAP

Project Name: Proposed Fire Station # 32	**OTTO ROSENAU & ASSOCIATES, INC.**	**For:** Snohomish Regional Fire & Rescue
Location: 19959 Oaks St, Monroe, Washington		**ORA Project No.:** 24-0267
Date: April 25, 2025		**Figure:** 1



PRELIMINARY SITE PLAN

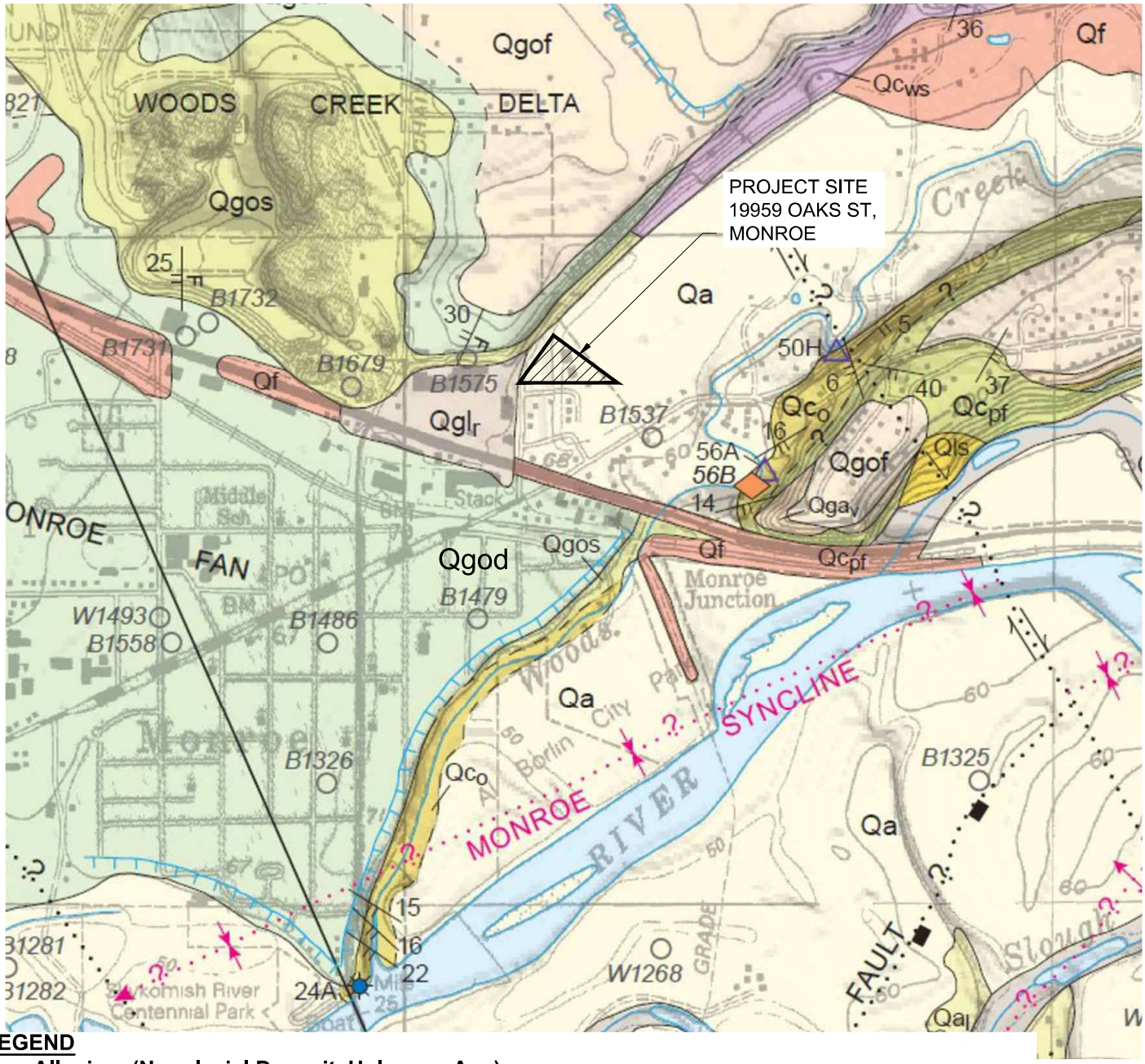
Project Name: Proposed Fire Station # 32	**OTTO ROSENAU & ASSOCIATES, INC.**	**For:** Snohomish Regional Fire & Rescue
Location: 19959 Oaks St, Monroe, Washington		**ORA Project No.:** 24-0267
Date: April 25, 2025		**Figure:** 2

LEGEND

- **B-1 - Boring completed by ORA on 5/21/2024**
- **MW-4/B-4 - Monitoring Well/Boring completed by ORA on 3/26/2025 and 3/27/2025**
- **CPT-1 - Cone Penetration Test completed by ORA on 5/28/2024**

REFERENCE: ALTA/NSPS Land Title Survey For OAC Services, Sheet 2 of 2, prepared by Harmsen dated 05/17/2024

Scale: 1" = 50'



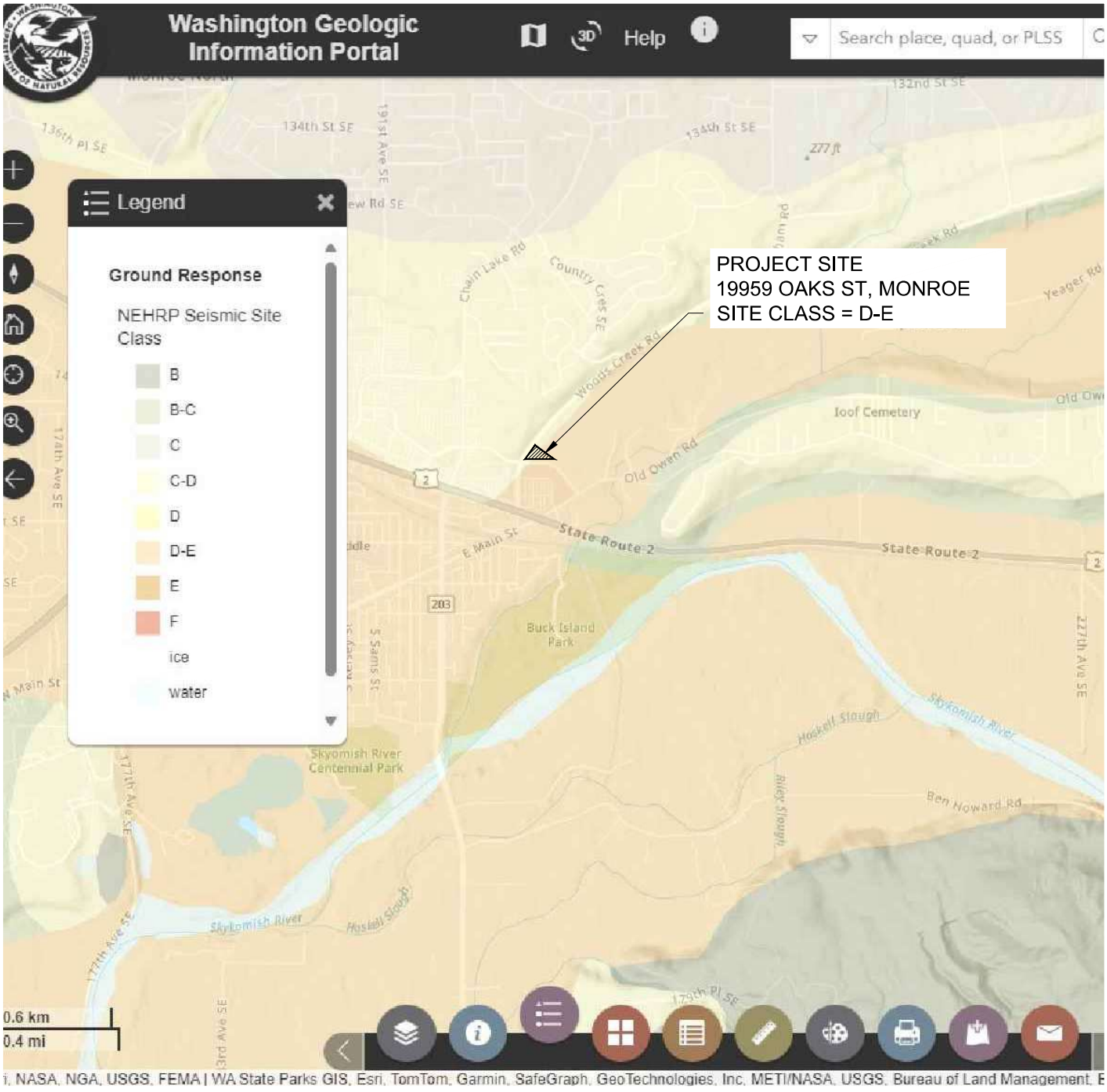
LEGEND

Qa - Alluvium (Nonglacial Deposit, Holocene Age)
Qglr - Recessional glaciolacustrine deposit (Glacial Deposit, Pleistocene Age)
Qgod - Deltaic outwash and kame deltas deposit (Glacial Deposit, Pleistocene Age)
Qgos - Outwash sand deposit (Glacial Deposit, Pleistocene Age)
Qgof - Fluvial outwash deposits (Glacial Deposit, Pleistocene Age)
Qco - Olympia beds, Snoqualmie and Skykomish provenance (Nonglacial Deposit, Pleistocene Age)

Note: The location of all features shown is approximate.
Reference: 7.5-minute quadrangle, Snohomish County, Washington: Washington Division of Geology and Earth Resources Map Series 2015-01 1:24000 scale

GEOLOGIC MAP

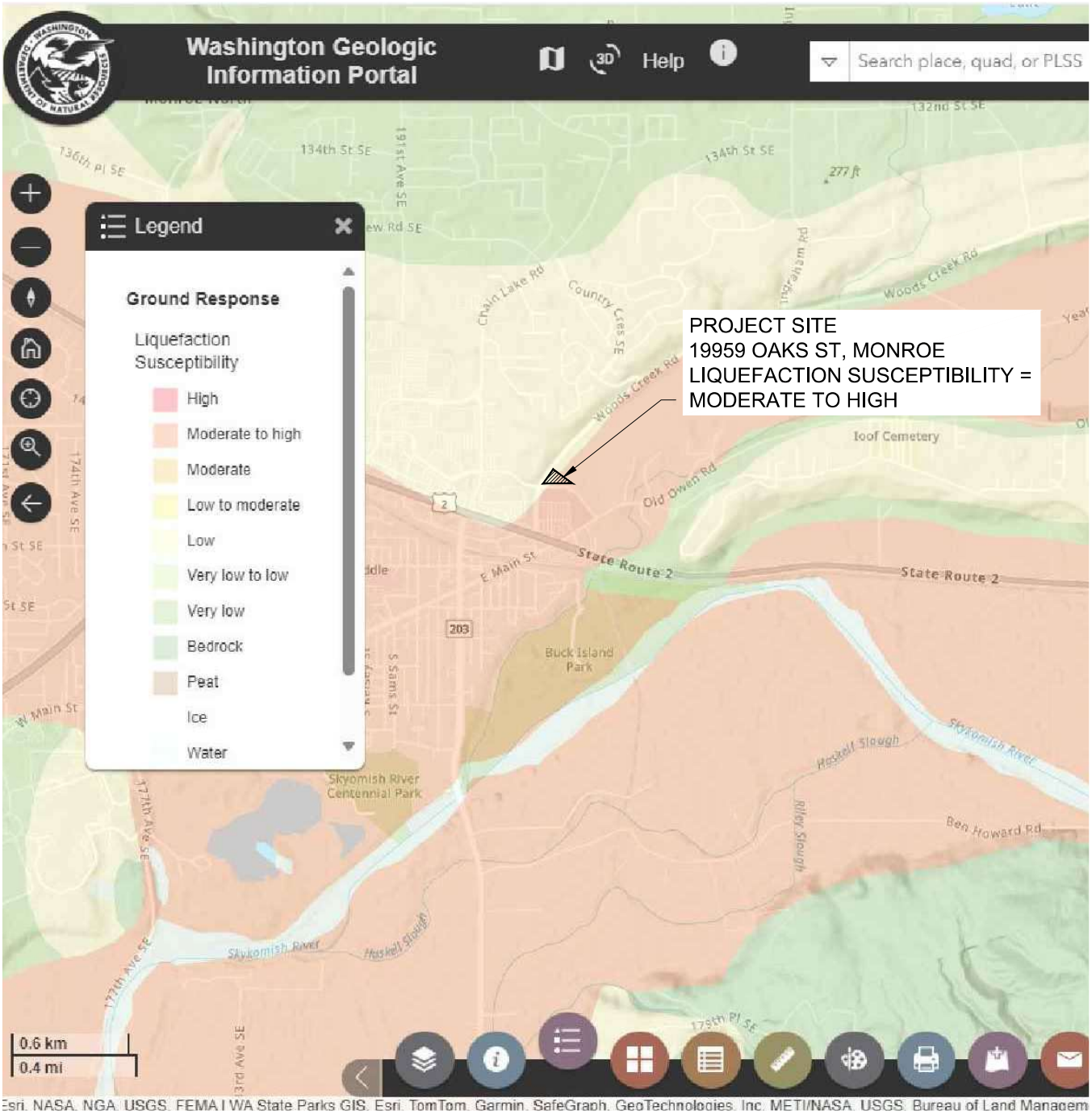
Project Name: Proposed Fire Station # 32	**OTTO ROSENAU & ASSOCIATES, INC.**	**For:** Snohomish Regional Fire & Rescue
Location: 19959 Oaks St, Monroe, Washington		**ORA Project No.:** 24-0267
Date: April 25, 2025		**Figure:** 3



Note: The location of all features shown is approximate.
Reference: Washington State Department of Natural Resources Geologic Portal at https://geologyportal.dnr.wa.gov/ Earthquakes/Ground Response/NEHRP Site Class

NEHRP SITE CLASSIFICATION

Project Name: Proposed Fire Station # 32	**OTTO ROSENAU & ASSOCIATES, INC.**	**For:** Snohomish Regional Fire & Rescue
Location: 19959 Oaks St, Monroe, Washington		**ORA Project No.:** 24-0267
Date: April 25, 2025		**Figure:** 4



Note: The location of all features shown is approximate.
Reference: Washington State Department of Natural Resources Geologic Portal at https://geologyportal.dnr.wa.gov/ Earthquakes/Ground Response/Liquefaction Susceptibility

LIQUEFACTION SUSCEPTIBILITY

Project Name: Proposed Fire Station # 32	**OTTO ROSENAU & ASSOCIATES, INC.**	**For:** Snohomish Regional Fire & Rescue
Location: 19959 Oaks St, Monroe, Washington		**ORA Project No.:** 24-0267
Date: April 25, 2025		**Figure:** 5

APPENDIX A
EXPLORATIONS

Boring Log Notes A-1

Soil Classification Chart A-3

Boring Logs for ORA Borings B-1 through B-7 ..... A-4

CPT Exploration Summary Report by ConeTec A-12

BORING LOG NOTES

These notes and boring logs are intended for use with this geotechnical report for the purposes and project described therein. The boring logs depict ORA's interpretation of subsurface conditions at the location of the boring on the date noted. Subsurface conditions may vary, and groundwater levels may change because of seasonal or numerous other factors. Accordingly, the boring logs should not be made a part of construction plans or be used to define construction conditions.

The approximate locations of the borings are shown on the Site Plan. The borings were located in the field by measuring from existing site features.

"Boring Size" refers the diameter and type of auger used. "HSA" denotes hollow-stem auger. "SSA" denotes solid-stem auger. "BA" denotes bucket auger.

"Sample Number and Type" refers to the sampling method and equipment used during exploration where:

- "SS" indicates split-spoon sampler with 1-3/8" inside diameter and 2" outside diameter.

"N-Values" refer to the Standard Penetration Test which records number of blows from a 140-pound hammer falling 30 inches required to advance a standard sampler eighteen inches. The blow counts required to drive the sampler through each 6-inch interval is recorded. The number of blows to drive the sampler for the last 12 inches of driving are added together and is considered to be the N-Value. The N-Value is presented in parentheses on the boring logs. The actual blow count values for each 6-inch interval is also presented. If the sample is driven less than 6 inches for a given interval, the actual distance driven is recorded.

"Moisture Content (MC)" refers to the moisture content of the soil expressed in percent by weight of dry sample as determined in the laboratory.

"Grain Size (GS)" refers to a grain size distribution analysis completed in general accordance with the ASTM D422 test procedure.

"Fines" is an estimate of the portion of a soil sample passing a No. 200 sieve as determined using the ASTM D422 test procedure.

"Atterberg Limits (AL)" refers to a determination of the liquid and plastic limits of a cohesive soil using the ASTM D 4318 test procedure.

"Dry Density (DD)" refers to an estimate of the dry density of a soil sample collected using a Shelby thin-wall sampling tube.

"Description and USCS Classification" refer to the materials encountered in the boring. The descriptions and classifications are generally based on visual examination in the field and laboratory. Where noted, laboratory tests were performed to determine the soil classification. The terms and symbols used in the boring logs are in general accordance with the Unified Soil Classification System. Laboratory tests are performed in general accordance with applicable procedures described by the American Society for Testing and Materials.

"▼" Indicates location of groundwater at the time noted.

TERMS for RELATIVE DENSITY of NON-COHESIVE SOIL

Term	Standard Penetration Resistance "N"
Very Loose	4 or less
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50 blows/foot

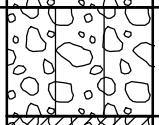
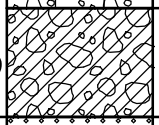
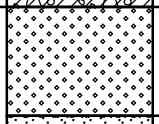
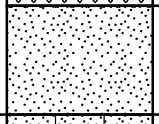
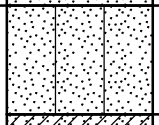
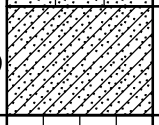
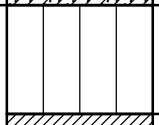
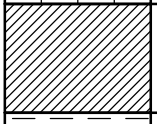
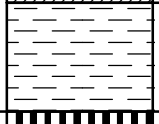
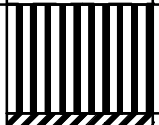
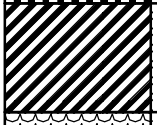
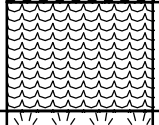
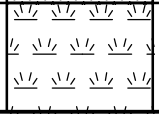
TERMS for RELATIVE CONSISTENCY of COHESIVE SOIL

Term	Unconfined Compressive Strength
Very Soft	0 to 0.25 tons/square-foot (tsf)
Soft	0.25 to 0.50 tsf
Medium Stiff	0.50 to 1.00 tsf
Stiff	1.00 to 2.00 tsf
Very Stiff	2.00 to 4.00 tsf
Hard	Over 4.00 tsf

DEFINITION of MATERIAL by DIAMETER of PARTICLE

Boulder	8-inches+
Cobble	3 to 8 inches
Gravel	3 inches to 5mm
Coarse Sand	5mm to 0.6mm
Medium Sand	0.6mm to 0.2mm
Fine Sand	0.2mm to 0.074mm
Silt	0.074mm to 0.005mm
Clay	less than 0.005mm

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(MORE THAN 12% FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(MORE THAN 12% FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND 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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: FINES ARE MATERIALS PASSING THE NO. 200 SIEVE.
COARSE GRAINED SOILS RECEIVE DUAL SYMBOLS IF THEY CONTAIN BETWEEN 5% AND 12% FINES.
FINE GRAINED SOILS RECEIVE DUAL SYMBOLS IF THEIR LIMITS PLOT LEFT OF THE "A" LINE WITH A PLASTICITY INDEX (PI) OF 4% TO 7%.

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BORING NUMBER B-1

CLIENT Snohomish Regional Fire & Rescue
PROJECT NAME Fire Station 32 Site Evaluation
PROJECT NUMBER 24-0267
PROJECT LOCATION 19959 Oaks St, Monroe, WA
DATE STARTED 5/21/24 **COMPLETED** 5/21/24
GROUND ELEVATION 75 ft NAVD 88 **HOLE SIZE** 8-inch diameter
DRILLING CONTRACTOR Geologic Drill Partners, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Track Rig Mounted Hollow Stem Auger
AT TIME OF DRILLING 10.00 ft / Elev 65.00 ft
LOGGED BY Scott Hoobler, PE **CHECKED BY** Scott Hoobler, PE
AT END OF DRILLING 0.00 ft / Elev 75.00 ft
NOTES SPT sampler, 140-pound automatic hammer, 30-inch drop
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					SM		SILTY SAND, (SM) brown, moist, medium dense, some gravel, (Fill)	
								2.0 / 73.0
	SPT 1	69	3-2-4 (6)	MC = 63%	ML		SILT, (ML) dark brown, moist, medium stiff, (Alluvium)	
5	SPT 2	100	0-2-3 (5)	MC = 40%	ML		SILT, (ML) dark grayish brown, moist, medium stiff, (Alluvium)	6.0 / 69.0
					SM		SILTY SAND, (SM) dark grayish brown, moist, loose, (Alluvium)	
	SPT 3	100	2-2-3 (5)	MC = 50%	SM		SILTY SAND, (SM) dark grayish brown, moist, loose, (Alluvium)	8.5 / 66.5
					SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) dark grayish brown, fine to medium grained, moist, loose, some wood debris, (Alluvium)	
10	SPT 4	100	2-3-3 (6)	MC = 36%	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) dark grayish brown, fine to medium grained, wet, loose, some wood debris, (Alluvium)	
	SPT 5	83	2-6-9 (15)	MC = 22% Fines = 6% GS	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) dark grayish brown, fine to medium grained, wet, medium dense, (Alluvium)	
15	SPT 6	100	2-2-6 (8)	MC = 25%	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) dark grayish brown, fine to medium grained, wet, loose, (Alluvium) (Drilling mud added at D = 15' to prevent heave)	18.0 / 57.0
20	SPT 7	100	0-0-2 (2)	MC = 28%	ML		SILT, (ML) dark grayish brown, wet, soft, (Alluvium)	21.0 / 54.0
					SM		SILTY SAND, (SM) dark grayish brown, moist, very loose, (Alluvium) (Artesian groundwater encountered at about D = 21', water flowed from boring hole onto adjacent ground surface, boring abandoned and sealed)	21.5 / 53.5

Bottom of borehole at 21.5 feet.

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BORING NUMBER B-2

CLIENT Snohomish Regional Fire & Rescue
PROJECT NAME Fire Station 32 Site Evaluation
PROJECT NUMBER 24-0267
PROJECT LOCATION 19959 Oaks St, Monroe, WA
DATE STARTED 5/21/24 **COMPLETED** 5/21/24
GROUND ELEVATION 76 ft NAVD 88 **HOLE SIZE** 8-inch diameter
DRILLING CONTRACTOR Geologic Drill Partners, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Track Rig Mounted Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Scott Hoobler, PE **CHECKED BY** Scott Hoobler, PE
AT END OF DRILLING 10.00 ft / Elev 66.00 ft
NOTES SPT sampler, 140-pound automatic hammer, 30-inch drop
0.25hrs AFTER DRILLING 7.50 ft / Elev 68.50 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					SM		SILTY SAND, (SM) brown, moist, medium dense, some gravel, (Fill)	
	SPT 1	67	16-13-6 (19)	MC = 35%	SM		SILTY SAND, (SM) brown, moist, medium dense, some gravel, (Fill)	72.5
					ML		SILT, (ML) dark grayish brown, moist, medium stiff, (Alluvium)	
5	SPT 2	100	5-4-3 (7)	MC = 44%	ML		SILT, (ML) dark grayish brown, moist, medium stiff, iron oxide staining, (Alluvium)	
						7.0		69.0
	SPT 3	39	1-1-2 (3)	MC = 34%	SM		SILTY SAND, (SM) grayish brown, moist to wet, very loose, (Alluvium)	
10	SPT 4	100	1-1-1 (2)	MC = 35%	SM		SILTY SAND, (SM) grayish brown, wet, very loose, some wood debris, (Alluvium)	
						12.0		64.0
	SPT 5	100	4-8-11 (19)	MC = 40%	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, wet, medium dense, (Alluvium)	
15	SPT 6	100	5-2-8 (10)	MC = 14%	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, wet, medium dense, (Alluvium)	
						16.5		59.5

Bottom of borehole at 16.5 feet.

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BORING NUMBER B-3

CLIENT Snohomish Regional Fire & Rescue
PROJECT NAME Fire Station 32 Site Evaluation
PROJECT NUMBER 24-0267
PROJECT LOCATION 19959 Oaks St, Monroe, WA
DATE STARTED 5/21/24 **COMPLETED** 5/21/24
GROUND ELEVATION 74 ft NAVD 88 **HOLE SIZE** 8-inch diameter
DRILLING CONTRACTOR Geologic Drill Partners, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Track Rig Mounted Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Scott Hoobler, PE **CHECKED BY** Scott Hoobler, PE
AT END OF DRILLING 10.00 ft / Elev 64.00 ft
NOTES SPT sampler, 140-pound automatic hammer, 30-inch drop
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					SM		SILTY SAND, (SM) brown, moist, medium dense, some gravel, (Fill)	
								2.0 / 72.0
	SPT 1	67	5-3-4 (7)	MC = 21%	ML		SILT, (ML) light grayish brown, moist, medium stiff, iron oxide staining, (Alluvium)	
5								
	SPT 2	100	2-2-2 (4)	MC = 32%	ML		SILT, (ML) light grayish brown, moist, soft, iron oxide staining, (Alluvium)	6.0 / 68.0
					SM		SILTY SAND, (SM) grayish brown, moist, very loose, trace wood debris, (Alluvium)	
	SPT 3	100	2-2-4 (6)	MC = 27%	SM		SILTY SAND, (SM) grayish brown, moist, very loose, (Alluvium)	8.5 / 65.5
					SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, moist, very loose to loose, (Alluvium)	
10								
	SPT 4	100	5-8-7 (15)	MC = 19%	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, wet, medium dense, (Alluvium)	
	SPT 5	100	5-7-5 (12)	MC = 13%	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, wet, medium dense, (Alluvium)	13.5 / 60.5
					SM		SILTY SAND, (SM) gray, wet, medium dense, (Alluvium)	
15								
	SPT 6	100	1-2-2 (4)	MC = 27%	SM		SILTY SAND, (SM) gray, wet, very loose to loose, (Alluvium)	
								16.5 / 57.5

Bottom of borehole at 16.5 feet.

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WELL NUMBER B-4

CLIENT Snohomish Regional Fire & Rescue **PROJECT NAME** Fire Station 32 Site Evaluation

PROJECT NUMBER 24-0267 **PROJECT LOCATION** 19959 Oaks St, Monroe, WA

DATE STARTED 3/26/25 **COMPLETED** 3/26/25 **GROUND ELEVATION** 76 ft NAVD 88 **HOLE SIZE** 6-inch diameter

DRILLING CONTRACTOR Holt Services, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Terra Sonic 150 CC Track Sonic Rig - 6" Casing/4" Core **AT TIME OF DRILLING** ---

LOGGED BY Anthony Coyne, PE **CHECKED BY** Anthony Coyne, PE **AT END OF DRILLING** 0.50 ft / Elev 75.50 ft

NOTES SPT sampler, 140-pound automatic hammer, 30-inch drop **220hrs AFTER DRILLING** 0.00 ft / Elev 76.00 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0								Casing Top Elev: 0 (ft) Casing Type: VWP
					GW-GM		WELL GRADED GRAVEL WITH SILT AND SAND, (GW-GM) brown, moist to wet, medium dense to dense, and cobbles, (Fill)	Cement and bentonite grouted hole
							2.5	73.5
5	GB 1			MC = 46%	MH		ELASTIC SILT, (MH) blueish gray, moist to wet, soft to medium stiff, Grab sample taken from cored material	WA DOE Well Tag # BQM 956
	SPT 2	78	1-1-1 (2)	MC = 60% LL = 58 PL = 35 , AL	MH		ELASTIC SILT, (MH) blueish gray, moist to wet, soft to medium stiff, high plasticity, with wood debris	
							7.5	68.5
10	GB 3			MC = 18%	SP-SM		(SP-SM) Grab sample taken from cored material	
	SPT 4	67	2-2-2 (4)	MC = 24% Fines = 11% , GS	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) blueish gray, fine to medium grained, wet, loose, with wood debris Grades to fine Sand with Silt from 12 ft to 13 ft Grades to fine to medium Sand with Silt from 13 ft to 14 ft Grades to fine Sand with Silt at 14 ft	
15								
	SPT 5	78	7-7-8 (15)	MC = 20%	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) blueish gray, fine grained, wet, loose, with wood debris	
							17.0	59.0
					ML		SILT, (ML) blueish gray, wet, soft to medium stiff, low plasticity	
							19.0	57.0
20								
	SPT 6	100	2-2-1 (3)	MC = 30% LL = 26 PL = 19 , AL	CL-ML		LEAN CLAY, SILTY, (CL-ML) blueish gray, wet, very soft to soft	
25								

(Continued Next Page)

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WELL NUMBER B-4

CLIENT Snohomish Regional Fire & Rescue **PROJECT NAME** Fire Station 32 Site Evaluation

PROJECT NUMBER 24-0267 **PROJECT LOCATION** 19959 Oaks St, Monroe, WA

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
25	GB 7			MC = 27%	CL-ML		LEAN CLAY, SILTY, (CL-ML) blueish gray, wet, very soft to soft, Grab sample taken from cored material	
							26.5	
					GP-GM		(GP-GM) Artesian groundwater pressure observed between 21.5 feet and 25 feet. Moderate artesian flow at ground surface with casing tip at 25 feet. No SPT sampling attempted for remainder of boring. Cored material was highly disturbed from 25 to 30 feet and appeared to consist of fine gravel and medium to coarse sand.	
30							31.0	
	GB 8			MC = 50%			(Tip of vibrating wire piezometer installed at depth of 30 feet)	Vibrating Wire Piezometer (VWP) grouted in place with cement and bentonite, Tip at D = 30 ft
							PEAT, (PT) dark brown, moist, stiff, Grab sample taken from cored material	
	GB 9			MC = 29%	ML		SILT, (ML) blueish gray, moist, medium stiff to stiff, low plasticity, with peat, and wood debris, Grab sample taken from cored material	
35								Cement and bentonite grouted hole
	GB 10			MC = 30%	ML		SILT, (ML) blueish gray, moist, medium stiff to stiff, low plasticity, some peat, Grab sample taken from cored material	
40							40.0	
							Groundwater observed at ground surface with no groundwater flow from casing with tip of casing at 40 feet.	
							Bottom of borehole at 40.0 feet.	

49.5
45.0
43.0
36.0

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WELL NUMBER B-5

CLIENT Snohomish Regional Fire & Rescue
PROJECT NAME Fire Station 32 Site Evaluation
PROJECT NUMBER 24-0267
PROJECT LOCATION 19959 Oaks St, Monroe, WA
DATE STARTED 3/27/25 **COMPLETED** 3/27/25
GROUND ELEVATION 75 ft NAVD 88 **HOLE SIZE** 6-inch diameter
DRILLING CONTRACTOR Holt Services, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Terra Sonic 150 CC Track Sonic Rig - 6" Casing/4" Core **AT TIME OF DRILLING** ---
LOGGED BY Anthony Coyne, PE **CHECKED BY** Anthony Coyne, PE **AT END OF DRILLING** 6.27 ft / Elev 68.73 ft
NOTES SPT sampler, 140-pound automatic hammer, 30-inch drop **195hrs AFTER DRILLING** 6.62 ft / Elev 68.38 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0								Casing Top Elev: 74.6 (ft) Casing Type: 2" PVC Pipe
					GW-GM		WELL GRADED GRAVEL WITH SILT AND SAND, (GW-GM) brown, moist, medium dense to dense, (Fill)	Steel Flush Monument set in concrete
							2.0 / 73.0	
					ML		SILT, (ML) dark brown, moist, medium stiff to stiff, with sand, gravel, and organics, (Fill)	WA DOE Well Tag # BQM 957
							4.0 / 71.0	Bentonite Chips
5					ML		SILT, (ML) gray, moist to wet, soft to medium stiff, trace organics, iron oxide staining	
	SPT 1	89	2-2-2 (4)	MC = 36%			7.5 / 67.5	Solid pipe with 12/20 Sand Filter
					SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) blueish gray, fine to medium grained, wet, loose, (increasing coarseness with depth)	
10							9.5 / 65.5	
	SPT 2	6	1-1-1 (2)	MC = 16%	SW-SM		WELL GRADED SAND WITH SILT, (SW-SM) blueish gray, fine to coarse grained, wet, loose	Slotted pipe with 12/20 Sand Filter
							12.0 / 63.0	
					ML		SILT, (ML) gray, wet, soft to medium stiff	
15							14.5 / 60.5	
	SPT 3	100	6-8-5 (13)	MC = 24% Fines = 6% , GS	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, wet, medium dense	Cap
							16.5 / 58.5	

Bottom of borehole at 16.5 feet.

GENERAL BH / TP / WELL - GINT STD US.GDT - 4/15/25 14:06 - C:\USERS\ANTHONY.COYNE\ONEDRIVE - OTTO ROSENAU\GEOTECH\GINT\PROJECTS\FIRE STATION 32 MONROE.GPJ

Otto Rosenau & Associates, Inc.
6747 Martin Luther King Jr Way South
Seattle, WA 98118
Telephone: (206) 725-4600

WELL NUMBER B-6

CLIENT Snohomish Regional Fire & Rescue
PROJECT NAME Fire Station 32 Site Evaluation
PROJECT NUMBER 24-0267
PROJECT LOCATION 19959 Oaks St, Monroe, WA
DATE STARTED 3/27/25 **COMPLETED** 3/27/25
GROUND ELEVATION 76 ft NAVD 88 **HOLE SIZE** 6-inch diameter
DRILLING CONTRACTOR Holt Services, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Terra Sonic 150 CC Track Sonic Rig - 6" Casing/4" Core **AT TIME OF DRILLING** ---
LOGGED BY Anthony Coyne, PE **CHECKED BY** Anthony Coyne, PE **AT END OF DRILLING** 5.11 ft / Elev 70.89 ft
NOTES SPT sampler, 140-pound automatic hammer, 30-inch drop **188hrs AFTER DRILLING** 5.13 ft / Elev 70.87 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
0									Casing Top Elev: 75.66 (ft) Casing Type: 2" PVC Pipe
							0.3 2-inch thick grass sod zone	75.8	Steel Flush Monument set in concrete
					SM		SILTY SAND WITH GRAVEL, (SM) light brown, moist to wet, loose to medium dense, (Fill)		
							2.0	74.0	
					GW-GM		WELL GRADED GRAVEL WITH SILT AND SAND, (GW-GM) brown, wet, loose to medium dense, (Fill)		WA DOE Well Tag # BQM 958
							3.5	72.5	Bentonite Chips
					OL		3.7 ORGANIC SOIL, (OL) dark brown, moist to wet, medium stiff	72.3	
5									
	SPT 1	89	1-1-1 (2)	MC = 59% LL = 63 PL = 37 , AL	MH		ELASTIC SILT, (MH) blueish gray, moist to wet, medium stiff, with organics, iron oxide staining		Solid pipe with 12/20 Sand Filter
							9.0	67.0	
10					SM		SILTY SAND, (SM) blueish gray, moist to wet, loose to medium dense, (decreasing fines content with depth)		
							10.0	66.0	
	SPT 2	100	2-2-5 (7)	MC = 20%	SP-SM		11.0 POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, moist to wet, loose to medium dense	65.0	Slotted pipe with 12/20 Sand Filter
15									
	SPT 3	100	5-8-9 (17)	MC = 14% Fines = 5% , GS	SW-SM		WELL GRADED SAND WITH SILT, (SW-SM) gray, wet, medium dense		
							16.5	59.5	Cap

Bottom of borehole at 16.5 feet.

GENERAL BH / TP / WELL - GINT STD US.GDT - 4/15/25 14:06 - C:\USERS\ANTHONY.COYNE\ONEDRIVE - OTTO ROSENAU\GEOTECH\GINT\PROJECTS\FIRE STATION 32 MONROE.GPJ

Otto Rosenau & Associates, Inc.
6747 Martin Luther King Jr Way South
Seattle, WA 98118
Telephone: (206) 725-4600

WELL NUMBER B-7

CLIENT Snohomish Regional Fire & Rescue
PROJECT NAME Fire Station 32 Site Evaluation
PROJECT NUMBER 24-0267
PROJECT LOCATION 19959 Oaks St, Monroe, WA
DATE STARTED 3/27/25 **COMPLETED** 3/27/25
GROUND ELEVATION 76 ft NAVD 88 **HOLE SIZE** 6-inch diameter
DRILLING CONTRACTOR Holt Services, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Terra Sonic 150 CC Track Sonic Rig - 6" Casing/4" Core **AT TIME OF DRILLING** ---
LOGGED BY Anthony Coyne, PE **CHECKED BY** Anthony Coyne, PE **AT END OF DRILLING** 4.82 ft / Elev 71.18 ft
NOTES SPT sampler, 140-pound automatic hammer, 30-inch drop **188hrs AFTER DRILLING** 5.19 ft / Elev 70.81 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0								Casing Top Elev: 75.64 (ft) Casing Type: 2" PVC Pipe
					GM		SILTY GRAVEL WITH SAND, (GM) brown, moist, (Fill) 1.0 / 75.0	Steel Flush Monument set in concrete
					ML		SILT, (ML) dark brown black, moist, medium stiff to stiff, with organics, (Fill) 3.5 / 72.5	WA DOE Well Tag # BQM 959
5								Bentonite Chips
	SPT 1	100	1-2-2 (4)	MC = 31%	ML		SILT, (ML) blueish gray, moist to wet, soft to medium stiff, trace organics 7.0 / 69.0	Solid pipe with 12/20 Sand Filter
10								
	SPT 2	100	2-5-9 (14)	MC = 25% Fines = 21% , GS	SP-SM		POORLY GRADED SAND WITH SILT, (SP-SM) gray, fine to medium grained, wet 12.0 / 64.0	Slotted pipe with 12/20 Sand Filter
					SW-SM		WELL GRADED SAND WITH SILT, (SW-SM) blueish gray, wet, (occasional 2- to 3-inch thick silt seams) 15.0 / 61.0	
15								
	SPT 3	100	6-6-8 (14)	MC = 20%	ML		SILT, (ML) blueish gray, wet, non plastic 16.5 / 59.5	Cap

Bottom of borehole at 16.5 feet.

GENERAL BH / TP / WELL - GINT STD US.GDT - 4/15/25 14:06 - C:\USERS\ANTHONY.COYNE\ONEDRIVE - OTTO ROSENAU\GEOTECH\GINT\PROJECTS\FIRE STATION 32 MONROE.GPJ

PRESENTATION OF SITE INVESTIGATION RESULTS

Prospective Fire Station, Monroe, WA

Prepared for:

Otto Rosenau & Associates, Inc.

ConeTec Job No: **24-59-27735**

Project Start Date: 2024-05-28
Project End Date: 2024-05-28
Release Date: 2024-05-31

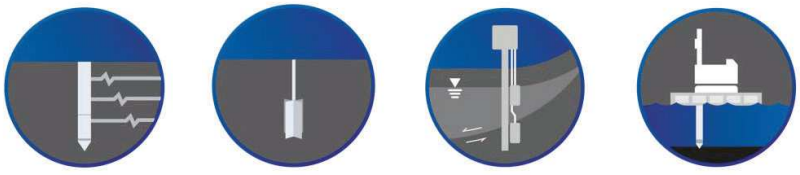
Report Prepared by:

ConeTec, Inc.

1237 S Director Street, Seattle, WA 98108

Tel: (253) 397-4861

ConeTecWA@conetec.com
www.conetec.com
www.conetecdataservices.com



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ABOUT THIS REPORT

The enclosed report presents the results of the site investigation program conducted by ConeTec, Inc. for Otto Rosenau & Associates, Inc..

Please note that this report, which also includes all accompanying data, are subject to the 3rd Party Disclaimer and Client Disclaimer that follow in the 'Limitations' section of this report. Please refer to the list of attached documents following the text of this report. A site map, test summaries, and test plots are all included in the body of the report.

Project	
Client	Otto Rosenau & Associates, Inc.
Project	Prospective Fire Station, Monroe, WA
ConeTec Project Number	24-59-27735
Test Types	CPTu/SCPTu
Additional Comments	None

Contents

The following listed below are included in the body of this report:

- **Site Map**
- **Limitations and Closure**
- **Project Information**
- **Report Appendices**

SITE MAP

All locations are approximate unless otherwise stated in the body of the report.

ConeTec Job Number: 24-59-27735

Client: Otto Rosenau & Associates, Inc.

Project: Prospective Fire Station, Monroe, WA

Date: 2024-05-31

LIMITATIONS

3rd Party Disclaimer

The "Report" refers to this report titled: Prospective Fire Station, Monroe, WA

The Report was prepared by ConeTec for: Otto Rosenau & Associates, Inc.

The Report is confidential and may not be distributed to or relied upon by any third parties without the express written consent of ConeTec. Any third parties gaining access to the Report do not acquire any rights as a result of such access. Any use which a third party makes of the Report, or any reliance on or decisions made based on it, are the responsibility of such third parties. ConeTec accepts no responsibility for loss, damage and/or expense, if any, suffered by any third parties as a result of decisions made, or actions taken or not taken, which are in any way based on, or related to, the Report or any portion(s) thereof.

Client Disclaimer

ConeTec was retained by: Otto Rosenau & Associates, Inc.

The "Report" refers to this report titled: Prospective Fire Station, Monroe, WA

ConeTec was retained to collect and provide the raw data ("Data") which is included in the Report.

ConeTec has collected and reported the Data in accordance with current industry standards. No other warranty, express or implied, with respect to the Data is made by ConeTec. In order to properly understand the Data included in the Report, reference must be made to the documents accompanying and other sources referenced in the Report in their entirety. Other than the Data, the contents of the Report (including any Interpretations) should not be relied upon in any fashion without independent verification and ConeTec is in no way responsible for any loss, damage or expense resulting from the use of, and/or reliance on, such material by any party.

Closure

Thank you for the opportunity to work on this project. The equipment used as well the field procedures followed, all complied with current accepted best practice standards.

Report prepared by: MH JM

PROJECT INFORMATION

Rig		
Description	**Deployment System**	**Test Type**
C02-023 CPT Truck Rig	Twin mounted cylinders	CPTu/SCPTu

Coordinates		
Test Type	**Collection Method**	**EPSG Number**
CPTu/SCPTu	Consumer Grade GPS	4326 (WGS84 / LatLong)

Piezocones Used for this Project						
Cone Description	**Cone Number**	**Cross Sectional Area** (cm^2)	**Sleeve Area** (cm^2)	**Tip Capacity** (bar)	**Sleeve Capacity** (bar)	**Pore Pressure Capacity** (bar)
EC855:T1500F15U35	855	15	225	1500	15	35

Cone Penetration Test (CPTu)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 Meters. This has been accounted for in the CPT data files.

Calculated Geotechnical Parameters	
Additional information	The Normalized Soil Behaviour Type Chart based on Q_{tn} (SBT Q_{tn}) (Robertson, 2009) was used to classify the soil for this project. A detailed set of calculated CPTu parameters have been generated and are provided in Excel format files in the release folder. The CPTu parameter calculations are based on values of corrected tip resistance (q_t) sleeve friction (f_s) and pore pressure (u_2). Effective stresses are calculated based on unit weights that have been assigned to the individual soil behaviour type zones and the assumed equilibrium pore pressure profile. Soils were classified as either drained or undrained based on the Q_{tn} Normalized Soil Behaviour Type Chart (Robertson, 2009). Calculations for both drained and undrained parameters were included for materials that classified as silt mixtures (zone 4).

REPORT APPENDICES

The appendices listed below are included in the report:

- **Cone Penetration Test (CPTu) Summary and Standard CPTu Plots**
- **Advanced Cone Penetration Test Plots**
- **Soil Behavior Type (SBT) Scatter Plots**
- **Pore Pressure Dissipation Test (PPDT) Summary and PPDT Plots**
- **Seismic Cone Penetration Test (SCPTu) Tabular Results**
- **SCPTu Plots**
- **SCPTu Velocity Wave Traces**
- **Supplementary Documents and Materials**

Cone Penetration Test (CPTu) Summary and Standard CPTu Plots

Job No:	24-59-27735
Client:	Otto Rosenau & Associates, Inc.
Project:	Prospective Fire Station, Monroe, WA
Start Date:	2024-05-28
End Date:	2024-05-28

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Cone Area (cm^2)	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Seismic Intervals	Latitude[2]	Longitude[2]	Refer to Notation Number
CPT-01	24-59-27735_SP01	2024-05-28	855:T1500F15U35	15	6.2	41.99	12	47.86088	-121.96446	
CPT-02	24-59-27735_CP02	2024-05-28	855:T1500F15U35	15	6.2	34.53		47.86070	-121.96387	3
Totals	2 Soundings					76.52 ft	12			

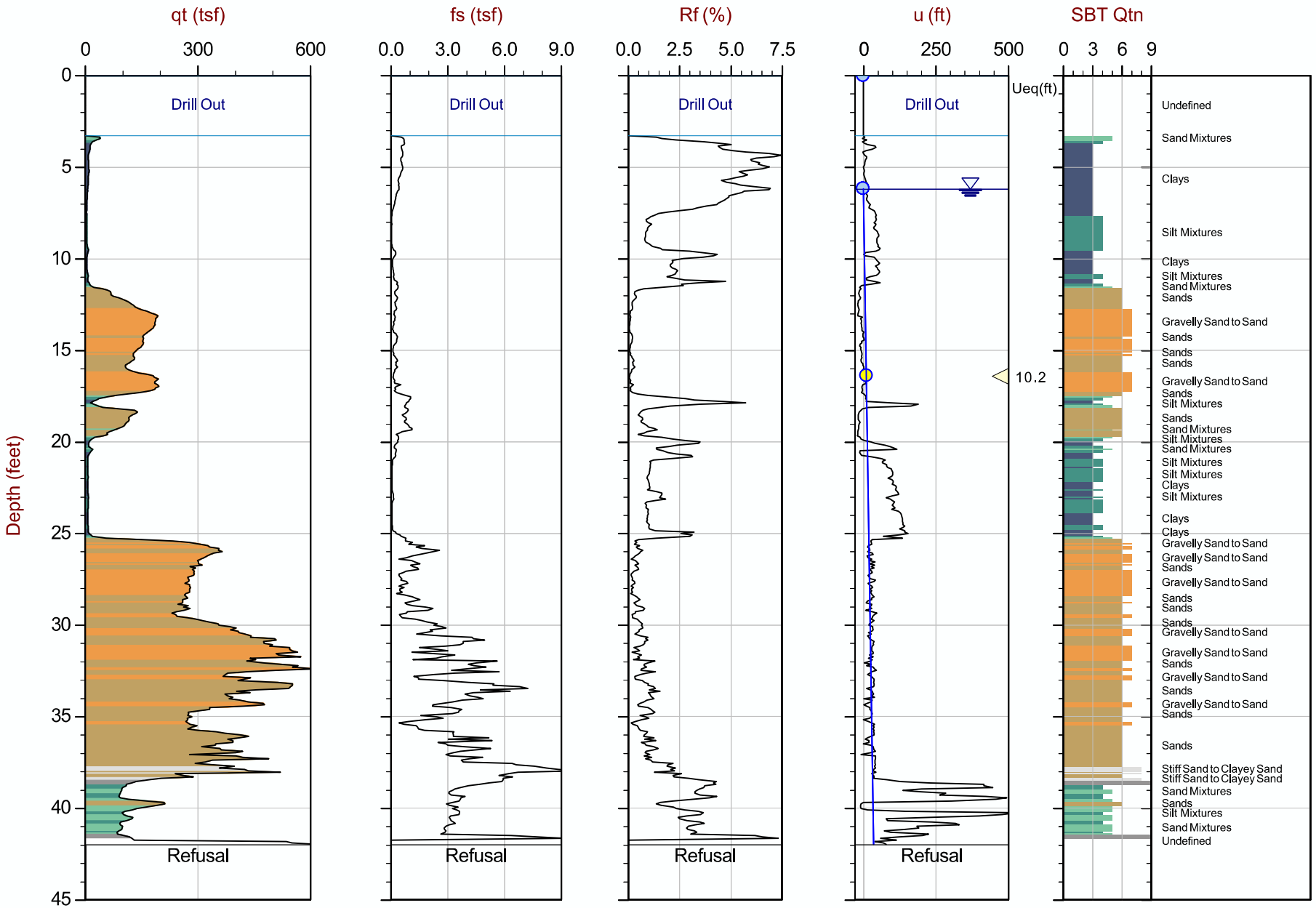
1. The assumed phreatic surface was based off the shallowest pore pressure dissipation tests performed within or nearest the sounding. Hydrostatic conditions were assumed for the calculated parameters.
2. The coordinates were collected using consumer grade GPS. EPSG number: 4326 (WGS84 / LatLong).
3. The assumed phreatic surface was based on the shallowest pore pressure dissipation test performed in the adjacent sounding (CPT-01).

CONETEC

Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 08:54
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-01
Cone: 855:T1500F15U35



Max Depth: 12.800 m / 41.99 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-59-27735_SP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.86088 Long: -121.96446

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

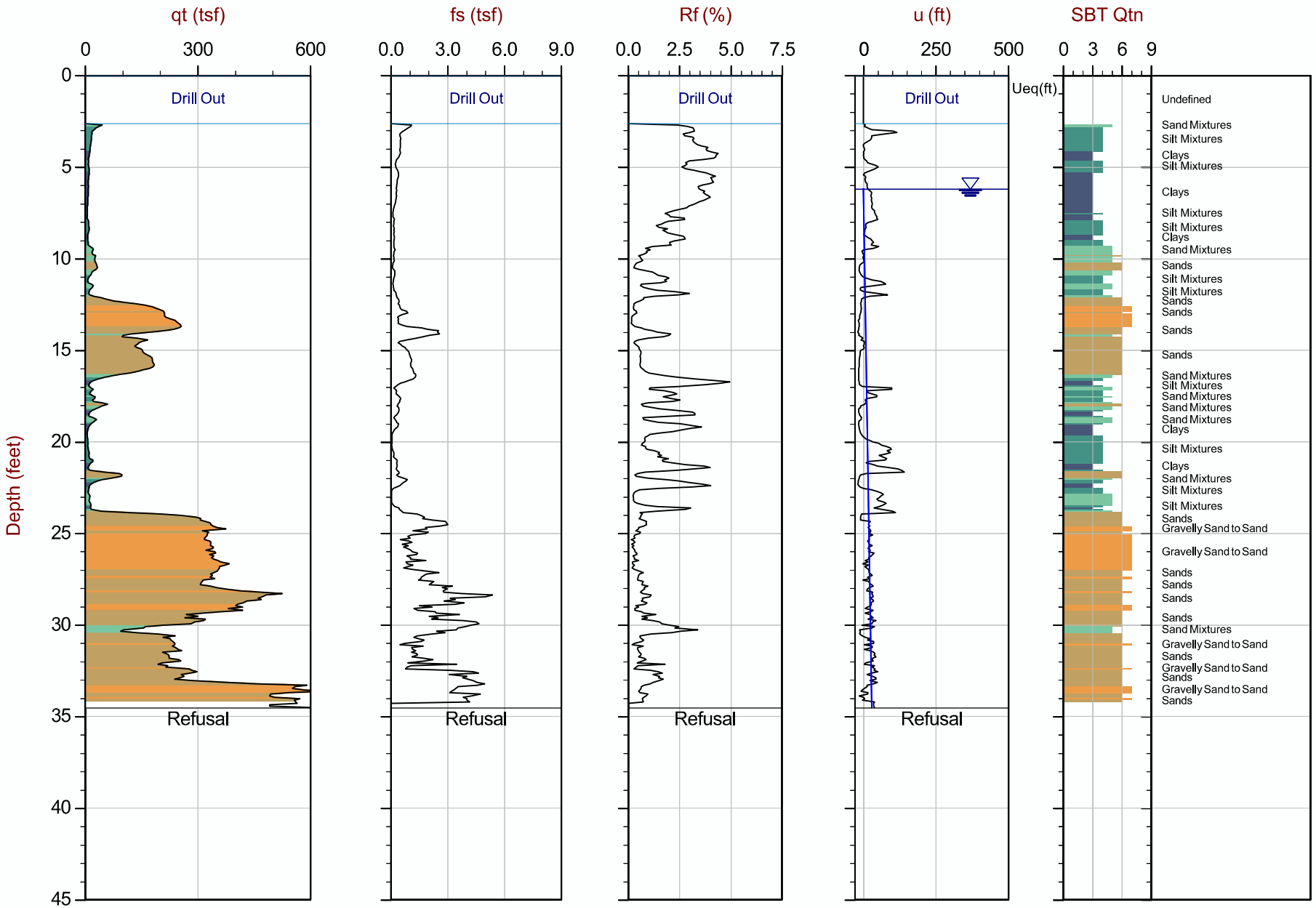
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 10:21
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-02
Cone: 855:T1500F15U35



Max Depth: 10.525 m / 34.53 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-59-27735_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.86069 Long: -121.96387

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

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

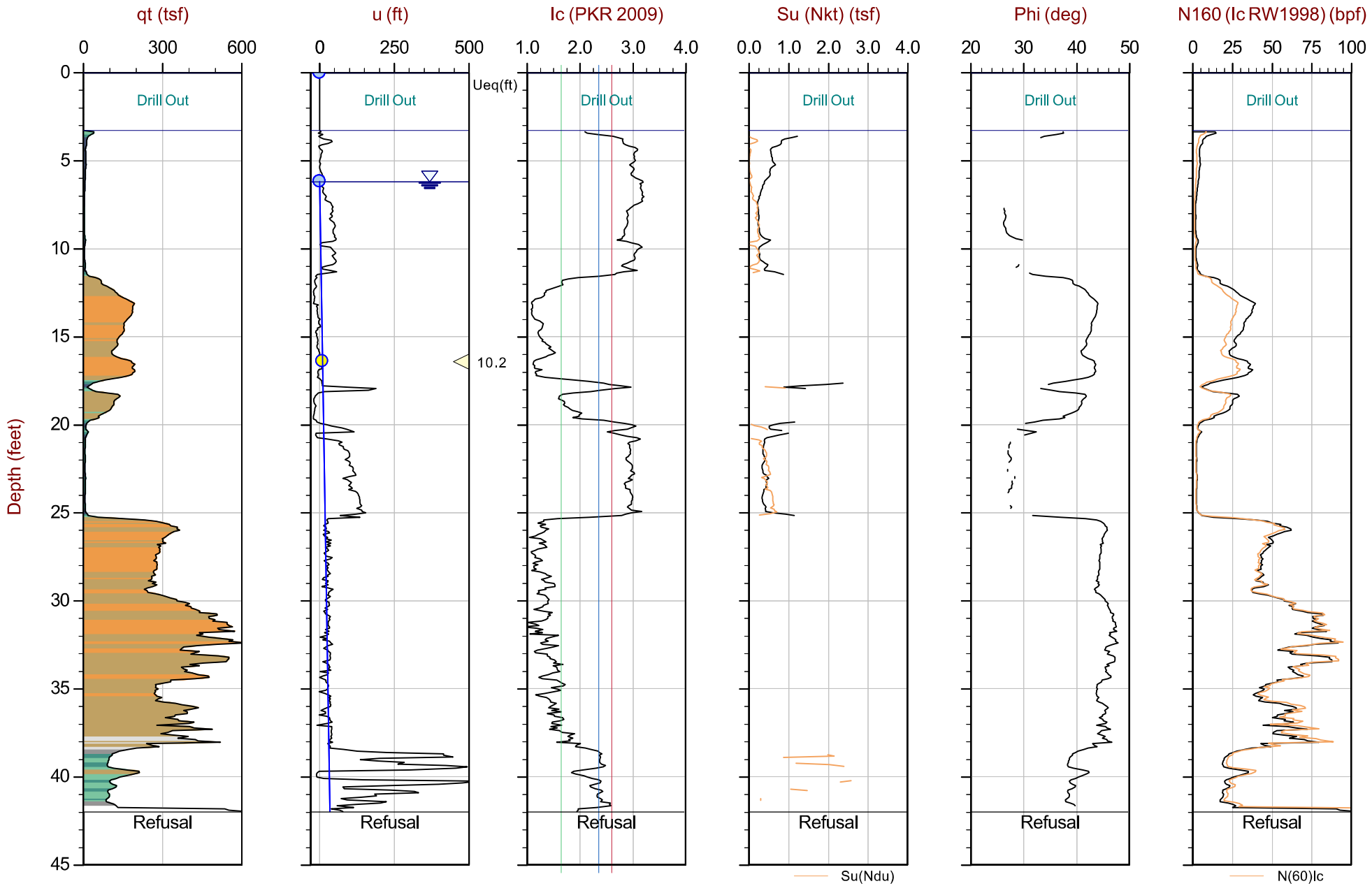
Advanced Cone Penetration Test Plots with Ic, Su(Nkt), Phi, and N1(60)Ic

CONETEC

Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 08:54
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-01
Cone: 855:T1500F15U35



Max Depth: 12.800 m / 41.99 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-59-27735_SP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 6.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.86088 Long: -121.96446

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

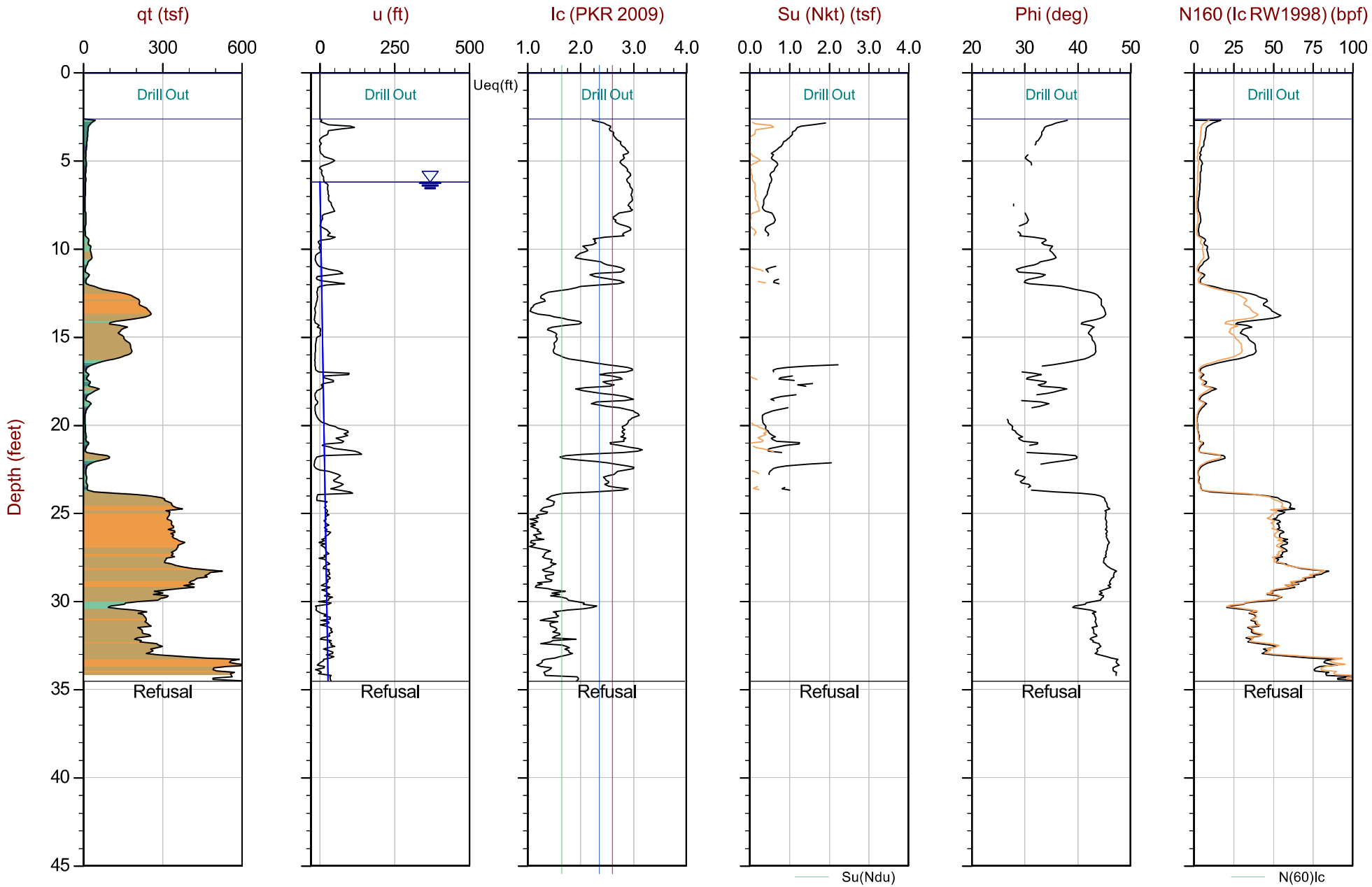
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 10:21
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-02
Cone: 855:T1500F15U35



Max Depth: 10.525 m / 34.53 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-59-27735_CP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt/Ndu: 15.0 / 6.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.86069 Long: -121.96387

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

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

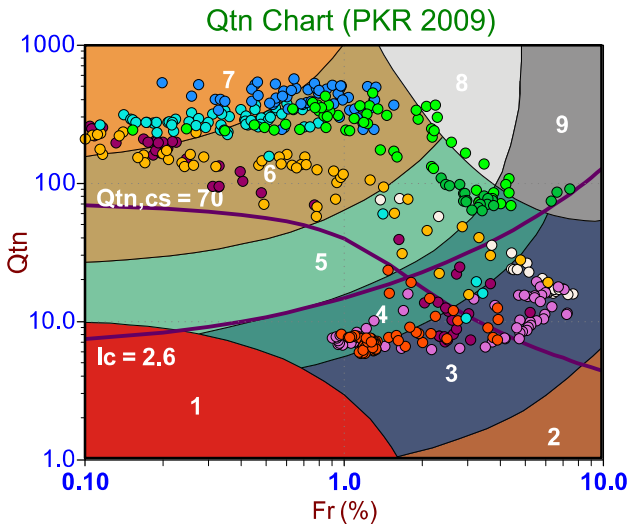
Soil Behavior Type (SBT) Scatter Plots

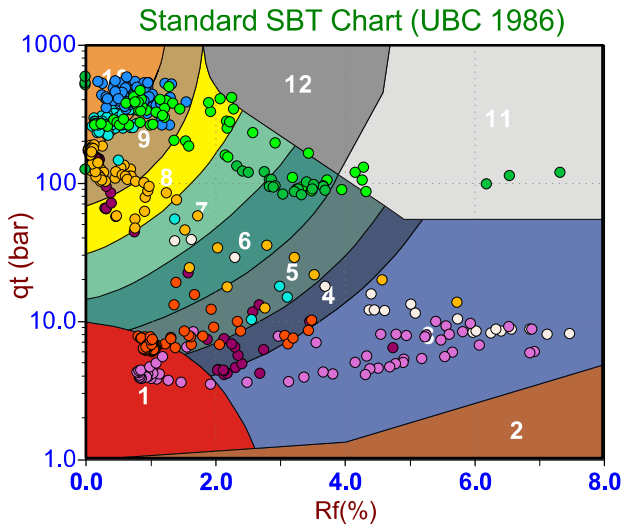
CONETEC

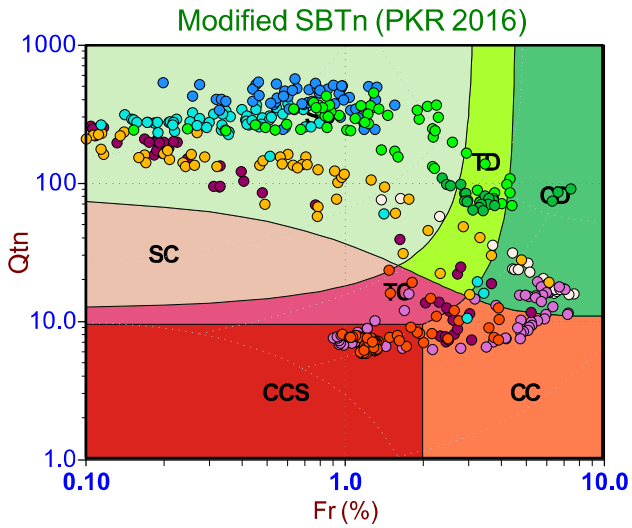
Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 08:54
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-01
Cone: 855:T1500F15U35







Depth Ranges
- >0.0 to 5.0 ft
- >5.0 to 10.0 ft
- >10.0 to 15.0 ft
- >15.0 to 20.0 ft
- >20.0 to 25.0 ft
- >25.0 to 30.0 ft
- >30.0 to 35.0 ft
- >35.0 to 40.0 ft
- >40.0 to 45.0 ft
- >45.0 to 50.0 ft
- >50.0 ft

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

Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

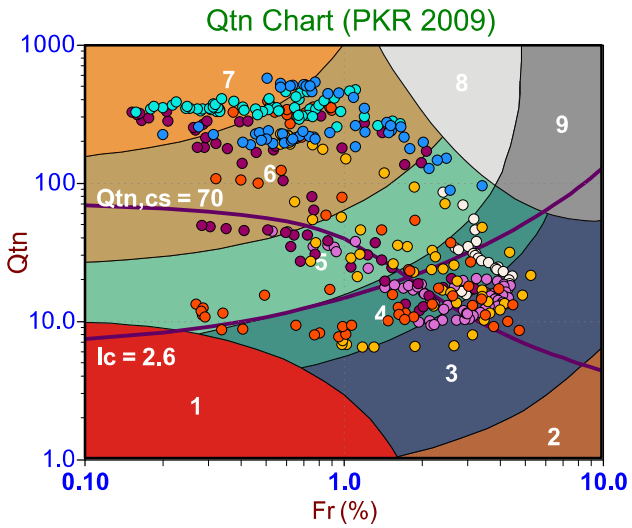
Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

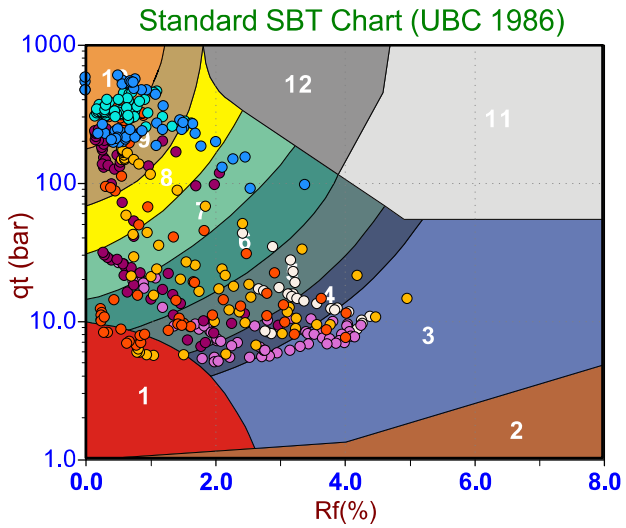
CONETEC

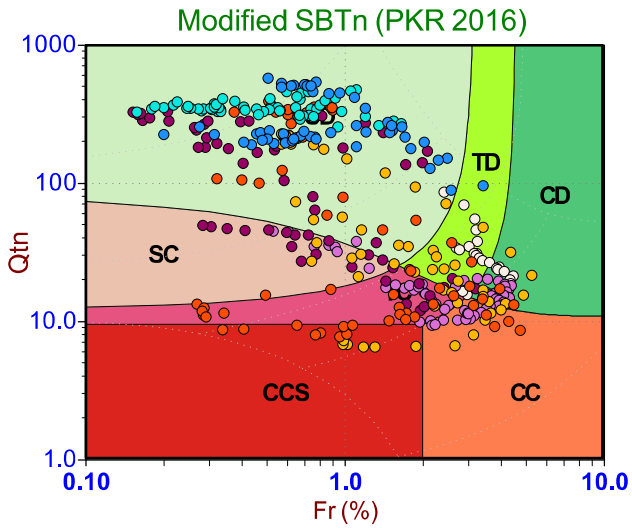
Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 10:21
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-02
Cone: 855:T1500F15U35







Depth Ranges
- >0.0 to 5.0 ft
- >5.0 to 10.0 ft
- >10.0 to 15.0 ft
- >15.0 to 20.0 ft
- >20.0 to 25.0 ft
- >25.0 to 30.0 ft
- >30.0 to 35.0 ft
- >35.0 to 40.0 ft
- >40.0 to 45.0 ft
- >45.0 to 50.0 ft
- >50.0 ft

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

Legend
- Sensitive Fines
- Organic Soil
- Clay
- Silty Clay
- Clayey Silt
- Silt
- Sandy Silt
- Silty Sand/Sand
- Sand
- Gravelly Sand
- Stiff Fine Grained
- Cemented Sand

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
- CD (Dil. clay like)
- TD (Dil. transitional)
- SD (Dil. sand like)

Pore Pressure Dissipation Test (PPDT) Summary and PPDT Plots

Job No:	24-59-27735
Client:	Otto Rosenau & Associates, Inc.
Project:	Prospective Fire Station, Monroe, WA
Start Date:	2024-05-28
End Date:	2024-05-28

CPTu PORE PRESSURE DISSIPATION SUMMARY

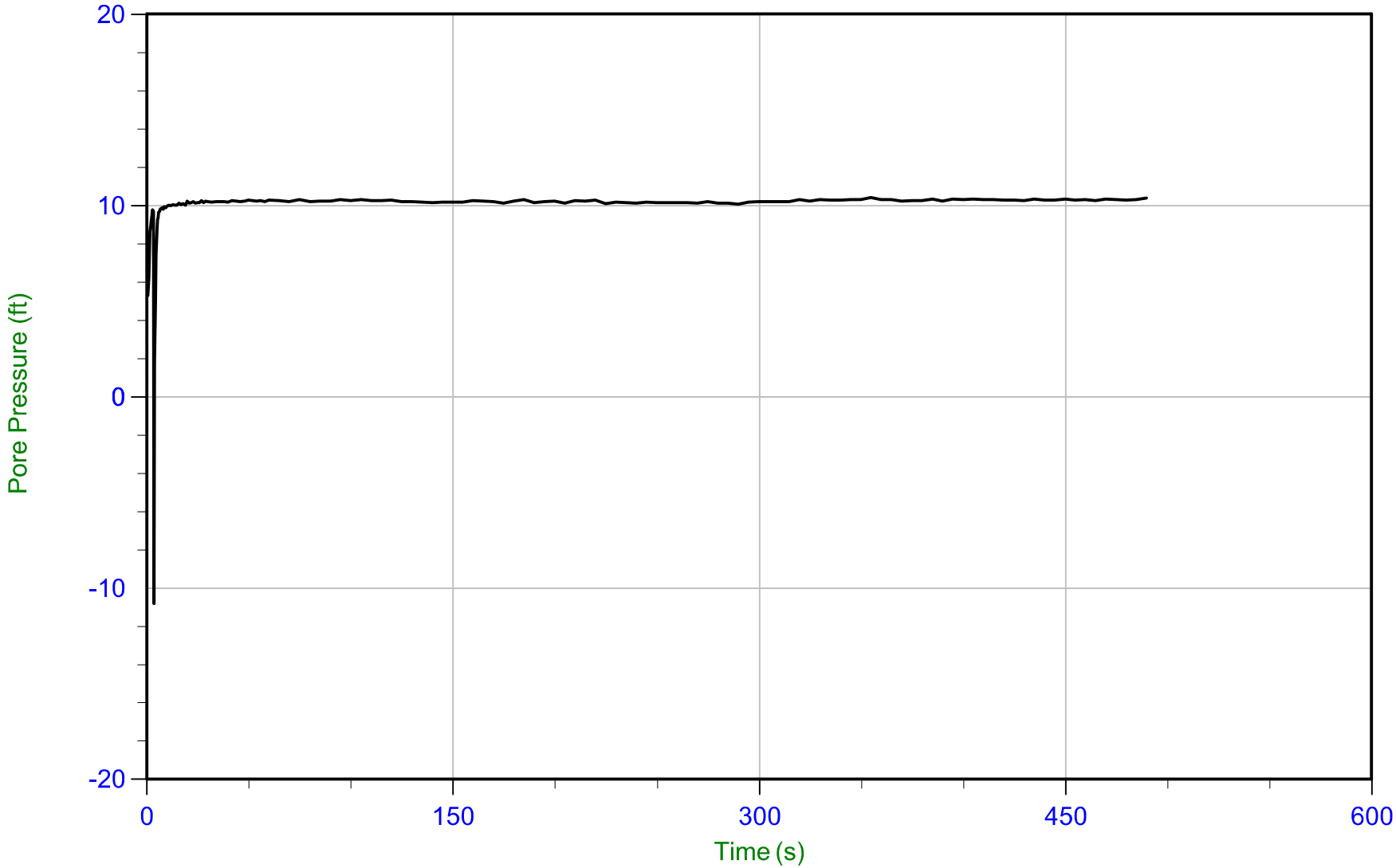
Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)	Refer to Notation Number
CPT-01	24-59-27735_SP01	15	490	16.40	10.2	6.2	
Totals			8 min				

CONETEC

Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 08:54
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-01
Cone: 855:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 24-59-27735_SP01.PPR3
Depth: 5.000 m / 16.404 ft
Duration: 490.0 s

u Min: -10.8 ft
u Max: 10.4 ft
u Final: 10.4 ft

WT: 1.888 m / 6.194 ft
Ueq: 10.2 ft

Seismic Cone Penetration Test (SCPTu) Tabular Results

Job No:	24-59-27735
Client:	Otto Rosenau & Associates, Inc.
Project:	Prospective Fire Station, Monroe, WA
Sounding ID:	CPT-01
Date:	2024-05-28
Seismic Source:	Beam
Seismic Offset (ft):	1.74
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
6.56	5.91	6.16			
9.84	9.19	9.35	3.19	7.59	421
13.12	12.47	12.59	3.24	9.12	355
16.40	15.75	15.84	3.26	4.34	750
19.69	19.03	19.11	3.26	4.90	666
22.97	22.31	22.38	3.27	5.98	547
26.25	25.59	25.65	3.27	7.56	433
29.53	28.87	28.92	3.27	3.92	835
32.87	32.22	32.27	3.34	3.73	895
36.09	35.43	35.48	3.21	3.40	945
39.63	38.98	39.02	3.54	3.17	1118
42.00	41.34	41.38	2.36	3.30	716

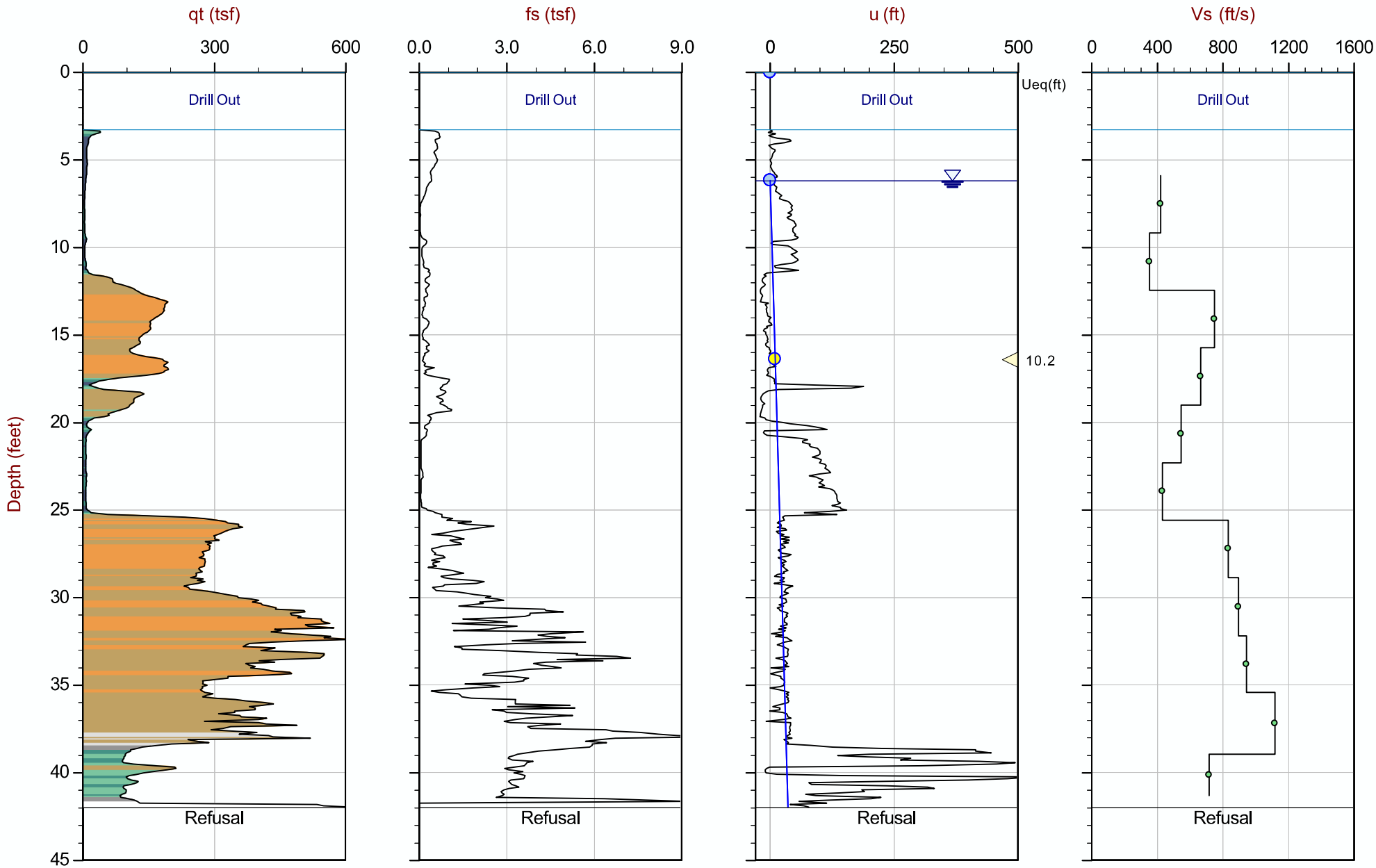
SCPTu Test Plots

CONETEC

Otto Rosenau & Associates

Job No: 24-59-27735
Date: 2024-05-28 08:54
Site: Prospective Fire Station, Monroe, WA

Sounding: CPT-01
Cone: 855:T1500F15U35



Max Depth: 12.800 m / 41.99 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 24-59-27735_SP01.COR
Unit Wt: SBTQtn (PKR2009)

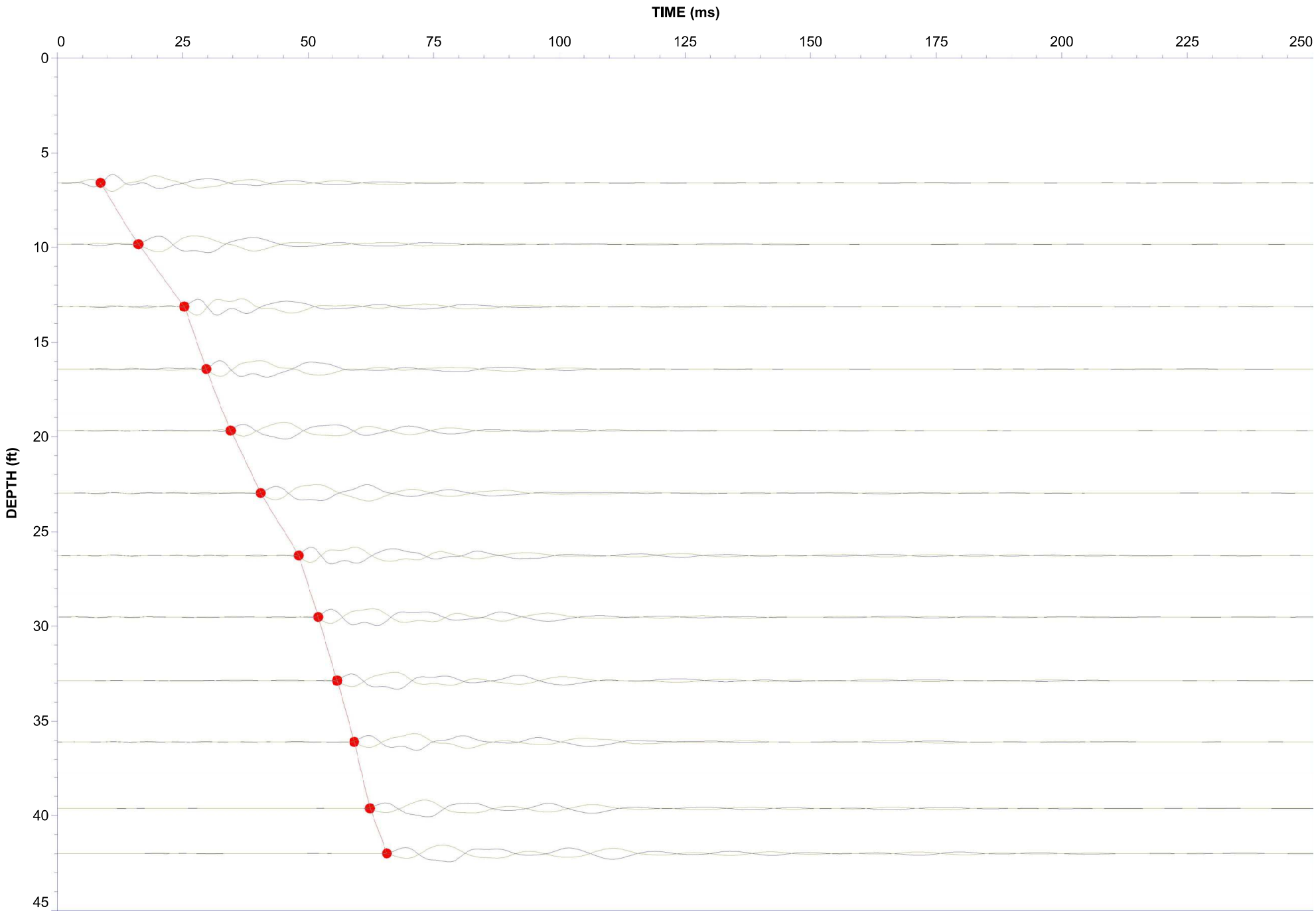
SBT: Robertson, 2009 and 2010
Coords: Lat: 47.86088 Long: -121.96446

Overplot Item: Ueq, Assumed Ueq, Dissipation, Ueq achieved, Dissipation, Ueq not achieved, Dissipation, Ueq assumed, Hydrostatic Line

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

SCPTu Velocity Wave Traces

Job No: 24-59-27735	Client: Otto Rosenau & Associates, Inc.	Project: Prospective Fire Station, Monroe, WA	Analysis: Shear Wave	Sounding: CPT-01
Filter: BP 0 - 200 Hz	Date: 2024-05-28	Cone: 855:T1500F15U35		



Supplementary Documents and Materials

Methodology Statements and Data File Formats

METHODOLOGY STATEMENTS

CONE PENETRATION TEST (CPTu) - eSeries

Cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd., a subsidiary of ConeTec.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and two geophone sensors for recording seismic signals. All signals are amplified and measured with minimum sixteen-bit resolution down hole within the cone body, and the signals are sent to the surface using a high bandwidth, error corrected digital interface through a shielded cable.

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

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

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

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

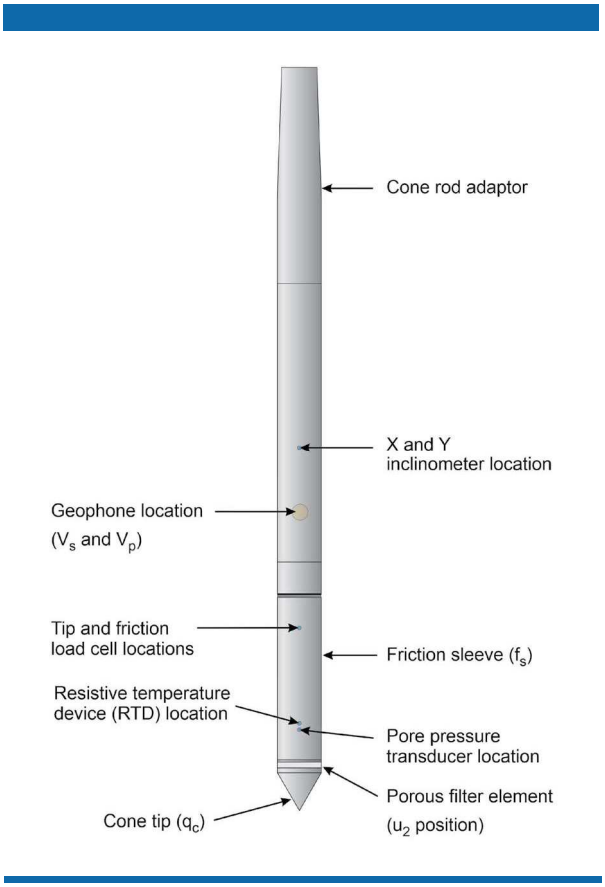


Figure CPTu. Piezocone Penetrometer (15 cm²)

The ConeTec data acquisition system consists of a Windows based computer, signal interface box, and power supply. The signal interface combines depth increment signals, seismic trigger signals and the downhole digital data. This combined data is then sent to the Windows based computer for collection and presentation. The data is recorded at fixed depth increments using a depth encoder that is either portable or integrated into the rig. The typical recording interval is 2.5 centimeters; custom recording intervals are possible.

The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

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

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

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

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

Additional information pertaining to ConeTec's cone penetration testing procedures:

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

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson, P.K., 2010. The Soil Behavior Type (SBT) classification chart developed by Robertson, P.K., 2010 is presented in Figure SBT. It should be noted that it is not always possible to accurately identify a soil behavior type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

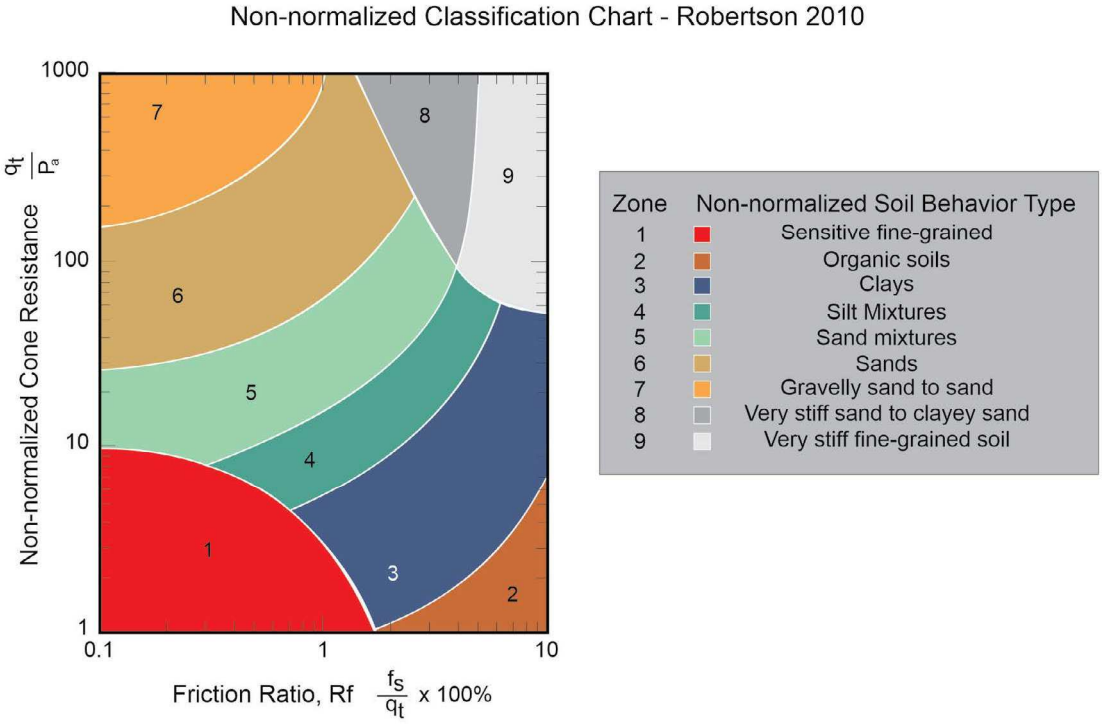


Figure SBT. Non-Normalized Soil Behavior Type Classification Chart (SBT)

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

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

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

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

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

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

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

REFERENCES

ASTM D5778-20, 2020, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D5778-20.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, "Cone Penetration Testing in Geotechnical Practice", Blackie Academic and Professional.

Mayne, P.W., 2013, "Evaluating yield stress of soils from laboratory consolidation and in-situ cone penetration tests", Sound Geotechnical Research to Practice (Holtz Volume) GSP 230, ASCE, Reston/VA: 406-420. DOI: 10.1061/9780784412770.027.

Mayne, P.W. and Peuchen, J., 2012, "Unit weight trends with cone resistance in soft to firm clays", Geotechnical and Geophysical Site Characterization 4, Vol. 1 (Proc. ISC-4, Pernambuco), CRC Press, London: 903-910.

Mayne, P.W., 2014, "Interpretation of geotechnical parameters from seismic piezocone tests", CPT'14 Keynote Address, Las Vegas, NV, May 2014.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, "Use of Piezometer Cone Data", Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., 2009, "Interpretation of cone penetration tests – a unified approach", Canadian Geotechnical Journal, Volume 46: 1337-1355. DOI: 10.1139/T09-065.

Robertson, P.K., 2010. Soil behavior type from the CPT: an update. 2nd International Symposium on Cone Penetration Testing, CPT'10, Huntington Beach, CA, USA

PORE PRESSURE DISSIPATION TEST

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

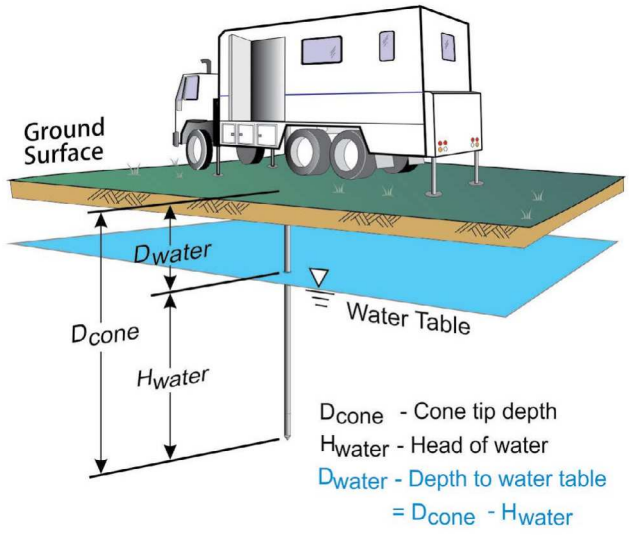


Figure PPD-1. Pore pressure dissipation test setup

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

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

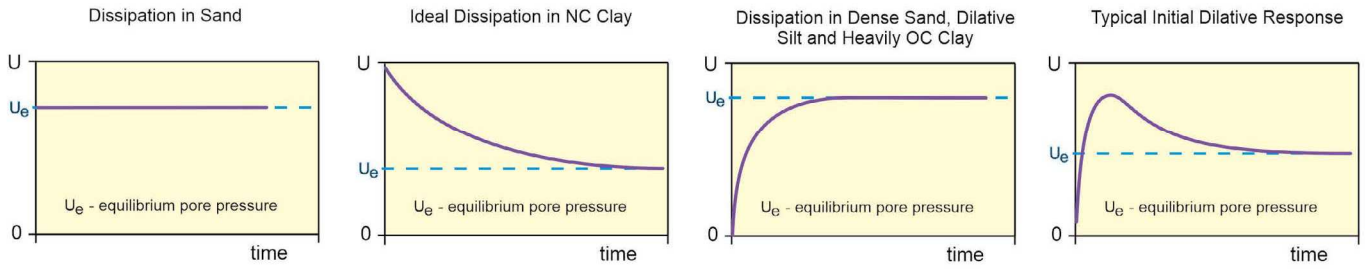


Figure PPD-2. Pore pressure dissipation curve examples

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

SEISMIC CONE PENETRATION TEST (SCPTu) - eSeries

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

ConeTec's piezocone penetrometers are manufactured with one horizontally active geophone (28 hertz) and one vertically active geophone (28 hertz). Both geophones are rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip. The vertically mounted geophone is more sensitive to compression waves.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances, an auger source or an imbedded impulsive source may be used for both shear waves and compression waves. The hammer and beam act as a contact trigger that initiates the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded in the memory of the cone using a fast analog to digital converter. The seismic trace is then transmitted digitally uphole to a Windows based computer through a signal interface box for recording and analysis. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

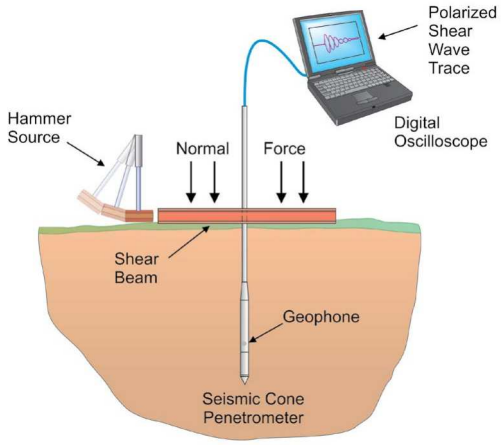


Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to ConeTec's SCPTu operating procedures which are in general accordance with the current ASTM D5778 and ASTM D7400 standards.

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

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

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

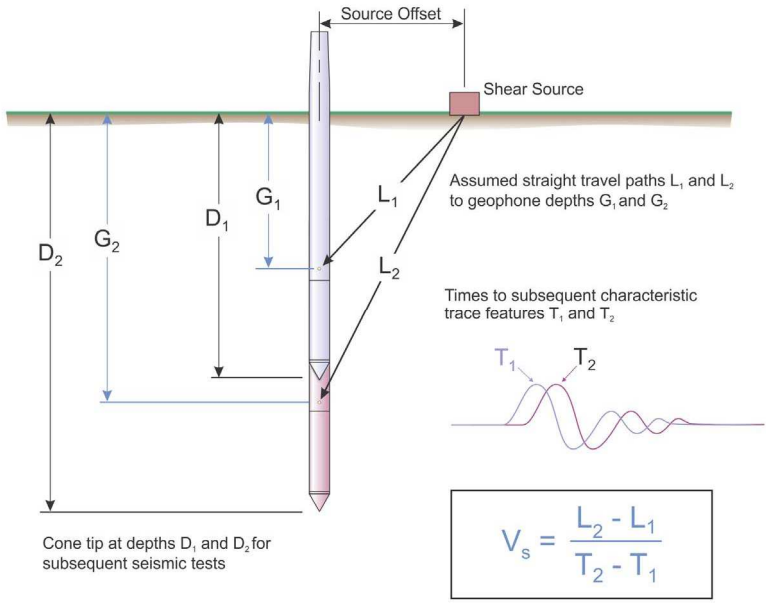


Figure SCPTu-2. Illustration of a seismic cone penetration test

For the determination of interval travel times the wave traces from all depths are displayed in analysis software. The results of the interval picks are supplied in the relevant appendix of this report. Standard practice for ConeTec is to record five wave traces for each source direction at each test depth. Outlier impacts are identified in the field and the impacts are repeated. For the final wave trace profile, the traces are stacked in the time domain to display a single average trace.

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

In some cases, usually for shear wave velocity testing, more than one characteristic marker may be used. If there is an overlap between different sets of characteristic markers, then the average time value for those sets of interval times is applied to the determination of velocity.

Ideally, all depths are used for the determination of the velocity profile. However, an interval may be skipped if there is some ambiguity or quality concern with a particular depth, resulting in a larger interval.

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

For all SCPTu soundings that have achieved a depth of at least 100 feet (30 meters), the average shear wave velocity to a depth of 100 feet ($\overline{v}_S$) has been calculated and provided for all applicable soundings using the following equation presented in ASCE (2010).

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

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

Average shear wave velocity, $\bar{v}_S$ is also referenced to V_{S100} or V_{S30}.

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

REFERENCES

American Society of Civil Engineers (ASCE), 2010, "Minimum Design Loads for Buildings and Other Structures", Standard ASCE/ SEI 7-10, American Society of Civil Engineers, ISBN 978-0-7844-1085-1, Reston, Virginia. DOI: 10.1061/9780784412916.

ASTM D5778-20, 2020, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D5778-20.

ASTM D7400/D7400M-19, 2019, "Standard Test Methods for Downhole Seismic Testing", ASTM International, West Conshohocken, PA. DOI: 10.1520/D7400_D7400M-19.

Robertson, P.K., Campanella, R.G., Gillespie D and Rice, A., 1986, "Seismic CPT to Measure In-Situ Shear Wave Velocity", Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8: 791-803. DOI: 10.1061/(ASCE)0733-9410(1986)112:8(791).

CPT Data Files (COR Extension)

ConeTec CPT data files are stored in ASCII text files that are readable by almost any text editor. ConeTec file names start with the job number (which includes the two digit year number) an underscore as a separating character, followed by two letters based on the type of test and the sounding ID. The last character position is reserved for an identifier letter (such as b, c, d etc) used to uniquely distinguish multiple soundings at the same location. The CPT sounding file has the extension COR. As an example, for job number 21-02-00001 the first CPT sounding will have file name 21-02-00001_CP01.COR

The sounding (COR) file consists of the following components:

1. Two lines of header information
2. Data records
3. End of data marker
4. Units information

Header Lines

Line 1: Columns 1-6 may be blank or may indicate the version number of the recording software
Columns 7-21 contain the sounding Date and Time (Date is MM:DD:YY)
Columns 23-38 contain the sounding Operator
Columns 51-100 contain extended Job Location information

Line 2: Columns 1-16 contain the Job Location
Columns 17-32 contain the Cone ID
Columns 33-47 contain the sounding number
Columns 51-100 may contain extended sounding ID information

Data Records

The data records contain 4 or more columns of data in floating point format. A comma and spaces separate each data item:

Column 1: Sounding Depth (meters)
Column 2: Tip (q_c), recorded in units selected by the operator
Column 3: Sleeve (f_s), recorded in units selected by the operator
Column 4: Dynamic pore pressure (u), recorded in units selected by the operator
Column 5: Empty or may contain other requested data such as Gamma, Resistivity or UVIF data

End of Data Marker

After the last line of data there is a line containing an ASCII 26 (CTL-Z) character (small rectangular shaped character) followed by a newline (carriage return / line feed). This is used to mark the end of data.

Units Information

The last section of the file contains information about the units that were selected for the sounding. A separator bar makes up the first line. The second line contains the type of units used for depth, q_c, f_s and u. The third line contains the conversion values required for ConeTec's software to convert the recorded data to an internal set of base units (bar for q_c, bar for f_s and meters for u). Additional lines intended for internal ConeTec use may appear following the conversion values.

CPT Data Files (XLS Extension)

Excel format files of ConeTec CPT data are also generated from corresponding COR files. The XLS files have the same base file name as the COR file with a -BSC suffix. The information in the file is presented in table format and contains additional information about the sounding such as coordinate information, and tip net area ratio.

The BSCI suffix is given to XLS files which are enhanced versions of the BSC files and include the same data records in addition to inclination data collected for each sounding.

CPT Dissipation Files (XLS Extension)

Pore pressure dissipation files are provided in Excel format and contain each dissipation trace that exceeds a minimum duration (selected during post-processing) formatted column wise within the spreadsheet. The first column (Column A) contains the time in seconds and the second column (Column B) contains the time in minutes. Subsequent columns contain the dissipation trace data. The columns extend to the longest trace of the data set.

Detailed header information is provided at the top of the worksheet. The test depth in meters and feet, the number of points in the trace and the particular units are all presented at the top of each trace column.

CPT Dissipation files have the same naming convention as the CPT sounding files with a "–PPD" suffix.

Data Records

Each file will contain dissipation traces that exceed a minimum duration (selected during post-processing) in a particular column. The dissipation pore pressure values are typically recorded at varying time intervals throughout the trace; rapidly to start and increasing as the duration of the test lengthens. The test depth in meters and feet, the number of points in the trace and the trace number are identified at the top of each trace column.

Cone Type Designations

Cone ID	Cone Description	Tip Cross Sect. Area (cm^2)	Tip Capacity (bar)	Sleeve Area (cm^2)**	Sleeve Capacity (bar)	Pore Pressure Capacity (bar)
EC###	A15T1500F15U35	15	1500	225	15	35
EC###	A15T375F10U35	15	375	225	10	35
EC###	A10T1000F10U35	10	1000	150	10	35

refers to the Cone ID number
**Outer Cylindrical Area

Description of Methods for Calculated CPT Geotechnical Parameters

CALCULATED CPT GEOTECHNICAL PARAMETERS

A Detailed Description of the Methods Used in ConeTec's CPT Geotechnical Parameter Calculation and Plotting Software

Revision SZW-Rev 18

Revised February 10, 2023
Prepared by Jim Greig, M.A.Sc, P.Eng (BC, AB, ON)

CONETEC

Limitations

The geotechnical parameter output was prepared specifically for the site and project named in the accompanying report subject to objectives, site conditions and criteria provided to ConeTec by the client. The output may not be relied upon by any other party or for any other site without the express written permission of ConeTec Group (ConeTec) or any of its affiliates. For this project, ConeTec has provided site investigation services, prepared factual data reporting and produced geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

To understand the calculations that have been performed and to be able to reproduce the calculated parameters the user is directed to the basic descriptions for the methods in this document and the detailed descriptions and their associated limitations and appropriateness in the technical references cited for each parameter.

ConeTec's Calculated CPT Geotechnical Parameters as of February 10, 2023.

ConeTec's CPT parameter calculation and plotting routine provides a tabular output of geotechnical parameters based on current published CPT correlations and is subject to change to reflect the current state of practice. Due to drainage conditions and the basic assumptions and limitations of the correlations, not all geotechnical parameters provided are considered applicable for all soil types. The results are presented only as a guide for geotechnical use and should be carefully examined for consideration in any geotechnical design. Reference to current literature is strongly recommended. ConeTec does not warranty the correctness or the applicability of any of the geotechnical parameters calculated by the program and does not assume liability for any use of the results in any design or review. For verification purposes we recommend that representative hand calculations be done for any parameter that is critical for design purposes. The end user of the parameter output should also be fully aware of the techniques and the limitations of any method used by the program. The purpose of this document is to inform the user as to which methods were used and to direct the end user to the appropriate technical papers and/or publications for further reference.

The geotechnical parameter output was prepared specifically for the site and project named in the accompanying report subject to objectives, site conditions and criteria provided to ConeTec by the client. The output may not be relied upon by any other party or for any other site without the express written permission of ConeTec Group (ConeTec) or any of its affiliates.

The CPT calculations are based on values of tip resistance, sleeve friction and pore pressures considered at each data point or averaged over a user specified layer thickness (e.g., 0.20 m). Note that q_t is the tip resistance corrected for pore pressure effects and q_c is the recorded tip resistance. The corrected tip resistance (corrected using u_2 pore pressure values) is used for all calculations. Since all ConeTec cones have equal end area friction sleeves pore pressure corrections to sleeve friction, f_s, are not performed.

Corrected tip resistance: $q_t = q_c + (1-a) \cdot u_2$ (consistent units are required)

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure from behind the tip (u_2 position)
a is the Net Area Ratio for the cone (typically 0.80 for ConeTec cones)

The total stress calculations are based on soil unit weight values that have been assigned to the Soil Behavior Type (SBT) zones, from a user defined unit weight profile, by using a single uniform value throughout the profile, through unit weight estimation techniques described in various technical papers or from a combination of these methods. The parameter output files indicate the method(s) used.

Effective vertical overburden stresses are calculated using the total stress and equilibrium pore pressure (u_{eq} or u_o) values derived from an assumed hydrostatic distribution of pore pressures below the water table or from a user defined equilibrium pore pressure profile (typically obtained from CPT dissipation tests) or a combination of the two. For over water projects the stress effects of the column of water above the mudline are taken into account as is the appropriate unit weight of water. How this is done depends on where the instruments are zeroed (i.e. on deck or at the mudline). The parameter output files indicate the method(s) used.

A majority of parameter calculations are derived from or driven by results based on material types as determined by the various soil behavior type charts depicted in Figures 1 through 6. The parameter output files indicate the method(s) used.

The Soil Behavior Type classification chart shown in Figure 1 is the classic non-normalized SBT Chart developed at the University of British Columbia and reported in Robertson, Campanella, Gillespie and Greig (1986). Figure 2 shows the original normalized (linear method) SBTn chart developed by Robertson (1990). The Bq classification charts

shown in Figures 3a and 3b incorporate pore pressures into the SBT classification and are based on the methods described in Robertson (1990). Many of these charts have been summarized in Lunne, Robertson and Powell (1997). The Jefferies and Davies SBT chart shown in Figure 3c is based on the techniques discussed in Jefferies and Davies (1993) which introduced the concept of the Soil Behavior Type Index parameter, I_c. Take note that the I_c parameter developed by Robertson and Fear (1995) and Robertson and Wride (1998) is similar in concept but uses a slightly different calculation method than that defined by Jefferies and Davies (1993) as the latter incorporates pore pressure in their technique through the use of the Bq parameter. The normalized Qtn SBT chart shown in Figure 4 is based on the work by Robertson (2009) utilizing a variable stress ratio exponent, n, for normalization based on a slightly modified redefinition and iterative approach for I_c. The boundary curves drawn on the chart are based on the work described in Robertson (2010).

Figure 5 shows a revised 1986 SBT Chart presented to CPT'10 by Robertson (2010b). It is known as the Updated non-normalized Soil Behavior Chart (also referred to as the Rev SBT Chart (PKR2010) in our output files). This chart was produced to be more in line with all post-1986 Robertson charts having the same 9 soil type zones, a $\log_{10}$ axis for friction ratio, R_f in this case, and a unitless tip resistance axis.

Figure 6 shows a revised behavior based chart by Robertson (2016) depicting contractive-dilative zones. As the zones represent material behavior rather than soil gradation ConeTec has chosen a set of zone colors that are less likely to be confused with material type colors from previous SBT charts. These colors differ from those used by Dr. Robertson. A green palette was selected for the dilative (desirable) side of the chart and a red palette for the contractive side of the chart.

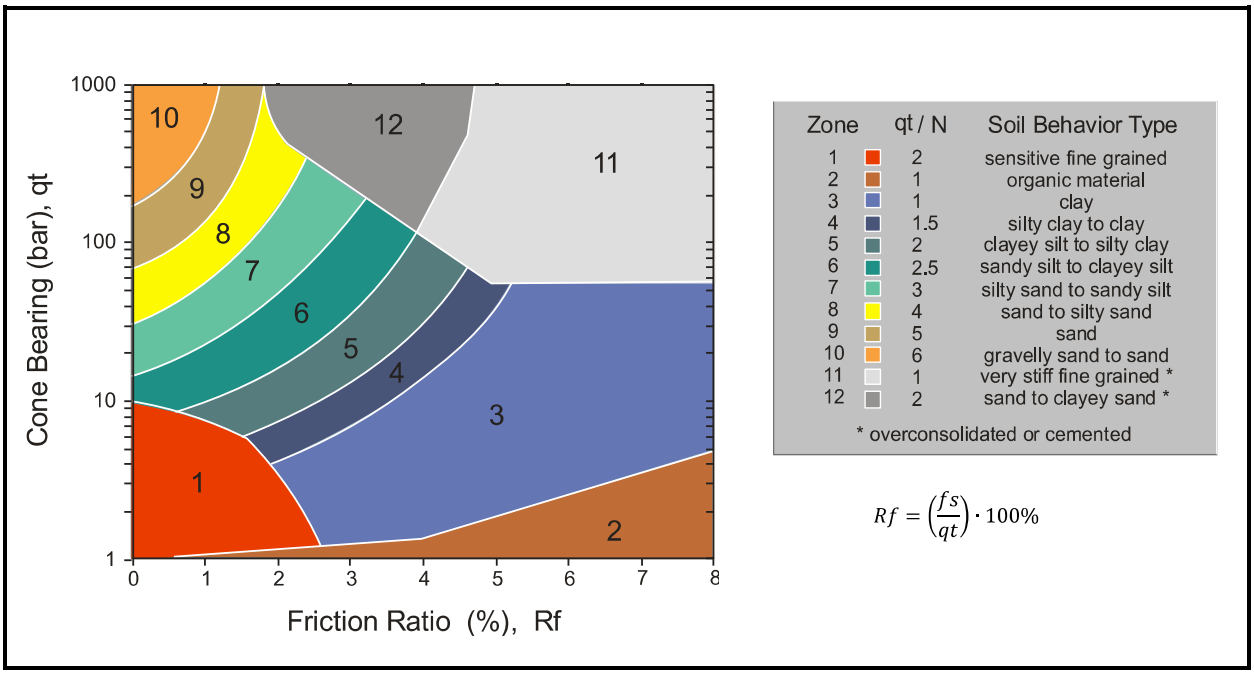


Figure 1. Non-normalized Soil Behavior Type Classification Chart (SBT)

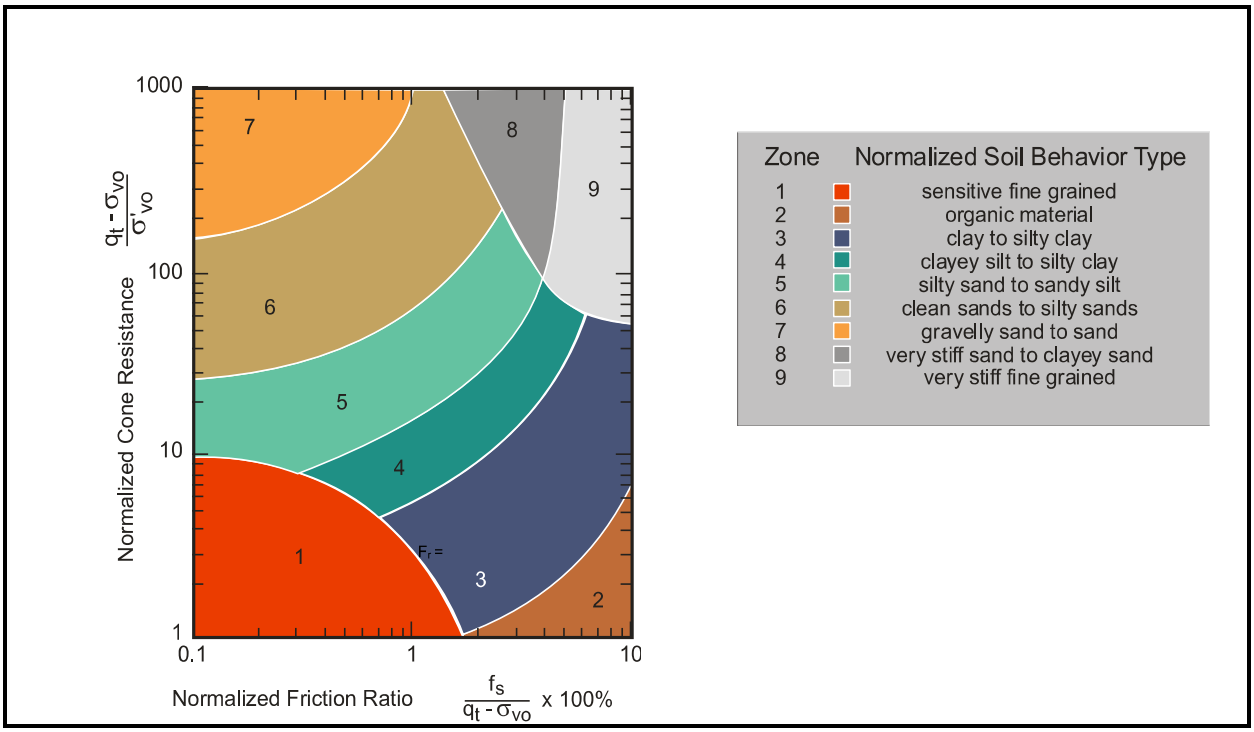


Figure 2. Normalized Soil Behavior Type Classification Chart (SBTn)

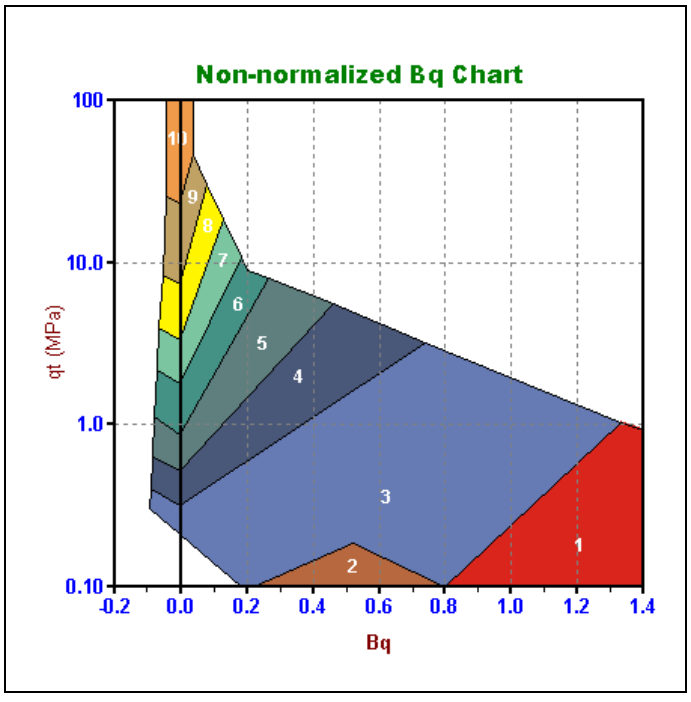


Figure 3a. Alternate Soil Behavior Type Chart (SBT Bq): q_t - B_q

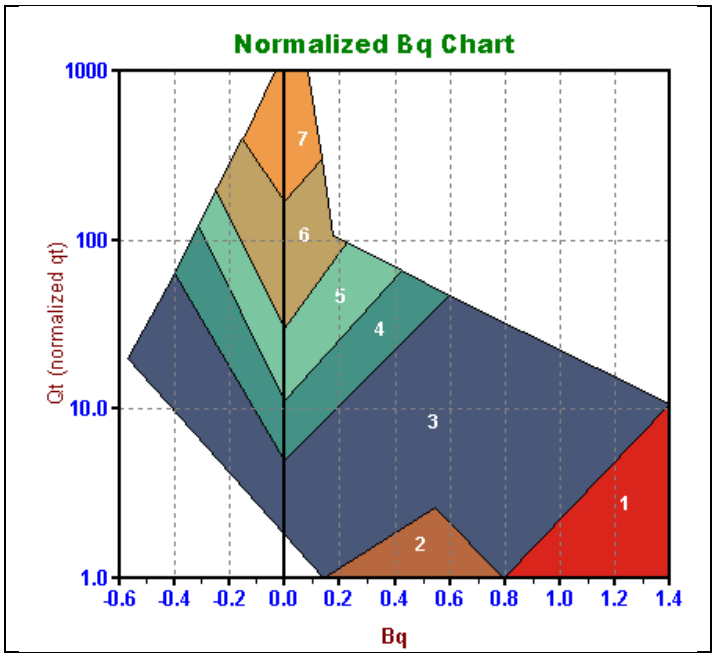


Figure 3b. Alternate Soil Behavior Type Charts (SBT Bqn): Q_t-B_q

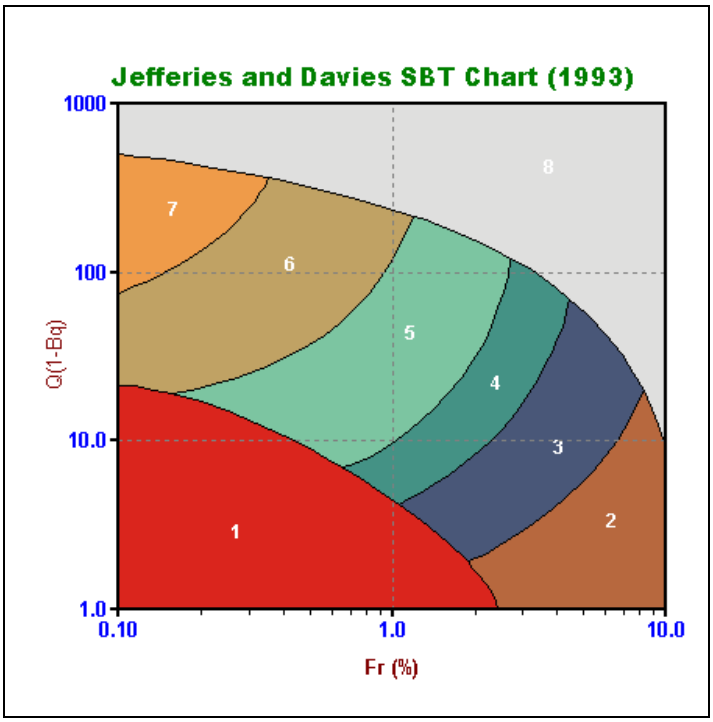


Figure 3c. Alternate Soil Behavior Type Charts: $Q(1-B_q)$ - F_r

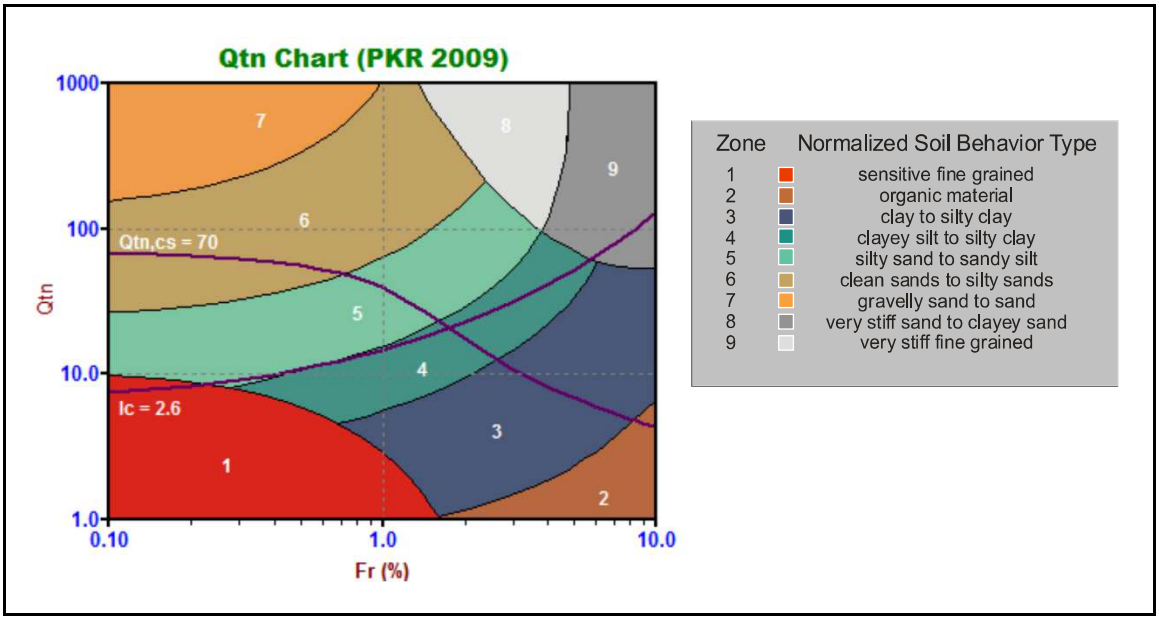


Figure 4. Normalized Soil Behavior Type Chart using Q_{tn} (SBT Qtn)

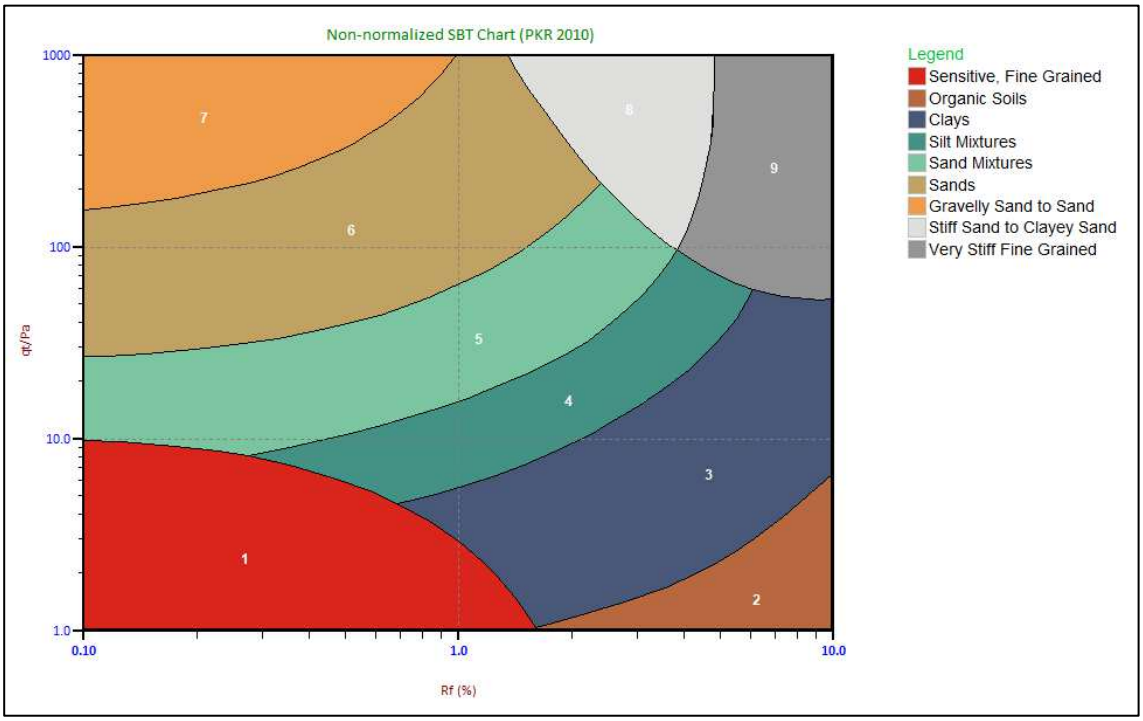


Figure 5. Non-normalized Soil Behavior Type Chart (2010)

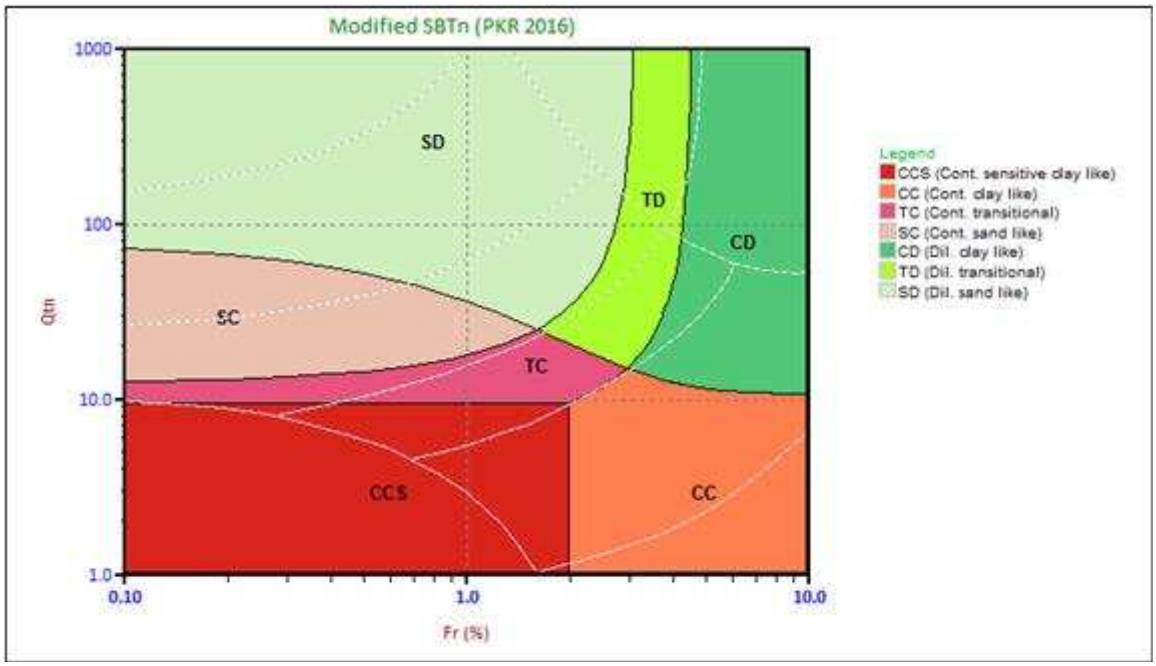


Figure 6. Modified SBTn Behavior Based Chart

Details regarding the geotechnical parameter calculations are provided in Tables 1a and 1b. The appropriate references cited are listed in Table 2. Non-liquefaction specific parameters are detailed in Table 1a and liquefaction specific parameters are detailed in Table 1b.

Where methods are based on charts or techniques that are too complex to describe in this summary, we recommend that the user refer to the cited material. Specific limitations for each method are described in the cited material.

Where the results of a calculation/correlation are deemed *'invalid'* the value will be represented by the text strings "-9999", "-9999.0", the value 0.0 (Zero) or an empty cell. Invalid results will occur because of (and not limited to) one or a combination of:

1. Invalid or undefined CPT data (e.g., drilled out section or data gap).

2. Where the calculation method is inappropriate, for example, drained parameters in a material behaving in an undrained manner (and vice versa).

3. Where input values are beyond the range of the referenced charts or specified limitations of the correlation method.

4. Where pre-requisite or intermediate parameter calculations are invalid.

The parameters selected for output from the program are often specific to a particular project. As such, not all of the calculated parameters listed in Tables 1and 1a may be included in the output files delivered with this report.

The output files are typically provided in Microsoft Excel XLS, XLSX or CSV format. The ConeTec software has several options for output depending on the number or types of calculated parameters desired or those specifically contracted for by the client. Each output file is named using the original file base name (from the .COR file) followed

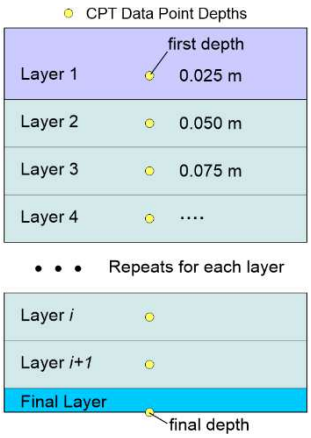
by a three or four character indicator of the output set selected (e.g. BSC, TBL, NLI, NL2, IFI, IFI2, IFI3) and possibly followed by an operator selected suffix identifying the characteristics of the particular calculation run.

Table 1a. CPT Parameter Calculation Methods – Non liquefaction Parameters

Reference Notes: CK* - Common Knowledge, U* - Unpublished

Calculated Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where calculations are done at each point then Mid Layer Depth = Recorded Depth)*	*[Depth (Layer Top) + Depth (Layer Bottom)]/ 2.0*	CK*
Elevation	Elevation of Mid Layer is based on the sounding collar elevation supplied by the client or through a site survey In Sweden a variation of elevation is used where the elevation increases with depth. We refer to this as inverse elevation.	Elevation = Collar Elevation – Depth InverseElevation = Collar Elevation + Depth	CK* N/A
Avg qc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when calculations are done at each point*	CK*
Avg qt	Averaged corrected tip (q_t) where: $q_t = q_c + (1-a)\cdot u_2$ Averaged q_t is not calculated using the average q_c and averaged u values. Averaged q_t is based on the average of the q_t values calculated at each data point.	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when calculations are done at each point*	1
Avg fs	Averaged sleeve friction (f_s) No pore pressure corrections are applied to f_s.	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when calculations are done at each point*	CK*
Avg Rf	Averaged friction ratio (R_f) where friction ratio is defined as: $R_f = 100\% \cdot \frac{fs}{q_t}$	$AvgRf = 100\% \cdot \frac{Avgfs}{Avgqt}$ *not an average of individual R_f values*	CK*
Avg u	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when calculations are done at each point*	CK*
Avg Res	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$AvgRes = \frac{1}{n}\sum_{i=1}^{n} Resistivity_i$ *n=1 when calculations are done at each point*	CK*
Avg UVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$AvgUVIF = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when calculations are done at each point*	CK*
Avg Temp	Averaged Temperature (this data is not always available)	$AvgTemp = \frac{1}{n}\sum_{i=1}^{n} Temperature_i$ *n=1 when calculations are done at each point*	CK*
Avg Gamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$AvgGamma = \frac{1}{n}\sum_{i=1}^{n} Gamma_i$ *n=1 when calculations are done at each point*	CK*
SBT	Soil Behavior Type as defined by Robertson et al 1986 (often referred to as Robertson and Campanella, 1986)	See Figure 1	1, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson 1990 (linear normalization using Q_t, now referred to as Q_{t1})	See Figure 2	2, 5

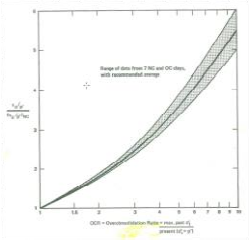
Calculated Parameter	Description	Equation	Ref
SBT-Bq	Non-normalized Soil Behavior type based on non-normalized tip resistance and the B_q parameter	See Figure 3a	1, 2, 5
SBT-Bqn	Normalized Soil Behavior type based on normalized tip resistance (Q_t, now called Q_{t1}) and the B_q parameter	See Figure 3b	2, 5
SBT-JandD	Soil Behavior Type as defined by Jeffries and Davies	See Figure 3c	7
SBT Qtn	Soil Behavior Type as defined by Robertson (2009) using a variable stress ratio exponent for normalization based on $I_{c\ (PKR\ 2009)}$	See Figure 4	15
Modified Non-normalized SBT Chart SBT (PKR2010)	This is a revised version of the simple 1986 non-normalized SBT chart (presented at CPT '10). The revised version has been reduced from 12 zones to 9 zones to be similar to the normalized Robertson charts. Other updates include a dimensionless tip resistance normalized to atmospheric pressure, q_t/P_a, on the vertical axis and a log scale for non-normalized friction ratio, R_f, along the horizontal axis.	See Figure 5	33
Modified SBTn (contractive /dilative)	Modified SBTn chart as defined by Robertson (2016) indicating zones of contractive/dilative behavior. Note that ConeTec displays the chart with colors different from Robertson. ConeTec's colors were chosen to avoid confusion with soil type descriptions.	See Figure 6	30
Unit Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) value assigned to each SBTn zone 4) value assigned to SBTn zone as determined from Robertson and Wride (1998) based on q_{c1n} 5) values assigned to SBT Qtn zones 6) values based on Robertson updated non-normalized Soil Behavior Type Chart (2010b) 6) Mayne f_s (sleeve friction) method 7) Robertson and Cabal 2010 method 8) user supplied unit weight profile The last option may co-exist with any of the other options.	See references	3, 5, 15, 21, 24, 29, 33

Calculated Parameter	Description	Equation	Ref
TStress σ_v	Total vertical overburden stress at Mid Layer Depth *A layer is defined as the averaging interval specified by the user where depths are reported at their respective mid-layer depth.* For data calculated at each point layers are defined using the recorded depth as the mid-point of the layer. Thus, a layer starts half-way between the previous depth and the current depth unless this is the first point in which case the layer start is at zero depth. The layer bottom is half-way from the current depth to the next depth unless it is the last data point. Defining layers affects how stresses are calculated since the unit weight attributed to a data point is used throughout the entire layer. This means that to calculate the stresses the total stress at the top and bottom of a layer are required. The stress at mid layer is determined by adding the incremental stress from the layer top to the mid-layer depth. The stress at the layer bottom becomes the stress at the top of the subsequent layer. Stresses are NOT calculated from mid-point to mid-point. For over-water work the total stress due to the column of water above the mid line is taken into account where appropriate.	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ *where* γ_i is layer unit weight h_i is layer thickness 	CK*
EStress σ_v'	Effective vertical overburden stress at mid-layer depth.	$\sigma_v' = \sigma_v - u_{eq}$	CK*
Equil u u_{eq} or u_0	Equilibrium pore pressures are determined from one of the following user selectable options: 1) hydrostatic below the water table 2) user supplied profile 3) combination of those above When a user supplied profile is used/provided a linear interpolation is performed between equilibrium pore pressures defined at specific depths. If the profile values start below the water table then a linear transition from zero pressure at the water table to the first defined pointed is used. Equilibrium pore pressures may come from dissipation tests, adjacent piezometers or other sources. Occasionally, an extra equilibrium point ("assumed value") will be provided in the profile that does not come from a recorded value to smooth out any abrupt changes or to deal with material interfaces. These "assumed" values will be indicated on our plots and in tabular summaries.	For the hydrostatic option: $u_{eq} = \gamma_w \cdot (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is the unit weight of water D is the current depth D_{wt} is the depth to the water table	CK*
K_0	Coefficient of earth pressure at rest, K_0.	$K_O = (1 - \sin\Phi') OCR^{\sin\Phi'}$	17
C_n	Overburden stress correction factor used for $(N_1)_{60}$ and older CPT parameters.	$C_n = (P_a/\sigma_v')^{0.5}$ where *0.0 < C_n < 2.0 (user adjustable, typically ranging from 1.7 to 2.0)* *P_a is atmospheric pressure (100 kPa)*	4, 12

Calculated Parameter	Description	Equation	Ref
C_q	Overburden stress normalizing factor.	$C_q = 1.8 / [0.8 + (\sigma_v'/P_a)]$ where *$0.0 < C_q < 2.0$ (user adjustable)* *P_a is atmospheric pressure (100 kPa)* *Robertson and Wride define C_q to be the same as C_n. The Olson definition above is used in the program.*	3, 12
N_{60}	SPT N value at 60% energy calculated from q_t/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	5
$(N_1)_{60}$	SPT N_{60} value corrected for overburden pressure.	*$(N_1)_{60} = C_n \bullet N_{60}$*	4
$N_{60}I_c$	SPT N_{60} values based on the I_c parameter, as defined by Robertson and Wride 1998 (3), or by Robertson 2009 (15).	$(q_t/P_a)/ N_{60} = 8.5 (1 – I_c/4.6)$ $(q_t/P_a)/ N_{60} = 10^{(1.1268 – 0.2817Ic)}$ P_a being atmospheric pressure	3, 5 15, 31
$(N_1)_{60}I_c$	SPT N_{60} value corrected for overburden pressure (using N_{60} I_c). User has 3 options.	*1) $(N_1)_{60}Ic = C_n \bullet (N_{60} I_c)$* 2) $q_{c1n}/ (N_1)_{60}I_c = 8.5 (1 – I_c/4.6)$ 3) $(Q_{tn})/ (N_1)_{60}I_c = 10^{(1.1268 – 0.2817Ic)}$	4 5 15, 31
S_u or S_u (N_{kt})	Undrained shear strength based on q_t S_u factor N_{kt} is user selectable.	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
S_u or S_u (N_{du}) or S_u ($N_{\Delta u}$)	Undrained shear strength based on pore pressure S_u factor $N_{\Delta u}$ is user selectable.	$Su = \frac{u_2 - u_{eq}}{N_{\Delta u}}$	1, 5
D_r	Relative Density determined from one of the following user selectable options: 1) Ticino Sand 2) Hokksund Sand 3) Schmertmann (1978) 4) Jamiolkowski (1985) - All Sands 5) Jamiolkowski et al (2003) (various compressibilities, K_o)	See reference (methods 1 through 4) Jamiolkowski et al (2003) reference	5 14
PHI ϕ	Friction Angle determined from one of the following user selectable options (methods 1 through 4 are for sands and method 5 is for silts and clays): 1) Campanella and Robertson 2) Durgunoglu and Mitchel 3) Janbu 4) Kulhawy and Mayne 5) NTH method (clays and silts)	See appropriate reference	5 5 5 11 23
Delta U/q_t $\Delta u/q_t$ du/q_t	Differential pore pressure ratio (older parameter used before B_q was established)	$= \frac{\Delta u}{qt}$ *where: $\Delta u = u - u_{eq}$* *and u = dynamic pore pressure* *u_{eq} = equilibrium pore pressure*	39

Calculated Parameter	Description	Equation	Ref
B_q	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ where: $\Delta u = u - u_{eq}$ *and u = dynamic pore pressure* *u_{eq} = equilibrium pore pressure*	1, 2, 5
Net q_t or qtNet	Net tip resistance (used in many subsequent correlations)	$qt - \sigma_v$	36
q_e or qE or q_E	Effective tip resistance (using the dynamic pore pressure u_2 and not equilibrium pore pressure)	$q_t - u_2$	36
qeNorm	Normalized effective tip resistance	$\frac{qt - u_2}{\sigma_v'}$	36
Q_t or Norm: Qt or Q_{t1}	Normalized q_t for Soil Behavior Type classification as defined by Robertson (1990) using a linear stress normalization. Note this is different from Q_{tn}. This parameter was renamed to Q_{t1} in Robertson, 2009. Without normalization limits this parameter calculates to very high unrealistic values at low stresses.	$Qt = \frac{qt - \sigma_v}{\sigma_v'}$	2, 5, 15
F_r or Norm: Fr	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson (1990)	$Fr = 100\% \cdot \frac{fs}{qt - \sigma_v}$	2, 5
Q(1-B_q) Q(1-B_q) + 1	Q(1-B_q) grouping as suggested by Jefferies and Davies for their classification chart and the establishment of their I_c parameter. Later papers added the +1 term to the equation.	$Q \cdot (1 - Bq)$ $Q \cdot (1 - Bq) + 1$ *where Bq is defined as above and Q is the same as the normalized tip resistance, Q_{t1}, defined above*	6, 7, 34
q_{c1}	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method has stress units)	$q_{c1} = q_t \cdot (Pa/\sigma_v')^{0.5}$ where: P_a = atmospheric pressure	21
q_{c1} (0.5)	Normalized tip resistance, q_{c1}, using a fixed stress ratio exponent, n (this method is unit-less)	$q_{c1}(0.5) = (q_t/P_a) \cdot (Pa/\sigma_v')^{0.5}$ where: P_a = atmospheric pressure	5
q_{c1} (C_n)	Normalized tip resistance, q_{c1}, based on C_n (this method has stress units)	$q_{c1}(Cn) = C_n * q_t$	5, 12
q_{c1} (C_q)	Normalized tip resistance, q_{c1}, based on C_q (this method has stress units)	$q_{c1}(Cq) = C_q * q_t$ (some papers use q_c)	5, 12
q_{c1n}	normalized tip resistance, q_{c1n}, using a variable stress ratio exponent, n (where n=0.0, 0.70, or 1.0) (this method is unit-less)	$q_{c1n} = (q_t / P_a)(P_a/\sigma_v')^n$ where: P_a = atm. Pressure and n varies as described below	3

Calculated Parameter	Description	Equation	Ref
I_c or Ic (RW1998)	Soil Behavior Type Index as defined by Robertson and Wride (1997, 1998) for estimating grain size characteristics and providing smooth gradational changes across the SBTn chart. Ic(RW1998) is different from that of Jefferies and Davies (7) and is different from Ic(PKR2009).	$I_c = [(3.47 - \log_{10}Q)^2 + (\log_{10} Fr + 1.22)^2]^{0.5}$ *Where:* $Q = \left(\frac{qt - \sigma_v}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *Or* $Q = q_{c1n} = \left(\frac{qt}{P_a}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *depending on the iteration in determining I_c* *And* *Fr is in percent* *P_a = atmospheric pressure* *n has the following distinct values:* *0.5, 0.75 and 1.0* *and is determined in an iterative manner based on the resulting I_c in each iteration* *Note that NCEER replaced 0.75 with 0.70*	3, 4, 5 10
I_c (PKR 2009)	Soil Behavior Type Index, I_c (PKR 2009) is based on a variable stress ratio exponent n, which itself is based on I_c (PKR 2009). An iterative calculation is required to determine I_c (PKR 2009) and its corresponding n (PKR 2009).	*I_c (PKR 2009) =* *$[(3.47 - \log_{10}Q_{tn})^2 + (1.22 + \log_{10}F_r)^2]^{0.5}$*	15
n (PKR 2009)	Stress ratio exponent n, based on I_c (PKR 2009). An iterative calculation is required to determine n (PKR 2009) and its corresponding I_c (PKR 2009).	*n (PKR 2009) = 0.381 (I_c) + 0.05 (σ_v'/P_a) – 0.15*	15
Q_{tn} (PKR 2009)	Normalized tip resistance using a variable stress ratio exponent based on I_c (PKR 2009) and n (PKR 2009). An iterative calculation is required to determine Q_{tn} (PKR 2009).	*$Q_{tn} = [(qt - \sigma_v)/P_a](P_a/\sigma_v')^n$* *where P_a = atmospheric pressure (100 kPa)* *n = stress ratio exponent described above*	15
FC	Apparent fines content (%)	*FC=1.75($Ic^{3.25}$) - 3.7* *FC=100 for $I_c > 3.5$* *FC=0 for $I_c < 1.26$* *FC = 5% if 1.64 < I_c < 2.6 AND F_r<0.5*	3
I_c Zone	This parameter is the Soil Behavior Type zone based on the I_c parameter (valid for zones 2 through 7 on SBTn or SBT Qtn charts)	$I_c < 1.31$ Zone = 7 $1.31 < I_c < 2.05$ Zone = 6 $2.05 < I_c < 2.60$ Zone = 5 $2.60 < I_c < 2.95$ Zone = 4 $2.95 < I_c < 3.60$ Zone = 3 $I_c > 3.60$ Zone = 2	3
CD	The contractive / dilative boundary on Robertson's Modified SBTn (contractive/dilative) Chart shown in Figure 6 above. The boundary is marked as CD = 70 on the chart in the relevant paper. Similar to the $Q_{tn,cs}$ = 70 line in Figure 4.	$CD = 70 = (Q_{tn} - 11)(1 + 0.06F_r)^{17}$ lower bound of CD = 60: $CD = 60 = (Q_{tn} - 9.5)(1 + 0.06F_r)^{17}$	30

Calculated Parameter	Description	Equation	Ref
I_B	Hyberbolic fit defining the boundary between SBT soil types proposed by Schneider as a better fit than the I_c circles. I_B = 32 represents the boundary for most sand like soils. I_B = 22 represents the upper boundary for most clay like soils. The region between I_B=22 and I_B=32 is the "transitional soil" zone.	$I_B = 100\ (Q_{tn} + 10) / (70 + Q_{tn} F_r)$	30
State Param or State Parameter or ψ	The state parameter index, ψ, is defined as the difference between the current void ratio, e, and the critical void ratio, e_c. Positive ψ - contractive soil Negative ψ - dilative soil This is based on the work by Been and Jefferies (1985) and Plewes, Davies and Jefferies (1992) This method uses mean normal stresses based on a uniform value of K_0 or a calculated K_0 using methods described elsewhere in this document	See reference	6, 8
Yield Stress σ_p'	Yield stress is calculated using the following methods 1) General method 2) 1st order approximation using q_tNet (clays) 3) 1st order approximation using Δu_2 (clays) 4) 1st order approximation using q_e (clays) 5) Based on Vs	All stresses in kPa 1) $\sigma_p' = 0.33 \cdot (q_t - \sigma_v)^{m'} (\sigma_{atm}/100)^{1-m'}$ where $m' = 1 - \frac{0.28}{1 + (I_c / 2.65)^{25}}$ 2) $\sigma_p' = 0.33 \cdot (q_t - \sigma_v)$ 3) $\sigma_p' = 0.54 \cdot (\Delta u_2)$ $\Delta u_2 = u_2 - u_0$ 4) $\sigma_p' = 0.60 \cdot (q_t - u_2)$ 5) $\sigma_p' = (Vs/4.59)^{1.47}$	19 20 20 20 18
OCR OCR(JS1978) YSR(Mayne2014) YSR (qtNet) YSR (deltaU) YSR (qe) YSR (Vs) OCR (PKR2015)	Over Consolidation Ratio based on 1) Schmertmann (1978) method involving a plot plot of S_u/σ_v' /($S_u/\sigma_v')_{NC}$ and OCR  2) based on Yield stresses described above 3) approximate version based on qtNet 4) approximate version based on Δu 5) approximate version based on effective tip, q_e 6) approximate version based on shear wave velocity, V_s and σ_v' 7) based on Qt	1) requires a user defined value for NC S_u/P_c' ratio 2 through 5) *based on yield stresses* 6) YSR (Vs) = $\sigma_p'(Vs) / \sigma_v'$ 7) OCR = $0.25 \cdot (Qt)^{1.25}$	9 19 20 20 20 18 32
Es/qt	Intermediate parameter for calculating Young's Modulus, E, in sands. It is the Y axis of the reference chart. Note that Figured 5.59 from reference 5, Lunne, Robertson and Powell, (LRP) has an error. The X axis values are too high by a factor of 10. The plot is based on Baldi's (not Bellotti as cited in	Based on Figure 5.59 in the reference	5, 37

Calculated Parameter	Description	Equation	Ref
	LRP) original Figure 3 where the X axis is: $\frac{q_c}{\sqrt{\sigma'_v}}$ (both in kPa) with a range of 200 to 3000. Figure 5.59 from LRP shows a dimensionless form of the equation, q_{c1}, displaying the same range of values. Figure 5.59's X axis uses $q_{c1} = \left(\frac{q_c}{P_a}\right)\left(\frac{P_a}{\sigma'_v}\right)^{0.5}$ The two expressions are not the same: they differ by a factor of $\frac{\sqrt{P_a}}{P_a}$. With P_a taken to be 100 kPa the factor is 1/10. Substituting typical values of 200 bar (20000 kPa) for q_c and 225 kPa for σ_v' one gets: 20000 / 15 = 1333.33 for Bellotti's axis and $(200/1)(100/225)^{0.5}$ = 200 * (10/15) = 133.3 for LRP's axis (noting that P_a = 1 bar) showing a factor of 10 difference.		
Es or E_s Young's Modulus E	Young's Modulus based on the work done in Italy. There are three types of sands considered in this technique. The user selects the appropriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in the E_s/q_t chart. E_s is evaluated for an axial strain of 0.1%.	Mean normal stress is evaluated from: $\sigma'_m = \frac{1}{3}(\sigma'_v + \sigma'_h + \sigma'_h)$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress *and* $\sigma_h = K_o \cdot \sigma_v'$ with K_o assumed to be 0.5	5
Delta U/TStress $\Delta u / \sigma_v$	Differential pore pressure ratio with respect to total stress	$= \frac{\Delta u}{\sigma_v}$ *where:* $\Delta u = u - u_{eq}$	39
Delta U/EStress, P Value, Excess Pore Pressure Ratio $\Delta u/\sigma_v'$	Differential pore pressure ratio with respect to effective stress. Key parameter (P, Normalized Pore Pressure Parameter, Excess Pore Pressure Ratio) in the Winckler et. al. static liquefaction method.	$= \frac{\Delta u}{\sigma'_v}$ *where:* $\Delta u = u - u_{eq}$	25, 25a
Su/EStress S_u/σ_v'	Undrained shear strength ratio with respect to vertical effective overburden stress using the S_u (N_{kt}) method	= *Su* (N_{kt}) / σ_v'	9, 23
Vs or V_s	Recorded shear wave velocities (not estimated). The shear wave velocities are typically collected over 1 m depth intervals. Each data point over the relevant depth range is assigned the same V_s value.	recorded data	27
Vp or V_p	Recorded compression wave (or P wave) velocities (not estimated). The P wave velocities are typically collected over 1 m depth intervals. Each data point over the relevant depth range is assigned the same V_p value.	recorded data	27

Calculated Parameter	Description	Equation	Ref
V_{s30} V_{s100}	The average shear wave velocity of the near surface materials to a depth of 30 m (100 ft). It is based on the sum of all travel times through all layers in the top 30m (100 ft). V_{s100} is the same calculation as V_{s30} except down to a depth of 100 feet.	$V_{s30} = \frac{total\ thickness\ of\ all\ layers\ to\ 30\ m}{\Sigma\left(\frac{layer\ thickness}{layer\ shear\ wave\ velocity}\right)}$ $V_{s30} = \frac{total\ thickness\ of\ all\ layers\ to\ 30\ m}{\Sigma\ (layer\ travel\ times)}$	38
G_{max}	G_{max} determined from SCPT shear wave velocities (not estimated values). Note that seismic data (V_s) is collected over set depth intervals (typically 1 meter). Each data point over the test segment is assigned the same V_s value. Since soil density changes with depth, slightly different G_{max} values may be calculated over the test depth interval.	$G_{max} = \rho V_s^2$ where ρ is the mass density of the soil determined from the estimated unit weights at each test depth	27
qtNet/G_{max}	Net tip resistance ratio with respect to the small strain modulus G_{max} determined from SCPT shear wave velocities (not estimated values)	$= (qt - \sigma_v) / G_{max}$ where $G_{max} = \rho V_s^2$ and ρ is the mass density of the soil determined from the estimated unit weights at each test depth	15, 28, 30
qUlt	A site specific and client specific parameter for estimating the limiting stress for "crane walk" accessibility	$q_{ult} = CraneWalkFactor \cdot S_u$ Where: *CraneWalkFactor* is client provided	U*
Estimated G_o	Estimated value for small strain shear modulus	$G_o = 0.0188[10^{(0.55Ic + 1,68)}](q_t - \sigma_v)$	15
Estimated E_{25}	Estimated value for Young's Modulus, E, at a 25% working load	$E_{25} = \alpha_E$ (qtNet) where $\alpha_E = 0.015[10^{(0.55Ic + 1,68)}]$	15
k_{SBT}	Estimated soil permeability derived from Soil Behavior Type (SBT) Chart I_c values.	For $1.0 < I_c \leq 3.27$: $k = 10^{(0.952 - 3.04Ic)}$ in m/s For $3.27 < Ic < 4.0$: $k = 10^{(-4.52 - 1.37Ic)}$ in m/s	35
M or D' Constrained Modulus	Constrained Modulus based on 1) Robertson, M 2) Mayne, D'	1) Robertson $M = \alpha_M (q_t - \sigma_v)$ $I_c > 2.2$ (fine grained) $\alpha_M = Qt$ when $Qt < 14$ $\alpha_M = 14$ when $Qt > 14$ $Ic < 2.2$ (coarse grained) $\alpha_M = 0.0188\ [10^{(0.55Ic + 1.68)}]$ $D' = \alpha_D (qt - \sigma_v)$ where $\alpha_D = 5$	32 23

Table 1b. CPT Parameter Calculation Methods – Liquefaction Parameters

Calculated Parameter	Description	Equation	Ref
K_{SPT} or K_s	Equivalent clean sand factor for $(N_1)60$	$K_{SPT} = 1 + ((0.75/30) \bullet (FC - 5))$	10
K_{CPT} or K_c (RW1998)	Equivalent clean sand correction for q_{c1N}	$K_{cpt} = 1.0$ for $I_c \leq 1.64$ $K_{cpt} = f(I_c)$ for $I_c > 1.64$ (see reference) $K_c = -0.403\ I_c^4 + 5.581\ I_c^3 - 21.63 I_c^2 + 33.75\ I_c - 17.88$	3, 10
K_c (PKR 2010)	Clean sand equivalent factor to be applied to Q_{tn}	$K_c = 1.0$ for $I_c \leq 1.64$ $K_c = -0.403\ I_c^4 + 5.581\ I_c^3 - 21.63 I_c^2 + 33.75\ I_c - 17.88$ for $I_c > 1.64$	16
$(N_1)_{60cs}I_C$	Clean sand equivalent SPT $(N_1)_{60}I_c$. User has 3 options.	1) $(N_1)_{60cs}Ic = \alpha + \beta((N_1)_{60}I_c)$ 2) $(N_1)_{60cs}Ic = K_{SPT} * ((N_1)_{60}I_c)$ 3) $(q_{c1ncs})/(N_1)_{60cs}I_c = 8.5\ (1 - I_c/4.6)$ FC ≤ 5%: $\alpha = 0,\ \beta = 1.0$ FC ≥ 35% $\alpha = 5.0,\ \beta = 1.2$ 5% < FC < 35% $\alpha = exp[1.76 - (190/FC^2)]$ $\beta = [0.99 + (FC^{1.5}/1000)]$	10 10 5
q_{c1ncs}	Clean sand equivalent q_{c1n}	$q_{c1ncs} = q_{c1n} \bullet K_{cpt}$	3
$Q_{tn,cs}$ (PKR 2010)	Clean sand equivalent for Q_{tn} described above - Q_{tn} being the normalized tip resistance based on a variable stress exponent as defined by Robertson (2009)	$Q_{tn,cs} = Q_{tn} \cdot K_c$ (PKR 2016)	16
Su(Liq)/ESv or $S_u(Liq)/\sigma_v'$	Liquefied shear strength ratio as defined by Olson and Stark	$\frac{S_u(Liq)}{\sigma_v'} = 0.03 + 0.0143(q_{c1})$ Note: σ_v' and s_v' are synonymous	13
Su(Liq)/ESv or $S_u(Liq)/\sigma_v'$ (PKR 2010)	Liquefied shear strength ratio as defined by Robertson (2010)	$\frac{S_u(Liq)}{\sigma_v'}$ Based on a function involving $Q_{tn,cs}$	16
S_u (Liq) (PKR 2010)	Liquefied shear strength derived from the liquefied shear strength ratio and effective overburden stress	$S_u(Liq) = \sigma_v' \cdot \left(\frac{S_u(Liq)}{\sigma_v'}\right)$	16
Cont/Dilat Tip	Contractive / Dilative q_{c1} Boundary based on $(N_1)_{60}$	$(\sigma_v')_{boundary} = 9.58 \times 10^{-4}\ [(N_1)_{60}]^{4.79}$ q_{c1} is calculated from specified q_t(MPa)/N ratio	13
CRR	Cyclic Resistance Ratio (for Magnitude 7.5)	$q_{c1ncs} < 50$: $CRR_{7.5} = 0.833\ [q_{c1ncs}/1000] + 0.05$ $50 \leq q_{c1ncs} < 160$: $CRR_{7.5} = 93\ [q_{c1ncs}/1000]^3 + 0.08$	10
Kg or K_g	Small strain Stiffness Ratio Factor, K_g	$[G_{max}/q_t]/[q_{c1n}{}^{-m}]$ m = empirical exponent, typically 0.75	26

Calculated Parameter	Description	Equation	Ref
K_g*	Revised K_g factor extended to fine grained soils (Robertson).	$K_g^* = (G_o / q_n)(Q_{tn})^{0.75}$ where q_n is the net tip resistance = $q_t - \sigma_v$	30
SP Distance	State Parameter Distance, Winckler static liquefaction method	Perpendicular distance on Q_{tn} chart from plotted point to state parameter Ψ = -0.05 curve	25
URS NP Fr	Normalized friction ratio point on Ψ = -0.05 curve used in SP distance calculation		25
URS NP Q_{tn}	Normalized tip resistance (Q_{tn}) point on Ψ = -0.05 curve used in SP Distance calculation		25

Table 2. References

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No.	Reference
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Piezocone Calibration Sheets

Adara Systems Ltd.
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CERTIFICATE OF CALIBRATION

Calibration Information			
Cone Serial Number	EC855	Model	A15 T1500 F15 U35
Date	2024-02-08		
Technician Performing Calibration	Richard Chen	Signature	
Calibration Approved By	Vishrut Khunt	Signature	

Lab Condition	As Found	As Left		
Lab Temperature	N/A	23˚C		
Lab Humidity	N/A	29%	Reason for Calibration	Repair

Cone Information				
Tip Stress Limit	1500	bar	Tip End Area	15 cm²
Friction Stress Limit	15	bar	Friction Surface Area	225 cm²
Pressure Limit	35	bar	RTD Location	Pressure Carrier
X-Inclinometer Limit	30	degrees	Geophone	X and Z
Y-Inclinometer Limit	30	degrees	Temperature Range	-20°C to 60°C

Baseline Summary: (For Reference Only)

Channel	Units	As Found	As Left
Tip	bar	-0.001	0.503
Sleeve	bar	0.000	-0.012
Pressure	bar	0.037	1.012
X-Inclinometer	degrees	-0.675	0.000
Y-Inclinometer	degrees	1.925	0.000
Temperature	˚C	24.574	22.279

Classified in accordance with ISO 22476-1:2012 Class 1
Classified in accordance with ISO 22476-1:2012 Class 2

Calibrated in general accordance with the ASTM D5778-20 and D7400-08 standards

Calibrated with Adara calibration procedure EC_CPTCAL-2.2

Collective uncertainty of the measurement standards conforms to a test uncertainty ratio (TUR) of 3:1 for tip and sleeve measurement and 4:1 for pressure measurement with a confidence level k=2

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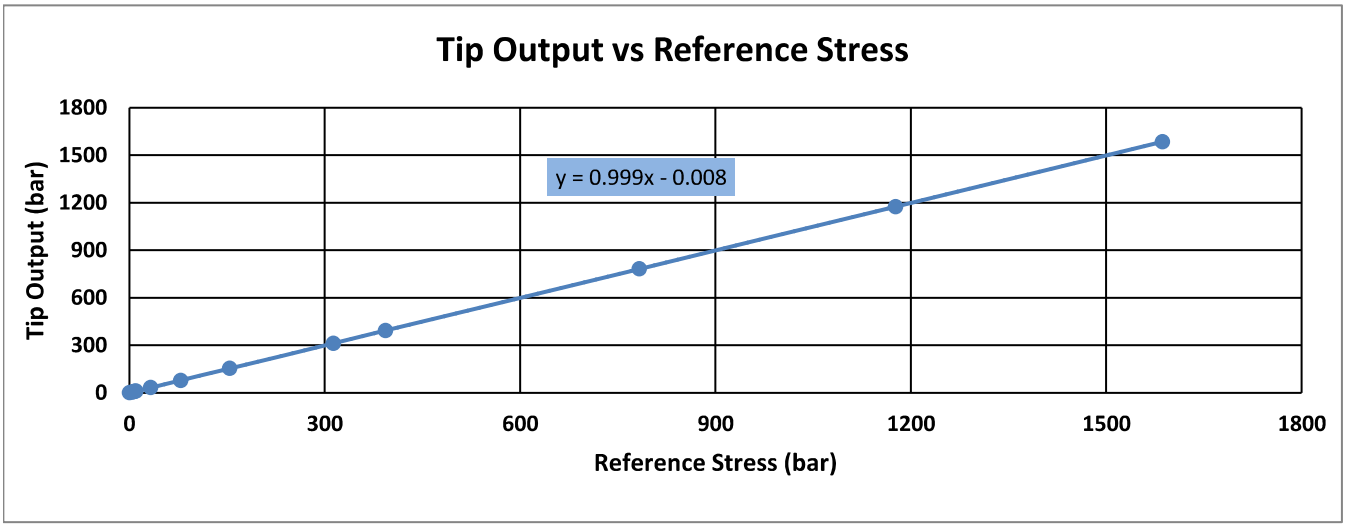
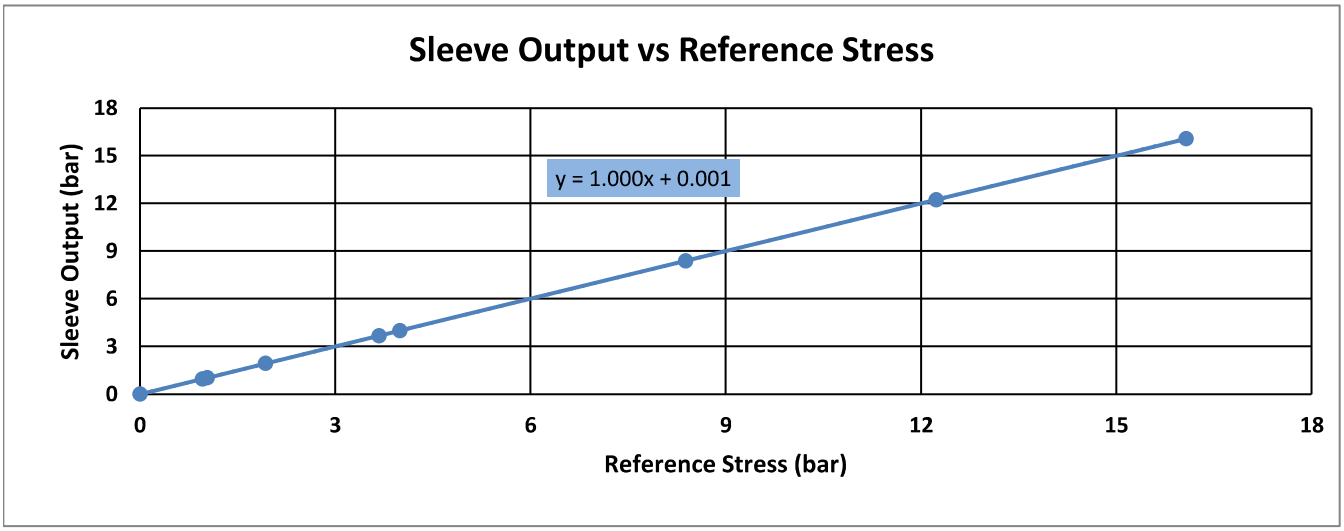
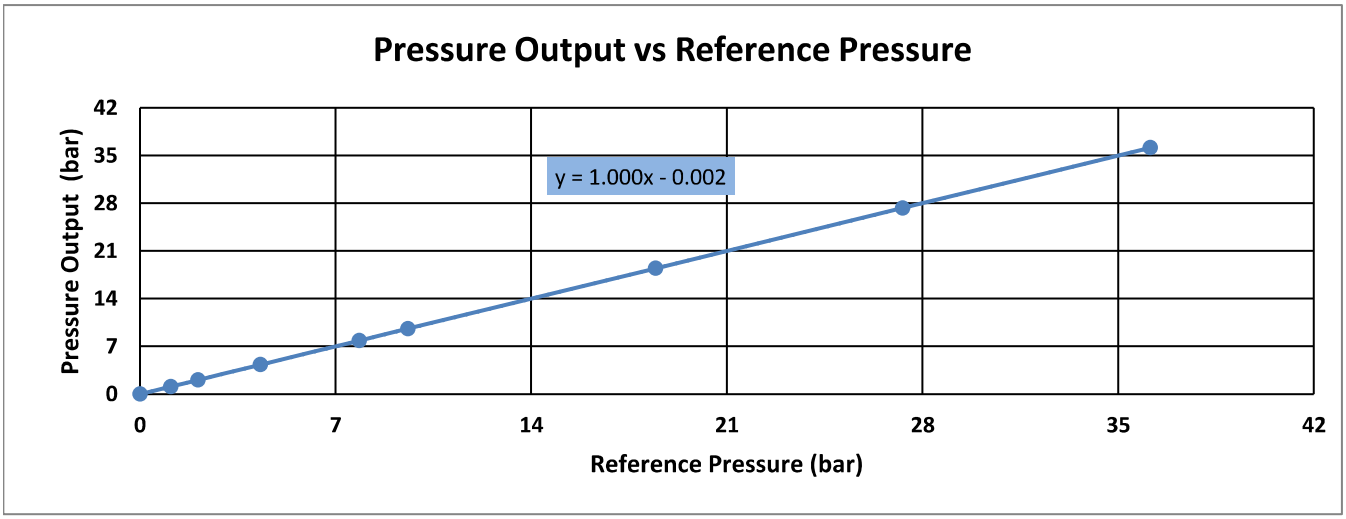
Cone Output vs Reference Stress/Pressure Plots







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Calibration Results

Tip Calibration					
	As Found			As Left	
Max. Non Linearity	N/A	N/A	Max. Non Linearity	0.08%	PASS
Calibration Error	N/A	N/A	Calibration Error	0.10%	PASS

Sleeve Calibration					
	As Found			As Left	
Max. Non Linearity	N/A	N/A	Max. Non Linearity	0.05%	PASS
Calibration Error	N/A	N/A	Calibration Error	0.14%	PASS

Pressure Calibration					
	As Found			As Left	
Max. Non Linearity	N/A	N/A	Max. Non Linearity	0.02%	PASS
Calibration Error	N/A	N/A	Calibration Error	0.18%	PASS

X-Inclinometer Calibration					
	As Found			As Left	
Max. Non Linearity	N/A	N/A	Max. Non Linearity	-0.37%	PASS
Calibration Error	N/A	N/A	Calibration Error	0.75%	PASS

Y-Inclinometer Calibration					
	As Found			As Left	
Max. Non Linearity	N/A	N/A	Max. Non Linearity	-0.25%	PASS
Calibration Error	N/A	N/A	Calibration Error	0.50%	PASS

Seismic Calibration					
	As Found			As Left	
Trigger Delay Error	N/A	N/A	Trigger Delay Error	0.01%	PASS

Temperature Calibration			
Full Scale Error	0.18%	PASS	

Channel	Cold	Room	Hot	Units
Ref_Temp	4.8	22.1	42.7	˚C
Tip	-2.473	-0.197	2.769	bar
Sleeve	0.012	-0.016	-0.038	bar
Pressure	1.042	1.057	1.054	bar
Temperature	4.941	21.927	42.790	˚C

Tip Temperature Coefficient	0.138 bar/˚C	PASS
Sleeve Temperature Coefficient	-0.001 bar/˚C	PASS
Pressure Temperature Coefficient	0.000 bar/˚C	PASS

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Testing Equipment Details

Testing Machines	Model Number	Serial Number	Calibration Number	Due Date
Tip Load Cell	Precision	P-10289	100490	2025-09-18
Sleeve Load Cell	Precision	P-10868	100579	2025-10-01
Digital Loadcell Indicator	4215	62140	100490	2024-07-18
Fluke Reference Pressure Monitor	RPM4 A10Ms	3910	100835	2024-12-12
Tektronix Function Generator	AFG3021B	C030955	100751	2024-10-20
Thermometer	THS-222-555	D23255834	100410	2024-07-11
Thermometer	THS-222-555	D23255829	100410	2024-07-11
Thermometer	THS-222-555	D20345575	100565	2024-07-14

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Adara Error Definitions

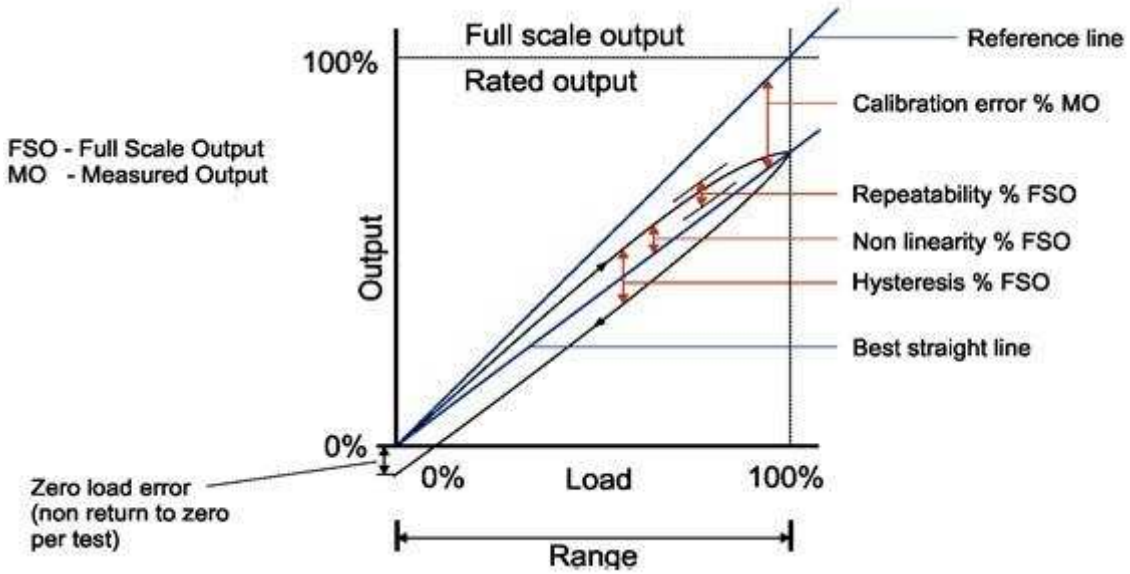


Figure 1: Definition of Calibration Terms for Load Cell and Transducers (Adapted from [1])

Actual Sensitivity	The slope of the best fit line through all data points starting at zero load.
Slope Error	The error in the best fit line compared to the ideal linear calibration in % . Slope Error = (Best Fit Slope - Ideal Slope) / Ideal Slope
Maximum Non Linearity	This value represents the maximum error (absolute value) relative to the best fit line considering each calibration point starting at loads greater than approximately 10% of FSO. The reported errors are a percent error of FSO. Adara's Pass/Fail criteria is 0.5% of FSO (ASTM is 0.5% of FSO at loads > 20% FSO).
Calibration Error	This value represents the maximum error (absolute value) in the recorded load value as compared to the actual load value for each calibration point for loads greater than approximately 10% of FSO. Adara's Pass/Fail criteria for the tip and sleeve is 0.5% of MO and 1.0% of MO for the pore pressure (ASTM for the tip and sleeve is 1.5% and 1.0% of MO respectively at loads greater than 20% of FSO)

Temperature Check Passing Criteria

Tip Temperature Coefficient	<0.200	bar/˚C
Sleeve Temperature Coefficient	<0.005	bar/˚C
Pressure Temperature Coefficient	<0.0196	bar/˚C

Adara Systems Ltd.
201-8327 Eastlake Drive, Burnaby, BC, Canada V5A4W2
Tel: 1-604-273-6013

ASTM D5778-20 Annex A Summary [1]

A1.4 Force Transducer Calibration Requirements

A1.4.1 states the following limits:

Non Linearity	Tip	≤ +0.5% of FSO
	Sleeve	≤ +1.0% of FSO
Calibration Error	Tip	≤ +1.5% of MO at loads > 20% FSO
	Sleeve	≤ +1.0% of MO at loads > 20% FSO

A1.5 Pressure Transducer Calibrations

A1.5.1 limits:

Non Linearity	Pore Pressure	≤ +1.0% of FSO
Calibration Error	Pore Pressure	not specified

ISO 22476 -1:2012 Summary [2]

Section 5.2 states the following allowable minimum accuracy

Class 1	Cone Resistance	35 kPa or 5%
	Sleeve Friction	5 kPa or 10%
	Pore Pressure	10 kPa or 2%
Class 2	Cone Resistance	100 kPa or 5%
	Sleeve Friction	15 kPa or 15%
	Pore Pressure	25 kPa or 3%

Note: ISO Compliance is based on low end calibration only.

References

[1] ASTM D5778-20. "Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils". ASTM, West Conshohocken, PA, USA.

[2] ISO 22476-1:2012. "Geotechnical investigation and testing - Field Testing - Part 1: Electrical cone and piezocone penetration test". ISO, Geneva, Switzerland.

ASTM D7400-08. "Standard Test Methods for Downhole Seismic Testing". ASTM, West Conshohocken, PA, USA.

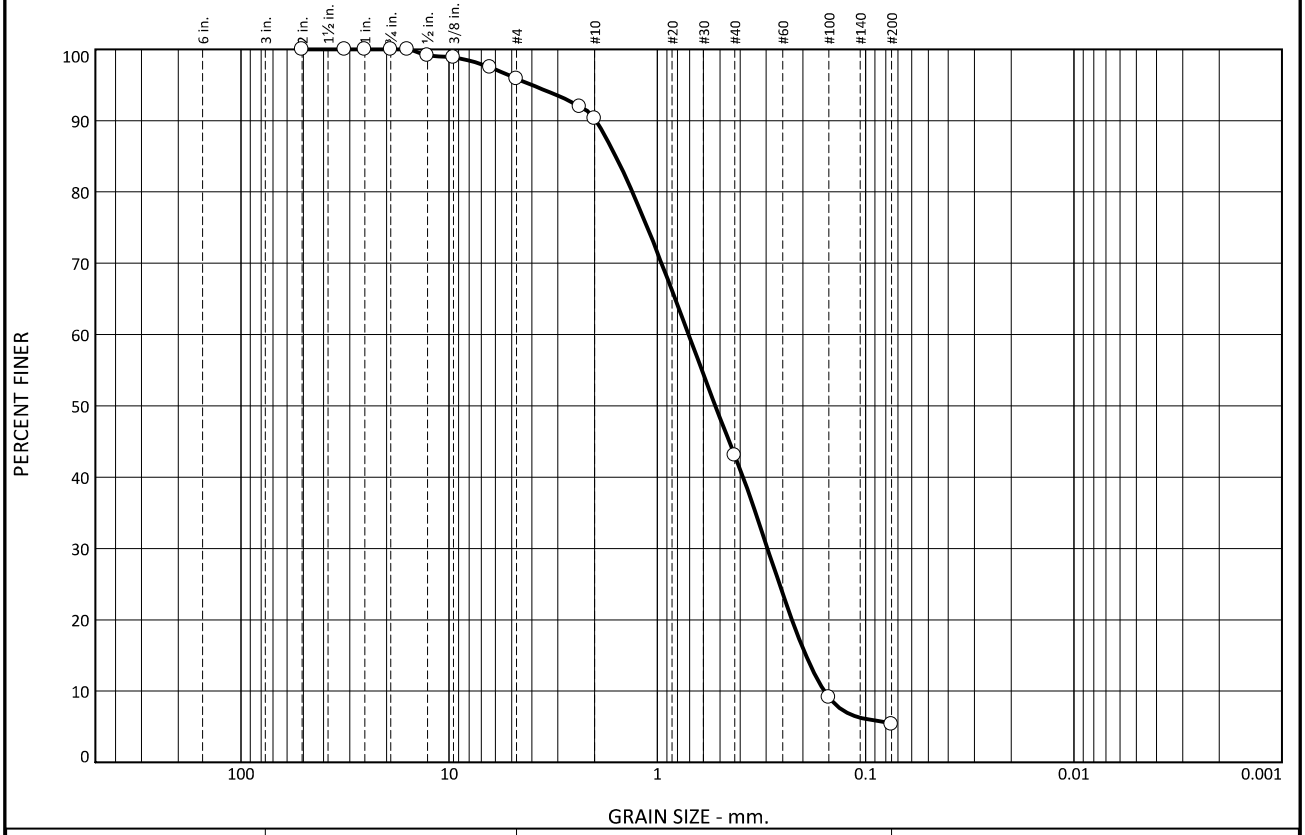
APPENDIX B
LABORATORY TESTING

Grain Size Analyses B-1

Liquid And Plastic Limit Determinations B-6

Particle Size Distribution Report

ASTM D422 & D1140



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	4	6	47	38	5	

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
2	100			
1 1/4	100			
1	100			
3/4	100			
5/8	100			
1/2	99			
3/8	99			
1/4	97			
#4	96			
#8	92			
#10	90			
#40	43			
#100	9			
#200	5.4			

* (no specification provided)

Material Description

ORA sample ID: 1530 Gray poorly graded sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.9704 D_{85}= 1.5866 D_{60}= 0.7074
D_{50}= 0.5262 D_{30}= 0.2956 D_{15}= 0.1934
D_{10}= 0.1577 C_u= 4.49 C_c= 0.78

Classification

USCS= SP-SM AASHTO= A-1-b

Test Remarks

Test equipment ID: Set 5
Was sample soaked? Not required
As received MC: 22.0%

Location: B-1, S-5, Depth: 12.5' - 14'
Sample Number: 1530

Sample Date: 5/21/2024

OTTO ROSENAU & ASSOCIATES, INC.

Client: Snohomish Regional Fire & Rescue
Project: Fire Station 32
19959 Oaks Street, Monroe
Project No: 24-0267

Figure 1530

Tested By: Andy Duong **Checked By:** Scott Hoobler, P.E.

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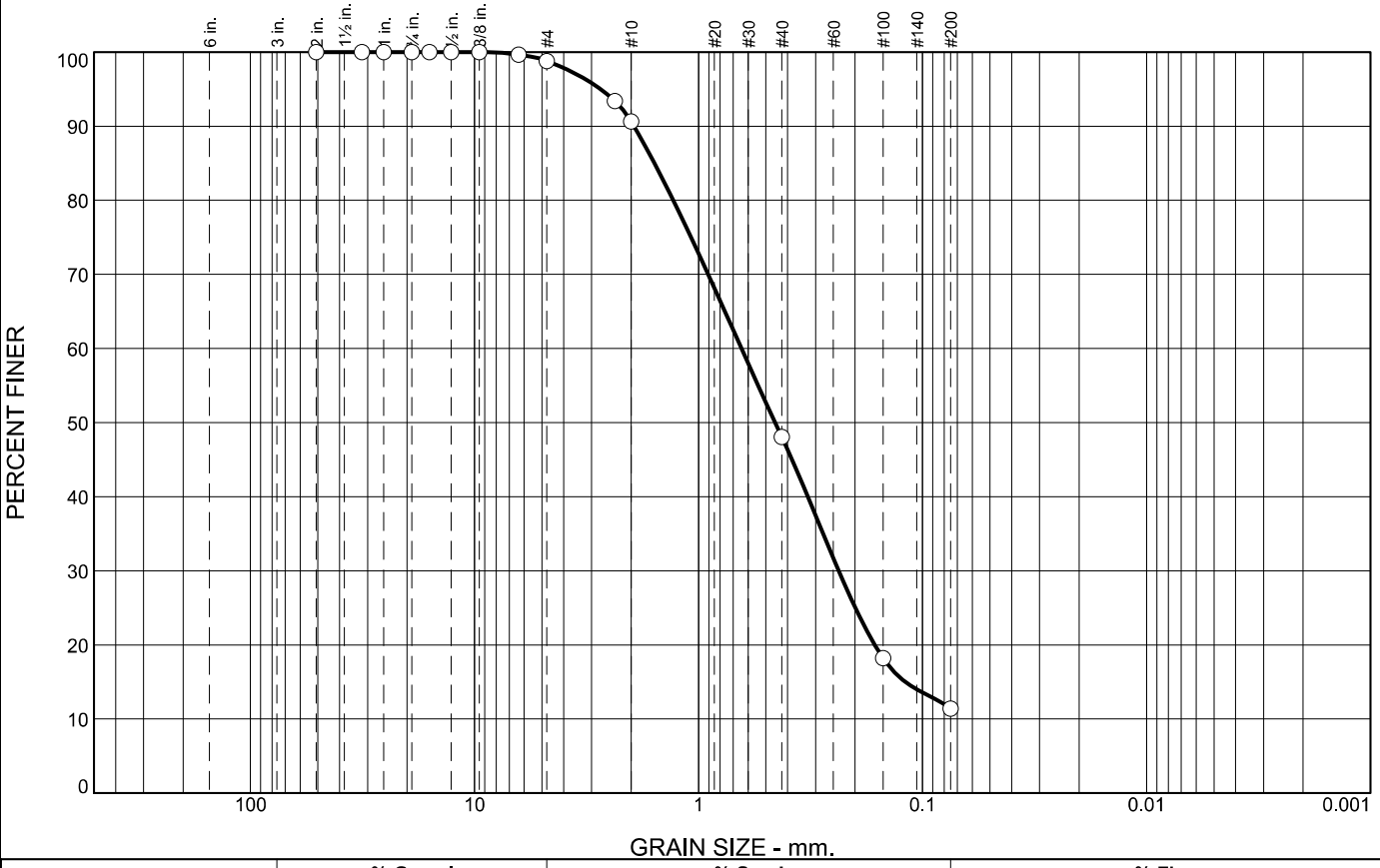
Particle Size Distribution Report

ASTM D422 & D1140



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	8	43	37	11	

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
2	100			
1 1/4	100			
1	100			
3/4	100			
5/8	100			
1/2	100			
3/8	100			
1/4	100			
#4	99			
#8	93			
#10	91			
#40	48			
#100	18			
#200	11			

* (no specification provided)

Material Description

ORA sample ID: 1801-1

Atterberg Limits

PL= LL= NP PI=

Coefficients

D_{90}= 1.9443 D_{85}= 1.5746 D_{60}= 0.6430
D_{50}= 0.4554 D_{30}= 0.2369 D_{15}= 0.1194
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Test Remarks

Test equipment ID: Set 5
Was sample soaked? No
As received MC: 24.4%

Location: B-4, S-4, Depth: 10.0' - 11.5'
Sample Number: 1801-1

Sample Date: 3/26/2025

OTTO ROSENAU & ASSOCIATES, INC.

Client: Snohomish Regional Fire & Rescue
Project: Fire Station 32 - Monroe
19959 Oaks Street, Monroe
Project No: 24-0267

Figure 1801-1

Tested By: Andy Duong **Checked By:** Anthony Coyne, P.E.

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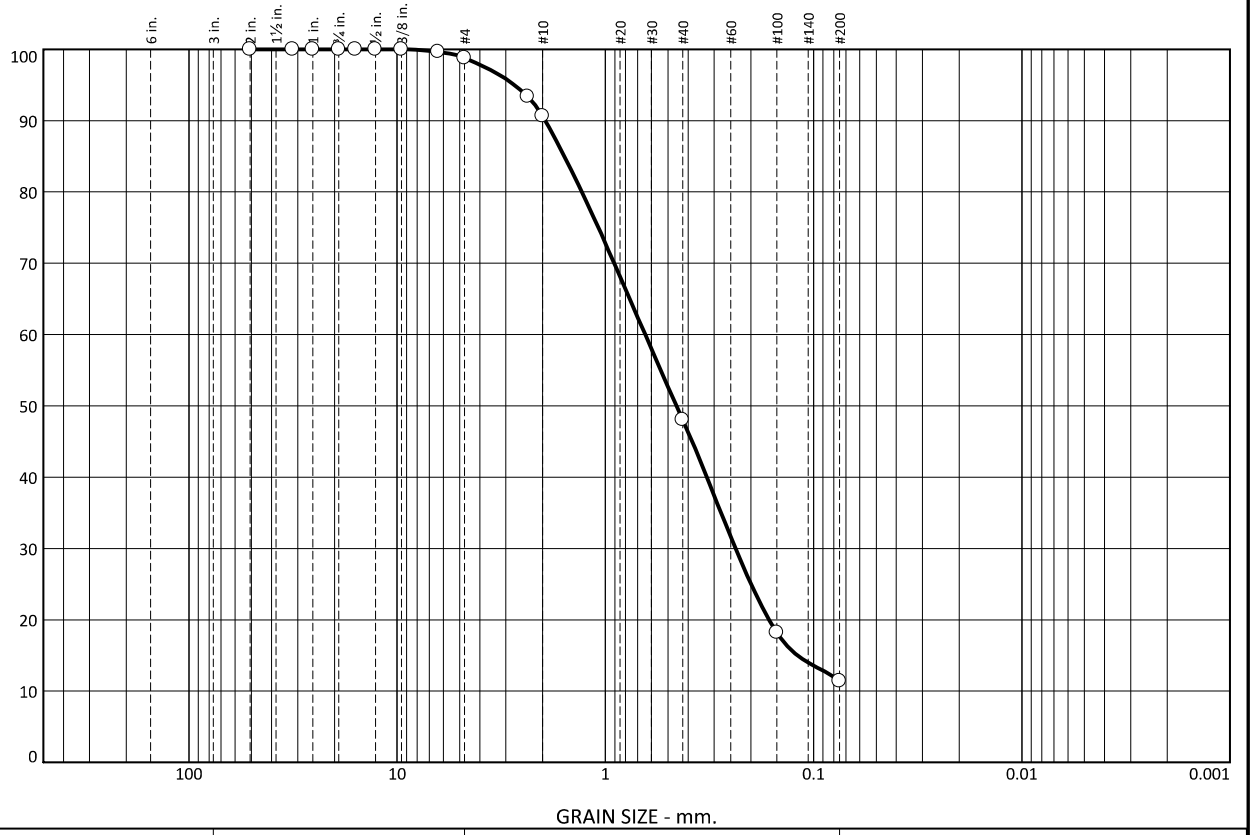
Particle Size Distribution Report

ASTM D422 & D1140



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	8	43	37	11	

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
2	100			
1 1/4	100			
1	100			
3/4	100			
5/8	100			
1/2	100			
3/8	100			
1/4	100			
#4	99			
#8	93			
#10	91			
#40	48			
#100	18			
#200	11			

* (no specification provided)

Material Description

ORA sample ID: 1801-1

Atterberg Limits

PL= LL= NP PI=

Coefficients

D_{90}= 1.9443 D_{85}= 1.5746 D_{60}= 0.6430
D_{50}= 0.4554 D_{30}= 0.2369 D_{15}= 0.1194
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Test Remarks

Test equipment ID: Set 5
Was sample soaked? No
As received MC: 24.4%

Location: B-4, S-4, Depth: 10.0' - 11.5'
Sample Number: 1801-1 **Sample Date:** 3/26/2025

OTTO ROSENAU & ASSOCIATES, INC.

Client: Snohomish Regional Fire & Rescue
Project: Fire Station 32 - Monroe
19959 Oaks Street, Monroe
Project No: 24-0267 **Figure** 1801-1

Tested By: Andy Duong **Checked By:** Anthony Coyne, P.E.

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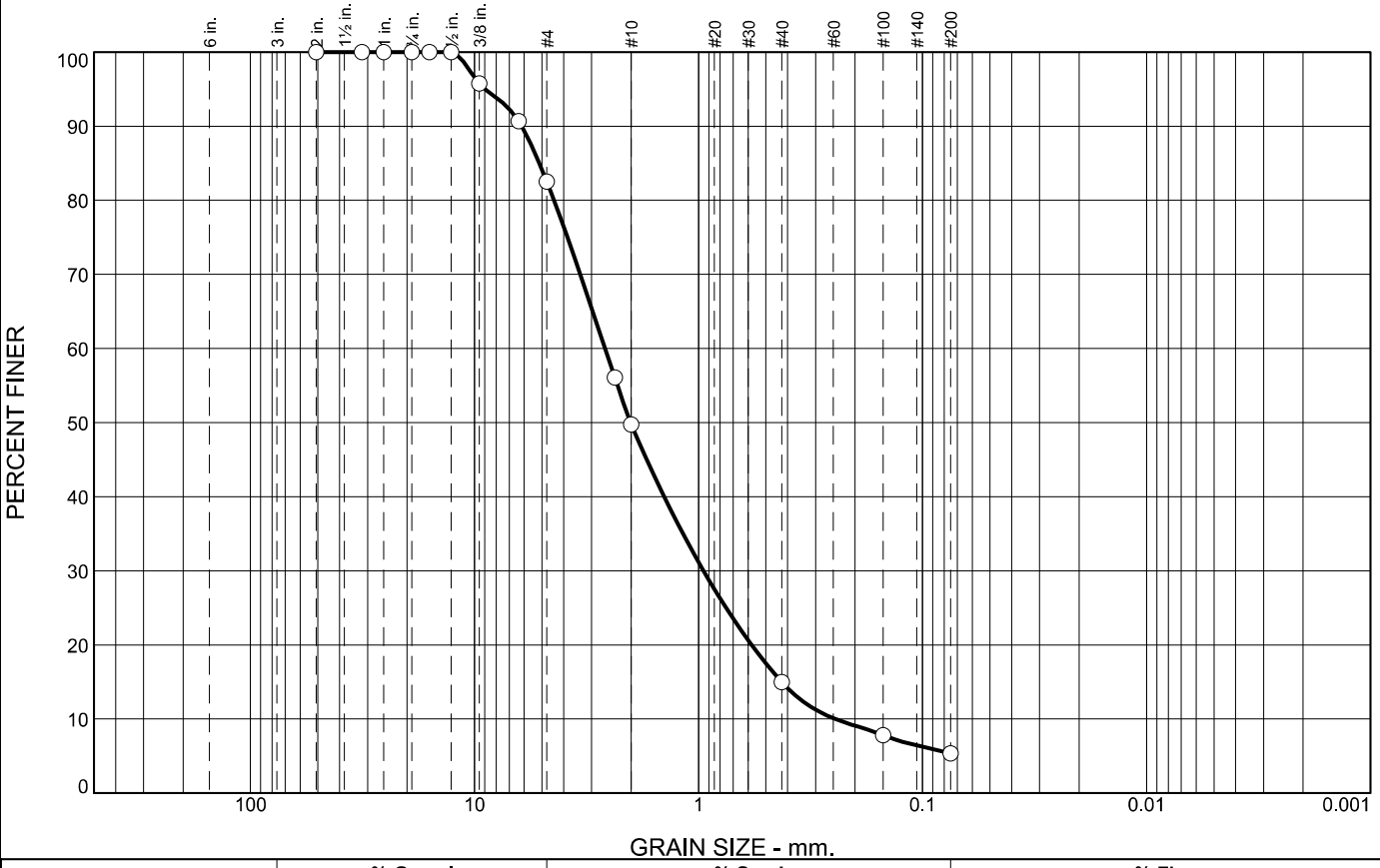
Particle Size Distribution Report

ASTM D422 & D1140



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	17	33	35	10	5	

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
2	100			
1 1/4	100			
1	100			
3/4	100			
5/8	100			
1/2	100			
3/8	96			
1/4	91			
#4	83			
#8	56			
#10	50			
#40	15			
#100	8			
#200	5.4			

* (no specification provided)

Material Description

ORA sample ID: 1801-3 well-graded sand with silt and gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 6.1498 D_{85}= 5.1321 D_{60}= 2.6113
D_{50}= 2.0165 D_{30}= 0.9505 D_{15}= 0.4255
D_{10}= 0.2446 C_u= 10.68 C_c= 1.41

Classification

USCS= SW-SM AASHTO= A-1-a

Test Remarks

Test equipment ID: Set 5
Was sample soaked? Not required
As received MC: 13.5%

Location: B-6, S-3, Depth: 15.0' - 16.5'
Sample Number: 1801-3

Sample Date: 3/26/2025

OTTO ROSENAU & ASSOCIATES, INC.

Client: Snohomish Regional Fire & Rescue
Project: Fire Station 32 - Monroe
19959 Oaks Street, Monroe
Project No: 24-0267

Figure 1801-3

Tested By: Andy Duong **Checked By:** Anthony Coyne, P.E.

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Particle Size Distribution Report

ASTM D422 & D1140

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	6	27	45	21	

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
2	100			
1 1/4	100			
1	100			
3/4	100			
5/8	100			
1/2	100			
3/8	100			
1/4	100			
#4	99			
#8	95			
#10	93			
#40	66			
#100	37			
#200	21			

* (no specification provided)

Material Description

ORA sample ID: 1801-4 silty sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.5762 D_{85}= 1.1387 D_{60}= 0.3327
D_{50}= 0.2350 D_{30}= 0.1114 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Test Remarks

Test equipment ID: Set 5
Was sample soaked? Not required
As received MC: 25.1%

Location: B-7, S-2, Depth: 10.0' - 11.5'
Sample Number: 1801-4

Sample Date: 3/26/2025

OTTO ROSENAU & ASSOCIATES, INC.

Client: Snohomish Regional Fire & Rescue
Project: Fire Station 32 - Monroe
19959 Oaks Street, Monroe
Project No: 24-0267

Figure 1801-4

Tested By: Andy Duong **Checked By:** Anthony Coyne, P.E.

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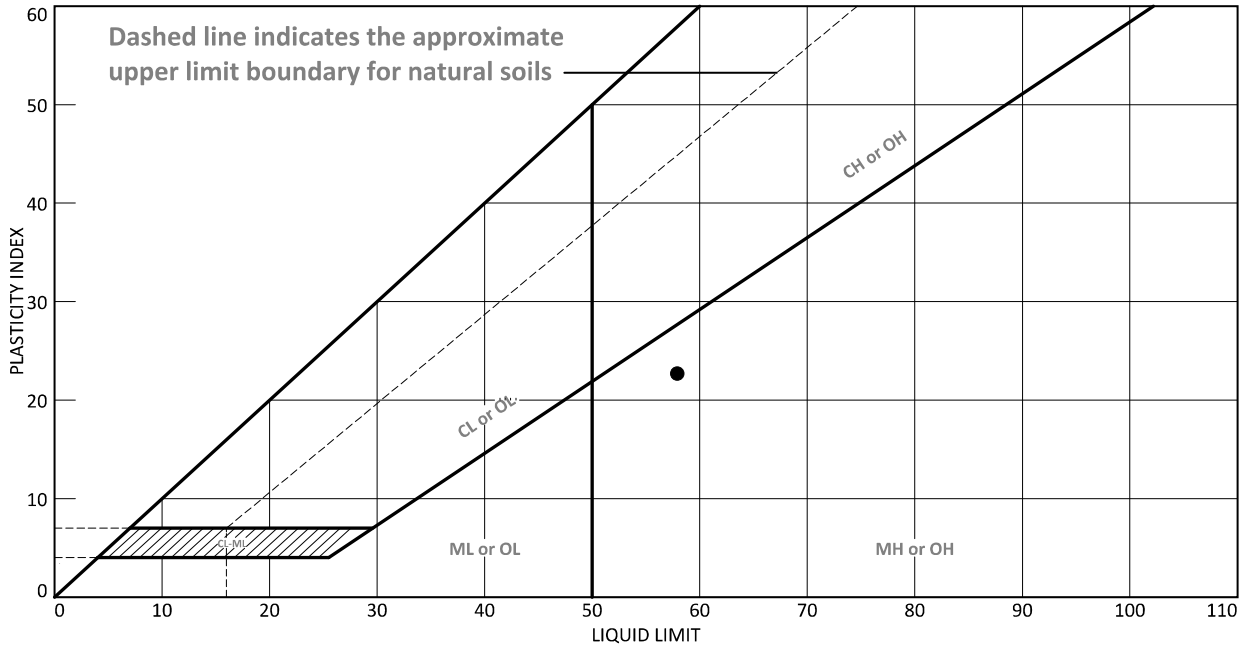
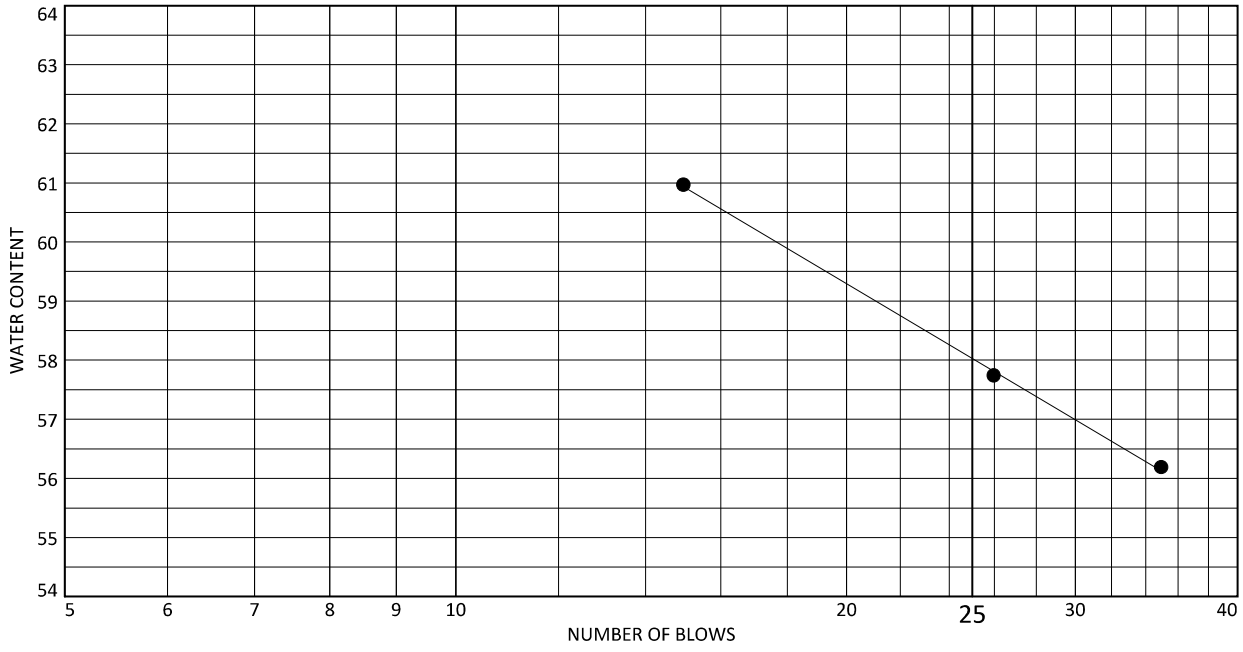
LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	ORA sample ID: 1801-5 Gray elastic silt	58.0	35.4	22.6			MH

Project No. 24-0267 **Client:** Snohomish Regional Fire & Rescue

Project: Fire Station 32 - Monroe

19959 Oaks Street, Monroe

Location: B-4, S-1, Depth: 4.0'-4.5'

Sample Number: 1801-5

Remarks:

●Natural Moisture Content = 46.2%

OTTO ROSENAU & ASSOCIATES, INC.

Figure 1801-5

Tested By: Joe Tester **Checked By:** Anthony Coyne, P.E.

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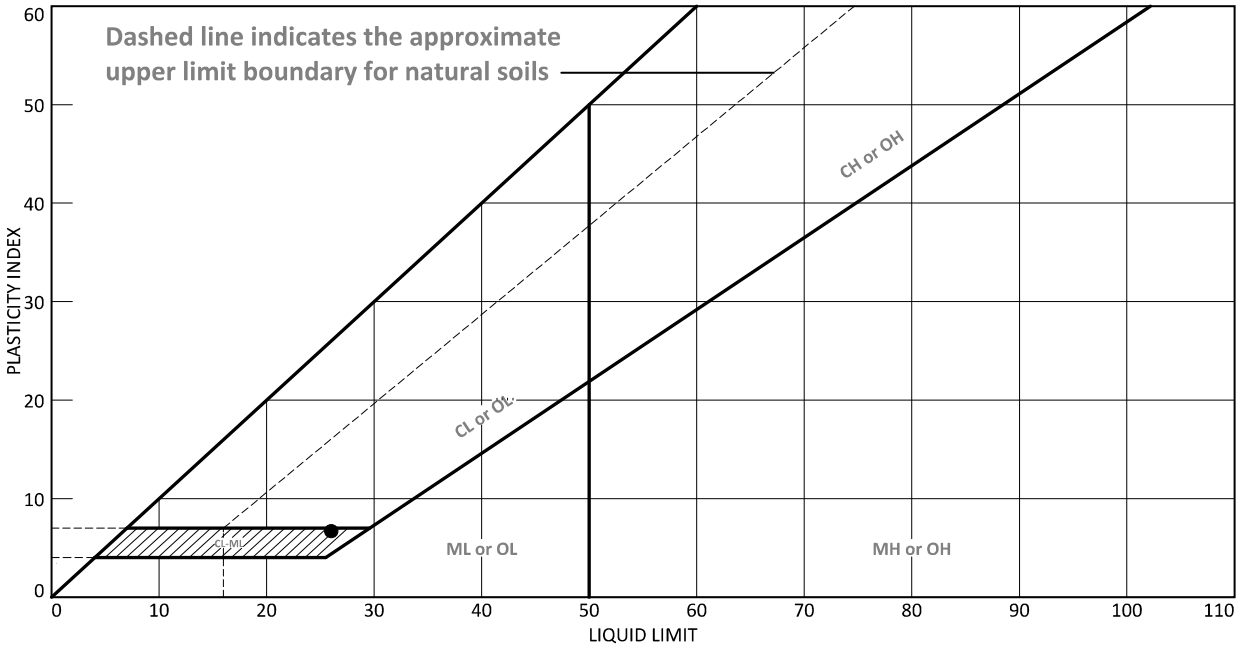
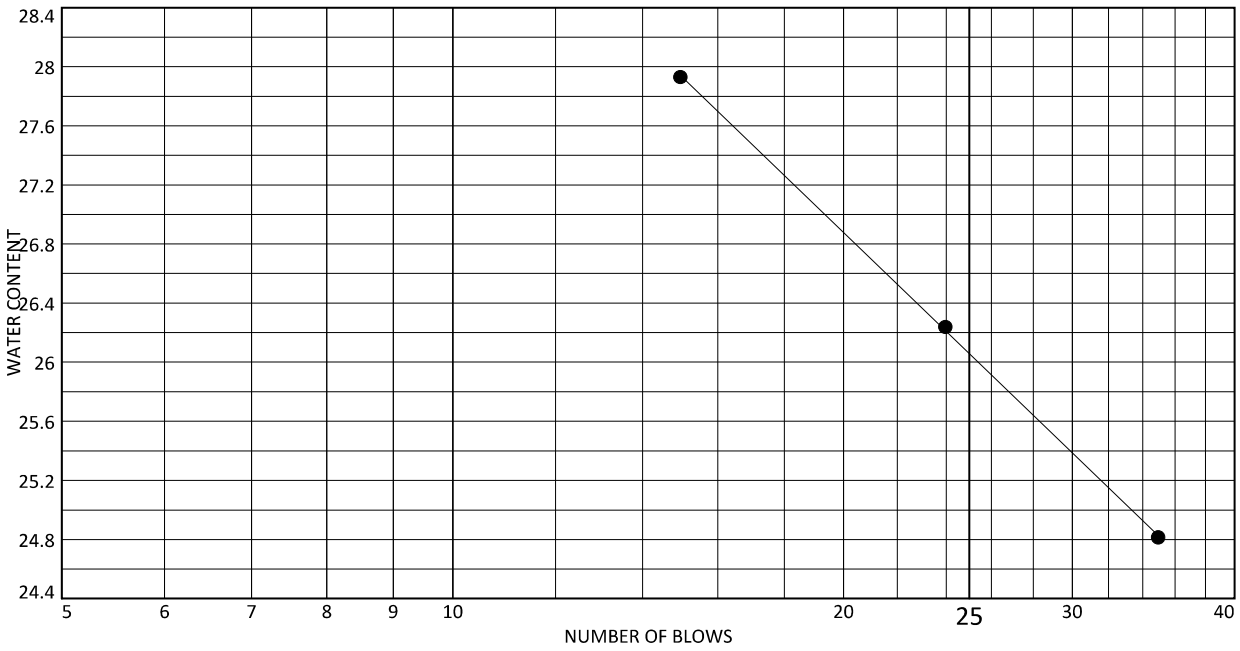
LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	ORA sample ID: 1801-6 Gray lean silty clay	26.1	19.5	6.6			CL-ML

Project No. 24-0267 **Client:** Snohomish Regional Fire & Rescue

Project: Fire Station 32 - Monroe

19959 Oaks Street, Monroe

Location: B-4, S-6, Depth: 20.0'-21.5'

Sample Number: 1801-6

Remarks:

●Natural Moisture Content = 30.3%

OTTO ROSENAU & ASSOCIATES, INC.

Figure 1801-6

Tested By: Joe Tester **Checked By:** Anthony Coyne, P.E.

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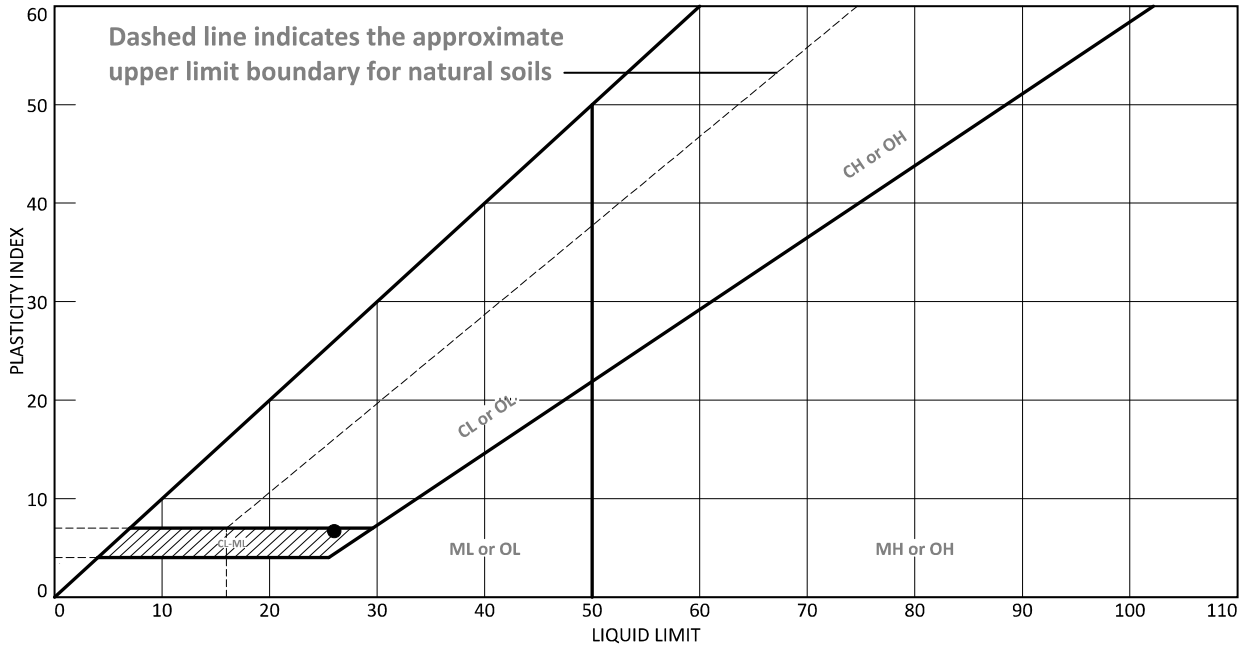
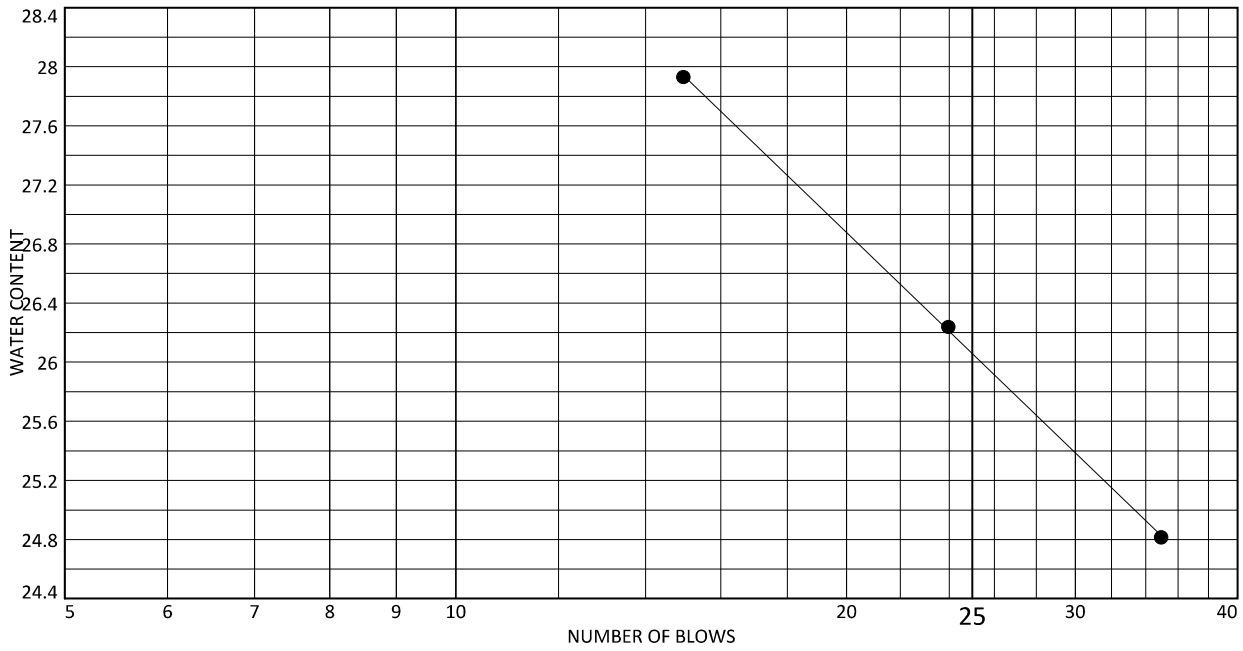
LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	ORA sample ID: 1801-6 Gray lean silty clay	26.1	19.5	6.6			CL-ML

Project No. 24-0267 **Client:** Snohomish Regional Fire & Rescue

Project: Fire Station 32 - Monroe

19959 Oaks Street, Monroe

Location: B-4, S-6, Depth: 5.0'-6.5'

Sample Number: 1801-6

Remarks:

●Natural Moisture Content = 30.3%

OTTO ROSENAU & ASSOCIATES, INC.

Figure 1801-6

Tested By: Joe Tester **Checked By:** Anthony Coyne, P.E.

APPENDIX C

RESULTS OF GEOPHYSICAL (REMI) SURVEY

Report for REMI Survey at a proposed fire station in Monroe, WA by Global Geophysics (2024) C-1

Global Geophysics

P.O. Box 2229
Redmond, WA 98073-2229

Tel: 425-890-4321
Fax: 206-5820-0838

August 15, 2024 Our ref: 114-0813.000

Otto Rosenau & Associates, Inc.
Geotechnical Engineering, Construction Inspection & Materials Testing
6747 M.L. King Way South
Seattle, WA 98118

Attention: Mr. Anthony Coyne

RE: REPORT FOR REFRACTION MICROTREMOR SURVEY AT A PROPOSED FIRE STATION IN MONROE, WA

Dear Mr. Coyne:

Global Geophysics LLC. conducted a refraction microtremor (ReMi) survey at proposed fire station in Monroe, WA on August 13, 2024. The objective of the survey was to provide Vs100.

GEOPHYSICAL METHODS AND FIELD PROCEDURES

Refraction microtremor was used for this project. The following paragraphs describe the method and field procedure.

Refraction Microtremor

The refraction microtremor (ReMi) method determines variations in surface wave velocities with increasing distances and wavelengths. The data from these measurements are used to model the shear wave velocities of the subsurface. This information can then be used to infer rock/soil types, stratigraphy and soil conditions.

The ReMi survey requires a seismic source, to generate surface-waves, and at least 24 geophones, to measure the ground response at increasing distances from the source. Surface waves are a special type of seismic wave whose propagation is confined to the near surface medium. The depth of subsurface penetration of a surface-wave is directly proportional to its wavelength. In a non-homogeneous medium, surface-waves are dispersive, i.e. each wavelength has a characteristic velocity stemming from subsurface heterogeneities. The relationship between surface-wave velocity and wavelength is used to calculate the shear-wave velocity of the medium with increasing depth.

The seismic source can be either active or passive, depending on the application and location of the survey. Examples of active sources include explosives, weight-drops, and vibrating pads. Examples of passive sources are drill rigs, road traffic, micro-tremors, and water-wave action (in near-shore environments). Geophone measures the arrival time of the various components of the surface wave-train traveling from the seismic source.

The surface-wave velocity with respect to frequency (called the 'dispersion curve') is determined by measuring the delay time in wave propagation between the geophones. The dispersion curve is then matched to a theoretical dispersion curve using an iterative forward-modeling procedure. The result is a profile of shear-wave velocity versus depth. This shear wave profile can be with used other parameters such as density, to estimate the dynamic shear modulus of the medium as a function of depth.

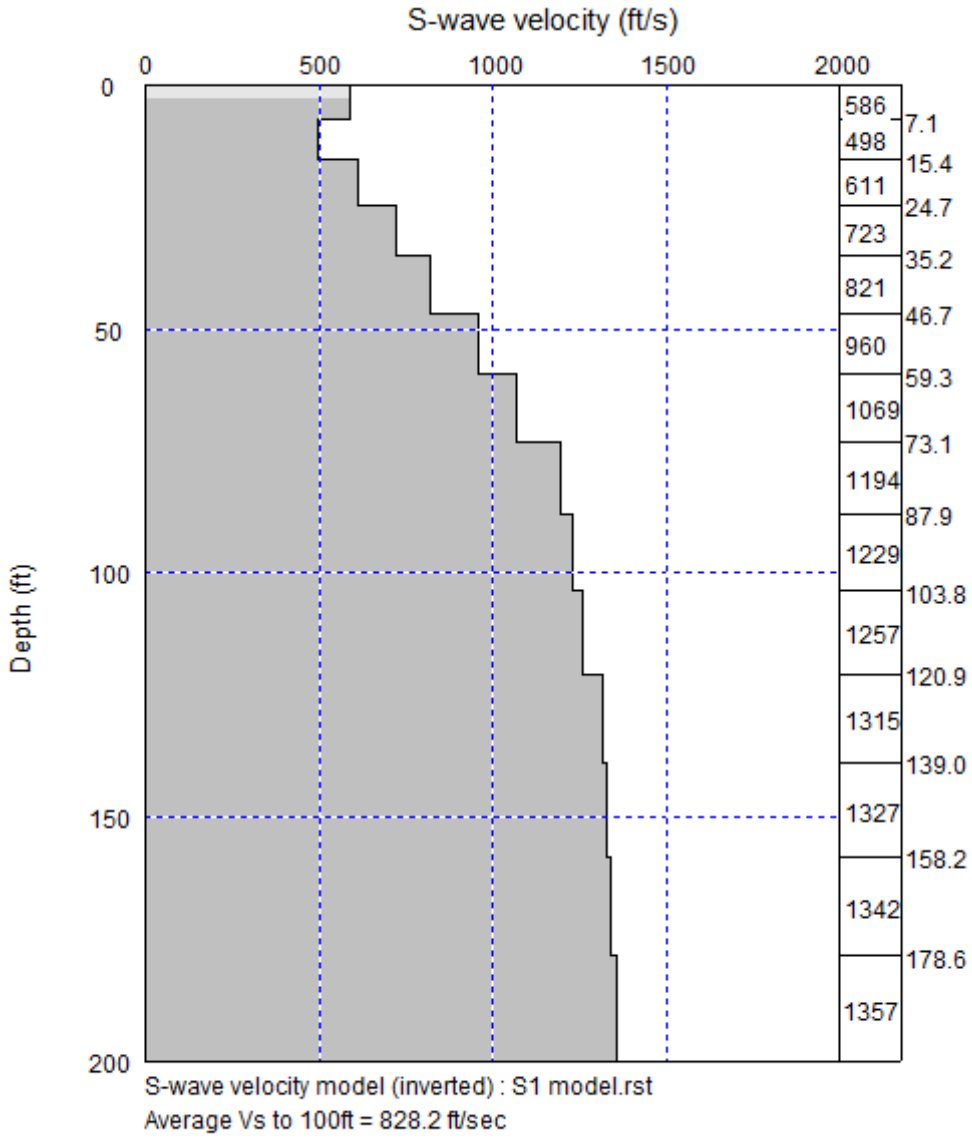
The ReMi survey was conducted using one Geometrics Geode 24-channel digital seismograph. The 24 geophones were placed at 10 ft spacing and the seismic energy source was the traffic vibration. The signal was detected by the geophones and recorded in a computer for further processing.

RESULTS

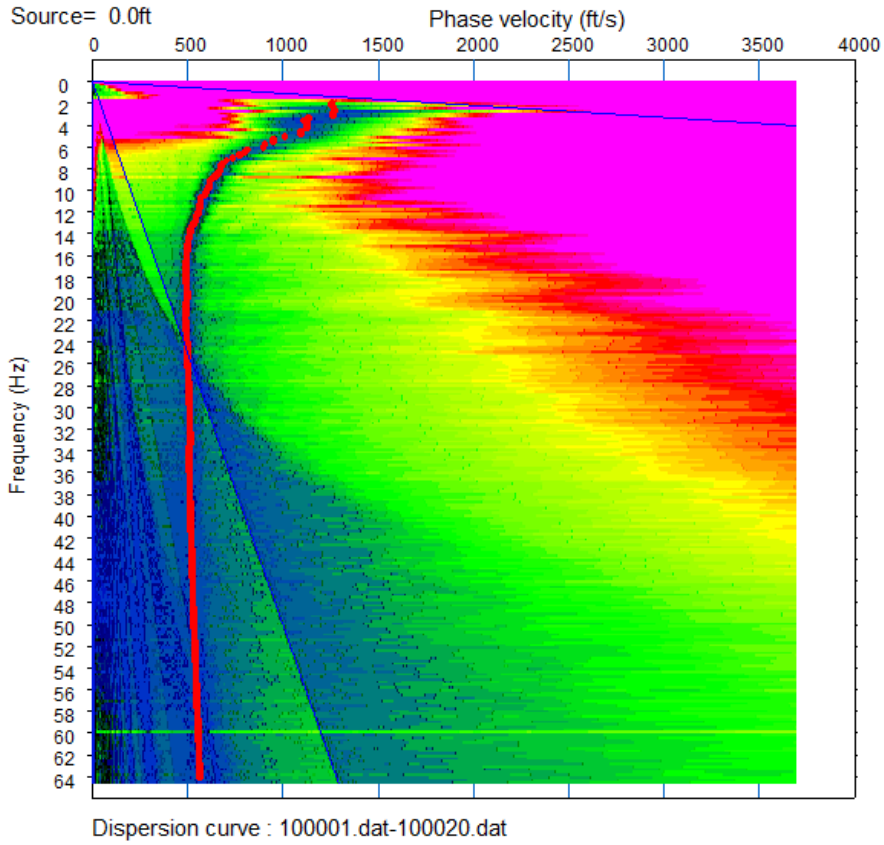
The data were collected along 1 transect. The approximate line location is shown below.

The 1D Vs100 models are shown below:

- Vs30 =828.2 ft/s



The dispersion curve is shown below:



Depth(ft)	S-wave velocity(ft/s)
0	586
7	498
15	611
25	723
35	821
47	960
59	1069
73	1195
88	1230
104	1258
121	1315
139	1328
158	1342
179	1358
200	1358

LIMITATION OF GEOPHYSICAL METHODS

Global geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. ReMi is a remote sensing geophysical method that may not detect all subsurface conditions due to the limitations of the methods, soil conditions, size of the features and their depths.

Sincerely,

Global Geophysics

John Liu, Ph.D., R.G.
Principal Geophysicist

APPENDIX D

SEISMIC DESIGN CRITERIA

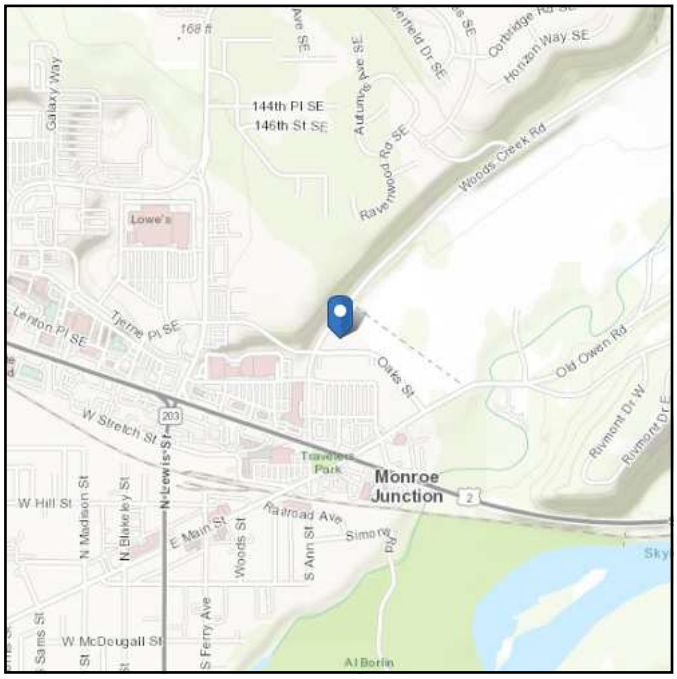
ASCE 7-16 Hazards Report D-1

USGS Deaggregation D-4

ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	47.860741
Risk Category:	IV	**Longitude:**	-121.964541
Soil Class:	D - Stiff Soil	**Elevation:**	73.714946994705 ft (NAVD 88)



Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.144	S_{D1} :	N/A
S_1 :	0.402	T_L :	6
F_a :	1.042	PGA :	0.49
F_v :	N/A	PGA_M :	0.544
S_{MS} :	1.193	F_{PGA} :	1.11
S_{M1} :	N/A	I_e :	1.5
S_{DS} :	0.795	C_v :	1.329

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Wed Oct 23 2024

Date Source: USGS Seismic Design Maps

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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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 (u…

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

47.860741

Time Horizon

Return period in years

2475

Longitude

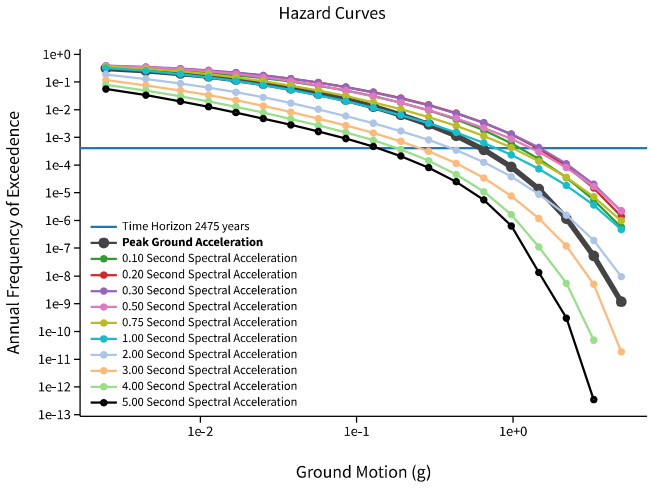
Decimal degrees, negative values for western longitudes

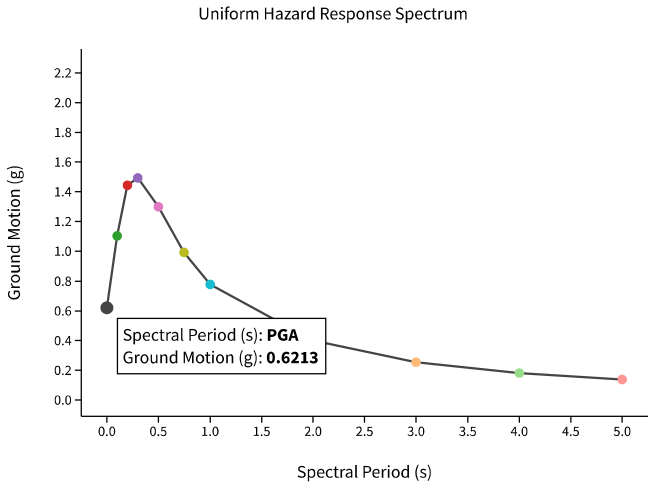
-121.964541

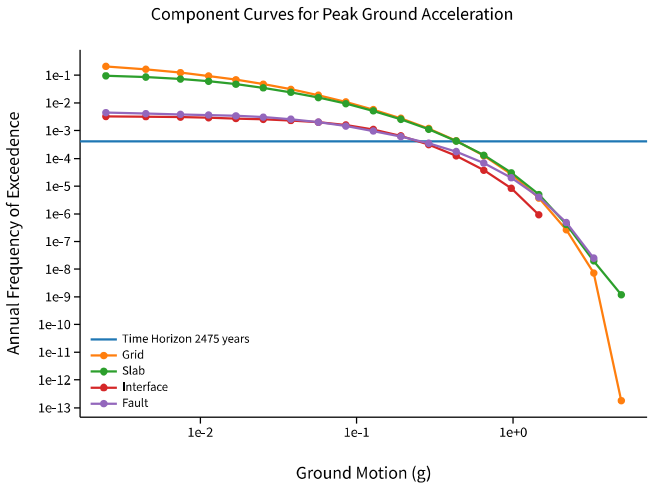
Site Class

259 m/s (Site class D)

Hazard Curve





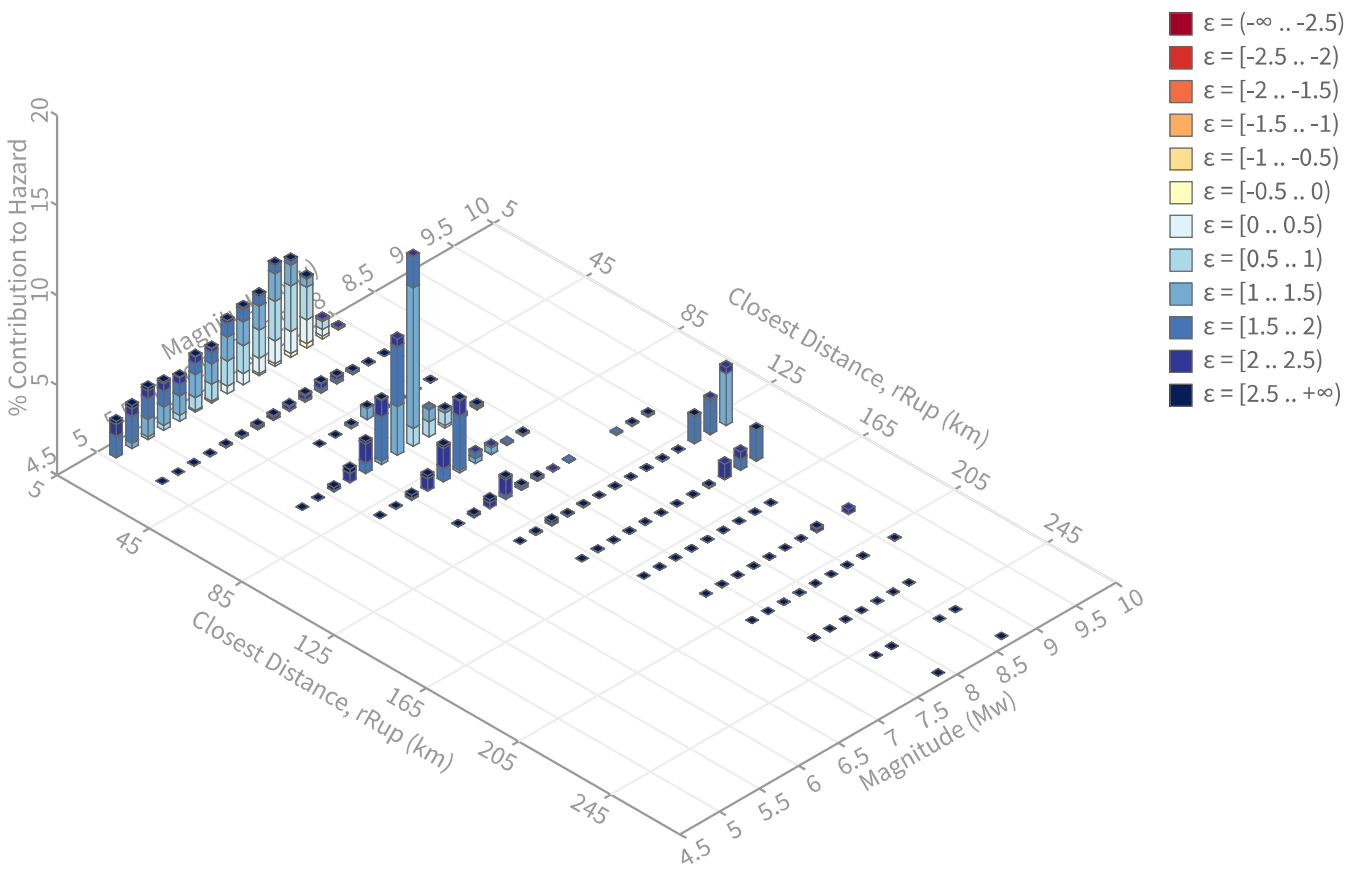


View Raw Data

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 0.62125637 g

Recovered targets

Return period: 2626.882 yrs
Exceedance rate: 0.00038067946 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.33 %

Mean (over all sources)

m: 7.01
r: 49.53 km
ε_0: 1.41 σ

Mode (largest m-r bin)

m: 7.11
r: 67.93 km
ε_0: 1.29 σ
Contribution: 10.55 %

Mode (largest m-r-ε_0 bin)

m: 7.1
r: 67.3 km
ε_0: 1.24 σ
Contribution: 7.82 %

Discretization

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

Epsilon keys

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

Deaggregation Contributors

Source Set / Source	Type	r	m	ε_0	lon	lat	az	%
pacnwdeep.2014.in	Slab							16.78
pacnwdeep.2014.in	Slab							16.04
Geologic Model Partial Rupture	Fault							9.83
Southern Whidbey Island North Alt2		9.31	6.99	0.65	122.001°W	47.766°N	194.52	3.51
Southern Whidbey Island Middle Alt2		12.98	7.00	1.04	122.017°W	47.716°N	193.75	1.98
Southern Whidbey Island North		9.23	6.97	0.71	122.052°W	47.811°N	229.49	1.59
Southern Whidbey Island South Alt2		15.98	7.01	1.35	122.214°W	47.818°N	255.86	1.15
Southern Whidbey Island Middle		13.05	6.98	1.07	122.099°W	47.780°N	228.37	1.03
puget_2014.ch.in	Grid							8.29
PointSourceFixedStrike: -122.000, 47.900		6.28	5.86	1.10	122.000°W	47.900°N	328.81	1.22
PointSourceFixedStrike: -121.900, 47.900		6.52	5.92	1.11	121.900°W	47.900°N	47.77	1.09
puget_2014.gr.in	Grid							7.32
PointSourceFixedStrike: -122.000, 47.900		6.28	5.86	1.10	122.000°W	47.900°N	328.81	1.22
PointSourceFixedStrike: -121.900, 47.900		6.52	5.92	1.11	121.900°W	47.900°N	47.77	1.09
sub0_ch_bot.in	Interface							6.75
Cascadia Megathrust - whole CSZ Characteristic		120.35	9.13	1.54	123.509°W	47.780°N	266.14	6.75
Geologic Model Full Rupture	Fault							5.45
Southern Whidbey Island North Alt2		8.62	7.47	0.36	122.001°W	47.766°N	194.52	1.46
Southern Whidbey Island North		7.50	7.37	0.28	122.052°W	47.811°N	229.49	1.34
WUSmap_2014_fixSm.ch.in (opt)	Grid							3.89
sub0_ch_mid.in	Interface							3.53
Cascadia Megathrust - whole CSZ Characteristic		150.77	8.94	1.97	123.916°W	47.709°N	264.12	3.53
WUSmap_2014_fixSm.gr.in (opt)	Grid							3.09
puget_2014_M8.in	Grid							2.36
pacnwdeep_Mmax75.2014.in	Slab							2.08
WUSmap_2014_adSm.ch.in (opt)	Grid							1.78
WUSmap_2014_adSm.gr.in (opt)	Grid							1.42
pacnwdeep_Mmax75.2014.in	Slab							1.40

APPENDIX E
LIQUEFACTION ANALYSIS

Combined Liquefaction Analysis Results for CPT-1 and CPT-2 ..... E-1

TABLE OF CONTENTS

CPT-1 results

Summary data report	1
Input field data	8
Cyclic stress resistance results	19
Cyclic resistance ratio results	30
Liquefaction potential index data	41
Vertical settlements summary report	47
Vertical settlements data report	48
Lateral displacements summary report	53
Lateral displacements data report	54
Strength loss data report	64

CPT-2 results

Summary data report	77
Input field data	84
Cyclic stress resistance results	93
Cyclic resistance ratio results	102
Liquefaction potential index data	111
Vertical settlements summary report	116
Vertical settlements data report	117
Lateral displacements summary report	122
Lateral displacements data report	123
Strength loss data report	131

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6747 Martin Luther King Jr Way S, Seattle, WA
www.ottorosenau.com

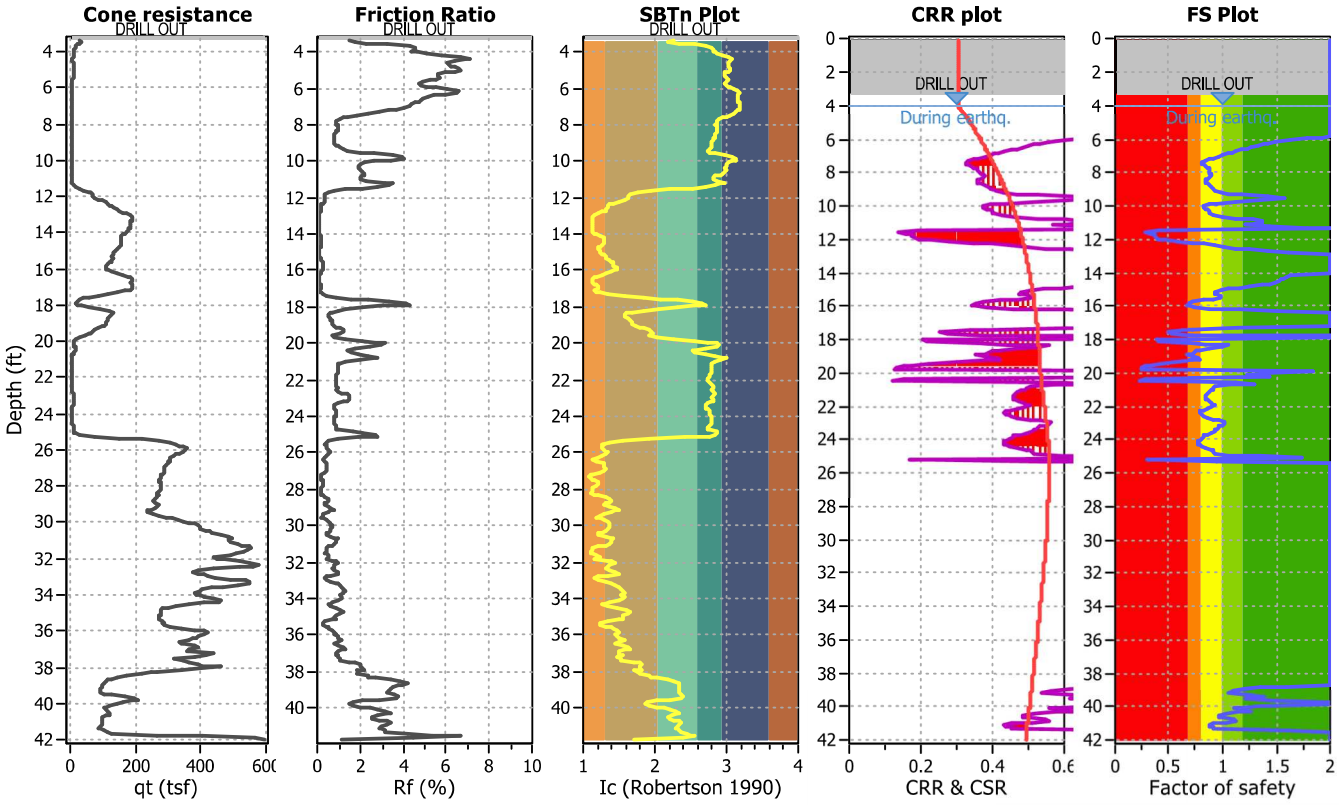
LIQUEFACTION ANALYSIS REPORT

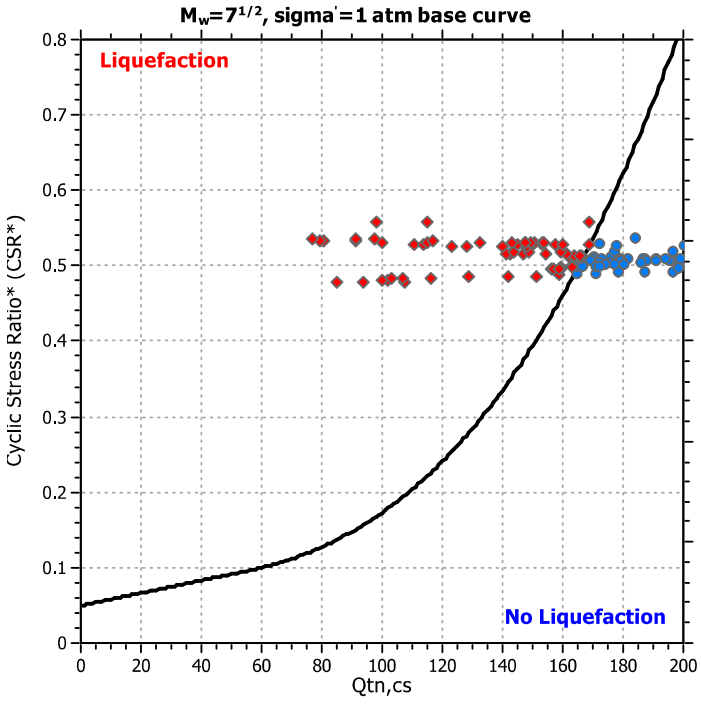
Project title : Fire Station #32 - Site Evaluation **Location : 19959 Oaks St, Monroe, WA**

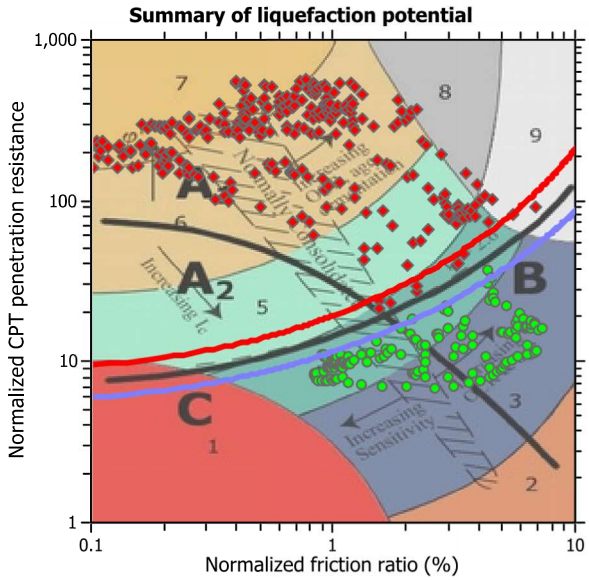
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	4.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	4.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.54	Unit weight calculation:	Based on SBT	K_σ applied:	No	MSF method:	Method based

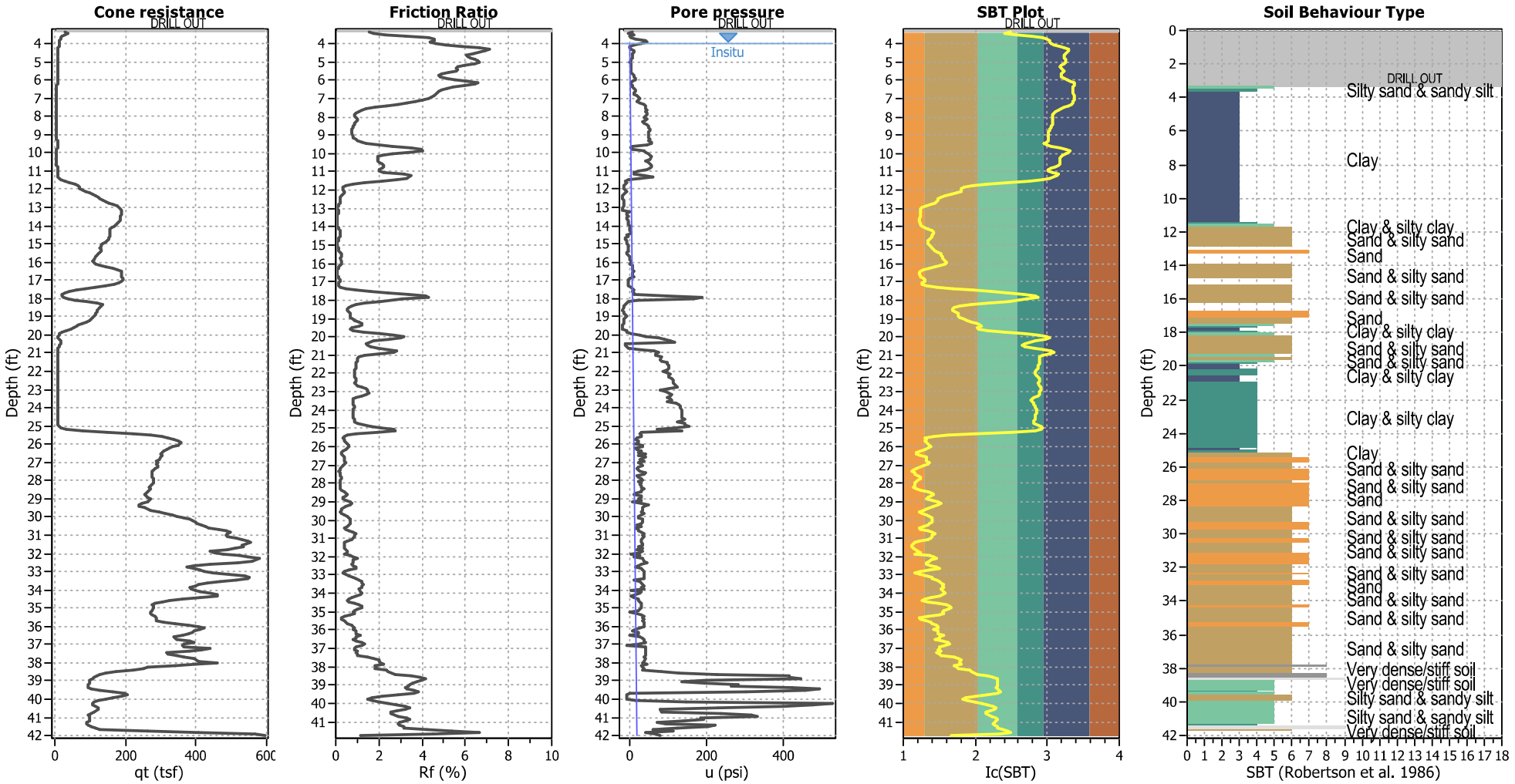






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and grounc geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



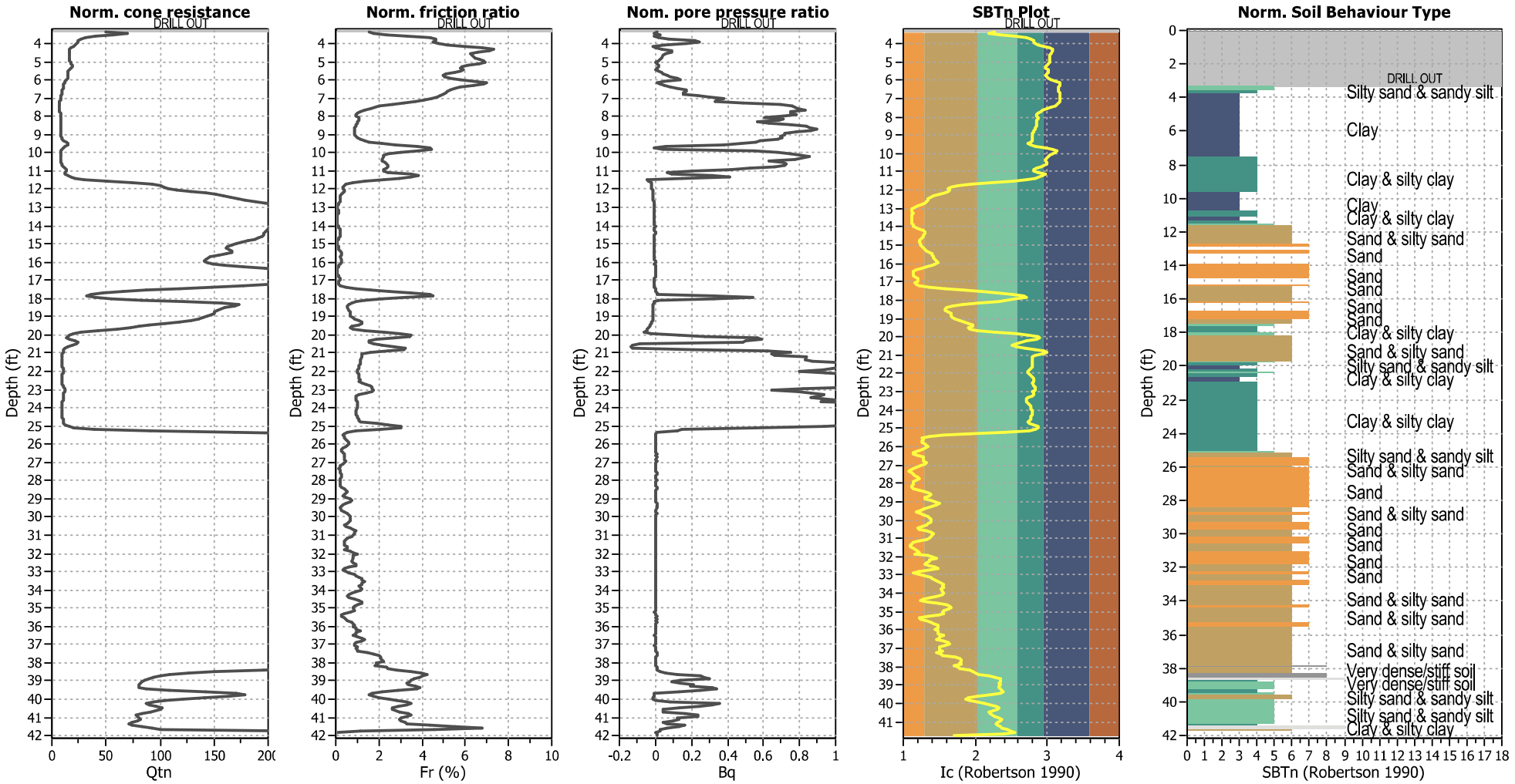
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



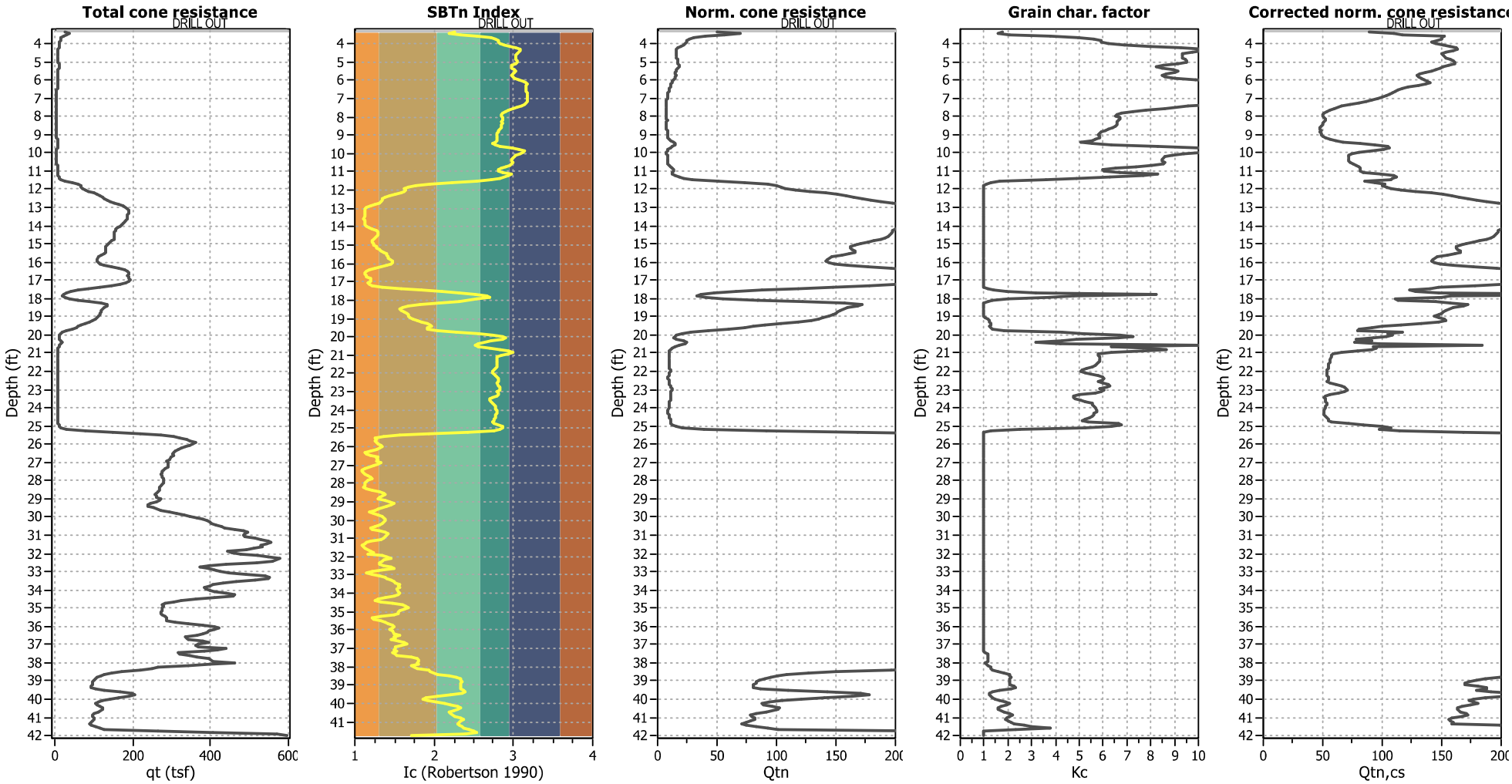
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

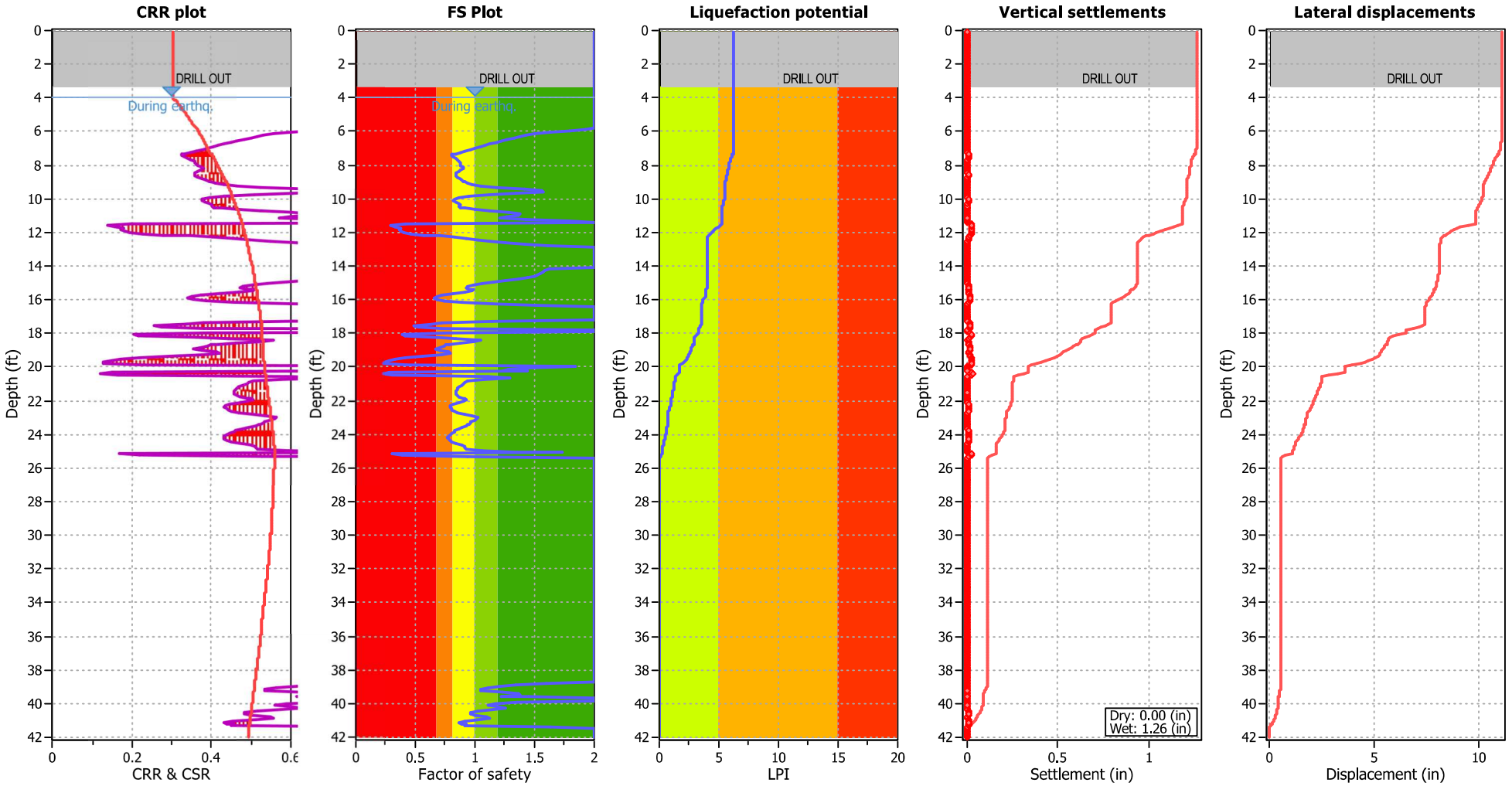
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

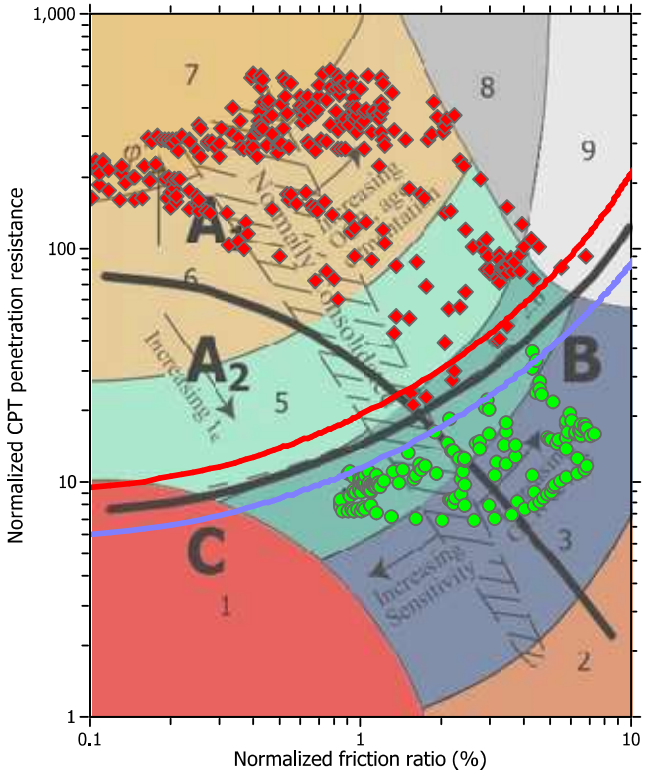
F.S. color scheme

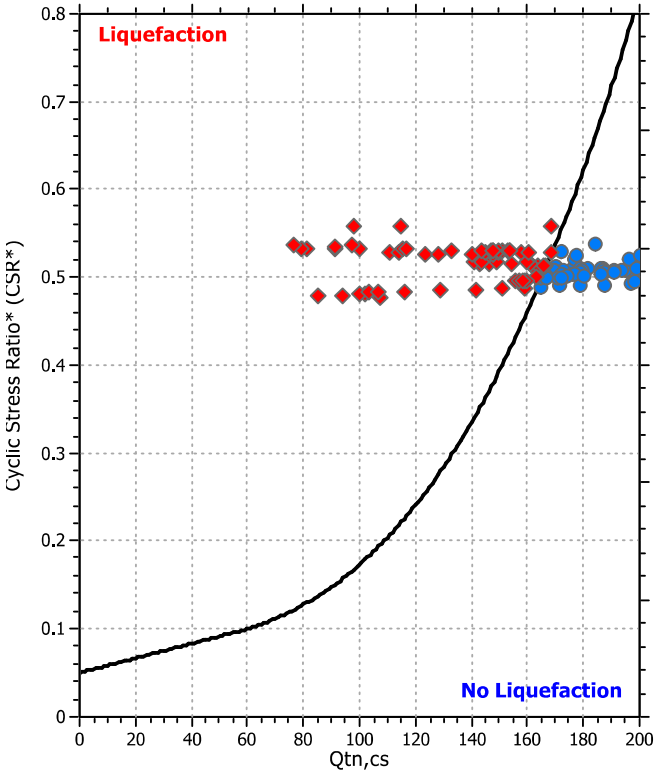
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

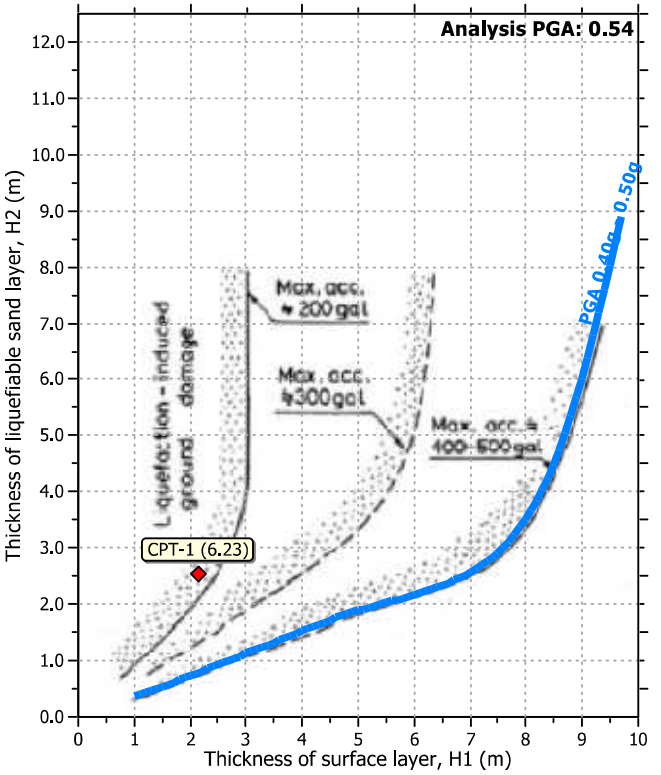
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



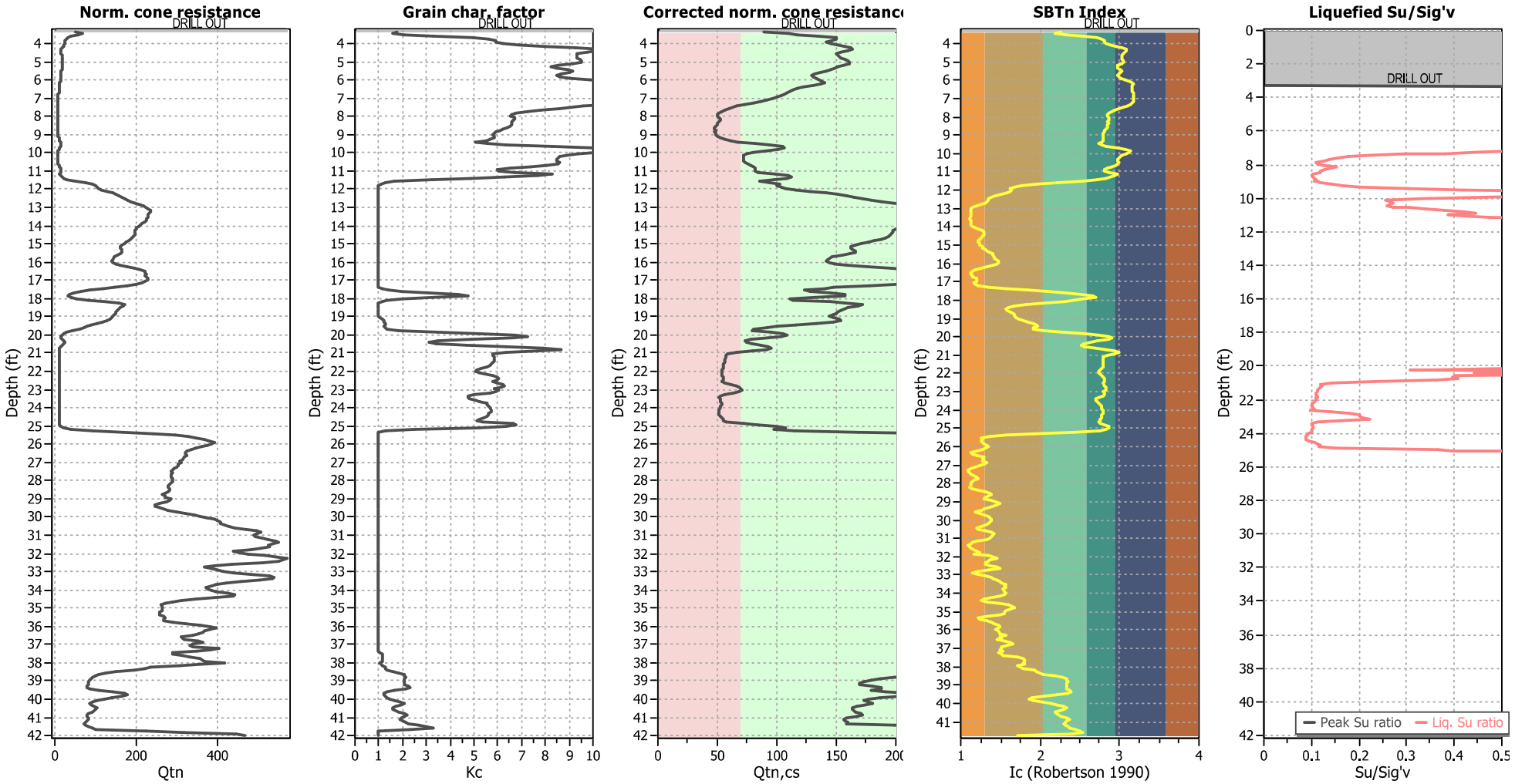




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	0.08	-8888.00	-8888.00	-8888.00	N/A	120.90
2	0.16	-8888.00	-8888.00	-8888.00	N/A	120.90
3	0.25	-8888.00	-8888.00	-8888.00	N/A	120.90
4	0.33	-8888.00	-8888.00	-8888.00	N/A	120.90
5	0.41	-8888.00	-8888.00	-8888.00	N/A	120.90
6	0.49	-8888.00	-8888.00	-8888.00	N/A	120.90
7	0.57	-8888.00	-8888.00	-8888.00	N/A	120.90
8	0.66	-8888.00	-8888.00	-8888.00	N/A	120.90
9	0.74	-8888.00	-8888.00	-8888.00	N/A	120.90
10	0.82	-8888.00	-8888.00	-8888.00	N/A	120.90
11	0.90	-8888.00	-8888.00	-8888.00	N/A	120.90
12	0.98	-8888.00	-8888.00	-8888.00	N/A	120.90
13	1.07	-8888.00	-8888.00	-8888.00	N/A	120.90
14	1.15	-8888.00	-8888.00	-8888.00	N/A	120.90
15	1.23	-8888.00	-8888.00	-8888.00	N/A	120.90
16	1.31	-8888.00	-8888.00	-8888.00	N/A	120.90
17	1.39	-8888.00	-8888.00	-8888.00	N/A	120.90
18	1.48	-8888.00	-8888.00	-8888.00	N/A	120.90
19	1.56	-8888.00	-8888.00	-8888.00	N/A	120.90
20	1.64	-8888.00	-8888.00	-8888.00	N/A	120.90
21	1.72	-8888.00	-8888.00	-8888.00	N/A	120.90
22	1.80	-8888.00	-8888.00	-8888.00	N/A	120.90
23	1.89	-8888.00	-8888.00	-8888.00	N/A	120.90
24	1.97	-8888.00	-8888.00	-8888.00	N/A	120.90
25	2.05	-8888.00	-8888.00	-8888.00	N/A	120.90
26	2.13	-8888.00	-8888.00	-8888.00	N/A	120.90
27	2.21	-8888.00	-8888.00	-8888.00	N/A	120.90
28	2.30	-8888.00	-8888.00	-8888.00	N/A	120.90
29	2.38	-8888.00	-8888.00	-8888.00	N/A	120.90
30	2.46	-8888.00	-8888.00	-8888.00	N/A	120.90
31	2.54	-8888.00	-8888.00	-8888.00	N/A	120.90
32	2.62	-8888.00	-8888.00	-8888.00	N/A	120.90
33	2.71	-8888.00	-8888.00	-8888.00	N/A	120.90
34	2.79	-8888.00	-8888.00	-8888.00	N/A	120.90
35	2.87	-8888.00	-8888.00	-8888.00	N/A	120.90
36	2.95	-8888.00	-8888.00	-8888.00	N/A	120.90
37	3.03	-8888.00	-8888.00	-8888.00	N/A	120.90
38	3.12	-8888.00	-8888.00	-8888.00	N/A	120.90
39	3.20	-8888.00	-8888.00	-8888.00	N/A	120.90
40	3.28	-8888.00	-8888.00	-8888.00	N/A	120.90
41	3.36	39.58	0.55	4.70	21.03	111.67
42	3.44	40.57	0.67	-3.52	18.64	115.77
43	3.53	30.01	0.70	11.01	24.07	115.78
44	3.61	18.67	0.69	-2.70	32.68	115.22
45	3.69	16.41	0.73	3.40	41.59	114.53
46	3.77	13.76	0.70	14.50	44.75	113.73
47	3.85	12.37	0.55	39.73	46.35	112.90
48	3.94	12.33	0.56	42.58	46.35	112.33

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	4.02	12.31	0.58	29.68	47.78	112.52
50	4.10	11.93	0.61	8.59	50.57	112.62
51	4.18	10.86	0.62	-2.62	55.28	112.58
52	4.27	9.19	0.63	-0.17	60.50	112.36
53	4.35	8.41	0.63	4.05	64.04	112.06
54	4.43	8.33	0.60	10.29	63.88	111.63
55	4.51	8.52	0.54	10.37	62.16	111.17
56	4.59	8.59	0.52	7.11	60.67	110.92
57	4.68	8.82	0.54	5.51	60.72	111.08
58	4.76	8.83	0.57	4.55	60.71	111.40
59	4.84	9.12	0.58	3.91	61.12	111.70
60	4.92	9.10	0.60	2.34	61.43	111.98
61	5.00	9.16	0.63	0.17	61.39	112.18
62	5.09	9.48	0.62	1.20	59.95	112.24
63	5.17	10.02	0.60	3.12	57.45	112.05
64	5.25	10.31	0.56	2.56	56.36	111.70
65	5.33	9.58	0.54	1.30	57.24	111.20
66	5.41	8.74	0.51	0.59	59.19	110.61
67	5.50	8.34	0.47	2.46	60.02	110.00
68	5.58	8.28	0.44	4.09	59.43	109.40
69	5.66	8.19	0.41	5.47	58.01	108.91
70	5.74	8.34	0.38	8.38	57.26	108.73
71	5.82	8.34	0.40	10.04	57.68	108.80
72	5.91	7.96	0.42	13.66	59.55	108.93
73	5.99	7.49	0.42	14.69	62.63	108.91
74	6.07	6.96	0.43	5.59	66.76	108.80
75	6.15	6.30	0.44	2.02	70.49	108.66
76	6.23	6.16	0.42	2.74	71.29	108.13
77	6.32	6.19	0.35	4.69	70.47	107.33
78	6.40	5.74	0.32	7.11	69.20	106.32
79	6.48	5.55	0.29	10.37	69.23	105.58
80	6.56	5.42	0.27	13.52	69.21	104.96
81	6.64	5.15	0.26	12.80	69.51	104.47
82	6.73	5.06	0.25	11.45	70.52	103.96
83	6.81	4.79	0.23	11.21	70.82	103.47
84	6.89	4.67	0.22	16.22	70.92	102.98
85	6.97	4.58	0.21	19.57	71.26	102.41
86	7.05	4.15	0.19	23.44	71.15	101.69
87	7.14	4.18	0.17	20.29	70.94	100.63
88	7.22	3.99	0.14	19.15	70.03	99.49
89	7.30	3.65	0.12	26.45	68.43	98.06
90	7.38	3.53	0.09	36.23	65.92	96.44
91	7.46	3.42	0.07	39.60	61.65	94.60
92	7.55	3.50	0.06	41.78	57.76	93.01
93	7.63	3.59	0.05	45.26	54.50	91.86
94	7.71	3.70	0.04	41.92	52.34	91.14
95	7.79	3.75	0.04	43.08	50.22	90.40
96	7.87	3.89	0.04	44.89	49.26	89.98

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
97	7.96	3.82	0.04	41.47	49.03	90.00
98	8.04	3.94	0.04	36.13	49.91	90.87
99	8.12	4.07	0.05	43.03	49.88	91.42
100	8.20	4.11	0.05	41.91	49.64	91.50
101	8.28	4.10	0.04	34.37	49.30	90.85
102	8.37	3.95	0.04	37.27	49.41	90.39
103	8.45	3.84	0.04	43.27	49.33	89.92
104	8.53	3.70	0.04	48.33	48.98	89.58
105	8.61	3.73	0.03	49.51	48.38	89.32
106	8.69	3.78	0.04	52.63	47.70	89.44
107	8.78	3.94	0.04	52.20	47.00	89.71
108	8.86	4.12	0.04	48.69	46.33	89.83
109	8.94	4.18	0.04	45.95	45.94	90.01
110	9.02	4.26	0.04	46.14	45.80	90.23
111	9.10	4.33	0.04	46.01	45.93	91.09
112	9.19	4.56	0.05	48.57	45.89	92.21
113	9.27	4.85	0.06	50.93	45.29	93.71
114	9.35	5.46	0.07	49.41	44.63	96.04
115	9.43	6.39	0.11	56.81	42.37	98.84
116	9.51	8.40	0.15	54.20	44.53	102.23
117	9.60	7.83	0.24	43.44	48.24	104.24
118	9.68	7.26	0.26	7.64	56.56	105.03
119	9.76	5.85	0.26	1.75	63.18	104.41
120	9.84	5.20	0.22	5.35	67.91	103.02
121	9.92	4.26	0.17	35.88	67.22	101.06
122	10.01	4.11	0.12	41.74	64.20	98.84
123	10.09	4.00	0.09	46.21	60.85	97.35
124	10.17	4.06	0.10	50.35	58.88	96.91
125	10.25	4.21	0.10	55.17	57.85	97.08
126	10.33	4.34	0.10	50.76	57.25	97.09
127	10.42	4.38	0.10	41.91	57.32	97.11
128	10.50	4.33	0.10	47.37	57.72	97.53
129	10.58	4.50	0.11	50.29	57.41	98.31
130	10.66	4.82	0.13	54.58	55.54	99.36
131	10.74	5.57	0.14	56.34	52.66	100.45
132	10.83	6.47	0.16	51.26	49.04	101.44
133	10.91	7.51	0.17	44.50	46.63	101.70
134	10.99	7.57	0.15	22.98	46.79	101.78
135	11.07	7.08	0.16	8.83	49.87	101.81
136	11.15	6.45	0.18	11.30	56.49	103.92
137	11.24	6.46	0.32	36.60	54.06	106.24
138	11.32	10.03	0.36	57.55	48.01	107.82
139	11.40	11.96	0.32	26.79	41.45	108.68
140	11.48	13.80	0.37	-6.40	32.40	109.46
141	11.56	23.36	0.37	-12.39	19.67	111.00
142	11.65	46.19	0.35	-7.82	11.78	111.49
143	11.73	59.77	0.29	-12.38	7.39	111.03
144	11.81	67.66	0.22	-15.51	5.00	110.02

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
145	11.89	68.60	0.21	-16.05	4.87	109.49
146	11.98	68.84	0.23	-14.94	4.94	110.45
147	12.06	74.87	0.30	-12.40	4.69	111.93
148	12.14	88.53	0.35	-10.02	4.01	113.00
149	12.22	98.26	0.33	-11.38	2.92	113.06
150	12.30	110.13	0.27	-17.16	1.92	112.15
151	12.39	117.55	0.22	-18.72	1.28	111.52
152	12.47	122.11	0.24	-19.57	0.93	111.33
153	12.55	128.16	0.24	-19.49	0.84	112.07
154	12.63	133.53	0.28	-18.46	0.69	112.70
155	12.71	141.32	0.30	-15.80	0.49	113.21
156	12.80	151.25	0.28	-15.28	0.00	112.47
157	12.88	163.88	0.18	-16.82	0.00	111.35
158	12.96	175.73	0.17	-17.90	0.00	110.06
159	13.04	186.24	0.17	-18.99	0.00	110.55
160	13.12	194.73	0.20	-19.77	0.00	111.29
161	13.21	191.01	0.23	-3.46	0.00	111.70
162	13.29	187.30	0.20	-9.88	0.00	111.61
163	13.37	187.45	0.20	-7.49	0.00	110.40
164	13.45	186.89	0.13	-6.64	0.00	109.78
165	13.53	185.08	0.16	-7.62	0.00	108.96
166	13.62	186.69	0.15	-7.46	0.00	108.53
167	13.70	183.32	0.11	-6.91	0.00	107.55
168	13.78	181.68	0.11	-5.41	0.00	106.38
169	13.86	176.40	0.10	-5.11	0.00	106.94
170	13.94	172.21	0.13	-4.39	0.00	107.41
171	14.03	166.57	0.14	2.08	0.00	110.23
172	14.11	161.08	0.27	-1.97	0.00	112.08
173	14.19	155.98	0.30	-2.20	0.18	113.93
174	14.27	153.18	0.35	-2.17	0.36	114.41
175	14.35	155.25	0.34	1.59	0.40	114.48
176	14.44	154.20	0.31	3.28	0.32	114.10
177	14.52	153.46	0.30	-7.39	0.21	113.57
178	14.60	155.18	0.27	-5.24	0.04	112.65
179	14.68	154.71	0.20	-11.14	0.00	110.99
180	14.76	150.60	0.14	-12.97	0.00	109.19
181	14.85	148.41	0.14	-8.58	0.00	107.56
182	14.93	141.25	0.11	-9.31	0.00	106.89
183	15.01	137.11	0.11	-8.05	0.00	106.30
184	15.09	133.64	0.12	-6.25	0.06	107.02
185	15.17	128.55	0.15	-4.95	0.19	107.27
186	15.26	128.27	0.13	-4.73	0.45	108.92
187	15.34	128.76	0.22	-6.43	0.65	110.44
188	15.42	131.69	0.26	-4.62	1.08	112.62
189	15.50	130.45	0.33	-8.53	1.45	113.76
190	15.58	124.77	0.36	-8.97	1.64	113.59
191	15.67	119.45	0.25	-7.10	1.79	112.98
192	15.75	114.05	0.27	-1.58	1.88	111.97

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
193	15.83	106.91	0.26	-2.01	2.38	112.71
194	15.91	107.33	0.34	1.23	2.53	112.82
195	15.99	109.63	0.29	1.21	2.19	112.35
196	16.08	115.43	0.20	-1.85	1.48	111.10
197	16.16	125.53	0.20	5.47	0.67	109.88
198	16.24	143.44	0.17	7.46	0.00	109.38
199	16.32	166.62	0.14	6.75	0.00	108.72
200	16.40	182.12	0.14	7.75	0.00	108.11
201	16.49	184.20	0.12	9.13	0.00	108.82
202	16.57	194.91	0.17	6.47	0.00	110.12
203	16.65	190.72	0.22	5.74	0.00	110.90
204	16.73	185.68	0.18	6.88	0.00	111.21
205	16.81	185.53	0.20	11.62	0.00	114.22
206	16.90	193.32	0.52	-2.25	0.00	115.04
207	16.98	195.99	0.28	-4.96	0.00	115.12
208	17.06	187.29	0.21	-4.90	0.00	112.80
209	17.14	184.99	0.25	-3.85	0.00	111.64
210	17.22	174.55	0.18	-3.57	0.00	112.42
211	17.31	145.51	0.30	-6.76	1.00	114.41
212	17.39	113.25	0.53	0.77	4.01	117.19
213	17.47	81.83	0.76	5.39	8.88	119.30
214	17.55	60.02	1.05	8.84	15.55	119.86
215	17.63	36.73	1.03	7.89	22.87	119.57
216	17.72	30.23	0.98	10.40	31.46	118.42
217	17.80	20.64	0.95	9.14	38.66	117.19
218	17.88	13.74	0.82	91.82	40.84	116.44
219	17.96	21.36	0.80	189.00	32.66	116.35
220	18.04	34.33	0.72	163.62	23.37	116.96
221	18.13	47.78	0.74	17.15	14.50	118.41
222	18.21	91.23	0.89	-3.86	8.78	120.07
223	18.29	131.58	0.93	-8.55	5.66	121.07
224	18.37	139.44	0.84	-13.96	4.35	120.96
225	18.45	134.03	0.75	-16.22	3.94	119.93
226	18.54	125.82	0.61	-18.13	4.14	119.26
227	18.62	119.20	0.68	-18.74	4.67	119.29
228	18.70	116.32	0.79	-18.46	5.37	119.99
229	18.78	116.99	0.83	-17.29	5.56	120.12
230	18.86	116.44	0.73	-14.41	5.59	119.88
231	18.95	111.29	0.73	-10.97	5.91	119.83
232	19.03	107.21	0.84	-14.73	6.76	120.42
233	19.11	105.05	0.95	-15.55	7.73	121.02
234	19.19	99.05	0.98	-15.68	9.06	121.57
235	19.27	89.06	1.12	-16.98	10.68	121.70
236	19.36	78.67	1.11	-18.00	11.81	120.44
237	19.44	65.23	0.60	-19.04	12.18	118.09
238	19.52	57.20	0.44	-19.61	10.62	114.37
239	19.60	60.70	0.29	-19.68	10.93	112.83
240	19.69	49.16	0.38	-20.56	13.95	112.12

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
241	19.77	25.61	0.41	-10.96	21.65	111.92
242	19.85	18.51	0.41	-8.40	33.59	110.62
243	19.93	12.96	0.36	3.39	42.43	109.63
244	20.01	10.43	0.37	25.01	49.97	108.38
245	20.10	8.70	0.31	40.43	52.14	106.98
246	20.18	8.41	0.21	73.79	49.63	105.26
247	20.26	8.88	0.19	91.00	41.25	104.31
248	20.34	13.06	0.19	104.61	33.62	105.81
249	20.42	19.28	0.28	115.38	31.54	107.03
250	20.51	16.33	0.28	-11.80	33.49	107.48
251	20.59	12.75	0.25	-13.26	40.35	106.56
252	20.67	10.48	0.24	-10.42	48.10	105.77
253	20.75	8.21	0.25	-6.33	55.04	105.10
254	20.83	7.01	0.23	26.45	57.92	103.76
255	20.92	6.68	0.15	62.86	53.90	101.51
256	21.00	6.71	0.09	75.65	48.32	98.66
257	21.08	6.73	0.07	65.63	45.71	96.75
258	21.16	6.46	0.08	66.04	45.61	96.24
259	21.24	6.30	0.07	80.65	45.94	96.15
260	21.33	6.31	0.07	79.46	45.97	96.01
261	21.41	6.12	0.07	82.89	45.94	95.90
262	21.49	6.06	0.07	95.42	45.84	95.80
263	21.57	6.06	0.07	97.77	45.52	95.71
264	21.65	6.00	0.07	100.81	45.15	95.74
265	21.74	6.25	0.07	100.58	44.50	95.82
266	21.82	6.48	0.07	100.76	43.31	95.99
267	21.90	6.94	0.07	97.12	42.56	96.00
268	21.98	6.99	0.07	85.46	42.34	96.02
269	22.06	6.73	0.07	96.94	43.11	95.86
270	22.15	6.26	0.07	103.18	44.22	95.67
271	22.23	5.94	0.07	102.33	45.64	95.34
272	22.31	5.67	0.07	99.38	46.48	95.21
273	22.39	5.64	0.07	110.16	46.74	95.24
274	22.47	5.70	0.07	113.42	46.47	95.42
275	22.56	5.79	0.07	112.38	45.83	95.35
276	22.64	5.95	0.06	110.85	46.60	96.28
277	22.72	6.00	0.09	117.18	47.71	97.76
278	22.80	6.35	0.12	119.93	48.01	99.56
279	22.88	7.30	0.13	122.03	47.30	100.46
280	22.97	7.62	0.13	99.29	45.96	100.94
281	23.05	8.36	0.14	78.88	46.74	101.21
282	23.13	7.54	0.15	93.58	46.39	100.72
283	23.21	7.35	0.11	99.23	45.24	99.39
284	23.29	7.35	0.07	107.15	42.06	97.33
285	23.38	7.51	0.07	104.20	40.69	96.17
286	23.46	7.26	0.07	98.55	40.69	95.94
287	23.54	7.21	0.07	104.82	41.12	95.99
288	23.62	7.21	0.07	109.58	42.24	95.92

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
289	23.70	6.48	0.07	97.67	43.26	95.85
290	23.79	6.31	0.07	120.47	44.48	95.69
291	23.87	6.11	0.07	126.54	44.44	95.58
292	23.95	5.98	0.07	129.96	44.89	95.32
293	24.03	5.70	0.06	131.64	45.27	95.05
294	24.11	5.61	0.06	133.71	45.37	94.70
295	24.20	5.63	0.06	134.67	45.31	94.67
296	24.28	5.69	0.06	135.03	45.00	94.65
297	24.36	5.78	0.06	135.20	44.81	94.88
298	24.44	5.93	0.06	135.91	44.68	95.39
299	24.52	6.19	0.07	136.74	43.97	96.11
300	24.61	6.74	0.08	141.97	43.02	96.79
301	24.69	7.18	0.08	136.62	42.65	97.05
302	24.77	6.89	0.08	124.81	43.58	97.86
303	24.85	6.92	0.10	141.97	49.70	101.53
304	24.93	7.00	0.25	142.53	50.12	104.50
305	25.02	9.73	0.28	154.60	48.15	108.50
306	25.10	14.76	0.49	121.60	43.25	111.02
307	25.18	18.20	0.56	69.49	27.20	115.08
308	25.26	56.16	0.79	135.09	11.01	118.35
309	25.34	151.60	0.78	29.79	3.78	120.67
310	25.43	233.35	0.78	25.03	1.12	122.71
311	25.51	277.42	1.16	27.04	0.01	123.68
312	25.59	306.32	0.96	28.91	0.18	126.13
313	25.67	325.92	1.79	18.01	0.00	126.60
314	25.75	331.10	1.33	14.50	0.12	127.85
315	25.84	356.25	1.64	21.33	0.40	129.02
316	25.92	355.00	2.56	22.62	0.69	130.19
317	26.00	365.44	2.22	14.37	0.90	130.42
318	26.08	342.74	1.87	30.87	0.46	129.12
319	26.16	333.24	1.52	32.99	0.06	127.46
320	26.25	325.33	1.14	12.91	0.00	125.47
321	26.33	316.82	0.82	16.45	0.00	122.68
322	26.41	308.31	0.44	27.97	0.00	122.46
323	26.49	299.10	1.09	20.95	0.00	123.70
324	26.57	301.84	1.27	39.14	0.28	126.12
325	26.66	301.12	1.55	22.86	0.18	126.10
326	26.74	311.95	1.06	38.59	0.25	125.85
327	26.82	279.63	1.17	26.62	0.21	125.57
328	26.90	293.84	1.41	36.77	0.70	126.26
329	26.98	285.05	1.46	20.88	0.35	125.59
330	27.07	290.75	0.80	28.22	0.00	123.88
331	27.15	289.58	0.65	30.86	0.00	120.72
332	27.23	290.39	0.44	22.54	0.00	119.17
333	27.31	287.85	0.44	16.11	0.00	118.38
334	27.40	273.16	0.50	20.70	0.00	119.04
335	27.48	274.92	0.58	23.32	0.00	119.38
336	27.56	276.39	0.52	41.89	0.00	120.75

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
337	27.64	275.95	0.83	36.94	0.00	121.84
338	27.72	266.16	0.90	16.23	0.00	122.07
339	27.81	278.63	0.59	21.39	0.00	120.73
340	27.89	278.68	0.44	29.24	0.00	120.03
341	27.97	280.21	0.71	32.18	0.00	119.56
342	28.05	278.56	0.48	22.70	0.00	119.75
343	28.13	278.45	0.48	28.47	0.00	119.28
344	28.22	277.94	0.61	24.36	0.00	118.38
345	28.30	267.78	0.31	27.59	0.00	119.46
346	28.38	264.29	0.71	30.56	0.00	121.54
347	28.46	269.11	1.15	36.18	0.47	124.32
348	28.54	272.82	1.30	27.26	1.20	125.97
349	28.63	259.10	1.53	28.96	1.34	126.06
350	28.71	259.98	1.21	14.80	1.00	124.96
351	28.79	259.05	0.76	9.06	0.50	123.37
352	28.87	246.91	0.85	28.44	0.34	123.26
353	28.95	274.61	1.16	27.48	1.27	125.67
354	29.04	261.52	1.84	19.92	2.07	128.01
355	29.12	279.48	2.23	28.73	2.78	129.01
356	29.20	262.89	1.95	7.73	2.25	127.68
357	29.28	243.05	0.87	29.70	1.54	125.14
358	29.36	231.47	0.83	46.03	0.27	121.22
359	29.45	240.97	0.46	37.58	0.00	119.99
360	29.53	244.23	0.54	31.10	0.00	119.13
361	29.61	273.27	0.59	30.86	0.00	122.41
362	29.69	295.75	1.30	27.59	0.28	125.31
363	29.77	312.16	1.63	36.84	0.84	127.77
364	29.86	328.41	1.90	30.61	1.17	129.48
365	29.94	353.22	2.46	20.74	1.25	130.35
366	30.02	355.78	2.28	19.49	1.30	131.29
367	30.10	385.23	2.68	31.43	1.22	131.83
368	30.18	401.50	2.91	32.40	0.94	131.70
369	30.27	387.28	2.08	33.23	0.60	131.28
370	30.35	406.82	2.21	28.16	0.04	130.09
371	30.43	409.75	1.81	17.98	0.00	129.26
372	30.51	425.58	1.37	27.21	0.00	129.93
373	30.59	442.07	2.67	14.48	0.56	132.58
374	30.68	440.47	4.30	19.35	1.33	134.96
375	30.76	505.64	4.35	19.95	1.79	136.41
376	30.84	508.15	4.95	28.54	1.46	136.20
377	30.92	474.63	3.81	36.11	1.42	135.85
378	31.00	476.76	3.81	32.70	1.03	135.03
379	31.09	498.27	3.64	34.88	0.63	134.44
380	31.17	491.19	2.90	30.85	0.00	132.70
381	31.25	545.28	1.51	28.40	0.00	131.64
382	31.33	545.28	2.48	28.40	0.00	131.86
383	31.41	551.36	3.02	28.67	0.00	131.49
384	31.50	565.16	1.13	33.78	0.00	131.18

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
385	31.58	509.23	2.25	34.05	0.00	131.51
386	31.66	514.74	3.37	20.63	0.00	133.04
387	31.74	574.35	2.68	32.79	0.00	133.06
388	31.82	439.03	2.41	17.34	0.00	130.76
389	31.91	453.57	1.18	30.79	0.91	133.33
390	31.99	430.24	5.63	24.84	1.56	134.92
391	32.07	474.51	4.54	2.45	2.23	136.71
392	32.15	520.36	4.09	26.70	1.16	136.27
393	32.23	566.90	4.39	10.64	0.98	136.65
394	32.32	551.77	5.02	34.05	0.59	136.71
395	32.40	612.21	3.96	38.29	0.46	135.95
396	32.48	508.13	3.20	44.50	1.16	136.17
397	32.56	432.16	5.71	28.70	2.15	135.43
398	32.64	380.36	3.37	22.02	2.67	134.61
399	32.73	373.59	2.29	14.44	0.99	130.79
400	32.81	366.82	1.21	27.48	0.00	128.55
401	32.89	439.93	1.48	31.34	0.00	127.34
402	32.97	423.25	1.48	36.93	0.00	129.78
403	33.05	406.57	2.79	35.98	0.52	132.68
404	33.14	512.00	4.12	35.38	1.40	135.74
405	33.22	551.95	5.44	36.28	1.55	137.28
406	33.30	551.95	5.39	36.28	2.16	137.28
407	33.38	547.01	6.79	35.37	2.71	137.28
408	33.46	542.08	7.25	11.57	3.05	137.28
409	33.55	454.43	4.74	23.41	3.78	137.28
410	33.63	403.38	6.30	30.56	3.52	137.05
411	33.71	439.03	4.36	32.28	3.82	136.49
412	33.79	372.03	3.93	34.78	3.17	135.30
413	33.87	380.22	4.20	28.40	3.62	135.35
414	33.96	393.74	4.60	38.23	3.93	135.90
415	34.04	384.20	4.88	1.86	3.51	135.74
416	34.12	412.52	3.78	30.22	2.68	135.04
417	34.20	433.82	3.26	25.87	1.27	133.77
418	34.28	473.50	2.75	11.86	0.32	132.63
419	34.37	477.85	2.23	1.40	0.00	131.60
420	34.45	422.22	2.19	11.22	0.81	131.77
421	34.53	331.93	3.19	21.52	2.50	132.80
422	34.61	331.93	3.75	21.52	4.29	133.55
423	34.69	302.62	3.59	26.50	5.13	133.67
424	34.78	274.30	3.59	29.10	5.56	133.18
425	34.86	275.12	3.27	29.96	4.69	131.53
426	34.94	273.67	1.57	28.26	3.80	130.48
427	35.02	284.16	2.43	27.55	3.48	129.95
428	35.10	272.60	2.77	20.69	3.69	130.24
429	35.19	273.66	1.85	-0.23	2.77	128.45
430	35.27	268.56	0.94	18.07	0.81	124.43
431	35.35	273.03	0.42	29.39	0.00	121.16
432	35.43	279.14	0.69	38.02	0.00	122.58

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
433	35.52	297.59	1.34	32.79	0.66	125.09
434	35.60	284.47	1.41	37.13	1.35	126.57
435	35.68	273.50	1.47	32.74	1.69	127.32
436	35.76	299.91	1.79	36.59	2.47	130.01
437	35.84	349.35	3.32	35.34	2.71	132.04
438	35.93	371.16	3.29	37.42	2.57	133.51
439	36.01	416.19	3.30	36.20	1.97	133.67
440	36.09	435.62	3.30	25.36	2.51	135.02
441	36.17	411.36	5.18	14.27	2.65	134.79
442	36.25	380.38	3.05	5.89	3.82	135.90
443	36.34	393.80	5.35	19.42	2.82	134.26
444	36.42	393.80	2.51	19.42	3.01	134.10
445	36.50	347.65	2.92	-0.72	2.23	132.21
446	36.58	346.92	3.00	25.20	3.63	133.08
447	36.66	310.15	3.83	33.43	4.73	134.69
448	36.75	358.14	5.27	34.74	5.27	135.56
449	36.83	362.35	4.47	36.30	4.16	135.72
450	36.91	419.91	3.67	42.05	2.98	134.65
451	36.99	400.95	3.30	25.97	2.92	133.40
452	37.07	278.20	2.92	-7.98	2.79	132.95
453	37.16	401.93	3.13	41.52	3.41	134.12
454	37.24	419.15	4.86	41.63	2.41	135.34
455	37.32	489.16	4.16	41.76	3.08	135.57
456	37.40	338.29	3.73	39.57	3.40	134.75
457	37.48	320.17	3.83	39.68	6.41	135.58
458	37.57	292.98	6.41	40.40	7.73	136.97
459	37.65	341.79	6.64	40.77	8.28	137.28
460	37.73	397.44	7.59	38.20	8.17	137.28
461	37.81	357.67	8.22	40.76	8.00	137.28
462	37.89	424.07	8.86	35.21	8.32	137.28
463	37.98	434.61	9.86	32.81	6.37	137.28
464	38.06	520.01	6.73	43.81	7.26	137.28
465	38.14	239.87	6.22	28.16	7.71	137.28
466	38.22	260.18	5.71	34.33	11.20	137.12
467	38.30	287.80	6.43	37.05	11.83	136.89
468	38.39	202.21	5.94	33.35	14.03	136.68
469	38.47	171.67	5.94	80.66	18.59	135.81
470	38.55	135.24	5.86	126.21	21.57	135.10
471	38.63	122.81	5.19	225.59	24.04	134.18
472	38.71	106.87	4.69	415.18	24.09	133.15
473	38.80	106.87	4.09	415.18	24.22	132.15
474	38.88	97.17	3.68	446.58	23.90	131.23
475	38.96	95.56	3.38	201.13	24.09	130.55
476	39.04	96.19	3.26	136.65	23.98	130.05
477	39.12	93.28	3.09	196.76	23.78	129.79
478	39.21	92.05	3.06	283.59	24.12	129.70
479	39.29	89.66	3.20	262.87	25.44	130.30
480	39.37	87.56	3.91	422.43	26.17	130.75

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
481	39.45	90.14	3.69	494.74	24.65	131.26
482	39.53	111.57	3.67	456.94	19.34	131.59
483	39.62	164.09	3.60	303.68	13.90	131.93
484	39.70	210.46	3.27	-0.57	10.44	131.83
485	39.78	212.88	2.94	-7.54	9.43	131.53
486	39.86	192.59	3.08	-9.63	10.93	131.56
487	39.94	161.65	3.56	-10.03	13.54	131.45
488	40.03	138.71	3.26	-7.63	16.63	131.39
489	40.11	125.79	3.49	13.68	19.52	131.11
490	40.19	105.25	3.64	145.79	22.21	131.12
491	40.27	95.39	3.63	529.95	23.84	131.04
492	40.35	98.87	3.60	478.50	22.79	130.77
493	40.44	108.29	3.16	399.49	20.42	130.55
494	40.52	125.03	3.08	231.25	18.75	130.33
495	40.60	123.56	3.13	78.24	18.96	130.32
496	40.68	109.89	3.18	83.42	21.29	130.28
497	40.76	92.91	3.31	236.55	23.91	130.26
498	40.85	90.21	3.42	318.34	25.04	130.08
499	40.93	91.82	3.09	331.35	24.14	129.82
500	41.01	98.25	2.92	185.18	22.88	129.38
501	41.09	97.67	2.81	190.83	22.37	129.20
502	41.17	96.99	2.85	140.44	23.20	129.11
503	41.26	89.72	2.92	71.93	24.53	129.02
504	41.34	84.82	2.86	92.27	25.24	128.76
505	41.42	85.22	2.65	223.91	28.60	131.39
506	41.50	101.44	6.36	204.20	30.65	134.17
507	41.58	117.15	7.73	123.83	32.72	136.85
508	41.67	124.42	9.16	58.79	25.79	134.70
509	41.75	130.13	0.00	113.80	6.21	132.04
510	41.83	535.63	0.00	40.14	N/A	87.36
511	41.91	550.55	0.00	68.02	N/A	87.36
512	41.99	616.17	0.00	78.54	N/A	87.36

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
1	0.08	0.00	0.00	0.00	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
2	0.16	0.01	0.00	0.01	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
3	0.25	0.01	0.00	0.01	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
4	0.33	0.02	0.00	0.02	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
5	0.41	0.02	0.00	0.02	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
6	0.49	0.03	0.00	0.03	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
7	0.57	0.03	0.00	0.03	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
8	0.66	0.04	0.00	0.04	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
9	0.74	0.04	0.00	0.04	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
10	0.82	0.05	0.00	0.05	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
11	0.90	0.05	0.00	0.05	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
12	0.98	0.06	0.00	0.06	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
13	1.07	0.06	0.00	0.06	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
14	1.15	0.07	0.00	0.07	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
15	1.23	0.07	0.00	0.07	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
16	1.31	0.08	0.00	0.08	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
17	1.39	0.08	0.00	0.08	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
18	1.48	0.09	0.00	0.09	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
19	1.56	0.09	0.00	0.09	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
20	1.64	0.10	0.00	0.10	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
21	1.72	0.10	0.00	0.10	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
22	1.80	0.11	0.00	0.11	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
23	1.89	0.11	0.00	0.11	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
24	1.97	0.12	0.00	0.12	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
25	2.05	0.12	0.00	0.12	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
26	2.13	0.13	0.00	0.13	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
27	2.21	0.13	0.00	0.13	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
28	2.30	0.14	0.00	0.14	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
29	2.38	0.14	0.00	0.14	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
30	2.46	0.15	0.00	0.15	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
31	2.54	0.15	0.00	0.15	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
32	2.62	0.16	0.00	0.16	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
33	2.71	0.16	0.00	0.16	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
34	2.79	0.17	0.00	0.17	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
35	2.87	0.17	0.00	0.17	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
36	2.95	0.18	0.00	0.18	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
37	3.03	0.18	0.00	0.18	0.99	0.349	1.15	0.304	1.00	1.00	2.000	No
38	3.12	0.19	0.00	0.19	0.99	0.349	1.15	0.304	1.00	1.00	2.000	No
39	3.20	0.19	0.00	0.19	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
40	3.28	0.20	0.00	0.20	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
41	3.36	0.20	0.00	0.20	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
42	3.44	0.21	0.00	0.21	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
43	3.53	0.21	0.00	0.21	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
44	3.61	0.22	0.00	0.22	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
45	3.69	0.22	0.00	0.22	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
46	3.77	0.23	0.00	0.23	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
47	3.85	0.23	0.00	0.23	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
48	3.94	0.24	0.00	0.24	0.99	0.348	1.15	0.303	1.00	1.00	2.000	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	4.02	0.24	0.00	0.24	0.99	0.349	1.15	0.304	1.00	1.00	0.304	No
50	4.10	0.24	0.00	0.24	0.99	0.353	1.15	0.307	1.00	1.00	0.307	No
51	4.18	0.25	0.01	0.24	0.99	0.356	1.15	0.310	1.00	1.00	0.310	No
52	4.27	0.25	0.01	0.25	0.99	0.360	1.15	0.313	1.00	1.00	0.313	No
53	4.35	0.26	0.01	0.25	0.99	0.363	1.15	0.316	1.00	1.00	0.316	No
54	4.43	0.26	0.01	0.25	0.99	0.367	1.15	0.319	1.00	1.00	0.319	No
55	4.51	0.27	0.02	0.25	0.99	0.370	1.15	0.322	1.00	1.00	0.322	No
56	4.59	0.27	0.02	0.25	0.99	0.373	1.15	0.325	1.00	1.00	0.325	No
57	4.68	0.28	0.02	0.26	0.99	0.376	1.15	0.327	1.00	1.00	0.327	No
58	4.76	0.28	0.02	0.26	0.99	0.380	1.15	0.330	1.00	1.00	0.330	No
59	4.84	0.29	0.03	0.26	0.99	0.383	1.15	0.333	1.00	1.00	0.333	No
60	4.92	0.29	0.03	0.26	0.99	0.386	1.15	0.335	1.00	1.00	0.335	No
61	5.00	0.30	0.03	0.26	0.99	0.389	1.15	0.338	1.00	1.00	0.338	No
62	5.09	0.30	0.03	0.27	0.99	0.392	1.15	0.341	1.00	1.00	0.341	No
63	5.17	0.30	0.04	0.27	0.99	0.395	1.15	0.343	1.00	1.00	0.343	No
64	5.25	0.31	0.04	0.27	0.99	0.397	1.15	0.346	1.00	1.00	0.346	No
65	5.33	0.31	0.04	0.27	0.99	0.400	1.15	0.348	1.00	1.00	0.348	No
66	5.41	0.32	0.04	0.27	0.99	0.403	1.15	0.350	1.00	1.00	0.350	No
67	5.50	0.32	0.05	0.28	0.99	0.406	1.15	0.353	1.00	1.00	0.353	No
68	5.58	0.33	0.05	0.28	0.99	0.409	1.15	0.355	1.00	1.00	0.355	No
69	5.66	0.33	0.05	0.28	0.99	0.411	1.15	0.358	1.00	1.00	0.358	No
70	5.74	0.34	0.05	0.28	0.99	0.414	1.15	0.360	1.00	1.00	0.360	No
71	5.82	0.34	0.06	0.28	0.99	0.416	1.15	0.362	1.00	1.00	0.362	No
72	5.91	0.35	0.06	0.29	0.99	0.419	1.15	0.364	1.00	1.00	0.364	No
73	5.99	0.35	0.06	0.29	0.99	0.422	1.15	0.367	1.00	1.00	0.367	No
74	6.07	0.35	0.06	0.29	0.99	0.424	1.15	0.369	1.00	1.00	0.369	No
75	6.15	0.36	0.07	0.29	0.99	0.427	1.15	0.371	1.00	1.00	0.371	No
76	6.23	0.36	0.07	0.29	0.99	0.429	1.15	0.373	1.00	1.00	0.373	No
77	6.32	0.37	0.07	0.30	0.99	0.431	1.15	0.375	1.00	1.00	0.375	No
78	6.40	0.37	0.07	0.30	0.99	0.434	1.15	0.377	1.00	1.00	0.377	No
79	6.48	0.38	0.08	0.30	0.99	0.436	1.15	0.379	1.00	1.00	0.379	No
80	6.56	0.38	0.08	0.30	0.99	0.438	1.15	0.381	1.00	1.00	0.381	No
81	6.64	0.38	0.08	0.30	0.99	0.441	1.15	0.383	1.00	1.00	0.383	No
82	6.73	0.39	0.09	0.30	0.99	0.443	1.15	0.385	1.00	1.00	0.385	No
83	6.81	0.39	0.09	0.31	0.99	0.445	1.15	0.387	1.00	1.00	0.387	No
84	6.89	0.40	0.09	0.31	0.99	0.448	1.15	0.389	1.00	1.00	0.389	No
85	6.97	0.40	0.09	0.31	0.99	0.450	1.15	0.391	1.00	1.00	0.391	No
86	7.05	0.41	0.10	0.31	0.99	0.452	1.15	0.393	1.00	1.00	0.393	No
87	7.14	0.41	0.10	0.31	0.99	0.454	1.15	0.395	1.00	1.00	0.395	No
88	7.22	0.41	0.10	0.31	0.99	0.457	1.15	0.397	1.00	1.00	0.397	No
89	7.30	0.42	0.10	0.31	0.99	0.459	1.15	0.399	1.00	1.00	0.399	No
90	7.38	0.42	0.11	0.32	0.98	0.461	1.15	0.401	1.00	1.00	0.401	No
91	7.46	0.43	0.11	0.32	0.98	0.463	1.15	0.403	1.00	1.00	0.403	No
92	7.55	0.43	0.11	0.32	0.98	0.465	1.15	0.405	1.00	1.00	0.405	No
93	7.63	0.43	0.11	0.32	0.98	0.468	1.15	0.407	1.00	1.00	0.407	No
94	7.71	0.44	0.12	0.32	0.98	0.470	1.15	0.408	1.00	1.00	0.408	No
95	7.79	0.44	0.12	0.32	0.98	0.472	1.15	0.410	1.00	1.00	0.410	No
96	7.87	0.44	0.12	0.32	0.98	0.474	1.15	0.412	1.00	1.00	0.412	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
97	7.96	0.45	0.12	0.32	0.98	0.476	1.15	0.414	1.00	1.00	0.414	No
98	8.04	0.45	0.13	0.33	0.98	0.479	1.15	0.416	1.00	1.00	0.416	No
99	8.12	0.46	0.13	0.33	0.98	0.481	1.15	0.418	1.00	1.00	0.418	No
100	8.20	0.46	0.13	0.33	0.98	0.483	1.15	0.420	1.00	1.00	0.420	No
101	8.28	0.46	0.13	0.33	0.98	0.485	1.15	0.422	1.00	1.00	0.422	No
102	8.37	0.47	0.14	0.33	0.98	0.487	1.15	0.423	1.00	1.00	0.423	No
103	8.45	0.47	0.14	0.33	0.98	0.489	1.15	0.425	1.00	1.00	0.425	No
104	8.53	0.47	0.14	0.33	0.98	0.491	1.15	0.427	1.00	1.00	0.427	No
105	8.61	0.48	0.14	0.33	0.98	0.493	1.15	0.429	1.00	1.00	0.429	No
106	8.69	0.48	0.15	0.34	0.98	0.495	1.15	0.431	1.00	1.00	0.431	No
107	8.78	0.49	0.15	0.34	0.98	0.497	1.15	0.432	1.00	1.00	0.432	No
108	8.86	0.49	0.15	0.34	0.98	0.499	1.15	0.434	1.00	1.00	0.434	No
109	8.94	0.49	0.15	0.34	0.98	0.501	1.15	0.436	1.00	1.00	0.436	No
110	9.02	0.50	0.16	0.34	0.98	0.503	1.15	0.438	1.00	1.00	0.438	No
111	9.10	0.50	0.16	0.34	0.98	0.505	1.15	0.439	1.00	1.00	0.439	No
112	9.19	0.50	0.16	0.34	0.98	0.507	1.15	0.441	1.00	1.00	0.441	No
113	9.27	0.51	0.16	0.34	0.98	0.509	1.15	0.443	1.00	1.00	0.443	No
114	9.35	0.51	0.17	0.34	0.98	0.511	1.15	0.444	1.00	1.00	0.444	No
115	9.43	0.52	0.17	0.35	0.98	0.513	1.15	0.446	1.00	1.00	0.446	No
116	9.51	0.52	0.17	0.35	0.98	0.514	1.15	0.447	1.00	1.00	0.447	No
117	9.60	0.52	0.17	0.35	0.98	0.516	1.15	0.448	1.00	1.00	0.448	No
118	9.68	0.53	0.18	0.35	0.98	0.517	1.15	0.450	1.00	1.00	0.450	No
119	9.76	0.53	0.18	0.35	0.98	0.519	1.15	0.451	1.00	1.00	0.451	No
120	9.84	0.54	0.18	0.35	0.98	0.521	1.15	0.453	1.00	1.00	0.453	No
121	9.92	0.54	0.18	0.36	0.98	0.522	1.15	0.454	1.00	1.00	0.454	No
122	10.01	0.55	0.19	0.36	0.98	0.524	1.15	0.455	1.00	1.00	0.455	No
123	10.09	0.55	0.19	0.36	0.98	0.525	1.15	0.457	1.00	1.00	0.457	No
124	10.17	0.55	0.19	0.36	0.98	0.527	1.15	0.458	1.00	1.00	0.458	No
125	10.25	0.56	0.20	0.36	0.98	0.529	1.15	0.460	1.00	1.00	0.460	No
126	10.33	0.56	0.20	0.36	0.98	0.530	1.15	0.461	1.00	1.00	0.461	No
127	10.42	0.57	0.20	0.36	0.98	0.532	1.15	0.462	1.00	1.00	0.462	No
128	10.50	0.57	0.20	0.37	0.98	0.533	1.15	0.464	1.00	1.00	0.464	No
129	10.58	0.57	0.21	0.37	0.98	0.535	1.15	0.465	1.00	1.00	0.465	No
130	10.66	0.58	0.21	0.37	0.98	0.536	1.15	0.466	1.00	1.00	0.466	No
131	10.74	0.58	0.21	0.37	0.98	0.538	1.15	0.468	1.00	1.00	0.468	No
132	10.83	0.59	0.21	0.37	0.98	0.539	1.15	0.469	1.00	1.00	0.469	No
133	10.91	0.59	0.22	0.37	0.98	0.541	1.15	0.470	1.00	1.00	0.470	No
134	10.99	0.59	0.22	0.38	0.98	0.542	1.15	0.471	1.00	1.00	0.471	No
135	11.07	0.60	0.22	0.38	0.98	0.543	1.15	0.472	1.00	1.00	0.472	No
136	11.15	0.60	0.22	0.38	0.98	0.545	1.15	0.474	1.00	1.00	0.474	No
137	11.24	0.61	0.23	0.38	0.98	0.546	1.15	0.475	1.00	1.00	0.475	No
138	11.32	0.61	0.23	0.38	0.98	0.547	1.15	0.476	1.00	1.00	0.476	No
139	11.40	0.62	0.23	0.38	0.98	0.548	1.15	0.477	1.00	1.00	0.477	No
140	11.48	0.62	0.23	0.39	0.98	0.550	1.15	0.478	1.00	1.00	0.478	No
141	11.56	0.62	0.24	0.39	0.98	0.551	1.15	0.479	1.00	1.00	0.479	No
142	11.65	0.63	0.24	0.39	0.98	0.552	1.15	0.480	1.00	1.00	0.480	No
143	11.73	0.63	0.24	0.39	0.98	0.553	1.15	0.481	1.00	1.00	0.481	No
144	11.81	0.64	0.24	0.39	0.98	0.554	1.15	0.482	1.00	1.00	0.482	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
145	11.89	0.64	0.25	0.40	0.98	0.555	1.15	0.482	1.00	1.00	0.482	No
146	11.98	0.65	0.25	0.40	0.97	0.556	1.15	0.483	1.00	1.00	0.483	No
147	12.06	0.65	0.25	0.40	0.97	0.557	1.15	0.484	1.00	1.00	0.484	No
148	12.14	0.66	0.25	0.40	0.97	0.558	1.15	0.485	1.00	1.00	0.485	No
149	12.22	0.66	0.26	0.40	0.97	0.559	1.15	0.486	1.00	1.00	0.486	No
150	12.30	0.67	0.26	0.41	0.97	0.560	1.15	0.487	1.00	1.00	0.487	No
151	12.39	0.67	0.26	0.41	0.97	0.561	1.15	0.488	1.00	1.00	0.488	No
152	12.47	0.67	0.26	0.41	0.97	0.562	1.15	0.488	1.00	1.00	0.488	No
153	12.55	0.68	0.27	0.41	0.97	0.563	1.15	0.489	1.00	1.00	0.489	No
154	12.63	0.68	0.27	0.41	0.97	0.564	1.15	0.490	1.00	1.00	0.490	No
155	12.71	0.69	0.27	0.42	0.97	0.565	1.15	0.491	1.00	1.00	0.491	No
156	12.80	0.69	0.27	0.42	0.97	0.565	1.15	0.492	1.00	1.00	0.492	No
157	12.88	0.70	0.28	0.42	0.97	0.566	1.15	0.492	1.00	1.00	0.492	No
158	12.96	0.70	0.28	0.42	0.97	0.567	1.15	0.493	1.00	1.00	0.493	No
159	13.04	0.71	0.28	0.42	0.97	0.568	1.15	0.494	1.00	1.00	0.494	No
160	13.12	0.71	0.28	0.43	0.97	0.569	1.15	0.495	1.00	1.00	0.495	No
161	13.21	0.72	0.29	0.43	0.97	0.570	1.15	0.496	1.00	1.00	0.496	No
162	13.29	0.72	0.29	0.43	0.97	0.571	1.15	0.496	1.00	1.00	0.496	No
163	13.37	0.73	0.29	0.43	0.97	0.572	1.15	0.497	1.00	1.00	0.497	No
164	13.45	0.73	0.29	0.43	0.97	0.573	1.15	0.498	1.00	1.00	0.498	No
165	13.53	0.73	0.30	0.44	0.97	0.573	1.15	0.499	1.00	1.00	0.499	No
166	13.62	0.74	0.30	0.44	0.97	0.574	1.15	0.499	1.00	1.00	0.499	No
167	13.70	0.74	0.30	0.44	0.97	0.575	1.15	0.500	1.00	1.00	0.500	No
168	13.78	0.75	0.31	0.44	0.97	0.576	1.15	0.501	1.00	1.00	0.501	No
169	13.86	0.75	0.31	0.44	0.97	0.577	1.15	0.502	1.00	1.00	0.502	No
170	13.94	0.76	0.31	0.45	0.97	0.578	1.15	0.502	1.00	1.00	0.502	No
171	14.03	0.76	0.31	0.45	0.97	0.579	1.15	0.503	1.00	1.00	0.503	No
172	14.11	0.77	0.32	0.45	0.97	0.579	1.15	0.504	1.00	1.00	0.504	No
173	14.19	0.77	0.32	0.45	0.97	0.580	1.15	0.504	1.00	1.00	0.504	No
174	14.27	0.77	0.32	0.45	0.97	0.581	1.15	0.505	1.00	1.00	0.505	No
175	14.35	0.78	0.32	0.46	0.97	0.582	1.15	0.506	1.00	1.00	0.506	No
176	14.44	0.78	0.33	0.46	0.97	0.582	1.15	0.506	1.00	1.00	0.506	No
177	14.52	0.79	0.33	0.46	0.97	0.583	1.15	0.507	1.00	1.00	0.507	No
178	14.60	0.79	0.33	0.46	0.97	0.584	1.15	0.507	1.00	1.00	0.507	No
179	14.68	0.80	0.33	0.46	0.97	0.584	1.15	0.508	1.00	1.00	0.508	No
180	14.76	0.80	0.34	0.47	0.97	0.585	1.15	0.509	1.00	1.00	0.509	No
181	14.85	0.81	0.34	0.47	0.97	0.586	1.15	0.509	1.00	1.00	0.509	No
182	14.93	0.81	0.34	0.47	0.97	0.587	1.15	0.510	1.00	1.00	0.510	No
183	15.01	0.82	0.34	0.47	0.97	0.587	1.15	0.511	1.00	1.00	0.511	No
184	15.09	0.82	0.35	0.47	0.97	0.588	1.15	0.511	1.00	1.00	0.511	No
185	15.17	0.82	0.35	0.48	0.97	0.589	1.15	0.512	1.00	1.00	0.512	No
186	15.26	0.83	0.35	0.48	0.97	0.590	1.15	0.513	1.00	1.00	0.513	No
187	15.34	0.83	0.35	0.48	0.97	0.590	1.15	0.513	1.00	1.00	0.513	No
188	15.42	0.84	0.36	0.48	0.97	0.591	1.15	0.514	1.00	1.00	0.514	No
189	15.50	0.84	0.36	0.48	0.97	0.592	1.15	0.514	1.00	1.00	0.514	No
190	15.58	0.85	0.36	0.49	0.97	0.592	1.15	0.515	1.00	1.00	0.515	No
191	15.67	0.85	0.36	0.49	0.97	0.593	1.15	0.515	1.00	1.00	0.515	No
192	15.75	0.86	0.37	0.49	0.97	0.593	1.15	0.516	1.00	1.00	0.516	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
193	15.83	0.86	0.37	0.49	0.97	0.594	1.15	0.516	1.00	1.00	0.516	No
194	15.91	0.87	0.37	0.49	0.97	0.595	1.15	0.517	1.00	1.00	0.517	No
195	15.99	0.87	0.37	0.50	0.97	0.595	1.15	0.517	1.00	1.00	0.517	No
196	16.08	0.87	0.38	0.50	0.97	0.596	1.15	0.518	1.00	1.00	0.518	No
197	16.16	0.88	0.38	0.50	0.97	0.596	1.15	0.518	1.00	1.00	0.518	No
198	16.24	0.88	0.38	0.50	0.97	0.597	1.15	0.519	1.00	1.00	0.519	No
199	16.32	0.89	0.38	0.50	0.97	0.598	1.15	0.520	1.00	1.00	0.520	No
200	16.40	0.89	0.39	0.51	0.97	0.598	1.15	0.520	1.00	1.00	0.520	No
201	16.49	0.90	0.39	0.51	0.97	0.599	1.15	0.521	1.00	1.00	0.521	No
202	16.57	0.90	0.39	0.51	0.97	0.599	1.15	0.521	1.00	1.00	0.521	No
203	16.65	0.91	0.39	0.51	0.96	0.600	1.15	0.522	1.00	1.00	0.522	No
204	16.73	0.91	0.40	0.51	0.96	0.601	1.15	0.522	1.00	1.00	0.522	No
205	16.81	0.92	0.40	0.52	0.96	0.601	1.15	0.523	1.00	1.00	0.523	No
206	16.90	0.92	0.40	0.52	0.96	0.602	1.15	0.523	1.00	1.00	0.523	No
207	16.98	0.92	0.40	0.52	0.96	0.602	1.15	0.523	1.00	1.00	0.523	No
208	17.06	0.93	0.41	0.52	0.96	0.603	1.15	0.524	1.00	1.00	0.524	No
209	17.14	0.93	0.41	0.52	0.96	0.603	1.15	0.524	1.00	1.00	0.524	No
210	17.22	0.94	0.41	0.53	0.96	0.604	1.15	0.525	1.00	1.00	0.525	No
211	17.31	0.94	0.42	0.53	0.96	0.604	1.15	0.525	1.00	1.00	0.525	No
212	17.39	0.95	0.42	0.53	0.96	0.604	1.15	0.525	1.00	1.00	0.525	No
213	17.47	0.95	0.42	0.53	0.96	0.605	1.15	0.526	1.00	1.00	0.526	No
214	17.55	0.96	0.42	0.54	0.96	0.605	1.15	0.526	1.00	1.00	0.526	No
215	17.63	0.96	0.43	0.54	0.96	0.605	1.15	0.526	1.00	1.00	0.526	No
216	17.72	0.97	0.43	0.54	0.96	0.606	1.15	0.527	1.00	1.00	0.527	No
217	17.80	0.97	0.43	0.54	0.96	0.606	1.15	0.527	1.00	1.00	0.527	No
218	17.88	0.98	0.43	0.54	0.96	0.606	1.15	0.527	1.00	1.00	0.527	No
219	17.96	0.98	0.44	0.55	0.96	0.607	1.15	0.528	1.00	1.00	0.528	No
220	18.04	0.99	0.44	0.55	0.96	0.607	1.15	0.528	1.00	1.00	0.528	No
221	18.13	0.99	0.44	0.55	0.96	0.607	1.15	0.528	1.00	1.00	0.528	No
222	18.21	1.00	0.44	0.55	0.96	0.608	1.15	0.528	1.00	1.00	0.528	No
223	18.29	1.00	0.45	0.56	0.96	0.608	1.15	0.529	1.00	1.00	0.529	No
224	18.37	1.01	0.45	0.56	0.96	0.608	1.15	0.529	1.00	1.00	0.529	No
225	18.45	1.01	0.45	0.56	0.96	0.609	1.15	0.529	1.00	1.00	0.529	No
226	18.54	1.02	0.45	0.56	0.96	0.609	1.15	0.529	1.00	1.00	0.529	No
227	18.62	1.02	0.46	0.57	0.96	0.609	1.15	0.530	1.00	1.00	0.530	No
228	18.70	1.03	0.46	0.57	0.96	0.609	1.15	0.530	1.00	1.00	0.530	No
229	18.78	1.03	0.46	0.57	0.96	0.610	1.15	0.530	1.00	1.00	0.530	No
230	18.86	1.04	0.46	0.57	0.96	0.610	1.15	0.530	1.00	1.00	0.530	No
231	18.95	1.04	0.47	0.57	0.96	0.610	1.15	0.530	1.00	1.00	0.530	No
232	19.03	1.05	0.47	0.58	0.96	0.610	1.15	0.531	1.00	1.00	0.531	No
233	19.11	1.05	0.47	0.58	0.96	0.611	1.15	0.531	1.00	1.00	0.531	No
234	19.19	1.06	0.47	0.58	0.96	0.611	1.15	0.531	1.00	1.00	0.531	No
235	19.27	1.06	0.48	0.58	0.96	0.611	1.15	0.531	1.00	1.00	0.531	No
236	19.36	1.07	0.48	0.59	0.96	0.611	1.15	0.531	1.00	1.00	0.531	No
237	19.44	1.07	0.48	0.59	0.96	0.612	1.15	0.532	1.00	1.00	0.532	No
238	19.52	1.08	0.48	0.59	0.96	0.612	1.15	0.532	1.00	1.00	0.532	No
239	19.60	1.08	0.49	0.59	0.96	0.612	1.15	0.532	1.00	1.00	0.532	No
240	19.69	1.08	0.49	0.60	0.96	0.613	1.15	0.533	1.00	1.00	0.533	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
241	19.77	1.09	0.49	0.60	0.96	0.613	1.15	0.533	1.00	1.00	0.533	No
242	19.85	1.09	0.49	0.60	0.96	0.613	1.15	0.533	1.00	1.00	0.533	No
243	19.93	1.10	0.50	0.60	0.96	0.614	1.15	0.534	1.00	1.00	0.534	No
244	20.01	1.10	0.50	0.60	0.96	0.614	1.15	0.534	1.00	1.00	0.534	No
245	20.10	1.11	0.50	0.60	0.96	0.615	1.15	0.534	1.00	1.00	0.534	No
246	20.18	1.11	0.50	0.61	0.96	0.615	1.15	0.535	1.00	1.00	0.535	No
247	20.26	1.12	0.51	0.61	0.96	0.616	1.15	0.535	1.00	1.00	0.535	No
248	20.34	1.12	0.51	0.61	0.96	0.616	1.15	0.536	1.00	1.00	0.536	No
249	20.42	1.12	0.51	0.61	0.96	0.616	1.15	0.536	1.00	1.00	0.536	No
250	20.51	1.13	0.51	0.61	0.96	0.617	1.15	0.536	1.00	1.00	0.536	No
251	20.59	1.13	0.52	0.62	0.96	0.617	1.15	0.537	1.00	1.00	0.537	No
252	20.67	1.14	0.52	0.62	0.96	0.618	1.15	0.537	1.00	1.00	0.537	No
253	20.75	1.14	0.52	0.62	0.95	0.618	1.15	0.537	1.00	1.00	0.537	No
254	20.83	1.15	0.53	0.62	0.95	0.619	1.15	0.538	1.00	1.00	0.538	No
255	20.92	1.15	0.53	0.62	0.95	0.619	1.15	0.538	1.00	1.00	0.538	No
256	21.00	1.15	0.53	0.62	0.95	0.620	1.15	0.539	1.00	1.00	0.539	No
257	21.08	1.16	0.53	0.63	0.95	0.620	1.15	0.539	1.00	1.00	0.539	No
258	21.16	1.16	0.54	0.63	0.95	0.621	1.15	0.540	1.00	1.00	0.540	No
259	21.24	1.17	0.54	0.63	0.95	0.621	1.15	0.540	1.00	1.00	0.540	No
260	21.33	1.17	0.54	0.63	0.95	0.622	1.15	0.541	1.00	1.00	0.541	No
261	21.41	1.17	0.54	0.63	0.95	0.623	1.15	0.541	1.00	1.00	0.541	No
262	21.49	1.18	0.55	0.63	0.95	0.623	1.15	0.542	1.00	1.00	0.542	No
263	21.57	1.18	0.55	0.63	0.95	0.624	1.15	0.542	1.00	1.00	0.542	No
264	21.65	1.19	0.55	0.63	0.95	0.624	1.15	0.543	1.00	1.00	0.543	No
265	21.74	1.19	0.55	0.64	0.95	0.625	1.15	0.543	1.00	1.00	0.543	No
266	21.82	1.19	0.56	0.64	0.95	0.625	1.15	0.544	1.00	1.00	0.544	No
267	21.90	1.20	0.56	0.64	0.95	0.626	1.15	0.544	1.00	1.00	0.544	No
268	21.98	1.20	0.56	0.64	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
269	22.06	1.21	0.56	0.64	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
270	22.15	1.21	0.57	0.64	0.95	0.628	1.15	0.546	1.00	1.00	0.546	No
271	22.23	1.21	0.57	0.64	0.95	0.628	1.15	0.546	1.00	1.00	0.546	No
272	22.31	1.22	0.57	0.65	0.95	0.629	1.15	0.547	1.00	1.00	0.547	No
273	22.39	1.22	0.57	0.65	0.95	0.629	1.15	0.547	1.00	1.00	0.547	No
274	22.47	1.22	0.58	0.65	0.95	0.630	1.15	0.548	1.00	1.00	0.548	No
275	22.56	1.23	0.58	0.65	0.95	0.630	1.15	0.548	1.00	1.00	0.548	No
276	22.64	1.23	0.58	0.65	0.95	0.631	1.15	0.548	1.00	1.00	0.548	No
277	22.72	1.24	0.58	0.65	0.95	0.631	1.15	0.549	1.00	1.00	0.549	No
278	22.80	1.24	0.59	0.65	0.95	0.632	1.15	0.549	1.00	1.00	0.549	No
279	22.88	1.24	0.59	0.66	0.95	0.632	1.15	0.550	1.00	1.00	0.550	No
280	22.97	1.25	0.59	0.66	0.95	0.633	1.15	0.550	1.00	1.00	0.550	No
281	23.05	1.25	0.59	0.66	0.95	0.633	1.15	0.550	1.00	1.00	0.550	No
282	23.13	1.26	0.60	0.66	0.95	0.633	1.15	0.551	1.00	1.00	0.551	No
283	23.21	1.26	0.60	0.66	0.95	0.634	1.15	0.551	1.00	1.00	0.551	No
284	23.29	1.27	0.60	0.66	0.95	0.634	1.15	0.551	1.00	1.00	0.551	No
285	23.38	1.27	0.60	0.66	0.95	0.635	1.15	0.552	1.00	1.00	0.552	No
286	23.46	1.27	0.61	0.67	0.95	0.635	1.15	0.552	1.00	1.00	0.552	No
287	23.54	1.28	0.61	0.67	0.95	0.636	1.15	0.553	1.00	1.00	0.553	No
288	23.62	1.28	0.61	0.67	0.95	0.636	1.15	0.553	1.00	1.00	0.553	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
289	23.70	1.29	0.61	0.67	0.95	0.637	1.15	0.554	1.00	1.00	0.554	No
290	23.79	1.29	0.62	0.67	0.95	0.637	1.15	0.554	1.00	1.00	0.554	No
291	23.87	1.29	0.62	0.67	0.95	0.638	1.15	0.554	1.00	1.00	0.554	No
292	23.95	1.30	0.62	0.67	0.95	0.638	1.15	0.555	1.00	1.00	0.555	No
293	24.03	1.30	0.63	0.68	0.95	0.639	1.15	0.555	1.00	1.00	0.555	No
294	24.11	1.30	0.63	0.68	0.94	0.639	1.15	0.556	1.00	1.00	0.556	No
295	24.20	1.31	0.63	0.68	0.94	0.639	1.15	0.556	1.00	1.00	0.556	No
296	24.28	1.31	0.63	0.68	0.94	0.640	1.15	0.556	1.00	1.00	0.556	No
297	24.36	1.32	0.64	0.68	0.94	0.640	1.15	0.557	1.00	1.00	0.557	No
298	24.44	1.32	0.64	0.68	0.94	0.641	1.15	0.557	1.00	1.00	0.557	No
299	24.52	1.32	0.64	0.68	0.94	0.641	1.15	0.558	1.00	1.00	0.558	No
300	24.61	1.33	0.64	0.69	0.94	0.642	1.15	0.558	1.00	1.00	0.558	No
301	24.69	1.33	0.65	0.69	0.94	0.642	1.15	0.558	1.00	1.00	0.558	No
302	24.77	1.34	0.65	0.69	0.94	0.642	1.15	0.559	1.00	1.00	0.559	No
303	24.85	1.34	0.65	0.69	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
304	24.93	1.34	0.65	0.69	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
305	25.02	1.35	0.66	0.69	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
306	25.10	1.35	0.66	0.70	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
307	25.18	1.36	0.66	0.70	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
308	25.26	1.36	0.66	0.70	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
309	25.34	1.37	0.67	0.70	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
310	25.43	1.37	0.67	0.70	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
311	25.51	1.38	0.67	0.71	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
312	25.59	1.38	0.67	0.71	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
313	25.67	1.39	0.68	0.71	0.94	0.643	1.15	0.559	1.00	1.00	0.559	No
314	25.75	1.39	0.68	0.72	0.94	0.642	1.15	0.559	1.00	1.00	0.559	No
315	25.84	1.40	0.68	0.72	0.94	0.642	1.15	0.558	1.00	1.00	0.558	No
316	25.92	1.40	0.68	0.72	0.94	0.642	1.15	0.558	1.00	1.00	0.558	No
317	26.00	1.41	0.69	0.72	0.94	0.642	1.15	0.558	1.00	1.00	0.558	No
318	26.08	1.42	0.69	0.73	0.94	0.642	1.15	0.558	1.00	1.00	0.558	No
319	26.16	1.42	0.69	0.73	0.94	0.641	1.15	0.558	1.00	1.00	0.558	No
320	26.25	1.43	0.69	0.73	0.94	0.641	1.15	0.557	1.00	1.00	0.557	No
321	26.33	1.43	0.70	0.73	0.94	0.641	1.15	0.557	1.00	1.00	0.557	No
322	26.41	1.44	0.70	0.74	0.94	0.641	1.15	0.557	1.00	1.00	0.557	No
323	26.49	1.44	0.70	0.74	0.94	0.641	1.15	0.557	1.00	1.00	0.557	No
324	26.57	1.45	0.70	0.74	0.94	0.641	1.15	0.557	1.00	1.00	0.557	No
325	26.66	1.45	0.71	0.74	0.94	0.640	1.15	0.557	1.00	1.00	0.557	No
326	26.74	1.46	0.71	0.75	0.94	0.640	1.15	0.557	1.00	1.00	0.557	No
327	26.82	1.46	0.71	0.75	0.93	0.640	1.15	0.556	1.00	1.00	0.556	No
328	26.90	1.47	0.71	0.75	0.93	0.640	1.15	0.556	1.00	1.00	0.556	No
329	26.98	1.47	0.72	0.75	0.93	0.640	1.15	0.556	1.00	1.00	0.556	No
330	27.07	1.48	0.72	0.76	0.93	0.639	1.15	0.556	1.00	1.00	0.556	No
331	27.15	1.48	0.72	0.76	0.93	0.639	1.15	0.556	1.00	1.00	0.556	No
332	27.23	1.49	0.72	0.76	0.93	0.639	1.15	0.556	1.00	1.00	0.556	No
333	27.31	1.49	0.73	0.76	0.93	0.639	1.15	0.556	1.00	1.00	0.556	No
334	27.40	1.50	0.73	0.77	0.93	0.639	1.15	0.556	1.00	1.00	0.556	No
335	27.48	1.50	0.73	0.77	0.93	0.639	1.15	0.556	1.00	1.00	0.556	No
336	27.56	1.51	0.74	0.77	0.93	0.639	1.15	0.555	1.00	1.00	0.555	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
337	27.64	1.51	0.74	0.77	0.93	0.639	1.15	0.555	1.00	1.00	0.555	No
338	27.72	1.52	0.74	0.78	0.93	0.639	1.15	0.555	1.00	1.00	0.555	No
339	27.81	1.52	0.74	0.78	0.93	0.639	1.15	0.555	1.00	1.00	0.555	No
340	27.89	1.53	0.75	0.78	0.93	0.638	1.15	0.555	1.00	1.00	0.555	No
341	27.97	1.53	0.75	0.78	0.93	0.638	1.15	0.555	1.00	1.00	0.555	No
342	28.05	1.54	0.75	0.79	0.93	0.638	1.15	0.555	1.00	1.00	0.555	No
343	28.13	1.54	0.75	0.79	0.93	0.638	1.15	0.555	1.00	1.00	0.555	No
344	28.22	1.55	0.76	0.79	0.93	0.638	1.15	0.555	1.00	1.00	0.555	No
345	28.30	1.55	0.76	0.79	0.93	0.638	1.15	0.555	1.00	1.00	0.555	No
346	28.38	1.56	0.76	0.79	0.93	0.638	1.15	0.554	1.00	1.00	0.554	No
347	28.46	1.56	0.76	0.80	0.93	0.637	1.15	0.554	1.00	1.00	0.554	No
348	28.54	1.57	0.77	0.80	0.93	0.637	1.15	0.554	1.00	1.00	0.554	No
349	28.63	1.57	0.77	0.80	0.93	0.637	1.15	0.554	1.00	1.00	0.554	No
350	28.71	1.58	0.77	0.81	0.93	0.637	1.15	0.554	1.00	1.00	0.554	No
351	28.79	1.58	0.77	0.81	0.93	0.637	1.15	0.553	1.00	1.00	0.553	No
352	28.87	1.59	0.78	0.81	0.93	0.636	1.15	0.553	1.00	1.00	0.553	No
353	28.95	1.59	0.78	0.81	0.93	0.636	1.15	0.553	1.00	1.00	0.553	No
354	29.04	1.60	0.78	0.82	0.93	0.636	1.15	0.553	1.00	1.00	0.553	No
355	29.12	1.60	0.78	0.82	0.92	0.636	1.15	0.553	1.00	1.00	0.553	No
356	29.20	1.61	0.79	0.82	0.92	0.635	1.15	0.552	1.00	1.00	0.552	No
357	29.28	1.61	0.79	0.82	0.92	0.635	1.15	0.552	1.00	1.00	0.552	No
358	29.36	1.62	0.79	0.83	0.92	0.635	1.15	0.552	1.00	1.00	0.552	No
359	29.45	1.62	0.79	0.83	0.92	0.635	1.15	0.552	1.00	1.00	0.552	No
360	29.53	1.63	0.80	0.83	0.92	0.635	1.15	0.552	1.00	1.00	0.552	No
361	29.61	1.63	0.80	0.83	0.92	0.634	1.15	0.552	1.00	1.00	0.552	No
362	29.69	1.64	0.80	0.84	0.92	0.634	1.15	0.551	1.00	1.00	0.551	No
363	29.77	1.64	0.80	0.84	0.92	0.634	1.15	0.551	1.00	1.00	0.551	No
364	29.86	1.65	0.81	0.84	0.92	0.634	1.15	0.551	1.00	1.00	0.551	No
365	29.94	1.65	0.81	0.84	0.92	0.633	1.15	0.551	1.00	1.00	0.551	No
366	30.02	1.66	0.81	0.85	0.92	0.633	1.15	0.550	1.00	1.00	0.550	No
367	30.10	1.66	0.81	0.85	0.92	0.633	1.15	0.550	1.00	1.00	0.550	No
368	30.18	1.67	0.82	0.85	0.92	0.632	1.15	0.550	1.00	1.00	0.550	No
369	30.27	1.67	0.82	0.86	0.92	0.632	1.15	0.549	1.00	1.00	0.549	No
370	30.35	1.68	0.82	0.86	0.92	0.632	1.15	0.549	1.00	1.00	0.549	No
371	30.43	1.69	0.82	0.86	0.92	0.631	1.15	0.549	1.00	1.00	0.549	No
372	30.51	1.69	0.83	0.86	0.92	0.631	1.15	0.548	1.00	1.00	0.548	No
373	30.59	1.70	0.83	0.87	0.92	0.631	1.15	0.548	1.00	1.00	0.548	No
374	30.68	1.70	0.83	0.87	0.92	0.630	1.15	0.548	1.00	1.00	0.548	No
375	30.76	1.71	0.83	0.87	0.92	0.630	1.15	0.547	1.00	1.00	0.547	No
376	30.84	1.71	0.84	0.88	0.92	0.629	1.15	0.547	1.00	1.00	0.547	No
377	30.92	1.72	0.84	0.88	0.92	0.629	1.15	0.547	1.00	1.00	0.547	No
378	31.00	1.72	0.84	0.88	0.92	0.628	1.15	0.546	1.00	1.00	0.546	No
379	31.09	1.73	0.85	0.88	0.91	0.628	1.15	0.546	1.00	1.00	0.546	No
380	31.17	1.73	0.85	0.89	0.91	0.628	1.15	0.546	1.00	1.00	0.546	No
381	31.25	1.74	0.85	0.89	0.91	0.627	1.15	0.545	1.00	1.00	0.545	No
382	31.33	1.75	0.85	0.89	0.91	0.627	1.15	0.545	1.00	1.00	0.545	No
383	31.41	1.75	0.86	0.90	0.91	0.627	1.15	0.545	1.00	1.00	0.545	No
384	31.50	1.76	0.86	0.90	0.91	0.626	1.15	0.544	1.00	1.00	0.544	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
385	31.58	1.76	0.86	0.90	0.91	0.626	1.15	0.544	1.00	1.00	0.544	No
386	31.66	1.77	0.86	0.90	0.91	0.625	1.15	0.544	1.00	1.00	0.544	No
387	31.74	1.77	0.87	0.91	0.91	0.625	1.15	0.543	1.00	1.00	0.543	No
388	31.82	1.78	0.87	0.91	0.91	0.625	1.15	0.543	1.00	1.00	0.543	No
389	31.91	1.78	0.87	0.91	0.91	0.624	1.15	0.543	1.00	1.00	0.543	No
390	31.99	1.79	0.87	0.92	0.91	0.624	1.15	0.542	1.00	1.00	0.542	No
391	32.07	1.79	0.88	0.92	0.91	0.623	1.15	0.542	1.00	1.00	0.542	No
392	32.15	1.80	0.88	0.92	0.91	0.623	1.15	0.542	1.00	1.00	0.542	No
393	32.23	1.81	0.88	0.92	0.91	0.623	1.15	0.541	1.00	1.00	0.541	No
394	32.32	1.81	0.88	0.93	0.91	0.622	1.15	0.541	1.00	1.00	0.541	No
395	32.40	1.82	0.89	0.93	0.91	0.622	1.15	0.540	1.00	1.00	0.540	No
396	32.48	1.82	0.89	0.93	0.91	0.621	1.15	0.540	1.00	1.00	0.540	No
397	32.56	1.83	0.89	0.94	0.91	0.621	1.15	0.540	1.00	1.00	0.540	No
398	32.64	1.83	0.89	0.94	0.91	0.620	1.15	0.539	1.00	1.00	0.539	No
399	32.73	1.84	0.90	0.94	0.91	0.620	1.15	0.539	1.00	1.00	0.539	No
400	32.81	1.84	0.90	0.95	0.90	0.620	1.15	0.539	1.00	1.00	0.539	No
401	32.89	1.85	0.90	0.95	0.90	0.619	1.15	0.538	1.00	1.00	0.538	No
402	32.97	1.85	0.90	0.95	0.90	0.619	1.15	0.538	1.00	1.00	0.538	No
403	33.05	1.86	0.91	0.95	0.90	0.618	1.15	0.538	1.00	1.00	0.538	No
404	33.14	1.87	0.91	0.96	0.90	0.618	1.15	0.537	1.00	1.00	0.537	No
405	33.22	1.87	0.91	0.96	0.90	0.618	1.15	0.537	1.00	1.00	0.537	No
406	33.30	1.88	0.91	0.96	0.90	0.617	1.15	0.537	1.00	1.00	0.537	No
407	33.38	1.88	0.92	0.97	0.90	0.617	1.15	0.536	1.00	1.00	0.536	No
408	33.46	1.89	0.92	0.97	0.90	0.616	1.15	0.536	1.00	1.00	0.536	No
409	33.55	1.89	0.92	0.97	0.90	0.616	1.15	0.535	1.00	1.00	0.535	No
410	33.63	1.90	0.92	0.98	0.90	0.615	1.15	0.535	1.00	1.00	0.535	No
411	33.71	1.91	0.93	0.98	0.90	0.615	1.15	0.534	1.00	1.00	0.534	No
412	33.79	1.91	0.93	0.98	0.90	0.614	1.15	0.534	1.00	1.00	0.534	No
413	33.87	1.92	0.93	0.98	0.90	0.614	1.15	0.534	1.00	1.00	0.534	No
414	33.96	1.92	0.93	0.99	0.90	0.613	1.15	0.533	1.00	1.00	0.533	No
415	34.04	1.93	0.94	0.99	0.90	0.613	1.15	0.533	1.00	1.00	0.533	No
416	34.12	1.93	0.94	0.99	0.90	0.612	1.15	0.532	1.00	1.00	0.532	No
417	34.20	1.94	0.94	1.00	0.90	0.612	1.15	0.532	1.00	1.00	0.532	No
418	34.28	1.94	0.94	1.00	0.90	0.612	1.15	0.532	1.00	1.00	0.532	No
419	34.37	1.95	0.95	1.00	0.89	0.611	1.15	0.531	1.00	1.00	0.531	No
420	34.45	1.95	0.95	1.00	0.89	0.611	1.15	0.531	1.00	1.00	0.531	No
421	34.53	1.96	0.95	1.01	0.89	0.610	1.15	0.531	1.00	1.00	0.531	No
422	34.61	1.97	0.96	1.01	0.89	0.610	1.15	0.530	1.00	1.00	0.530	No
423	34.69	1.97	0.96	1.01	0.89	0.609	1.15	0.530	1.00	1.00	0.530	No
424	34.78	1.98	0.96	1.02	0.89	0.609	1.15	0.529	1.00	1.00	0.529	No
425	34.86	1.98	0.96	1.02	0.89	0.609	1.15	0.529	1.00	1.00	0.529	No
426	34.94	1.99	0.97	1.02	0.89	0.608	1.15	0.529	1.00	1.00	0.529	No
427	35.02	1.99	0.97	1.02	0.89	0.608	1.15	0.528	1.00	1.00	0.528	No
428	35.10	2.00	0.97	1.03	0.89	0.607	1.15	0.528	1.00	1.00	0.528	No
429	35.19	2.00	0.97	1.03	0.89	0.607	1.15	0.528	1.00	1.00	0.528	No
430	35.27	2.01	0.98	1.03	0.89	0.607	1.15	0.527	1.00	1.00	0.527	No
431	35.35	2.01	0.98	1.04	0.89	0.606	1.15	0.527	1.00	1.00	0.527	No
432	35.43	2.02	0.98	1.04	0.89	0.606	1.15	0.527	1.00	1.00	0.527	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
433	35.52	2.02	0.98	1.04	0.89	0.606	1.15	0.527	1.00	1.00	0.527	No
434	35.60	2.03	0.99	1.04	0.89	0.605	1.15	0.526	1.00	1.00	0.526	No
435	35.68	2.03	0.99	1.05	0.89	0.605	1.15	0.526	1.00	1.00	0.526	No
436	35.76	2.04	0.99	1.05	0.89	0.604	1.15	0.525	1.00	1.00	0.525	No
437	35.84	2.04	0.99	1.05	0.88	0.604	1.15	0.525	1.00	1.00	0.525	No
438	35.93	2.05	1.00	1.05	0.88	0.604	1.15	0.525	1.00	1.00	0.525	No
439	36.01	2.06	1.00	1.06	0.88	0.603	1.15	0.524	1.00	1.00	0.524	No
440	36.09	2.06	1.00	1.06	0.88	0.603	1.15	0.524	1.00	1.00	0.524	No
441	36.17	2.07	1.00	1.06	0.88	0.602	1.15	0.523	1.00	1.00	0.523	No
442	36.25	2.07	1.01	1.07	0.88	0.602	1.15	0.523	1.00	1.00	0.523	No
443	36.34	2.08	1.01	1.07	0.88	0.601	1.15	0.523	1.00	1.00	0.523	No
444	36.42	2.08	1.01	1.07	0.88	0.601	1.15	0.522	1.00	1.00	0.522	No
445	36.50	2.09	1.01	1.07	0.88	0.600	1.15	0.522	1.00	1.00	0.522	No
446	36.58	2.09	1.02	1.08	0.88	0.600	1.15	0.521	1.00	1.00	0.521	No
447	36.66	2.10	1.02	1.08	0.88	0.599	1.15	0.521	1.00	1.00	0.521	No
448	36.75	2.11	1.02	1.08	0.88	0.599	1.15	0.520	1.00	1.00	0.520	No
449	36.83	2.11	1.02	1.09	0.88	0.598	1.15	0.520	1.00	1.00	0.520	No
450	36.91	2.12	1.03	1.09	0.88	0.598	1.15	0.520	1.00	1.00	0.520	No
451	36.99	2.12	1.03	1.09	0.88	0.597	1.15	0.519	1.00	1.00	0.519	No
452	37.07	2.13	1.03	1.10	0.88	0.597	1.15	0.519	1.00	1.00	0.519	No
453	37.16	2.13	1.03	1.10	0.87	0.596	1.15	0.518	1.00	1.00	0.518	No
454	37.24	2.14	1.04	1.10	0.87	0.596	1.15	0.518	1.00	1.00	0.518	No
455	37.32	2.14	1.04	1.10	0.87	0.595	1.15	0.517	1.00	1.00	0.517	No
456	37.40	2.15	1.04	1.11	0.87	0.595	1.15	0.517	1.00	1.00	0.517	No
457	37.48	2.15	1.04	1.11	0.87	0.594	1.15	0.517	1.00	1.00	0.517	No
458	37.57	2.16	1.05	1.11	0.87	0.594	1.15	0.516	1.00	1.00	0.516	No
459	37.65	2.17	1.05	1.12	0.87	0.593	1.15	0.516	1.00	1.00	0.516	No
460	37.73	2.17	1.05	1.12	0.87	0.593	1.15	0.515	1.00	1.00	0.515	No
461	37.81	2.18	1.05	1.12	0.87	0.592	1.15	0.515	1.00	1.00	0.515	No
462	37.89	2.18	1.06	1.13	0.87	0.591	1.15	0.514	1.00	1.00	0.514	No
463	37.98	2.19	1.06	1.13	0.87	0.591	1.15	0.514	1.00	1.00	0.514	No
464	38.06	2.19	1.06	1.13	0.87	0.590	1.15	0.513	1.00	1.00	0.513	No
465	38.14	2.20	1.07	1.13	0.87	0.590	1.15	0.513	1.00	1.00	0.513	No
466	38.22	2.21	1.07	1.14	0.87	0.589	1.15	0.512	1.00	1.00	0.512	No
467	38.30	2.21	1.07	1.14	0.87	0.589	1.15	0.512	1.00	1.00	0.512	No
468	38.39	2.22	1.07	1.14	0.86	0.588	1.15	0.511	1.00	1.00	0.511	No
469	38.47	2.22	1.08	1.15	0.86	0.588	1.15	0.511	1.00	1.00	0.511	No
470	38.55	2.23	1.08	1.15	0.86	0.587	1.15	0.510	1.00	1.00	0.510	No
471	38.63	2.23	1.08	1.15	0.86	0.587	1.15	0.510	1.00	1.00	0.510	No
472	38.71	2.24	1.08	1.16	0.86	0.586	1.15	0.510	1.00	1.00	0.510	No
473	38.80	2.24	1.09	1.16	0.86	0.586	1.15	0.509	1.00	1.00	0.509	No
474	38.88	2.25	1.09	1.16	0.86	0.585	1.15	0.509	1.00	1.00	0.509	No
475	38.96	2.26	1.09	1.16	0.86	0.585	1.15	0.508	1.00	1.00	0.508	No
476	39.04	2.26	1.09	1.17	0.86	0.584	1.15	0.508	1.00	1.00	0.508	No
477	39.12	2.27	1.10	1.17	0.86	0.584	1.15	0.507	1.00	1.00	0.507	No
478	39.21	2.27	1.10	1.17	0.86	0.583	1.15	0.507	1.00	1.00	0.507	No
479	39.29	2.28	1.10	1.18	0.86	0.583	1.15	0.507	1.00	1.00	0.507	No
480	39.37	2.28	1.10	1.18	0.86	0.582	1.15	0.506	1.00	1.00	0.506	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
481	39.45	2.29	1.11	1.18	0.86	0.582	1.15	0.506	1.00	1.00	0.506	No
482	39.53	2.29	1.11	1.18	0.86	0.581	1.15	0.505	1.00	1.00	0.505	No
483	39.62	2.30	1.11	1.19	0.85	0.581	1.15	0.505	1.00	1.00	0.505	No
484	39.70	2.30	1.11	1.19	0.85	0.580	1.15	0.504	1.00	1.00	0.504	No
485	39.78	2.31	1.12	1.19	0.85	0.580	1.15	0.504	1.00	1.00	0.504	No
486	39.86	2.31	1.12	1.20	0.85	0.579	1.15	0.504	1.00	1.00	0.504	No
487	39.94	2.32	1.12	1.20	0.85	0.579	1.15	0.503	1.00	1.00	0.503	No
488	40.03	2.32	1.12	1.20	0.85	0.578	1.15	0.503	1.00	1.00	0.503	No
489	40.11	2.33	1.13	1.20	0.85	0.578	1.15	0.502	1.00	1.00	0.502	No
490	40.19	2.34	1.13	1.21	0.85	0.577	1.15	0.502	1.00	1.00	0.502	No
491	40.27	2.34	1.13	1.21	0.85	0.577	1.15	0.501	1.00	1.00	0.501	No
492	40.35	2.35	1.13	1.21	0.85	0.576	1.15	0.501	1.00	1.00	0.501	No
493	40.44	2.35	1.14	1.21	0.85	0.576	1.15	0.500	1.00	1.00	0.500	No
494	40.52	2.36	1.14	1.22	0.85	0.575	1.15	0.500	1.00	1.00	0.500	No
495	40.60	2.36	1.14	1.22	0.85	0.575	1.15	0.500	1.00	1.00	0.500	No
496	40.68	2.37	1.14	1.22	0.84	0.574	1.15	0.499	1.00	1.00	0.499	No
497	40.76	2.37	1.15	1.23	0.84	0.574	1.15	0.499	1.00	1.00	0.499	No
498	40.85	2.38	1.15	1.23	0.84	0.573	1.15	0.498	1.00	1.00	0.498	No
499	40.93	2.38	1.15	1.23	0.84	0.573	1.15	0.498	1.00	1.00	0.498	No
500	41.01	2.39	1.15	1.23	0.84	0.572	1.15	0.497	1.00	1.00	0.497	No
501	41.09	2.39	1.16	1.24	0.84	0.572	1.15	0.497	1.00	1.00	0.497	No
502	41.17	2.40	1.16	1.24	0.84	0.571	1.15	0.496	1.00	1.00	0.496	No
503	41.26	2.40	1.16	1.24	0.84	0.570	1.15	0.496	1.00	1.00	0.496	No
504	41.34	2.41	1.16	1.25	0.84	0.570	1.15	0.496	1.00	1.00	0.496	No
505	41.42	2.42	1.17	1.25	0.84	0.569	1.15	0.495	1.00	1.00	0.495	No
506	41.50	2.42	1.17	1.25	0.84	0.569	1.15	0.495	1.00	1.00	0.495	No
507	41.58	2.43	1.17	1.25	0.84	0.568	1.15	0.494	1.00	1.00	0.494	No
508	41.67	2.43	1.18	1.26	0.84	0.568	1.15	0.494	1.00	1.00	0.494	No
509	41.75	2.44	1.18	1.26	0.84	0.567	1.15	0.493	1.00	1.00	0.493	No
510	41.83	2.44	1.18	1.26	0.83	0.567	1.15	0.493	1.00	1.00	2.000	No
511	41.91	2.44	1.18	1.26	0.83	0.567	1.15	0.493	1.00	1.00	2.000	No
512	41.99	2.45	1.19	1.26	0.83	0.567	1.15	0.493	1.00	1.00	2.000	No

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
σ_v: Total overburden pressure at test point (tsf)
u_0: Water pressure at test point (tsf)
σ_v': Effective overburden pressure based on GWT during earthquake (tsf)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
CSR_{eq}: CSR adjusted for M=7.5
K_σ: Effective overburden stress factor
CSR^*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) calculation data ::

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	0.08	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
2	0.16	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
3	0.25	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
4	0.33	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
5	0.41	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
6	0.49	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
7	0.57	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
8	0.66	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
9	0.74	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
10	0.82	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
11	0.90	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
12	0.98	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
13	1.07	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
14	1.15	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
15	1.23	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
16	1.31	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
17	1.39	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
18	1.48	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
19	1.56	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
20	1.64	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
21	1.72	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
22	1.80	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
23	1.89	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
24	1.97	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
25	2.05	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
26	2.13	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
27	2.21	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
28	2.30	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
29	2.38	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
30	2.46	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
31	2.54	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
32	2.62	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
33	2.71	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
34	2.79	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
35	2.87	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
36	2.95	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
37	3.03	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
38	3.12	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
39	3.20	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
40	3.28	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
41	3.36	26.72	2.26	1.53	0.72	50.13	1.78	89.32	4.000	No	No	2.00
42	3.44	36.78	2.19	1.74	0.69	69.13	1.59	109.81	4.000	No	No	2.00
43	3.53	29.77	2.34	2.32	0.75	55.87	2.09	116.82	4.000	No	No	2.00
44	3.61	21.75	2.54	3.27	0.83	40.70	3.75	152.74	4.000	No	No	2.00
45	3.69	16.35	2.72	4.37	0.90	30.49	4.93	150.38	4.000	No	Yes	2.00
46	3.77	14.45	2.78	4.63	0.92	26.89	5.59	150.26	4.000	No	Yes	2.00
47	3.85	13.28	2.81	4.63	0.93	24.67	5.93	146.25	4.000	No	Yes	2.00
48	3.94	12.87	2.81	4.47	0.93	23.89	5.93	141.63	4.000	No	Yes	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	4.02	12.58	2.83	4.74	0.94	23.32	6.24	145.60	1.112	No	Yes	2.00
50	4.10	11.87	2.88	5.20	0.96	21.98	6.87	151.08	1.048	No	Yes	2.00
51	4.18	10.69	2.95	5.96	0.99	19.73	7.99	157.64	0.941	No	Yes	2.00
52	4.27	9.49	3.03	6.81	1.00	17.46	9.30	162.32	0.833	No	Yes	2.00
53	4.35	8.71	3.08	7.34	1.00	15.98	10.23	163.41	0.762	No	Yes	2.00
54	4.43	8.54	3.08	7.12	1.00	15.65	10.19	159.37	0.746	No	Yes	2.00
55	4.51	8.61	3.05	6.61	1.00	15.77	9.73	153.47	0.752	No	Yes	2.00
56	4.59	8.75	3.03	6.25	1.00	16.03	9.34	149.78	0.765	No	Yes	2.00
57	4.68	8.83	3.03	6.32	1.00	16.16	9.35	151.18	0.771	No	Yes	2.00
58	4.76	8.99	3.03	6.45	1.00	16.46	9.35	153.92	0.785	No	Yes	2.00
59	4.84	9.07	3.04	6.64	1.00	16.60	9.46	156.97	0.792	No	Yes	2.00
60	4.92	9.16	3.04	6.81	1.00	16.76	9.54	159.83	0.799	No	Yes	2.00
61	5.00	9.26	3.04	6.89	1.00	16.95	9.53	161.53	0.809	No	Yes	2.00
62	5.09	9.57	3.02	6.65	1.00	17.53	9.16	160.47	0.836	No	Yes	2.00
63	5.17	9.97	2.98	6.13	1.00	18.27	8.52	155.70	0.871	No	Yes	2.00
64	5.25	10.00	2.97	5.82	0.99	18.32	8.26	151.27	0.874	No	Yes	2.00
65	5.33	9.57	2.98	5.78	1.00	17.49	8.47	148.19	0.834	No	Yes	2.00
66	5.41	8.91	3.01	5.88	1.00	16.23	8.96	145.52	0.774	No	Yes	2.00
67	5.50	8.48	3.02	5.79	1.00	15.43	9.17	141.54	0.736	No	Yes	2.00
68	5.58	8.32	3.01	5.48	1.00	15.11	9.02	136.40	0.721	No	Yes	2.00
69	5.66	8.35	2.99	5.10	1.00	15.16	8.66	131.35	0.723	No	Yes	2.00
70	5.74	8.40	2.98	4.94	1.00	15.25	8.48	129.27	0.727	No	Yes	2.00
71	5.82	8.37	2.99	5.02	1.00	15.17	8.58	130.22	0.724	No	Yes	2.00
72	5.91	8.12	3.02	5.33	1.00	14.69	9.05	132.98	0.701	No	Yes	1.92
73	5.99	7.63	3.06	5.79	1.00	13.77	9.85	135.66	0.657	No	Yes	1.79
74	6.07	7.02	3.12	6.40	1.00	12.61	10.97	138.26	0.601	No	Yes	1.63
75	6.15	6.52	3.17	6.96	1.00	11.65	12.01	139.93	0.556	No	Yes	1.50
76	6.23	6.26	3.18	6.86	1.00	11.15	12.24	136.46	0.532	No	Yes	1.43
77	6.32	6.10	3.17	6.38	1.00	10.84	12.00	130.06	0.517	No	Yes	1.38
78	6.40	5.93	3.15	5.79	1.00	10.51	11.64	122.40	0.501	No	Yes	1.33
79	6.48	5.72	3.15	5.51	1.00	10.10	11.65	117.67	0.482	No	Yes	1.27
80	6.56	5.55	3.15	5.29	1.00	9.77	11.65	113.82	0.466	No	Yes	1.22
81	6.64	5.39	3.15	5.15	1.00	9.47	11.73	111.06	0.452	No	Yes	1.18
82	6.73	5.17	3.17	5.10	1.00	9.04	12.02	108.64	0.431	No	Yes	1.12
83	6.81	5.03	3.17	4.97	1.00	8.76	12.10	106.03	0.418	No	Yes	1.08
84	6.89	4.91	3.17	4.82	1.00	8.53	12.13	103.44	0.407	No	Yes	1.05
85	6.97	4.75	3.18	4.67	1.00	8.22	12.23	100.54	0.392	No	Yes	1.00
86	7.05	4.61	3.18	4.43	1.00	7.94	12.20	96.87	0.379	No	Yes	0.96
87	7.14	4.41	3.17	4.09	1.00	7.56	12.14	91.72	0.360	No	Yes	0.91
88	7.22	4.26	3.16	3.68	1.00	7.26	11.88	86.28	0.346	No	Yes	0.87
89	7.30	4.12	3.14	3.18	1.00	6.99	11.43	79.89	0.333	No	Yes	0.84
90	7.38	4.02	3.11	2.64	1.00	6.81	10.73	73.07	0.325	No	Yes	0.81
91	7.46	4.05	3.05	2.04	1.00	6.84	9.60	65.65	0.326	No	Yes	0.81
92	7.55	4.11	2.99	1.60	1.00	6.96	8.60	59.83	0.332	No	Yes	0.82
93	7.63	4.22	2.94	1.32	0.99	7.15	7.80	55.77	0.341	No	Yes	0.84
94	7.71	4.31	2.91	1.16	0.97	7.32	7.29	53.31	0.349	No	Yes	0.85
95	7.79	4.40	2.87	1.02	0.96	7.49	6.79	50.89	0.357	No	Yes	0.87
96	7.87	4.44	2.86	0.95	0.95	7.55	6.58	49.67	0.360	No	Yes	0.87

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
97	7.96	4.47	2.85	0.94	0.95	7.60	6.52	49.60	0.363	No	Yes	0.88
98	8.04	4.52	2.87	1.05	0.96	7.70	6.72	51.73	0.367	No	Yes	0.88
99	8.12	4.62	2.87	1.10	0.96	7.87	6.72	52.88	0.376	No	Yes	0.90
100	8.20	4.66	2.86	1.09	0.96	7.95	6.66	52.94	0.379	No	Yes	0.90
101	8.28	4.59	2.86	1.02	0.95	7.81	6.59	51.42	0.372	No	Yes	0.88
102	8.37	4.51	2.86	0.99	0.95	7.65	6.61	50.52	0.365	No	Yes	0.86
103	8.45	4.45	2.86	0.95	0.95	7.52	6.59	49.55	0.359	No	Yes	0.84
104	8.53	4.43	2.85	0.91	0.95	7.49	6.51	48.75	0.357	No	Yes	0.84
105	8.61	4.46	2.84	0.87	0.95	7.53	6.38	48.02	0.359	No	Yes	0.84
106	8.69	4.56	2.83	0.86	0.94	7.70	6.23	47.97	0.368	No	Yes	0.85
107	8.78	4.68	2.82	0.86	0.94	7.93	6.07	48.18	0.378	No	Yes	0.88
108	8.86	4.78	2.81	0.85	0.93	8.12	5.93	48.11	0.387	No	Yes	0.89
109	8.94	4.86	2.80	0.85	0.93	8.26	5.84	48.25	0.394	No	Yes	0.90
110	9.02	4.92	2.80	0.86	0.93	8.36	5.81	48.61	0.399	No	Yes	0.91
111	9.10	5.06	2.80	0.93	0.93	8.62	5.84	50.34	0.411	No	Yes	0.94
112	9.19	5.28	2.80	1.02	0.93	9.03	5.83	52.65	0.431	No	Yes	0.98
113	9.27	5.67	2.79	1.13	0.93	9.77	5.70	55.68	0.466	No	Yes	1.05
114	9.35	6.32	2.78	1.33	0.92	10.99	5.56	61.10	0.524	No	Yes	1.18
115	9.43	7.52	2.74	1.53	0.91	13.25	5.09	67.44	0.632	No	Yes	1.42
116	9.51	8.28	2.77	2.12	0.92	14.68	5.54	81.31	0.700	No	Yes	1.57
117	9.60	8.34	2.84	2.77	0.95	14.77	6.35	93.72	0.705	No	Yes	1.57
118	9.68	7.24	2.97	3.77	1.00	12.68	8.30	105.29	0.605	No	Yes	1.34
119	9.76	6.17	3.07	4.34	1.00	10.66	10.00	106.64	0.509	No	Yes	1.13
120	9.84	5.31	3.13	4.46	1.00	9.02	11.28	101.79	0.430	No	Yes	0.95
121	9.92	4.92	3.12	3.81	1.00	8.28	11.09	91.80	0.395	No	Yes	0.87
122	10.01	4.72	3.08	3.00	1.00	7.88	10.27	80.97	0.376	No	Yes	0.83
123	10.09	4.72	3.03	2.45	1.00	7.88	9.39	74.00	0.376	No	Yes	0.82
124	10.17	4.82	3.01	2.24	1.00	8.06	8.88	71.61	0.384	No	Yes	0.84
125	10.25	4.96	2.99	2.20	1.00	8.31	8.62	71.70	0.397	No	Yes	0.86
126	10.33	5.02	2.98	2.16	1.00	8.43	8.47	71.43	0.402	No	Yes	0.87
127	10.42	5.02	2.98	2.17	1.00	8.42	8.49	71.54	0.402	No	Yes	0.87
128	10.50	5.07	2.99	2.26	1.00	8.51	8.59	73.14	0.406	No	Yes	0.88
129	10.58	5.28	2.98	2.38	1.00	8.89	8.51	75.73	0.424	No	Yes	0.91
130	10.66	5.74	2.96	2.44	0.99	9.75	8.05	78.55	0.465	No	Yes	1.00
131	10.74	6.40	2.91	2.42	0.98	10.99	7.36	80.91	0.524	No	Yes	1.12
132	10.83	7.25	2.85	2.32	0.95	12.59	6.52	82.14	0.601	No	Yes	1.28
133	10.91	7.75	2.81	2.19	0.94	13.54	5.99	81.11	0.646	No	Yes	1.37
134	10.99	7.75	2.81	2.21	0.94	13.53	6.03	81.56	0.645	No	Yes	1.37
135	11.07	7.24	2.87	2.45	0.96	12.56	6.71	84.30	0.599	No	Yes	1.27
136	11.15	6.94	2.97	3.47	1.00	11.97	8.29	99.20	0.571	No	Yes	1.21
137	11.24	8.15	2.93	3.80	0.99	14.26	7.69	109.73	0.680	No	Yes	1.43
138	11.32	10.06	2.83	3.51	0.95	17.86	6.29	112.44	0.852	No	Yes	1.79
139	11.40	12.30	2.72	2.98	0.90	22.09	4.90	108.35	1.054	No	Yes	2.00
140	11.48	16.41	2.54	2.23	0.84	29.85	3.60	107.56	0.196	No	No	0.41
141	11.56	27.66	2.22	1.35	0.71	51.10	1.67	85.11	0.137	No	No	0.29
142	11.65	42.95	1.96	0.80	0.61	73.73	1.27	93.93	0.157	No	No	0.33
143	11.73	57.70	1.76	0.50	0.54	92.19	1.11	102.13	0.179	No	No	0.37
144	11.81	65.13	1.67	0.37	0.50	100.19	1.00	100.19	0.174	No	No	0.36

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
145	11.89	68.14	1.63	0.33	0.49	103.14	1.00	103.14	0.182	No	No	0.38
146	11.98	70.56	1.63	0.35	0.49	106.73	1.00	106.73	0.193	No	No	0.40
147	12.06	77.24	1.62	0.38	0.49	116.01	1.00	116.01	0.225	No	No	0.47
148	12.14	87.06	1.58	0.38	0.47	128.57	1.00	128.57	0.278	No	No	0.57
149	12.22	98.79	1.51	0.32	0.44	141.87	1.00	141.87	0.346	No	No	0.71
150	12.30	108.42	1.43	0.25	0.41	151.27	1.00	151.27	0.402	No	No	0.83
151	12.39	116.33	1.38	0.21	0.39	159.01	1.00	159.01	0.454	No	No	0.93
152	12.47	122.33	1.35	0.19	0.38	165.09	1.00	165.09	0.498	No	No	1.02
153	12.55	127.66	1.34	0.20	0.38	171.52	1.00	171.52	0.549	No	No	1.12
154	12.63	134.08	1.33	0.20	0.37	179.00	1.00	179.00	0.613	No	No	1.25
155	12.71	141.80	1.31	0.20	0.37	187.70	1.00	187.70	0.695	No	No	1.42
156	12.80	151.92	1.26	0.17	0.35	197.15	1.00	197.15	0.793	No	No	1.61
157	12.88	163.38	1.20	0.13	0.33	207.91	1.00	207.91	4.000	No	No	2.00
158	12.96	175.02	1.15	0.10	0.31	218.70	1.00	218.70	4.000	No	No	2.00
159	13.04	185.29	1.13	0.10	0.30	229.56	1.00	229.56	4.000	No	No	2.00
160	13.12	190.46	1.12	0.11	0.30	235.26	1.00	235.26	4.000	No	No	2.00
161	13.21	190.85	1.13	0.11	0.30	235.78	1.00	235.78	4.000	No	No	2.00
162	13.29	188.49	1.13	0.11	0.30	232.97	1.00	232.97	4.000	No	No	2.00
163	13.37	187.10	1.13	0.10	0.30	230.24	1.00	230.24	4.000	No	No	2.00
164	13.45	186.37	1.12	0.09	0.30	228.82	1.00	228.82	4.000	No	No	2.00
165	13.53	186.12	1.12	0.08	0.30	227.89	1.00	227.89	4.000	No	No	2.00
166	13.62	184.93	1.12	0.08	0.30	226.23	1.00	226.23	4.000	No	No	2.00
167	13.70	183.80	1.12	0.07	0.30	224.57	1.00	224.57	4.000	No	No	2.00
168	13.78	180.39	1.13	0.06	0.30	220.64	1.00	220.64	4.000	No	No	2.00
169	13.86	176.69	1.13	0.06	0.30	216.46	1.00	216.46	4.000	No	No	2.00
170	13.94	171.69	1.15	0.07	0.31	210.96	1.00	210.96	4.000	No	No	2.00
171	14.03	166.60	1.18	0.11	0.32	206.74	1.00	206.74	4.000	No	No	2.00
172	14.11	161.20	1.23	0.15	0.34	202.33	1.00	202.33	4.000	No	No	2.00
173	14.19	156.72	1.28	0.20	0.36	199.66	1.00	199.66	0.820	No	No	1.63
174	14.27	154.79	1.30	0.21	0.36	198.03	1.00	198.03	0.802	No	No	1.59
175	14.35	154.22	1.30	0.22	0.37	197.25	1.00	197.25	0.794	No	No	1.57
176	14.44	154.29	1.29	0.20	0.36	196.49	1.00	196.49	0.786	No	No	1.55
177	14.52	154.24	1.28	0.19	0.36	195.46	1.00	195.46	0.774	No	No	1.53
178	14.60	154.34	1.26	0.17	0.35	194.18	1.00	194.18	0.761	No	No	1.50
179	14.68	153.36	1.24	0.14	0.34	191.20	1.00	191.20	0.730	No	No	1.44
180	14.76	151.08	1.22	0.11	0.34	187.40	1.00	187.40	0.692	No	No	1.36
181	14.85	146.61	1.22	0.09	0.34	181.57	1.00	181.57	0.637	No	No	1.25
182	14.93	142.13	1.23	0.09	0.34	176.30	1.00	176.30	0.590	No	No	1.16
183	15.01	137.22	1.25	0.08	0.35	170.61	1.00	170.61	0.542	No	No	1.06
184	15.09	133.01	1.27	0.10	0.35	165.95	1.00	165.95	0.505	No	No	0.99
185	15.17	130.08	1.28	0.10	0.36	162.71	1.00	162.71	0.481	No	No	0.94
186	15.26	128.45	1.30	0.13	0.37	161.68	1.00	161.68	0.473	No	No	0.92
187	15.34	129.50	1.32	0.16	0.38	163.72	1.00	163.72	0.488	No	No	0.95
188	15.42	130.21	1.36	0.21	0.39	166.31	1.00	166.31	0.508	No	No	0.99
189	15.50	128.87	1.39	0.25	0.40	165.90	1.00	165.90	0.505	No	No	0.98
190	15.58	124.78	1.41	0.25	0.41	161.06	1.00	161.06	0.469	No	No	0.91
191	15.67	119.34	1.42	0.25	0.41	154.29	1.00	154.29	0.422	No	No	0.82
192	15.75	113.42	1.43	0.23	0.42	146.64	1.00	146.64	0.373	No	No	0.72

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
193	15.83	109.42	1.47	0.27	0.43	142.77	1.00	142.77	0.351	No	No	0.68
194	15.91	107.96	1.48	0.28	0.44	141.06	1.00	141.06	0.341	No	No	0.66
195	15.99	110.80	1.45	0.25	0.43	143.49	1.00	143.49	0.355	No	No	0.69
196	16.08	116.89	1.40	0.20	0.40	148.73	1.00	148.73	0.386	No	No	0.75
197	16.16	128.19	1.33	0.15	0.38	159.68	1.00	159.68	0.459	No	No	0.88
198	16.24	145.29	1.25	0.12	0.35	177.27	1.00	177.27	0.598	No	No	1.15
199	16.32	164.17	1.19	0.09	0.33	196.71	1.00	196.71	0.788	No	No	1.52
200	16.40	177.76	1.15	0.07	0.31	210.53	1.00	210.53	4.000	No	No	2.00
201	16.49	187.19	1.13	0.08	0.31	220.35	1.00	220.35	4.000	No	No	2.00
202	16.57	190.04	1.13	0.09	0.31	223.60	1.00	223.60	4.000	No	No	2.00
203	16.65	190.52	1.14	0.10	0.31	224.31	1.00	224.31	4.000	No	No	2.00
204	16.73	187.42	1.15	0.11	0.31	220.92	1.00	220.92	4.000	No	No	2.00
205	16.81	188.25	1.20	0.16	0.33	224.34	1.00	224.34	4.000	No	No	2.00
206	16.90	191.63	1.20	0.17	0.33	228.51	1.00	228.51	4.000	No	No	2.00
207	16.98	192.15	1.20	0.18	0.33	228.87	1.00	228.87	4.000	No	No	2.00
208	17.06	189.36	1.17	0.13	0.32	223.21	1.00	223.21	4.000	No	No	2.00
209	17.14	182.22	1.17	0.12	0.32	214.71	1.00	214.71	4.000	No	No	2.00
210	17.22	168.28	1.23	0.15	0.34	200.83	1.00	200.83	4.000	No	No	2.00
211	17.31	144.39	1.35	0.23	0.39	177.82	1.00	177.82	0.603	No	No	1.15
212	17.39	113.53	1.58	0.47	0.48	147.79	1.00	147.79	0.380	No	No	0.72
213	17.47	85.10	1.83	0.93	0.57	117.92	1.19	140.05	0.335	No	No	0.64
214	17.55	59.63	2.09	1.62	0.67	87.67	1.41	123.30	0.254	No	No	0.48
215	17.63	42.45	2.31	2.46	0.76	65.40	1.96	128.21	0.276	No	No	0.52
216	17.72	29.33	2.52	3.48	0.83	47.01	3.15	147.85	0.381	No	No	0.72
217	17.80	22.07	2.67	4.35	0.89	36.21	8.22	297.51	3.600	No	No	2.00
218	17.88	19.97	2.71	4.51	0.91	32.83	4.78	157.00	1.566	No	Yes	2.00
219	17.96	25.28	2.54	3.22	0.84	40.13	3.74	149.96	0.394	No	No	0.75
220	18.04	36.27	2.32	2.14	0.76	54.95	2.01	110.66	0.206	No	No	0.39
221	18.13	58.63	2.06	1.36	0.66	83.74	1.36	113.96	0.218	No	No	0.41
222	18.21	90.22	1.83	0.95	0.57	122.28	1.18	144.76	0.362	No	No	0.69
223	18.29	120.62	1.68	0.74	0.51	157.44	1.00	157.44	0.443	No	No	0.84
224	18.37	134.83	1.60	0.63	0.49	172.52	1.00	172.52	0.558	No	No	1.05
225	18.45	132.86	1.57	0.56	0.48	168.61	1.00	168.61	0.526	No	No	0.99
226	18.54	126.09	1.59	0.54	0.48	160.11	1.00	160.11	0.462	No	No	0.87
227	18.62	120.18	1.62	0.58	0.49	153.43	1.00	153.43	0.416	No	No	0.79
228	18.70	117.24	1.66	0.66	0.51	150.79	1.00	150.79	0.399	No	No	0.75
229	18.78	116.34	1.67	0.68	0.51	149.68	1.00	149.68	0.392	No	No	0.74
230	18.86	114.70	1.67	0.67	0.51	147.30	1.00	147.30	0.377	No	No	0.71
231	18.95	111.45	1.69	0.69	0.52	143.38	1.00	143.38	0.354	No	No	0.67
232	19.03	107.65	1.73	0.79	0.54	139.58	1.06	147.32	0.377	No	No	0.71
233	19.11	103.55	1.78	0.90	0.56	135.39	1.13	153.05	0.413	No	No	0.78
234	19.19	97.49	1.84	1.06	0.58	128.88	1.19	153.96	0.419	No	No	0.79
235	19.27	88.68	1.91	1.22	0.61	118.68	1.24	147.72	0.380	No	No	0.71
236	19.36	77.40	1.96	1.23	0.62	104.18	1.27	132.80	0.298	No	No	0.56
237	19.44	66.76	1.97	1.09	0.63	89.73	1.28	115.29	0.223	No	No	0.42
238	19.52	60.77	1.91	0.75	0.61	80.25	1.24	99.76	0.172	No	No	0.32
239	19.60	55.40	1.92	0.69	0.61	73.08	1.25	91.47	0.151	No	No	0.28
240	19.69	44.91	2.04	0.83	0.65	60.34	1.34	80.89	0.129	No	No	0.24

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
241	19.77	30.90	2.28	1.34	0.75	43.16	1.84	79.36	0.126	No	No	0.24
242	19.85	18.95	2.56	2.20	0.85	27.44	4.26	116.91	0.229	No	No	0.43
243	19.93	14.06	2.74	2.93	0.92	20.63	5.10	105.30	0.984	No	Yes	1.84
244	20.01	11.03	2.87	3.50	0.97	16.20	6.74	109.11	0.773	No	Yes	1.45
245	20.10	9.85	2.90	3.41	0.98	14.33	7.24	103.74	0.683	No	Yes	1.28
246	20.18	9.65	2.86	2.77	0.97	13.84	6.66	92.16	0.660	No	Yes	1.23
247	20.26	11.41	2.71	1.91	0.91	16.14	4.87	78.50	0.770	No	Yes	1.44
248	20.34	15.23	2.56	1.55	0.86	21.37	4.28	91.35	0.151	No	No	0.28
249	20.42	17.22	2.52	1.54	0.84	24.08	3.18	76.67	0.122	No	No	0.23
250	20.51	16.55	2.56	1.74	0.85	23.22	4.20	97.49	0.166	No	No	0.31
251	20.59	13.02	2.70	2.15	0.91	18.37	10.05	184.62	0.599	No	No	1.12
252	20.67	10.34	2.84	2.70	0.96	14.59	6.31	92.10	0.696	No	Yes	1.30
253	20.75	8.61	2.95	3.22	1.00	12.07	7.93	95.73	0.576	No	Yes	1.07
254	20.83	7.70	2.99	3.17	1.00	10.56	8.64	91.22	0.503	No	Yes	0.94
255	20.92	7.59	2.93	2.39	1.00	10.32	7.66	79.03	0.492	No	Yes	0.91
256	21.00	7.69	2.84	1.59	0.96	10.26	6.36	65.30	0.489	No	Yes	0.91
257	21.08	7.63	2.80	1.24	0.94	10.05	5.79	58.20	0.479	No	Yes	0.89
258	21.16	7.52	2.79	1.18	0.94	9.85	5.77	56.83	0.470	No	Yes	0.87
259	21.24	7.44	2.80	1.18	0.95	9.72	5.84	56.78	0.464	No	Yes	0.86
260	21.33	7.41	2.80	1.17	0.95	9.65	5.85	56.40	0.460	No	Yes	0.85
261	21.41	7.40	2.80	1.16	0.95	9.60	5.84	56.08	0.458	No	Yes	0.85
262	21.49	7.40	2.80	1.14	0.95	9.58	5.82	55.73	0.457	No	Yes	0.84
263	21.57	7.45	2.79	1.12	0.94	9.61	5.75	55.28	0.458	No	Yes	0.85
264	21.65	7.54	2.79	1.10	0.94	9.71	5.67	55.06	0.463	No	Yes	0.85
265	21.74	7.69	2.77	1.08	0.94	9.90	5.53	54.80	0.472	No	Yes	0.87
266	21.82	7.99	2.75	1.04	0.93	10.28	5.28	54.33	0.491	No	Yes	0.90
267	21.90	8.16	2.74	1.01	0.92	10.49	5.13	53.82	0.500	No	Yes	0.92
268	21.98	8.23	2.74	1.01	0.92	10.55	5.09	53.67	0.503	No	Yes	0.92
269	22.06	8.03	2.75	1.02	0.93	10.26	5.24	53.78	0.489	No	Yes	0.90
270	22.15	7.76	2.77	1.05	0.94	9.87	5.48	54.04	0.471	No	Yes	0.86
271	22.23	7.42	2.79	1.07	0.95	9.37	5.78	54.14	0.447	No	Yes	0.82
272	22.31	7.25	2.81	1.09	0.95	9.11	5.96	54.30	0.435	No	Yes	0.80
273	22.39	7.22	2.81	1.11	0.95	9.06	6.01	54.47	0.432	No	Yes	0.79
274	22.47	7.32	2.81	1.11	0.95	9.18	5.96	54.68	0.438	No	Yes	0.80
275	22.56	7.43	2.80	1.08	0.95	9.30	5.82	54.09	0.443	No	Yes	0.81
276	22.64	7.55	2.81	1.19	0.95	9.47	5.99	56.69	0.452	No	Yes	0.82
277	22.72	7.77	2.83	1.40	0.96	9.81	6.23	61.13	0.468	No	Yes	0.85
278	22.80	8.27	2.83	1.63	0.96	10.55	6.29	66.41	0.503	No	Yes	0.92
279	22.88	8.73	2.82	1.70	0.96	11.18	6.14	68.60	0.533	No	Yes	0.97
280	22.97	9.20	2.80	1.68	0.95	11.80	5.85	68.99	0.563	No	Yes	1.02
281	23.05	9.14	2.81	1.76	0.95	11.71	6.01	70.45	0.559	No	Yes	1.02
282	23.13	9.05	2.81	1.67	0.95	11.53	5.94	68.48	0.550	No	Yes	1.00
283	23.21	8.85	2.79	1.44	0.94	11.17	5.69	63.54	0.533	No	Yes	0.97
284	23.29	8.89	2.73	1.08	0.92	11.08	5.03	55.74	0.529	No	Yes	0.96
285	23.38	8.86	2.70	0.93	0.91	10.96	4.75	52.10	0.523	No	Yes	0.95
286	23.46	8.80	2.70	0.91	0.91	10.85	4.75	51.58	0.518	No	Yes	0.94
287	23.54	8.73	2.71	0.93	0.92	10.74	4.84	51.95	0.512	No	Yes	0.93
288	23.62	8.46	2.73	0.96	0.92	10.37	5.06	52.50	0.494	No	Yes	0.89

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
289	23.70	8.24	2.75	0.99	0.93	10.05	5.27	52.98	0.479	No	Yes	0.87
290	23.79	7.95	2.77	1.03	0.94	9.65	5.53	53.36	0.460	No	Yes	0.83
291	23.87	7.94	2.77	1.01	0.94	9.61	5.52	53.05	0.458	No	Yes	0.83
292	23.95	7.80	2.78	1.01	0.94	9.38	5.62	52.70	0.448	No	Yes	0.81
293	24.03	7.66	2.79	1.00	0.94	9.18	5.70	52.30	0.438	No	Yes	0.79
294	24.11	7.57	2.79	0.97	0.94	9.02	5.72	51.58	0.430	No	Yes	0.77
295	24.20	7.58	2.79	0.96	0.94	9.02	5.71	51.44	0.430	No	Yes	0.77
296	24.28	7.64	2.78	0.95	0.94	9.08	5.64	51.19	0.433	No	Yes	0.78
297	24.36	7.75	2.78	0.96	0.94	9.20	5.60	51.53	0.439	No	Yes	0.79
298	24.44	7.92	2.78	0.99	0.94	9.42	5.57	52.50	0.450	No	Yes	0.81
299	24.52	8.28	2.76	1.03	0.94	9.88	5.42	53.59	0.472	No	Yes	0.85
300	24.61	8.69	2.75	1.05	0.93	10.43	5.22	54.46	0.497	No	Yes	0.89
301	24.69	8.87	2.74	1.05	0.93	10.64	5.15	54.78	0.508	No	Yes	0.91
302	24.77	8.93	2.76	1.16	0.93	10.73	5.34	57.29	0.512	No	Yes	0.92
303	24.85	8.91	2.86	1.93	0.97	10.84	6.68	72.39	0.517	No	Yes	0.93
304	24.93	10.00	2.87	2.44	0.98	12.38	6.77	83.84	0.591	No	Yes	1.06
305	25.02	12.51	2.84	3.03	0.96	15.85	6.33	100.30	0.756	No	Yes	1.35
306	25.10	15.89	2.75	3.03	0.93	20.31	5.27	107.09	0.969	No	Yes	1.73
307	25.18	31.27	2.42	2.05	0.80	39.53	2.48	97.94	0.167	No	No	0.30
308	25.26	76.44	1.93	0.95	0.62	91.55	1.25	114.76	0.221	No	No	0.39
309	25.34	147.95	1.56	0.53	0.48	168.57	1.00	168.57	0.525	No	No	0.94
310	25.43	221.18	1.37	0.41	0.40	244.78	1.00	244.78	4.000	No	No	2.00
311	25.51	272.75	1.26	0.36	0.36	296.92	1.00	296.92	4.000	No	No	2.00
312	25.59	303.58	1.28	0.43	0.37	331.08	1.00	331.08	4.000	No	No	2.00
313	25.67	321.41	1.26	0.42	0.36	349.06	1.00	349.06	4.000	No	No	2.00
314	25.75	338.01	1.27	0.47	0.37	367.49	1.00	367.49	4.000	No	No	2.00
315	25.84	347.73	1.30	0.53	0.38	379.17	1.00	379.17	4.000	No	No	2.00
316	25.92	359.17	1.33	0.60	0.39	392.70	1.00	392.70	4.000	No	No	2.00
317	26.00	354.72	1.35	0.63	0.40	388.31	1.00	388.31	4.000	No	No	2.00
318	26.08	347.51	1.31	0.54	0.38	377.64	1.00	377.64	4.000	No	No	2.00
319	26.16	334.14	1.27	0.45	0.37	360.51	1.00	360.51	4.000	No	No	2.00
320	26.25	325.43	1.21	0.36	0.35	347.82	1.00	347.82	4.000	No	No	2.00
321	26.33	317.10	1.13	0.25	0.32	334.90	1.00	334.90	4.000	No	No	2.00
322	26.41	308.39	1.14	0.26	0.32	325.86	1.00	325.86	4.000	No	No	2.00
323	26.49	303.51	1.19	0.31	0.34	322.56	1.00	322.56	4.000	No	No	2.00
324	26.57	301.09	1.29	0.43	0.38	323.64	1.00	323.64	4.000	No	No	2.00
325	26.66	305.45	1.28	0.42	0.37	327.48	1.00	327.48	4.000	No	No	2.00
326	26.74	297.99	1.29	0.42	0.37	319.37	1.00	319.37	4.000	No	No	2.00
327	26.82	295.63	1.28	0.41	0.37	316.23	1.00	316.23	4.000	No	No	2.00
328	26.90	286.58	1.33	0.47	0.39	308.02	1.00	308.02	4.000	No	No	2.00
329	26.98	290.29	1.29	0.42	0.38	310.27	1.00	310.27	4.000	No	No	2.00
330	27.07	288.84	1.24	0.34	0.36	306.07	1.00	306.07	4.000	No	No	2.00
331	27.15	290.63	1.13	0.22	0.32	303.68	1.00	303.68	4.000	No	No	2.00
332	27.23	289.61	1.10	0.18	0.30	300.88	1.00	300.88	4.000	No	No	2.00
333	27.31	284.08	1.09	0.16	0.30	294.62	1.00	294.62	4.000	No	No	2.00
334	27.40	278.93	1.12	0.18	0.31	289.94	1.00	289.94	4.000	No	No	2.00
335	27.48	275.24	1.13	0.20	0.32	286.41	1.00	286.41	4.000	No	No	2.00
336	27.56	276.25	1.17	0.23	0.33	288.40	1.00	288.40	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
337	27.64	273.29	1.21	0.28	0.35	286.38	1.00	286.38	4.000	No	No	2.00
338	27.72	273.94	1.22	0.28	0.35	286.95	1.00	286.95	4.000	No	No	2.00
339	27.81	274.81	1.17	0.24	0.33	286.16	1.00	286.16	4.000	No	No	2.00
340	27.89	279.57	1.14	0.21	0.32	289.84	1.00	289.84	4.000	No	No	2.00
341	27.97	279.55	1.13	0.20	0.32	289.15	1.00	289.15	4.000	No	No	2.00
342	28.05	279.48	1.14	0.20	0.32	288.97	1.00	288.97	4.000	No	No	2.00
343	28.13	278.68	1.13	0.19	0.32	287.56	1.00	287.56	4.000	No	No	2.00
344	28.22	275.11	1.11	0.17	0.31	283.18	1.00	283.18	4.000	No	No	2.00
345	28.30	270.40	1.15	0.20	0.33	279.20	1.00	279.20	4.000	No	No	2.00
346	28.38	267.51	1.22	0.27	0.35	277.94	1.00	277.94	4.000	No	No	2.00
347	28.46	269.19	1.31	0.39	0.39	282.07	1.00	282.07	4.000	No	No	2.00
348	28.54	267.45	1.37	0.50	0.41	281.87	1.00	281.87	4.000	No	No	2.00
349	28.63	264.31	1.38	0.51	0.42	278.52	1.00	278.52	4.000	No	No	2.00
350	28.71	259.63	1.36	0.45	0.40	272.38	1.00	272.38	4.000	No	No	2.00
351	28.79	255.57	1.31	0.37	0.39	266.49	1.00	266.49	4.000	No	No	2.00
352	28.87	260.50	1.29	0.36	0.38	270.90	1.00	270.90	4.000	No	No	2.00
353	28.95	261.38	1.38	0.49	0.41	273.84	1.00	273.84	4.000	No	No	2.00
354	29.04	272.23	1.44	0.64	0.44	286.73	1.00	286.73	4.000	No	No	2.00
355	29.12	268.23	1.50	0.75	0.46	283.55	1.00	283.55	4.000	No	No	2.00
356	29.20	262.12	1.46	0.65	0.44	275.59	1.00	275.59	4.000	No	No	2.00
357	29.28	246.20	1.40	0.50	0.42	257.03	1.00	257.03	4.000	No	No	2.00
358	29.36	239.04	1.29	0.30	0.38	246.49	1.00	246.49	4.000	No	No	2.00
359	29.45	239.44	1.25	0.26	0.36	245.78	1.00	245.78	4.000	No	No	2.00
360	29.53	253.30	1.19	0.21	0.34	258.42	1.00	258.42	4.000	No	No	2.00
361	29.61	271.51	1.24	0.30	0.36	278.14	1.00	278.14	4.000	No	No	2.00
362	29.69	294.18	1.29	0.40	0.38	302.44	1.00	302.44	4.000	No	No	2.00
363	29.77	312.56	1.34	0.52	0.40	322.58	1.00	322.58	4.000	No	No	2.00
364	29.86	331.69	1.37	0.60	0.41	342.85	1.00	342.85	4.000	No	No	2.00
365	29.94	346.14	1.38	0.64	0.41	357.61	1.00	357.61	4.000	No	No	2.00
366	30.02	365.08	1.38	0.68	0.42	376.88	1.00	376.88	4.000	No	No	2.00
367	30.10	381.24	1.37	0.69	0.41	392.88	1.00	392.88	4.000	No	No	2.00
368	30.18	391.80	1.35	0.65	0.40	402.44	1.00	402.44	4.000	No	No	2.00
369	30.27	398.98	1.32	0.60	0.39	408.27	1.00	408.27	4.000	No	No	2.00
370	30.35	401.66	1.26	0.51	0.37	408.68	1.00	408.68	4.000	No	No	2.00
371	30.43	414.40	1.21	0.44	0.35	419.33	1.00	419.33	4.000	No	No	2.00
372	30.51	426.09	1.22	0.46	0.35	431.02	1.00	431.02	4.000	No	No	2.00
373	30.59	436.33	1.31	0.64	0.39	444.27	1.00	444.27	4.000	No	No	2.00
374	30.68	462.98	1.38	0.82	0.42	473.33	1.00	473.33	4.000	No	No	2.00
375	30.76	485.08	1.42	0.94	0.43	496.67	1.00	496.67	4.000	No	No	2.00
376	30.84	496.55	1.39	0.88	0.42	506.72	1.00	506.72	4.000	No	No	2.00
377	30.92	486.98	1.39	0.86	0.42	496.11	1.00	496.11	4.000	No	No	2.00
378	31.00	483.72	1.36	0.78	0.41	490.89	1.00	490.89	4.000	No	No	2.00
379	31.09	489.21	1.32	0.71	0.40	494.59	1.00	494.59	4.000	No	No	2.00
380	31.17	512.03	1.21	0.53	0.35	513.19	1.00	513.19	4.000	No	No	2.00
381	31.25	527.67	1.14	0.44	0.33	525.94	1.00	525.94	4.000	No	No	2.00
382	31.33	547.71	1.12	0.43	0.32	544.85	1.00	544.85	4.000	No	No	2.00
383	31.41	554.37	1.10	0.40	0.31	550.07	1.00	550.07	4.000	No	No	2.00
384	31.50	542.38	1.10	0.39	0.31	537.70	1.00	537.70	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
385	31.58	530.13	1.13	0.43	0.32	526.00	1.00	526.00	4.000	No	No	2.00
386	31.66	533.19	1.20	0.52	0.35	530.55	1.00	530.55	4.000	No	No	2.00
387	31.74	509.71	1.23	0.56	0.36	507.55	1.00	507.55	4.000	No	No	2.00
388	31.82	489.37	1.16	0.43	0.33	484.66	1.00	484.66	4.000	No	No	2.00
389	31.91	441.30	1.35	0.70	0.41	441.08	1.00	441.08	4.000	No	No	2.00
390	31.99	453.05	1.40	0.84	0.43	453.68	1.00	453.68	4.000	No	No	2.00
391	32.07	475.30	1.46	1.00	0.45	476.72	1.00	476.72	4.000	No	No	2.00
392	32.15	520.78	1.37	0.84	0.42	519.38	1.00	519.38	4.000	No	No	2.00
393	32.23	546.69	1.35	0.83	0.41	544.13	1.00	544.13	4.000	No	No	2.00
394	32.32	577.36	1.32	0.77	0.40	572.96	1.00	572.96	4.000	No	No	2.00
395	32.40	557.93	1.30	0.73	0.39	552.57	1.00	552.57	4.000	No	No	2.00
396	32.48	518.03	1.37	0.83	0.42	513.85	1.00	513.85	4.000	No	No	2.00
397	32.56	440.67	1.45	0.93	0.45	437.89	1.00	437.89	4.000	No	No	2.00
398	32.64	395.68	1.49	0.96	0.46	393.13	1.00	393.13	4.000	No	No	2.00
399	32.73	373.89	1.35	0.62	0.41	368.70	1.00	368.70	4.000	No	No	2.00
400	32.81	393.80	1.22	0.42	0.36	385.79	1.00	385.79	4.000	No	No	2.00
401	32.89	410.46	1.15	0.34	0.33	400.50	1.00	400.50	4.000	No	No	2.00
402	32.97	423.75	1.22	0.45	0.36	414.41	1.00	414.41	4.000	No	No	2.00
403	33.05	447.80	1.31	0.63	0.39	439.08	1.00	439.08	4.000	No	No	2.00
404	33.14	490.69	1.39	0.84	0.42	482.16	1.00	482.16	4.000	No	No	2.00
405	33.22	539.15	1.40	0.93	0.43	529.49	1.00	529.49	4.000	No	No	2.00
406	33.30	550.82	1.45	1.07	0.45	541.18	1.00	541.18	4.000	No	No	2.00
407	33.38	547.41	1.49	1.19	0.46	537.81	1.00	537.81	4.000	No	No	2.00
408	33.46	514.85	1.51	1.22	0.47	505.37	1.00	505.37	4.000	No	No	2.00
409	33.55	466.95	1.56	1.31	0.49	458.21	1.00	458.21	4.000	No	No	2.00
410	33.63	432.70	1.55	1.19	0.49	423.59	1.00	423.59	4.000	No	No	2.00
411	33.71	405.29	1.57	1.21	0.49	396.27	1.00	396.27	4.000	No	No	2.00
412	33.79	397.55	1.52	1.05	0.48	387.61	1.00	387.61	4.000	No	No	2.00
413	33.87	382.48	1.55	1.11	0.49	372.62	1.00	372.62	4.000	No	No	2.00
414	33.96	386.38	1.57	1.19	0.50	376.06	1.00	376.06	4.000	No	No	2.00
415	34.04	397.16	1.55	1.12	0.49	385.75	1.00	385.75	4.000	No	No	2.00
416	34.12	410.46	1.49	0.97	0.46	397.60	1.00	397.60	4.000	No	No	2.00
417	34.20	440.27	1.38	0.74	0.42	424.96	1.00	424.96	4.000	No	No	2.00
418	34.28	461.91	1.29	0.60	0.39	444.55	1.00	444.55	4.000	No	No	2.00
419	34.37	457.97	1.25	0.52	0.37	439.88	1.00	439.88	4.000	No	No	2.00
420	34.45	410.83	1.34	0.62	0.41	394.66	1.00	394.66	4.000	No	No	2.00
421	34.53	362.28	1.48	0.85	0.46	348.28	1.00	348.28	4.000	No	No	2.00
422	34.61	322.49	1.60	1.10	0.51	310.05	1.00	310.05	4.000	No	No	2.00
423	34.69	303.32	1.65	1.21	0.52	291.32	1.00	291.32	4.000	No	No	2.00
424	34.78	284.42	1.67	1.23	0.53	272.74	1.00	272.74	4.000	No	No	2.00
425	34.86	274.78	1.62	1.03	0.52	262.85	1.00	262.85	4.000	No	No	2.00
426	34.94	278.06	1.56	0.88	0.49	265.44	1.00	265.44	4.000	No	No	2.00
427	35.02	277.18	1.54	0.82	0.49	264.16	1.00	264.16	4.000	No	No	2.00
428	35.10	277.04	1.56	0.85	0.49	263.72	1.00	263.72	4.000	No	No	2.00
429	35.19	271.79	1.50	0.69	0.47	258.18	1.00	258.18	4.000	No	No	2.00
430	35.27	271.98	1.34	0.40	0.41	257.68	1.00	257.68	4.000	No	No	2.00
431	35.35	273.99	1.22	0.25	0.37	259.10	1.00	259.10	4.000	No	No	2.00
432	35.43	283.73	1.25	0.29	0.37	268.20	1.00	268.20	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
433	35.52	287.59	1.32	0.40	0.40	271.74	1.00	271.74	4.000	No	No	2.00
434	35.60	285.68	1.39	0.50	0.43	269.74	1.00	269.74	4.000	No	No	2.00
435	35.68	286.47	1.41	0.55	0.44	270.23	1.00	270.23	4.000	No	No	2.00
436	35.76	308.09	1.47	0.72	0.46	290.49	1.00	290.49	4.000	No	No	2.00
437	35.84	340.67	1.49	0.83	0.47	321.02	1.00	321.02	4.000	No	No	2.00
438	35.93	379.43	1.48	0.88	0.46	357.29	1.00	357.29	4.000	No	No	2.00
439	36.01	408.13	1.44	0.81	0.45	383.96	1.00	383.96	4.000	No	No	2.00
440	36.09	421.42	1.48	0.94	0.46	396.01	1.00	396.01	4.000	No	No	2.00
441	36.17	409.34	1.49	0.94	0.47	384.09	1.00	384.09	4.000	No	No	2.00
442	36.25	395.37	1.57	1.15	0.50	370.34	1.00	370.34	4.000	No	No	2.00
443	36.34	389.54	1.50	0.94	0.47	364.44	1.00	364.44	4.000	No	No	2.00
444	36.42	378.60	1.51	0.95	0.48	353.66	1.00	353.66	4.000	No	No	2.00
445	36.50	363.00	1.46	0.78	0.46	338.69	1.00	338.69	4.000	No	No	2.00
446	36.58	335.19	1.55	0.98	0.49	311.98	1.00	311.98	4.000	No	No	2.00
447	36.66	338.85	1.62	1.20	0.52	314.81	1.00	314.81	4.000	No	No	2.00
448	36.75	344.05	1.65	1.32	0.53	319.11	1.00	319.11	4.000	No	No	2.00
449	36.83	380.68	1.59	1.18	0.51	353.00	1.00	353.00	4.000	No	No	2.00
450	36.91	394.90	1.51	0.97	0.48	366.08	1.00	366.08	4.000	No	No	2.00
451	36.99	366.64	1.51	0.90	0.48	339.31	1.00	339.31	4.000	No	No	2.00
452	37.07	360.64	1.50	0.87	0.47	333.35	1.00	333.35	4.000	No	No	2.00
453	37.16	366.79	1.54	1.00	0.49	338.42	1.00	338.42	4.000	No	No	2.00
454	37.24	437.35	1.47	0.93	0.46	403.79	1.00	403.79	4.000	No	No	2.00
455	37.32	416.12	1.52	1.03	0.48	383.31	1.00	383.31	4.000	No	No	2.00
456	37.40	383.12	1.54	1.03	0.49	352.15	1.00	352.15	4.000	No	No	2.00
457	37.48	317.72	1.72	1.48	0.56	290.37	1.02	296.23	4.000	No	No	2.00
458	37.57	318.89	1.78	1.78	0.58	290.62	1.13	328.50	4.000	No	No	2.00
459	37.65	344.64	1.81	2.01	0.59	313.57	1.16	364.11	4.000	No	No	2.00
460	37.73	366.21	1.80	2.06	0.59	332.80	1.16	384.53	4.000	No	No	2.00
461	37.81	393.61	1.79	2.10	0.59	357.33	1.15	409.61	4.000	No	No	2.00
462	37.89	405.97	1.81	2.22	0.59	367.89	1.16	427.88	4.000	No	No	2.00
463	37.98	460.10	1.71	1.85	0.56	417.51	1.01	423.75	4.000	No	No	2.00
464	38.06	398.67	1.76	1.92	0.57	360.52	1.10	395.93	4.000	No	No	2.00
465	38.14	340.53	1.78	1.84	0.58	306.99	1.13	346.71	4.000	No	No	2.00
466	38.22	263.09	1.93	2.35	0.64	235.36	1.26	296.22	4.000	No	No	2.00
467	38.30	250.57	1.96	2.43	0.65	223.50	1.28	285.04	4.000	No	No	2.00
468	38.39	221.28	2.04	2.79	0.68	196.33	1.34	263.73	4.000	No	No	2.00
469	38.47	170.86	2.19	3.51	0.74	150.17	1.59	238.04	4.000	No	No	2.00
470	38.55	145.32	2.27	3.96	0.77	126.83	1.83	232.23	4.000	No	No	2.00
471	38.63	125.32	2.34	4.26	0.80	108.65	2.09	226.81	4.000	No	No	2.00
472	38.71	117.25	2.34	4.05	0.80	101.31	2.09	212.08	4.000	No	No	2.00
473	38.80	109.77	2.34	3.86	0.80	94.52	2.11	199.21	0.815	No	No	1.60
474	38.88	104.97	2.34	3.62	0.80	90.14	2.07	186.71	0.685	No	No	1.35
475	38.96	100.07	2.34	3.52	0.80	85.66	2.09	179.28	0.616	No	No	1.21
476	39.04	97.58	2.34	3.40	0.80	83.32	2.08	173.36	0.565	No	No	1.11
477	39.12	96.80	2.33	3.32	0.79	82.50	2.06	169.78	0.535	No	No	1.05
478	39.21	95.23	2.34	3.35	0.80	80.94	2.10	169.67	0.534	No	No	1.05
479	39.29	94.41	2.38	3.68	0.81	79.96	2.25	180.09	0.623	No	No	1.23
480	39.37	94.78	2.39	3.89	0.82	80.07	2.34	187.55	0.694	No	No	1.37

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
481	39.45	103.02	2.36	3.73	0.80	87.16	2.16	188.03	0.698	No	No	1.38
482	39.53	127.96	2.21	2.91	0.75	109.20	1.64	179.07	0.614	No	No	1.22
483	39.62	165.69	2.03	2.15	0.68	142.81	1.34	191.20	0.730	No	No	1.45
484	39.70	197.23	1.90	1.68	0.63	171.11	1.24	211.86	4.000	No	No	2.00
485	39.78	205.23	1.86	1.53	0.61	178.20	1.21	215.24	4.000	No	No	2.00
486	39.86	188.91	1.92	1.71	0.64	163.15	1.25	204.17	4.000	No	No	2.00
487	39.94	164.19	2.02	2.04	0.68	140.65	1.33	186.52	0.683	No	No	1.36
488	40.03	142.03	2.13	2.46	0.72	120.58	1.46	176.23	0.589	No	No	1.17
489	40.11	123.98	2.22	2.84	0.75	104.36	1.65	172.65	0.559	No	No	1.11
490	40.19	112.12	2.29	3.26	0.78	93.66	1.89	177.34	0.599	No	No	1.19
491	40.27	105.38	2.33	3.51	0.80	87.55	2.06	180.76	0.629	No	No	1.26
492	40.35	107.61	2.31	3.29	0.79	89.40	1.95	174.50	0.574	No	No	1.15
493	40.44	116.06	2.24	2.88	0.76	96.73	1.73	167.16	0.514	No	No	1.03
494	40.52	122.36	2.19	2.60	0.74	102.18	1.60	163.06	0.483	No	No	0.97
495	40.60	121.38	2.20	2.63	0.75	101.13	1.61	162.98	0.483	No	No	0.97
496	40.68	110.70	2.27	2.96	0.77	91.54	1.81	165.25	0.500	No	No	1.00
497	40.76	100.73	2.34	3.36	0.80	82.65	2.07	171.26	0.547	No	No	1.10
498	40.85	95.90	2.37	3.50	0.81	78.31	2.20	172.51	0.557	No	No	1.12
499	40.93	97.43	2.34	3.31	0.80	79.55	2.10	166.94	0.513	No	No	1.03
500	41.01	99.31	2.31	3.04	0.79	81.12	1.96	159.10	0.455	No	No	0.91
501	41.09	100.12	2.30	2.93	0.78	81.72	1.91	155.99	0.433	No	No	0.87
502	41.17	96.73	2.32	3.03	0.79	78.63	2.00	156.92	0.439	No	No	0.89
503	41.26	91.97	2.35	3.21	0.81	74.38	2.14	159.42	0.457	No	No	0.92
504	41.34	88.45	2.37	3.26	0.81	71.24	2.23	158.67	0.451	No	No	0.91
505	41.42	92.99	2.45	4.37	0.84	74.47	2.67	198.85	0.811	No	No	1.64
506	41.50	103.92	2.50	5.50	0.86	83.04	2.97	246.95	4.000	No	No	2.00
507	41.58	116.20	2.54	6.81	0.88	92.61	3.77	349.42	4.000	No	No	2.00
508	41.67	125.32	2.38	4.58	0.82	100.88	2.30	231.58	4.000	No	No	2.00
509	41.75	264.42	1.70	1.16	0.56	224.57	1.00	224.57	4.000	No	No	2.00
510	41.83	406.50	N/A	0.00	1.00	320.45	1.00	320.45	4.000	No	No	2.00
511	41.91	568.35	N/A	0.00	1.00	448.44	1.00	448.44	4.000	No	No	2.00
512	41.99	595.38	N/A	0.00	1.00	469.48	1.00	469.48	4.000	No	No	2.00

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_t: Total cone resistance
I_c: Soil behavior type index
Fr: Normalized friction ratio (%)
n: Stress exponent
Q_{tn}: Normalized cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for M_w=7.5
FS: Factor of safety against soil liquefaction

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.08	2.00	0.00	0.00	0.00	0.00	0.16	2.00	0.00	0.00	0.00	0.00
0.25	2.00	0.00	0.00	0.00	0.00	0.33	2.00	0.00	0.00	0.00	0.00
0.41	2.00	0.00	0.00	0.00	0.00	0.49	2.00	0.00	0.00	0.00	0.00
0.57	2.00	0.00	0.00	0.00	0.00	0.66	2.00	0.00	0.00	0.00	0.00
0.74	2.00	0.00	0.00	0.00	0.00	0.82	2.00	0.00	0.00	0.00	0.00
0.90	2.00	0.00	0.00	0.00	0.00	0.98	2.00	0.00	0.00	0.00	0.00
1.07	2.00	0.00	0.00	0.00	0.00	1.15	2.00	0.00	0.00	0.00	0.00
1.23	2.00	0.00	0.00	0.00	0.00	1.31	2.00	0.00	0.00	0.00	0.00
1.39	2.00	0.00	0.00	0.00	0.00	1.48	2.00	0.00	0.00	0.00	0.00
1.56	2.00	0.00	0.00	0.00	0.00	1.64	2.00	0.00	0.00	0.00	0.00
1.72	2.00	0.00	0.00	0.00	0.00	1.80	2.00	0.00	0.00	0.00	0.00
1.89	2.00	0.00	0.00	0.00	0.00	1.97	2.00	0.00	0.00	0.00	0.00
2.05	2.00	0.00	0.00	0.00	0.00	2.13	2.00	0.00	0.00	0.00	0.00
2.21	2.00	0.00	0.00	0.00	0.00	2.30	2.00	0.00	0.00	0.00	0.00
2.38	2.00	0.00	0.00	0.00	0.00	2.46	2.00	0.00	0.00	0.00	0.00
2.54	2.00	0.00	0.00	0.00	0.00	2.62	2.00	0.00	0.00	0.00	0.00
2.71	2.00	0.00	0.00	0.00	0.00	2.79	2.00	0.00	0.00	0.00	0.00
2.87	2.00	0.00	0.00	0.00	0.00	2.95	2.00	0.00	0.00	0.00	0.00
3.03	2.00	0.00	0.00	0.00	0.00	3.12	2.00	0.00	0.00	0.00	0.00
3.20	2.00	0.00	0.00	0.00	0.00	3.28	2.00	0.00	0.00	0.00	0.00
3.36	2.00	0.00	0.00	0.08	0.00	3.44	2.00	0.00	0.00	0.08	0.00
3.53	2.00	0.00	0.00	0.08	0.00	3.61	2.00	0.00	0.00	0.08	0.00
3.69	2.00	0.00	0.00	0.08	0.00	3.77	2.00	0.00	0.00	0.08	0.00
3.85	2.00	0.00	0.00	0.08	0.00	3.94	2.00	0.00	0.00	0.08	0.00
4.02	2.00	0.00	0.00	0.08	0.00	4.10	2.00	0.00	0.00	0.08	0.00
4.18	2.00	0.00	0.00	0.08	0.00	4.27	2.00	0.00	0.00	0.08	0.00
4.35	2.00	0.00	0.00	0.08	0.00	4.43	2.00	0.00	0.00	0.08	0.00
4.51	2.00	0.00	0.00	0.08	0.00	4.59	2.00	0.00	0.00	0.08	0.00
4.68	2.00	0.00	0.00	0.08	0.00	4.76	2.00	0.00	0.00	0.08	0.00
4.84	2.00	0.00	0.00	0.08	0.00	4.92	2.00	0.00	0.00	0.08	0.00
5.00	2.00	0.00	0.00	0.08	0.00	5.09	2.00	0.00	0.00	0.08	0.00
5.17	2.00	0.00	0.00	0.08	0.00	5.25	2.00	0.00	0.00	0.08	0.00
5.33	2.00	0.00	0.00	0.08	0.00	5.41	2.00	0.00	0.00	0.08	0.00
5.50	2.00	0.00	0.00	0.08	0.00	5.58	2.00	0.00	0.00	0.08	0.00
5.66	2.00	0.00	0.00	0.08	0.00	5.74	2.00	0.00	0.00	0.08	0.00
5.82	2.00	0.00	0.00	0.08	0.00	5.91	1.92	0.00	0.00	0.08	0.00
5.99	1.79	0.00	0.00	0.08	0.00	6.07	1.63	0.00	0.00	0.08	0.00
6.15	1.50	0.00	0.00	0.08	0.00	6.23	1.43	0.00	0.00	0.08	0.00
6.32	1.38	0.00	0.00	0.08	0.00	6.40	1.33	0.00	0.00	0.08	0.00
6.48	1.27	0.00	0.00	0.08	0.00	6.56	1.22	0.00	0.00	0.08	0.00
6.64	1.18	0.00	0.00	0.08	0.00	6.73	1.12	0.00	0.00	0.08	0.00
6.81	1.08	0.00	0.00	0.08	0.00	6.89	1.05	0.00	0.00	0.08	0.00
6.97	1.00	0.00	0.00	0.08	0.00	7.05	0.96	0.00	0.00	0.08	0.01
7.14	0.91	0.00	0.00	0.08	0.02	7.22	0.87	0.00	0.00	0.08	0.03
7.30	0.84	0.00	0.00	0.08	0.04	7.38	0.81	0.00	0.00	0.08	0.04
7.46	0.81	0.00	0.00	0.08	0.04	7.55	0.82	0.00	0.00	0.08	0.04
7.63	0.84	0.00	0.00	0.08	0.04	7.71	0.85	0.00	0.00	0.08	0.03
7.79	0.87	0.00	0.00	0.08	0.03	7.87	0.87	0.00	0.00	0.08	0.03

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
7.96	0.88	0.00	0.00	0.08	0.03	8.04	0.88	0.00	0.00	0.08	0.03
8.12	0.90	0.00	0.00	0.08	0.02	8.20	0.90	0.00	0.00	0.08	0.02
8.28	0.88	0.00	0.00	0.08	0.03	8.37	0.86	0.00	0.00	0.08	0.03
8.45	0.84	0.00	0.00	0.08	0.03	8.53	0.84	0.00	0.00	0.08	0.04
8.61	0.84	0.00	0.00	0.08	0.04	8.69	0.85	0.00	0.00	0.08	0.03
8.78	0.88	0.00	0.00	0.08	0.03	8.86	0.89	0.00	0.00	0.08	0.02
8.94	0.90	0.00	0.00	0.08	0.02	9.02	0.91	0.00	0.00	0.08	0.02
9.10	0.94	0.00	0.00	0.08	0.01	9.19	0.98	0.00	0.00	0.08	0.00
9.27	1.05	0.00	0.00	0.08	0.00	9.35	1.18	0.00	0.00	0.08	0.00
9.43	1.42	0.00	0.00	0.08	0.00	9.51	1.57	0.00	0.00	0.08	0.00
9.60	1.57	0.00	0.00	0.08	0.00	9.68	1.34	0.00	0.00	0.08	0.00
9.76	1.13	0.00	0.00	0.08	0.00	9.84	0.95	0.00	0.00	0.08	0.01
9.92	0.87	0.00	0.00	0.08	0.03	10.01	0.83	0.00	0.00	0.08	0.04
10.09	0.82	0.00	0.00	0.08	0.04	10.17	0.84	0.00	0.00	0.08	0.03
10.25	0.86	0.00	0.00	0.08	0.03	10.33	0.87	0.00	0.00	0.08	0.03
10.42	0.87	0.00	0.00	0.08	0.03	10.50	0.88	0.00	0.00	0.08	0.03
10.58	0.91	0.00	0.00	0.08	0.02	10.66	1.00	0.00	0.00	0.08	0.00
10.74	1.12	0.00	0.00	0.08	0.00	10.83	1.28	0.00	0.00	0.08	0.00
10.91	1.37	0.00	0.00	0.08	0.00	10.99	1.37	0.00	0.00	0.08	0.00
11.07	1.27	0.00	0.00	0.08	0.00	11.15	1.21	0.00	0.00	0.08	0.00
11.24	1.43	0.00	0.00	0.08	0.00	11.32	1.79	0.00	0.00	0.08	0.00
11.40	2.00	0.00	0.00	0.08	0.00	11.48	0.41	0.00	0.00	0.08	0.12
11.56	0.29	0.00	0.00	0.08	0.15	11.65	0.33	0.00	0.00	0.08	0.14
11.73	0.37	0.00	0.00	0.08	0.13	11.81	0.36	0.00	0.00	0.08	0.13
11.89	0.38	0.00	0.00	0.08	0.13	11.98	0.40	0.00	0.00	0.08	0.12
12.06	0.47	0.00	0.00	0.08	0.11	12.14	0.57	0.00	0.00	0.08	0.09
12.22	0.71	0.00	0.00	0.08	0.06	12.30	0.83	0.00	0.00	0.08	0.04
12.39	0.93	0.00	0.00	0.08	0.01	12.47	1.02	0.00	0.00	0.08	0.00
12.55	1.12	0.00	0.00	0.08	0.00	12.63	1.25	0.00	0.00	0.08	0.00
12.71	1.42	0.00	0.00	0.08	0.00	12.80	1.61	0.00	0.00	0.08	0.00
12.88	2.00	0.00	0.00	0.08	0.00	12.96	2.00	0.00	0.00	0.08	0.00
13.04	2.00	0.00	0.00	0.08	0.00	13.12	2.00	0.00	0.00	0.08	0.00
13.21	2.00	0.00	0.00	0.08	0.00	13.29	2.00	0.00	0.00	0.08	0.00
13.37	2.00	0.00	0.00	0.08	0.00	13.45	2.00	0.00	0.00	0.08	0.00
13.53	2.00	0.00	0.00	0.08	0.00	13.62	2.00	0.00	0.00	0.08	0.00
13.70	2.00	0.00	0.00	0.08	0.00	13.78	2.00	0.00	0.00	0.08	0.00
13.86	2.00	0.00	0.00	0.08	0.00	13.94	2.00	0.00	0.00	0.08	0.00
14.03	2.00	0.00	0.00	0.08	0.00	14.11	2.00	0.00	0.00	0.08	0.00
14.19	1.63	0.00	0.00	0.08	0.00	14.27	1.59	0.00	0.00	0.08	0.00
14.35	1.57	0.00	0.00	0.08	0.00	14.44	1.55	0.00	0.00	0.08	0.00
14.52	1.53	0.00	0.00	0.08	0.00	14.60	1.50	0.00	0.00	0.08	0.00
14.68	1.44	0.00	0.00	0.08	0.00	14.76	1.36	0.00	0.00	0.08	0.00
14.85	1.25	0.00	0.00	0.08	0.00	14.93	1.16	0.00	0.00	0.08	0.00
15.01	1.06	0.00	0.00	0.08	0.00	15.09	0.99	0.00	0.00	0.08	0.00
15.17	0.94	0.00	0.00	0.08	0.01	15.26	0.92	0.00	0.00	0.08	0.01
15.34	0.95	0.00	0.00	0.08	0.01	15.42	0.99	0.00	0.00	0.08	0.00
15.50	0.98	0.00	0.00	0.08	0.00	15.58	0.91	0.00	0.00	0.08	0.02
15.67	0.82	0.00	0.00	0.08	0.03	15.75	0.72	0.00	0.00	0.08	0.05

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
15.83	0.68	0.00	0.00	0.08	0.06	15.91	0.66	0.00	0.00	0.08	0.06
15.99	0.69	0.00	0.00	0.08	0.06	16.08	0.75	0.00	0.00	0.08	0.05
16.16	0.88	0.00	0.00	0.08	0.02	16.24	1.15	0.00	0.00	0.08	0.00
16.32	1.52	0.00	0.00	0.08	0.00	16.40	2.00	0.00	0.00	0.08	0.00
16.49	2.00	0.00	0.00	0.08	0.00	16.57	2.00	0.00	0.00	0.08	0.00
16.65	2.00	0.00	0.00	0.08	0.00	16.73	2.00	0.00	0.00	0.08	0.00
16.81	2.00	0.00	0.00	0.08	0.00	16.90	2.00	0.00	0.00	0.08	0.00
16.98	2.00	0.00	0.00	0.08	0.00	17.06	2.00	0.00	0.00	0.08	0.00
17.14	2.00	0.00	0.00	0.08	0.00	17.22	2.00	0.00	0.00	0.08	0.00
17.31	1.15	0.00	0.00	0.08	0.00	17.39	0.72	0.00	0.00	0.08	0.05
17.47	0.64	0.00	0.00	0.08	0.07	17.55	0.48	0.00	0.00	0.08	0.09
17.63	0.52	0.00	0.00	0.08	0.09	17.72	0.72	0.00	0.00	0.08	0.05
17.80	2.00	0.00	0.00	0.08	0.00	17.88	2.00	0.00	0.00	0.08	0.00
17.96	0.75	0.00	0.00	0.08	0.05	18.04	0.39	0.00	0.00	0.08	0.11
18.13	0.41	0.00	0.00	0.08	0.11	18.21	0.69	0.00	0.00	0.08	0.06
18.29	0.84	0.00	0.00	0.08	0.03	18.37	1.05	0.00	0.00	0.08	0.00
18.45	0.99	0.00	0.00	0.08	0.00	18.54	0.87	0.00	0.00	0.08	0.02
18.62	0.79	0.00	0.00	0.08	0.04	18.70	0.75	0.00	0.00	0.08	0.04
18.78	0.74	0.00	0.00	0.08	0.05	18.86	0.71	0.00	0.00	0.08	0.05
18.95	0.67	0.00	0.00	0.08	0.06	19.03	0.71	0.00	0.00	0.08	0.05
19.11	0.78	0.00	0.00	0.08	0.04	19.19	0.79	0.00	0.00	0.08	0.04
19.27	0.71	0.00	0.00	0.08	0.05	19.36	0.56	0.00	0.00	0.08	0.08
19.44	0.42	0.58	0.40	0.08	0.10	19.52	0.32	0.68	0.34	0.08	0.12
19.60	0.28	0.72	0.31	0.08	0.13	19.69	0.24	0.76	0.29	0.08	0.13
19.77	0.24	0.76	0.29	0.08	0.13	19.85	0.43	0.57	0.41	0.08	0.10
19.93	1.84	0.00	0.00	0.08	0.00	20.01	1.45	0.00	0.00	0.08	0.00
20.10	1.28	0.00	0.00	0.08	0.00	20.18	1.23	0.00	0.00	0.08	0.00
20.26	1.44	0.00	0.00	0.08	0.00	20.34	0.28	0.72	0.31	0.08	0.12
20.42	0.23	0.77	0.29	0.08	0.13	20.51	0.31	0.69	0.33	0.08	0.12
20.59	1.12	0.00	0.00	0.08	0.00	20.67	1.30	0.00	0.00	0.08	0.00
20.75	1.07	0.00	0.00	0.08	0.00	20.83	0.94	0.00	0.00	0.08	0.01
20.92	0.91	0.00	0.00	0.08	0.01	21.00	0.91	0.00	0.00	0.08	0.02
21.08	0.89	0.00	0.00	0.08	0.02	21.16	0.87	0.00	0.00	0.08	0.02
21.24	0.86	0.00	0.00	0.08	0.02	21.33	0.85	0.00	0.00	0.08	0.03
21.41	0.85	0.00	0.00	0.08	0.03	21.49	0.84	0.00	0.00	0.08	0.03
21.57	0.85	0.00	0.00	0.08	0.03	21.65	0.85	0.00	0.00	0.08	0.02
21.74	0.87	0.00	0.00	0.08	0.02	21.82	0.90	0.00	0.00	0.08	0.02
21.90	0.92	0.00	0.00	0.08	0.01	21.98	0.92	0.00	0.00	0.08	0.01
22.06	0.90	0.00	0.00	0.08	0.02	22.15	0.86	0.00	0.00	0.08	0.02
22.23	0.82	0.00	0.00	0.08	0.03	22.31	0.80	0.00	0.00	0.08	0.03
22.39	0.79	0.00	0.00	0.08	0.03	22.47	0.80	0.00	0.00	0.08	0.03
22.56	0.81	0.00	0.00	0.08	0.03	22.64	0.82	0.00	0.00	0.08	0.03
22.72	0.85	0.00	0.00	0.08	0.02	22.80	0.92	0.00	0.00	0.08	0.01
22.88	0.97	0.00	0.00	0.08	0.00	22.97	1.02	0.00	0.00	0.08	0.00
23.05	1.02	0.00	0.00	0.08	0.00	23.13	1.00	0.00	0.00	0.08	0.00
23.21	0.97	0.00	0.00	0.08	0.01	23.29	0.96	0.00	0.00	0.08	0.01
23.38	0.95	0.00	0.00	0.08	0.01	23.46	0.94	0.00	0.00	0.08	0.01
23.54	0.93	0.00	0.00	0.08	0.01	23.62	0.89	0.00	0.00	0.08	0.02

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
23.70	0.87	0.00	0.00	0.08	0.02	23.79	0.83	0.00	0.00	0.08	0.03
23.87	0.83	0.00	0.00	0.08	0.03	23.95	0.81	0.00	0.00	0.08	0.03
24.03	0.79	0.00	0.00	0.08	0.03	24.11	0.77	0.00	0.00	0.08	0.04
24.20	0.77	0.00	0.00	0.08	0.04	24.28	0.78	0.00	0.00	0.08	0.03
24.36	0.79	0.00	0.00	0.08	0.03	24.44	0.81	0.00	0.00	0.08	0.03
24.52	0.85	0.00	0.00	0.08	0.02	24.61	0.89	0.00	0.00	0.08	0.02
24.69	0.91	0.00	0.00	0.08	0.01	24.77	0.92	0.00	0.00	0.08	0.01
24.85	0.93	0.00	0.00	0.08	0.01	24.93	1.06	0.00	0.00	0.08	0.00
25.02	1.35	0.00	0.00	0.08	0.00	25.10	1.73	0.00	0.00	0.08	0.00
25.18	0.30	0.70	0.32	0.08	0.11	25.26	0.39	0.61	0.38	0.08	0.09
25.34	0.94	0.00	0.00	0.08	0.01	25.43	2.00	0.00	0.00	0.08	0.00
25.51	2.00	0.00	0.00	0.08	0.00	25.59	2.00	0.00	0.00	0.08	0.00
25.67	2.00	0.00	0.00	0.08	0.00	25.75	2.00	0.00	0.00	0.08	0.00
25.84	2.00	0.00	0.00	0.08	0.00	25.92	2.00	0.00	0.00	0.08	0.00
26.00	2.00	0.00	0.00	0.08	0.00	26.08	2.00	0.00	0.00	0.08	0.00
26.16	2.00	0.00	0.00	0.08	0.00	26.25	2.00	0.00	0.00	0.08	0.00
26.33	2.00	0.00	0.00	0.08	0.00	26.41	2.00	0.00	0.00	0.08	0.00
26.49	2.00	0.00	0.00	0.08	0.00	26.57	2.00	0.00	0.00	0.08	0.00
26.66	2.00	0.00	0.00	0.08	0.00	26.74	2.00	0.00	0.00	0.08	0.00
26.82	2.00	0.00	0.00	0.08	0.00	26.90	2.00	0.00	0.00	0.08	0.00
26.98	2.00	0.00	0.00	0.08	0.00	27.07	2.00	0.00	0.00	0.08	0.00
27.15	2.00	0.00	0.00	0.08	0.00	27.23	2.00	0.00	0.00	0.08	0.00
27.31	2.00	0.00	0.00	0.08	0.00	27.40	2.00	0.00	0.00	0.08	0.00
27.48	2.00	0.00	0.00	0.08	0.00	27.56	2.00	0.00	0.00	0.08	0.00
27.64	2.00	0.00	0.00	0.08	0.00	27.72	2.00	0.00	0.00	0.08	0.00
27.81	2.00	0.00	0.00	0.08	0.00	27.89	2.00	0.00	0.00	0.08	0.00
27.97	2.00	0.00	0.00	0.08	0.00	28.05	2.00	0.00	0.00	0.08	0.00
28.13	2.00	0.00	0.00	0.08	0.00	28.22	2.00	0.00	0.00	0.08	0.00
28.30	2.00	0.00	0.00	0.08	0.00	28.38	2.00	0.00	0.00	0.08	0.00
28.46	2.00	0.00	0.00	0.08	0.00	28.54	2.00	0.00	0.00	0.08	0.00
28.63	2.00	0.00	0.00	0.08	0.00	28.71	2.00	0.00	0.00	0.08	0.00
28.79	2.00	0.00	0.00	0.08	0.00	28.87	2.00	0.00	0.00	0.08	0.00
28.95	2.00	0.00	0.00	0.08	0.00	29.04	2.00	0.00	0.00	0.08	0.00
29.12	2.00	0.00	0.00	0.08	0.00	29.20	2.00	0.00	0.00	0.08	0.00
29.28	2.00	0.00	0.00	0.08	0.00	29.36	2.00	0.00	0.00	0.08	0.00
29.45	2.00	0.00	0.00	0.08	0.00	29.53	2.00	0.00	0.00	0.08	0.00
29.61	2.00	0.00	0.00	0.08	0.00	29.69	2.00	0.00	0.00	0.08	0.00
29.77	2.00	0.00	0.00	0.08	0.00	29.86	2.00	0.00	0.00	0.08	0.00
29.94	2.00	0.00	0.00	0.08	0.00	30.02	2.00	0.00	0.00	0.08	0.00
30.10	2.00	0.00	0.00	0.08	0.00	30.18	2.00	0.00	0.00	0.08	0.00
30.27	2.00	0.00	0.00	0.08	0.00	30.35	2.00	0.00	0.00	0.08	0.00
30.43	2.00	0.00	0.00	0.08	0.00	30.51	2.00	0.00	0.00	0.08	0.00
30.59	2.00	0.00	0.00	0.08	0.00	30.68	2.00	0.00	0.00	0.08	0.00
30.76	2.00	0.00	0.00	0.08	0.00	30.84	2.00	0.00	0.00	0.08	0.00
30.92	2.00	0.00	0.00	0.08	0.00	31.00	2.00	0.00	0.00	0.08	0.00
31.09	2.00	0.00	0.00	0.08	0.00	31.17	2.00	0.00	0.00	0.08	0.00
31.25	2.00	0.00	0.00	0.08	0.00	31.33	2.00	0.00	0.00	0.08	0.00
31.41	2.00	0.00	0.00	0.08	0.00	31.50	2.00	0.00	0.00	0.08	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.58	2.00	0.00	0.00	0.08	0.00	31.66	2.00	0.00	0.00	0.08	0.00
31.74	2.00	0.00	0.00	0.08	0.00	31.82	2.00	0.00	0.00	0.08	0.00
31.91	2.00	0.00	0.00	0.08	0.00	31.99	2.00	0.00	0.00	0.08	0.00
32.07	2.00	0.00	0.00	0.08	0.00	32.15	2.00	0.00	0.00	0.08	0.00
32.23	2.00	0.00	0.00	0.08	0.00	32.32	2.00	0.00	0.00	0.08	0.00
32.40	2.00	0.00	0.00	0.08	0.00	32.48	2.00	0.00	0.00	0.08	0.00
32.56	2.00	0.00	0.00	0.08	0.00	32.64	2.00	0.00	0.00	0.08	0.00
32.73	2.00	0.00	0.00	0.08	0.00	32.81	2.00	0.00	0.00	0.08	0.00
32.89	2.00	0.00	0.00	0.08	0.00	32.97	2.00	0.00	0.00	0.08	0.00
33.05	2.00	0.00	0.00	0.08	0.00	33.14	2.00	0.00	0.00	0.08	0.00
33.22	2.00	0.00	0.00	0.08	0.00	33.30	2.00	0.00	0.00	0.08	0.00
33.38	2.00	0.00	0.00	0.08	0.00	33.46	2.00	0.00	0.00	0.08	0.00
33.55	2.00	0.00	0.00	0.08	0.00	33.63	2.00	0.00	0.00	0.08	0.00
33.71	2.00	0.00	0.00	0.08	0.00	33.79	2.00	0.00	0.00	0.08	0.00
33.87	2.00	0.00	0.00	0.08	0.00	33.96	2.00	0.00	0.00	0.08	0.00
34.04	2.00	0.00	0.00	0.08	0.00	34.12	2.00	0.00	0.00	0.08	0.00
34.20	2.00	0.00	0.00	0.08	0.00	34.28	2.00	0.00	0.00	0.08	0.00
34.37	2.00	0.00	0.00	0.08	0.00	34.45	2.00	0.00	0.00	0.08	0.00
34.53	2.00	0.00	0.00	0.08	0.00	34.61	2.00	0.00	0.00	0.08	0.00
34.69	2.00	0.00	0.00	0.08	0.00	34.78	2.00	0.00	0.00	0.08	0.00
34.86	2.00	0.00	0.00	0.08	0.00	34.94	2.00	0.00	0.00	0.08	0.00
35.02	2.00	0.00	0.00	0.08	0.00	35.10	2.00	0.00	0.00	0.08	0.00
35.19	2.00	0.00	0.00	0.08	0.00	35.27	2.00	0.00	0.00	0.08	0.00
35.35	2.00	0.00	0.00	0.08	0.00	35.43	2.00	0.00	0.00	0.08	0.00
35.52	2.00	0.00	0.00	0.08	0.00	35.60	2.00	0.00	0.00	0.08	0.00
35.68	2.00	0.00	0.00	0.08	0.00	35.76	2.00	0.00	0.00	0.08	0.00
35.84	2.00	0.00	0.00	0.08	0.00	35.93	2.00	0.00	0.00	0.08	0.00
36.01	2.00	0.00	0.00	0.08	0.00	36.09	2.00	0.00	0.00	0.08	0.00
36.17	2.00	0.00	0.00	0.08	0.00	36.25	2.00	0.00	0.00	0.08	0.00
36.34	2.00	0.00	0.00	0.08	0.00	36.42	2.00	0.00	0.00	0.08	0.00
36.50	2.00	0.00	0.00	0.08	0.00	36.58	2.00	0.00	0.00	0.08	0.00
36.66	2.00	0.00	0.00	0.08	0.00	36.75	2.00	0.00	0.00	0.08	0.00
36.83	2.00	0.00	0.00	0.08	0.00	36.91	2.00	0.00	0.00	0.08	0.00
36.99	2.00	0.00	0.00	0.08	0.00	37.07	2.00	0.00	0.00	0.08	0.00
37.16	2.00	0.00	0.00	0.08	0.00	37.24	2.00	0.00	0.00	0.08	0.00
37.32	2.00	0.00	0.00	0.08	0.00	37.40	2.00	0.00	0.00	0.08	0.00
37.48	2.00	0.00	0.00	0.08	0.00	37.57	2.00	0.00	0.00	0.08	0.00
37.65	2.00	0.00	0.00	0.08	0.00	37.73	2.00	0.00	0.00	0.08	0.00
37.81	2.00	0.00	0.00	0.08	0.00	37.89	2.00	0.00	0.00	0.08	0.00
37.98	2.00	0.00	0.00	0.08	0.00	38.06	2.00	0.00	0.00	0.08	0.00
38.14	2.00	0.00	0.00	0.08	0.00	38.22	2.00	0.00	0.00	0.08	0.00
38.30	2.00	0.00	0.00	0.08	0.00	38.39	2.00	0.00	0.00	0.08	0.00
38.47	2.00	0.00	0.00	0.08	0.00	38.55	2.00	0.00	0.00	0.08	0.00
38.63	2.00	0.00	0.00	0.08	0.00	38.71	2.00	0.00	0.00	0.08	0.00
38.80	1.60	0.00	0.00	0.08	0.00	38.88	1.35	0.00	0.00	0.08	0.00
38.96	1.21	0.00	0.00	0.08	0.00	39.04	1.11	0.00	0.00	0.08	0.00
39.12	1.05	0.00	0.00	0.08	0.00	39.21	1.05	0.00	0.00	0.08	0.00
39.29	1.23	0.00	0.00	0.08	0.00	39.37	1.37	0.00	0.00	0.08	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
39.45	1.38	0.00	0.00	0.08	0.00	39.53	1.22	0.00	0.00	0.08	0.00
39.62	1.45	0.00	0.00	0.08	0.00	39.70	2.00	0.00	0.00	0.08	0.00
39.78	2.00	0.00	0.00	0.08	0.00	39.86	2.00	0.00	0.00	0.08	0.00
39.94	1.36	0.00	0.00	0.08	0.00	40.03	1.17	0.00	0.00	0.08	0.00
40.11	1.11	0.00	0.00	0.08	0.00	40.19	1.19	0.00	0.00	0.08	0.00
40.27	1.26	0.00	0.00	0.08	0.00	40.35	1.15	0.00	0.00	0.08	0.00
40.44	1.03	0.00	0.00	0.08	0.00	40.52	0.97	0.00	0.00	0.08	0.00
40.60	0.97	0.00	0.00	0.08	0.00	40.68	1.00	0.00	0.00	0.08	0.00
40.76	1.10	0.00	0.00	0.08	0.00	40.85	1.12	0.00	0.00	0.08	0.00
40.93	1.03	0.00	0.00	0.08	0.00	41.01	0.91	0.00	0.00	0.08	0.01
41.09	0.87	0.00	0.00	0.08	0.01	41.17	0.89	0.00	0.00	0.08	0.01
41.26	0.92	0.00	0.00	0.08	0.01	41.34	0.91	0.00	0.00	0.08	0.01
41.42	1.64	0.00	0.00	0.08	0.00	41.50	2.00	0.00	0.00	0.08	0.00
41.58	2.00	0.00	0.00	0.08	0.00	41.67	2.00	0.00	0.00	0.08	0.00
41.75	2.00	0.00	0.00	0.08	0.00	41.83	2.00	0.00	0.00	0.08	0.00
41.91	2.00	0.00	0.00	0.08	0.00	41.99	2.00	0.00	0.00	0.08	0.00

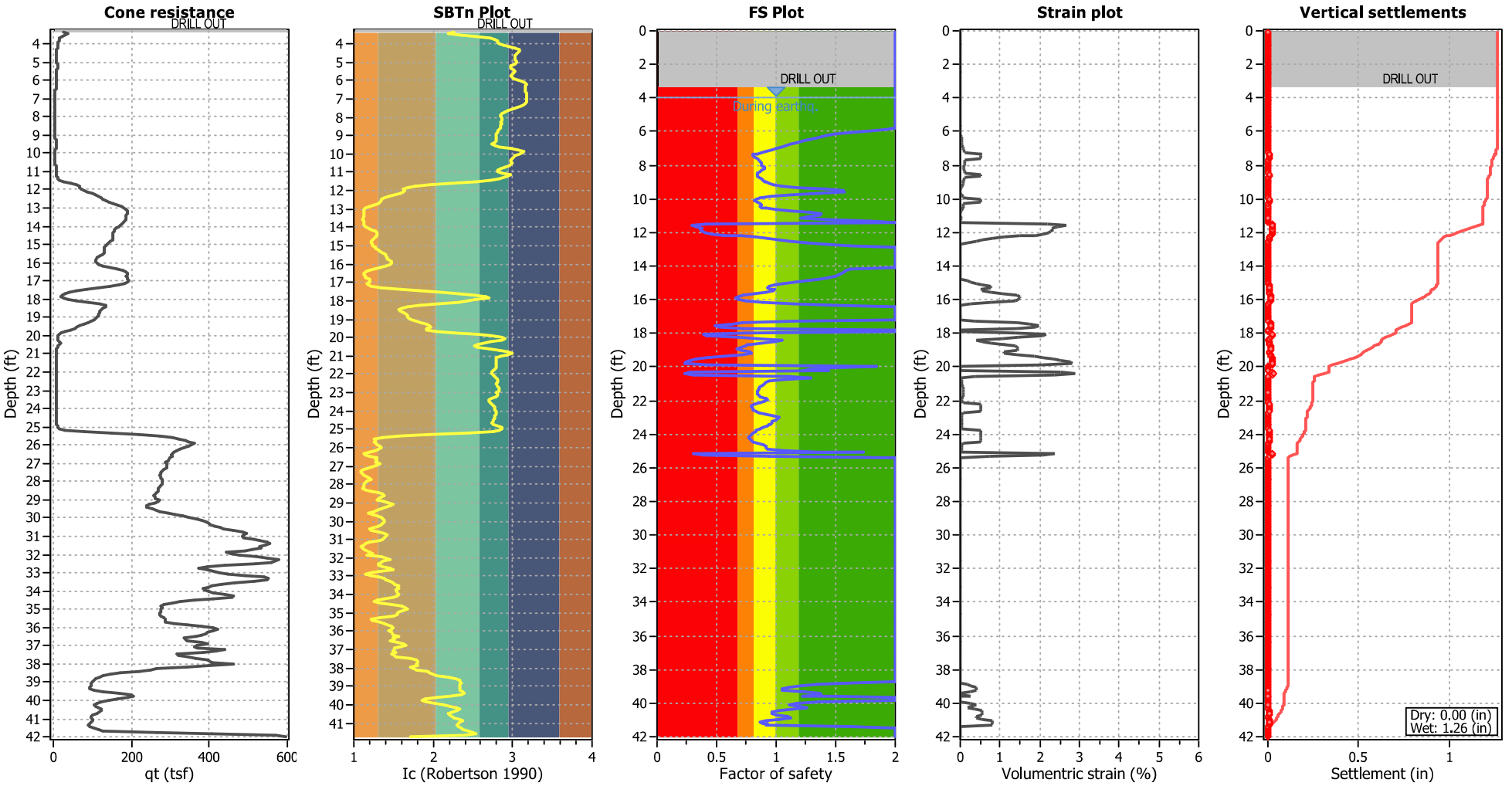
Overall liquefaction potential: 6.23

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
F_L: 1 - FS
w_z: Function value of the extend of soil liquefaction according to depth
d_z: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
4.02	145.60	2.00	0.00	1.00	0.00	4.10	151.08	2.00	0.00	1.00	0.00
4.18	157.64	2.00	0.00	1.00	0.00	4.27	162.32	2.00	0.00	1.00	0.00
4.35	163.41	2.00	0.00	1.00	0.00	4.43	159.37	2.00	0.00	1.00	0.00
4.51	153.47	2.00	0.00	1.00	0.00	4.59	149.78	2.00	0.00	1.00	0.00
4.68	151.18	2.00	0.00	1.00	0.00	4.76	153.92	2.00	0.00	1.00	0.00
4.84	156.97	2.00	0.00	1.00	0.00	4.92	159.83	2.00	0.00	1.00	0.00
5.00	161.53	2.00	0.00	1.00	0.00	5.09	160.47	2.00	0.00	1.00	0.00
5.17	155.70	2.00	0.00	1.00	0.00	5.25	151.27	2.00	0.00	1.00	0.00
5.33	148.19	2.00	0.00	1.00	0.00	5.41	145.52	2.00	0.00	1.00	0.00
5.50	141.54	2.00	0.00	1.00	0.00	5.58	136.40	2.00	0.00	1.00	0.00
5.66	131.35	2.00	0.00	1.00	0.00	5.74	129.27	2.00	0.00	1.00	0.00
5.82	130.22	2.00	0.00	1.00	0.00	5.91	132.98	1.92	0.00	1.00	0.00
5.99	135.66	1.79	0.00	1.00	0.00	6.07	138.26	1.63	0.01	1.00	0.00
6.15	139.93	1.50	0.01	1.00	0.00	6.23	136.46	1.43	0.02	1.00	0.00
6.32	130.06	1.38	0.02	1.00	0.00	6.40	122.40	1.33	0.02	1.00	0.00
6.48	117.67	1.27	0.03	1.00	0.00	6.56	113.82	1.22	0.03	1.00	0.00
6.64	111.06	1.18	0.04	1.00	0.00	6.73	108.64	1.12	0.05	1.00	0.00
6.81	106.03	1.08	0.05	1.00	0.00	6.89	103.44	1.05	0.06	1.00	0.00
6.97	100.54	1.00	0.07	1.00	0.00	7.05	96.87	0.96	0.08	1.00	0.00
7.14	91.72	0.91	0.10	1.00	0.00	7.22	86.28	0.87	0.11	1.00	0.00
7.30	79.89	0.84	0.50	1.00	0.00	7.38	73.07	0.81	0.50	1.00	0.00
7.46	65.65	0.81	0.50	1.00	0.00	7.55	59.83	0.82	0.50	1.00	0.00
7.63	55.77	0.84	0.50	1.00	0.00	7.71	53.31	0.85	0.12	1.00	0.00
7.79	50.89	0.87	0.11	1.00	0.00	7.87	49.67	0.87	0.10	1.00	0.00
7.96	49.60	0.88	0.10	1.00	0.00	8.04	51.73	0.88	0.10	1.00	0.00
8.12	52.88	0.90	0.09	1.00	0.00	8.20	52.94	0.90	0.09	1.00	0.00
8.28	51.42	0.88	0.10	1.00	0.00	8.37	50.52	0.86	0.10	1.00	0.00
8.45	49.55	0.84	0.11	1.00	0.00	8.53	48.75	0.84	0.50	1.00	0.00
8.61	48.02	0.84	0.50	1.00	0.00	8.69	47.97	0.85	0.10	1.00	0.00
8.78	48.18	0.88	0.09	1.00	0.00	8.86	48.11	0.89	0.09	1.00	0.00
8.94	48.25	0.90	0.08	1.00	0.00	9.02	48.61	0.91	0.08	1.00	0.00
9.10	50.34	0.94	0.07	1.00	0.00	9.19	52.65	0.98	0.06	1.00	0.00
9.27	55.68	1.05	0.04	1.00	0.00	9.35	61.10	1.18	0.03	1.00	0.00
9.43	67.44	1.42	0.01	1.00	0.00	9.51	81.31	1.57	0.01	1.00	0.00
9.60	93.72	1.57	0.01	1.00	0.00	9.68	105.29	1.34	0.02	1.00	0.00
9.76	106.64	1.13	0.03	1.00	0.00	9.84	101.79	0.95	0.06	1.00	0.00
9.92	91.80	0.87	0.08	1.00	0.00	10.01	80.97	0.83	0.50	1.00	0.00
10.09	74.00	0.82	0.50	1.00	0.00	10.17	71.61	0.84	0.50	1.00	0.00
10.25	71.70	0.86	0.08	1.00	0.00	10.33	71.43	0.87	0.08	1.00	0.00
10.42	71.54	0.87	0.08	1.00	0.00	10.50	73.14	0.88	0.08	1.00	0.00
10.58	75.73	0.91	0.07	1.00	0.00	10.66	78.55	1.00	0.05	1.00	0.00
10.74	80.91	1.12	0.03	1.00	0.00	10.83	82.14	1.28	0.02	1.00	0.00
10.91	81.11	1.37	0.01	1.00	0.00	10.99	81.56	1.37	0.01	1.00	0.00
11.07	84.30	1.27	0.02	1.00	0.00	11.15	99.20	1.21	0.02	1.00	0.00
11.24	109.73	1.43	0.01	1.00	0.00	11.32	112.44	1.79	0.00	1.00	0.00
11.40	108.35	2.00	0.00	1.00	0.00	11.48	107.56	0.41	2.20	1.00	0.02
11.56	85.11	0.29	2.67	1.00	0.03	11.65	93.93	0.33	2.46	1.00	0.02
11.73	102.13	0.37	2.30	1.00	0.02	11.81	100.19	0.36	2.33	1.00	0.02

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
11.89	103.14	0.38	2.28	1.00	0.02	11.98	106.73	0.40	2.22	1.00	0.02
12.06	116.01	0.47	2.07	1.00	0.02	12.14	128.57	0.57	1.90	1.00	0.02
12.22	141.87	0.71	1.50	1.00	0.01	12.30	151.27	0.83	1.11	1.00	0.01
12.39	159.01	0.93	0.79	1.00	0.01	12.47	165.09	1.02	0.55	1.00	0.01
12.55	171.52	1.12	0.39	1.00	0.00	12.63	179.00	1.25	0.19	1.00	0.00
12.71	187.70	1.42	0.00	1.00	0.00	12.80	197.15	1.61	0.00	1.00	0.00
12.88	207.91	2.00	0.00	1.00	0.00	12.96	218.70	2.00	0.00	1.00	0.00
13.04	229.56	2.00	0.00	1.00	0.00	13.12	235.26	2.00	0.00	1.00	0.00
13.21	235.78	2.00	0.00	1.00	0.00	13.29	232.97	2.00	0.00	1.00	0.00
13.37	230.24	2.00	0.00	1.00	0.00	13.45	228.82	2.00	0.00	1.00	0.00
13.53	227.89	2.00	0.00	1.00	0.00	13.62	226.23	2.00	0.00	1.00	0.00
13.70	224.57	2.00	0.00	1.00	0.00	13.78	220.64	2.00	0.00	1.00	0.00
13.86	216.46	2.00	0.00	1.00	0.00	13.94	210.96	2.00	0.00	1.00	0.00
14.03	206.74	2.00	0.00	1.00	0.00	14.11	202.33	2.00	0.00	1.00	0.00
14.19	199.66	1.63	0.00	1.00	0.00	14.27	198.03	1.59	0.00	1.00	0.00
14.35	197.25	1.57	0.00	1.00	0.00	14.44	196.49	1.55	0.00	1.00	0.00
14.52	195.46	1.53	0.00	1.00	0.00	14.60	194.18	1.50	0.00	1.00	0.00
14.68	191.20	1.44	0.00	1.00	0.00	14.76	187.40	1.36	0.00	1.00	0.00
14.85	181.57	1.25	0.19	1.00	0.00	14.93	176.30	1.16	0.27	1.00	0.00
15.01	170.61	1.06	0.39	1.00	0.00	15.09	165.95	0.99	0.55	1.00	0.01
15.17	162.71	0.94	0.76	1.00	0.01	15.26	161.68	0.92	0.77	1.00	0.01
15.34	163.72	0.95	0.56	1.00	0.01	15.42	166.31	0.99	0.55	1.00	0.01
15.50	165.90	0.98	0.55	1.00	0.01	15.58	161.06	0.91	0.77	1.00	0.01
15.67	154.29	0.82	1.08	1.00	0.01	15.75	146.64	0.72	1.43	1.00	0.01
15.83	142.77	0.68	1.48	1.00	0.01	15.91	141.06	0.66	1.51	1.00	0.01
15.99	143.49	0.69	1.47	1.00	0.01	16.08	148.73	0.75	1.40	1.00	0.01
16.16	159.68	0.88	0.78	1.00	0.01	16.24	177.27	1.15	0.27	1.00	0.00
16.32	196.71	1.52	0.00	1.00	0.00	16.40	210.53	2.00	0.00	1.00	0.00
16.49	220.35	2.00	0.00	1.00	0.00	16.57	223.60	2.00	0.00	1.00	0.00
16.65	224.31	2.00	0.00	1.00	0.00	16.73	220.92	2.00	0.00	1.00	0.00
16.81	224.34	2.00	0.00	1.00	0.00	16.90	228.51	2.00	0.00	1.00	0.00
16.98	228.87	2.00	0.00	1.00	0.00	17.06	223.21	2.00	0.00	1.00	0.00
17.14	214.71	2.00	0.00	1.00	0.00	17.22	200.83	2.00	0.00	1.00	0.00
17.31	177.82	1.15	0.38	1.00	0.00	17.39	147.79	0.72	1.41	1.00	0.01
17.47	140.05	0.64	1.77	1.00	0.02	17.55	123.30	0.48	1.97	1.00	0.02
17.63	128.21	0.52	1.91	1.00	0.02	17.72	147.85	0.72	1.41	1.00	0.01
17.80	297.51	2.00	0.00	1.00	0.00	17.88	157.00	2.00	0.00	1.00	0.00
17.96	149.96	0.75	1.38	1.00	0.01	18.04	110.66	0.39	2.15	1.00	0.02
18.13	113.96	0.41	2.10	1.00	0.02	18.21	144.76	0.69	1.45	1.00	0.01
18.29	157.44	0.84	1.05	1.00	0.01	18.37	172.52	1.05	0.39	1.00	0.00
18.45	168.61	0.99	0.54	1.00	0.01	18.54	160.11	0.87	0.78	1.00	0.01
18.62	153.43	0.79	1.09	1.00	0.01	18.70	150.79	0.75	1.12	1.00	0.01
18.78	149.68	0.74	1.39	1.00	0.01	18.86	147.30	0.71	1.42	1.00	0.01
18.95	143.38	0.67	1.47	1.00	0.01	19.03	147.32	0.71	1.42	1.00	0.01
19.11	153.05	0.78	1.09	1.00	0.01	19.19	153.96	0.79	1.08	1.00	0.01
19.27	147.72	0.71	1.41	1.00	0.01	19.36	132.80	0.56	1.85	1.00	0.02
19.44	115.29	0.42	2.08	1.00	0.02	19.52	99.76	0.32	2.34	1.00	0.02
19.60	91.47	0.28	2.51	1.00	0.02	19.69	80.89	0.24	2.78	1.00	0.03

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
19.77	79.36	0.24	2.82	1.00	0.03	19.85	116.91	0.43	2.06	1.00	0.02
19.93	105.30	1.84	0.00	1.00	0.00	20.01	109.11	1.45	0.01	1.00	0.00
20.10	103.74	1.28	0.01	1.00	0.00	20.18	92.16	1.23	0.02	1.00	0.00
20.26	78.50	1.44	0.01	1.00	0.00	20.34	91.35	0.28	2.52	1.00	0.02
20.42	76.67	0.23	2.91	1.00	0.03	20.51	97.49	0.31	2.39	1.00	0.02
20.59	184.62	1.12	0.37	1.00	0.00	20.67	92.10	1.30	0.01	1.00	0.00
20.75	95.73	1.07	0.03	1.00	0.00	20.83	91.22	0.94	0.04	1.00	0.00
20.92	79.03	0.91	0.05	1.00	0.00	21.00	65.30	0.91	0.05	1.00	0.00
21.08	58.20	0.89	0.05	1.00	0.00	21.16	56.83	0.87	0.06	1.00	0.00
21.24	56.78	0.86	0.06	1.00	0.00	21.33	56.40	0.85	0.06	1.00	0.00
21.41	56.08	0.85	0.06	1.00	0.00	21.49	55.73	0.84	0.06	1.00	0.00
21.57	55.28	0.85	0.06	1.00	0.00	21.65	55.06	0.85	0.06	1.00	0.00
21.74	54.80	0.87	0.06	1.00	0.00	21.82	54.33	0.90	0.05	1.00	0.00
21.90	53.82	0.92	0.05	1.00	0.00	21.98	53.67	0.92	0.04	1.00	0.00
22.06	53.78	0.90	0.05	1.00	0.00	22.15	54.04	0.86	0.06	1.00	0.00
22.23	54.14	0.82	0.50	1.00	0.00	22.31	54.30	0.80	0.50	1.00	0.00
22.39	54.47	0.79	0.50	1.00	0.00	22.47	54.68	0.80	0.50	1.00	0.00
22.56	54.09	0.81	0.50	1.00	0.00	22.64	56.69	0.82	0.50	1.00	0.00
22.72	61.13	0.85	0.06	1.00	0.00	22.80	66.41	0.92	0.05	1.00	0.00
22.88	68.60	0.97	0.04	1.00	0.00	22.97	68.99	1.02	0.03	1.00	0.00
23.05	70.45	1.02	0.03	1.00	0.00	23.13	68.48	1.00	0.03	1.00	0.00
23.21	63.54	0.97	0.04	1.00	0.00	23.29	55.74	0.96	0.04	1.00	0.00
23.38	52.10	0.95	0.04	1.00	0.00	23.46	51.58	0.94	0.04	1.00	0.00
23.54	51.95	0.93	0.04	1.00	0.00	23.62	52.50	0.89	0.05	1.00	0.00
23.70	52.98	0.87	0.05	1.00	0.00	23.79	53.36	0.83	0.50	1.00	0.00
23.87	53.05	0.83	0.50	1.00	0.00	23.95	52.70	0.81	0.50	1.00	0.00
24.03	52.30	0.79	0.50	1.00	0.00	24.11	51.58	0.77	0.50	1.00	0.00
24.20	51.44	0.77	0.50	1.00	0.00	24.28	51.19	0.78	0.50	1.00	0.00
24.36	51.53	0.79	0.50	1.00	0.00	24.44	52.50	0.81	0.50	1.00	0.00
24.52	53.59	0.85	0.06	1.00	0.00	24.61	54.46	0.89	0.05	1.00	0.00
24.69	54.78	0.91	0.04	1.00	0.00	24.77	57.29	0.92	0.04	1.00	0.00
24.85	72.39	0.93	0.04	1.00	0.00	24.93	83.84	1.06	0.03	1.00	0.00
25.02	100.30	1.35	0.01	1.00	0.00	25.10	107.09	1.73	0.00	1.00	0.00
25.18	97.94	0.30	2.38	1.00	0.02	25.26	114.76	0.39	2.09	1.00	0.02
25.34	168.57	0.94	0.72	1.00	0.01	25.43	244.78	2.00	0.00	1.00	0.00
25.51	296.92	2.00	0.00	1.00	0.00	25.59	331.08	2.00	0.00	1.00	0.00
25.67	349.06	2.00	0.00	1.00	0.00	25.75	367.49	2.00	0.00	1.00	0.00
25.84	379.17	2.00	0.00	1.00	0.00	25.92	392.70	2.00	0.00	1.00	0.00
26.00	388.31	2.00	0.00	1.00	0.00	26.08	377.64	2.00	0.00	1.00	0.00
26.16	360.51	2.00	0.00	1.00	0.00	26.25	347.82	2.00	0.00	1.00	0.00
26.33	334.90	2.00	0.00	1.00	0.00	26.41	325.86	2.00	0.00	1.00	0.00
26.49	322.56	2.00	0.00	1.00	0.00	26.57	323.64	2.00	0.00	1.00	0.00
26.66	327.48	2.00	0.00	1.00	0.00	26.74	319.37	2.00	0.00	1.00	0.00
26.82	316.23	2.00	0.00	1.00	0.00	26.90	308.02	2.00	0.00	1.00	0.00
26.98	310.27	2.00	0.00	1.00	0.00	27.07	306.07	2.00	0.00	1.00	0.00
27.15	303.68	2.00	0.00	1.00	0.00	27.23	300.88	2.00	0.00	1.00	0.00
27.31	294.62	2.00	0.00	1.00	0.00	27.40	289.94	2.00	0.00	1.00	0.00
27.48	286.41	2.00	0.00	1.00	0.00	27.56	288.40	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
27.64	286.38	2.00	0.00	1.00	0.00	27.72	286.95	2.00	0.00	1.00	0.00
27.81	286.16	2.00	0.00	1.00	0.00	27.89	289.84	2.00	0.00	1.00	0.00
27.97	289.15	2.00	0.00	1.00	0.00	28.05	288.97	2.00	0.00	1.00	0.00
28.13	287.56	2.00	0.00	1.00	0.00	28.22	283.18	2.00	0.00	1.00	0.00
28.30	279.20	2.00	0.00	1.00	0.00	28.38	277.94	2.00	0.00	1.00	0.00
28.46	282.07	2.00	0.00	1.00	0.00	28.54	281.87	2.00	0.00	1.00	0.00
28.63	278.52	2.00	0.00	1.00	0.00	28.71	272.38	2.00	0.00	1.00	0.00
28.79	266.49	2.00	0.00	1.00	0.00	28.87	270.90	2.00	0.00	1.00	0.00
28.95	273.84	2.00	0.00	1.00	0.00	29.04	286.73	2.00	0.00	1.00	0.00
29.12	283.55	2.00	0.00	1.00	0.00	29.20	275.59	2.00	0.00	1.00	0.00
29.28	257.03	2.00	0.00	1.00	0.00	29.36	246.49	2.00	0.00	1.00	0.00
29.45	245.78	2.00	0.00	1.00	0.00	29.53	258.42	2.00	0.00	1.00	0.00
29.61	278.14	2.00	0.00	1.00	0.00	29.69	302.44	2.00	0.00	1.00	0.00
29.77	322.58	2.00	0.00	1.00	0.00	29.86	342.85	2.00	0.00	1.00	0.00
29.94	357.61	2.00	0.00	1.00	0.00	30.02	376.88	2.00	0.00	1.00	0.00
30.10	392.88	2.00	0.00	1.00	0.00	30.18	402.44	2.00	0.00	1.00	0.00
30.27	408.27	2.00	0.00	1.00	0.00	30.35	408.68	2.00	0.00	1.00	0.00
30.43	419.33	2.00	0.00	1.00	0.00	30.51	431.02	2.00	0.00	1.00	0.00
30.59	444.27	2.00	0.00	1.00	0.00	30.68	473.33	2.00	0.00	1.00	0.00
30.76	496.67	2.00	0.00	1.00	0.00	30.84	506.72	2.00	0.00	1.00	0.00
30.92	496.11	2.00	0.00	1.00	0.00	31.00	490.89	2.00	0.00	1.00	0.00
31.09	494.59	2.00	0.00	1.00	0.00	31.17	513.19	2.00	0.00	1.00	0.00
31.25	525.94	2.00	0.00	1.00	0.00	31.33	544.85	2.00	0.00	1.00	0.00
31.41	550.07	2.00	0.00	1.00	0.00	31.50	537.70	2.00	0.00	1.00	0.00
31.58	526.00	2.00	0.00	1.00	0.00	31.66	530.55	2.00	0.00	1.00	0.00
31.74	507.55	2.00	0.00	1.00	0.00	31.82	484.66	2.00	0.00	1.00	0.00
31.91	441.08	2.00	0.00	1.00	0.00	31.99	453.68	2.00	0.00	1.00	0.00
32.07	476.72	2.00	0.00	1.00	0.00	32.15	519.38	2.00	0.00	1.00	0.00
32.23	544.13	2.00	0.00	1.00	0.00	32.32	572.96	2.00	0.00	1.00	0.00
32.40	552.57	2.00	0.00	1.00	0.00	32.48	513.85	2.00	0.00	1.00	0.00
32.56	437.89	2.00	0.00	1.00	0.00	32.64	393.13	2.00	0.00	1.00	0.00
32.73	368.70	2.00	0.00	1.00	0.00	32.81	385.79	2.00	0.00	1.00	0.00
32.89	400.50	2.00	0.00	1.00	0.00	32.97	414.41	2.00	0.00	1.00	0.00
33.05	439.08	2.00	0.00	1.00	0.00	33.14	482.16	2.00	0.00	1.00	0.00
33.22	529.49	2.00	0.00	1.00	0.00	33.30	541.18	2.00	0.00	1.00	0.00
33.38	537.81	2.00	0.00	1.00	0.00	33.46	505.37	2.00	0.00	1.00	0.00
33.55	458.21	2.00	0.00	1.00	0.00	33.63	423.59	2.00	0.00	1.00	0.00
33.71	396.27	2.00	0.00	1.00	0.00	33.79	387.61	2.00	0.00	1.00	0.00
33.87	372.62	2.00	0.00	1.00	0.00	33.96	376.06	2.00	0.00	1.00	0.00
34.04	385.75	2.00	0.00	1.00	0.00	34.12	397.60	2.00	0.00	1.00	0.00
34.20	424.96	2.00	0.00	1.00	0.00	34.28	444.55	2.00	0.00	1.00	0.00
34.37	439.88	2.00	0.00	1.00	0.00	34.45	394.66	2.00	0.00	1.00	0.00
34.53	348.28	2.00	0.00	1.00	0.00	34.61	310.05	2.00	0.00	1.00	0.00
34.69	291.32	2.00	0.00	1.00	0.00	34.78	272.74	2.00	0.00	1.00	0.00
34.86	262.85	2.00	0.00	1.00	0.00	34.94	265.44	2.00	0.00	1.00	0.00
35.02	264.16	2.00	0.00	1.00	0.00	35.10	263.72	2.00	0.00	1.00	0.00
35.19	258.18	2.00	0.00	1.00	0.00	35.27	257.68	2.00	0.00	1.00	0.00
35.35	259.10	2.00	0.00	1.00	0.00	35.43	268.20	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
35.52	271.74	2.00	0.00	1.00	0.00	35.60	269.74	2.00	0.00	1.00	0.00
35.68	270.23	2.00	0.00	1.00	0.00	35.76	290.49	2.00	0.00	1.00	0.00
35.84	321.02	2.00	0.00	1.00	0.00	35.93	357.29	2.00	0.00	1.00	0.00
36.01	383.96	2.00	0.00	1.00	0.00	36.09	396.01	2.00	0.00	1.00	0.00
36.17	384.09	2.00	0.00	1.00	0.00	36.25	370.34	2.00	0.00	1.00	0.00
36.34	364.44	2.00	0.00	1.00	0.00	36.42	353.66	2.00	0.00	1.00	0.00
36.50	338.69	2.00	0.00	1.00	0.00	36.58	311.98	2.00	0.00	1.00	0.00
36.66	314.81	2.00	0.00	1.00	0.00	36.75	319.11	2.00	0.00	1.00	0.00
36.83	353.00	2.00	0.00	1.00	0.00	36.91	366.08	2.00	0.00	1.00	0.00
36.99	339.31	2.00	0.00	1.00	0.00	37.07	333.35	2.00	0.00	1.00	0.00
37.16	338.42	2.00	0.00	1.00	0.00	37.24	403.79	2.00	0.00	1.00	0.00
37.32	383.31	2.00	0.00	1.00	0.00	37.40	352.15	2.00	0.00	1.00	0.00
37.48	296.23	2.00	0.00	1.00	0.00	37.57	328.50	2.00	0.00	1.00	0.00
37.65	364.11	2.00	0.00	1.00	0.00	37.73	384.53	2.00	0.00	1.00	0.00
37.81	409.61	2.00	0.00	1.00	0.00	37.89	427.88	2.00	0.00	1.00	0.00
37.98	423.75	2.00	0.00	1.00	0.00	38.06	395.93	2.00	0.00	1.00	0.00
38.14	346.71	2.00	0.00	1.00	0.00	38.22	296.22	2.00	0.00	1.00	0.00
38.30	285.04	2.00	0.00	1.00	0.00	38.39	263.73	2.00	0.00	1.00	0.00
38.47	238.04	2.00	0.00	1.00	0.00	38.55	232.23	2.00	0.00	1.00	0.00
38.63	226.81	2.00	0.00	1.00	0.00	38.71	212.08	2.00	0.00	1.00	0.00
38.80	199.21	1.60	0.00	1.00	0.00	38.88	186.71	1.35	0.19	1.00	0.00
38.96	179.28	1.21	0.27	1.00	0.00	39.04	173.36	1.11	0.39	1.00	0.00
39.12	169.78	1.05	0.39	1.00	0.00	39.21	169.67	1.05	0.39	1.00	0.00
39.29	180.09	1.23	0.27	1.00	0.00	39.37	187.55	1.37	0.00	1.00	0.00
39.45	188.03	1.38	0.00	1.00	0.00	39.53	179.07	1.22	0.27	1.00	0.00
39.62	191.20	1.45	0.00	1.00	0.00	39.70	211.86	2.00	0.00	1.00	0.00
39.78	215.24	2.00	0.00	1.00	0.00	39.86	204.17	2.00	0.00	1.00	0.00
39.94	186.52	1.36	0.00	1.00	0.00	40.03	176.23	1.17	0.27	1.00	0.00
40.11	172.65	1.11	0.39	1.00	0.00	40.19	177.34	1.19	0.27	1.00	0.00
40.27	180.76	1.26	0.19	1.00	0.00	40.35	174.50	1.15	0.38	1.00	0.00
40.44	167.16	1.03	0.55	1.00	0.01	40.52	163.06	0.97	0.56	1.00	0.01
40.60	162.98	0.97	0.56	1.00	0.01	40.68	165.25	1.00	0.55	1.00	0.01
40.76	171.26	1.10	0.39	1.00	0.00	40.85	172.51	1.12	0.39	1.00	0.00
40.93	166.94	1.03	0.55	1.00	0.01	41.01	159.10	0.91	0.79	1.00	0.01
41.09	155.99	0.87	0.81	1.00	0.01	41.17	156.92	0.89	0.80	1.00	0.01
41.26	159.42	0.92	0.79	1.00	0.01	41.34	158.67	0.91	0.79	1.00	0.01
41.42	198.85	1.64	0.00	1.00	0.00	41.50	246.95	2.00	0.00	1.00	0.00
41.58	349.42	2.00	0.00	1.00	0.00	41.67	231.58	2.00	0.00	1.00	0.00
41.75	224.57	2.00	0.00	1.00	0.00	41.83	320.45	2.00	0.00	1.00	0.00
41.91	448.44	2.00	0.00	1.00	0.00	41.99	469.48	2.00	0.00	1.00	0.00

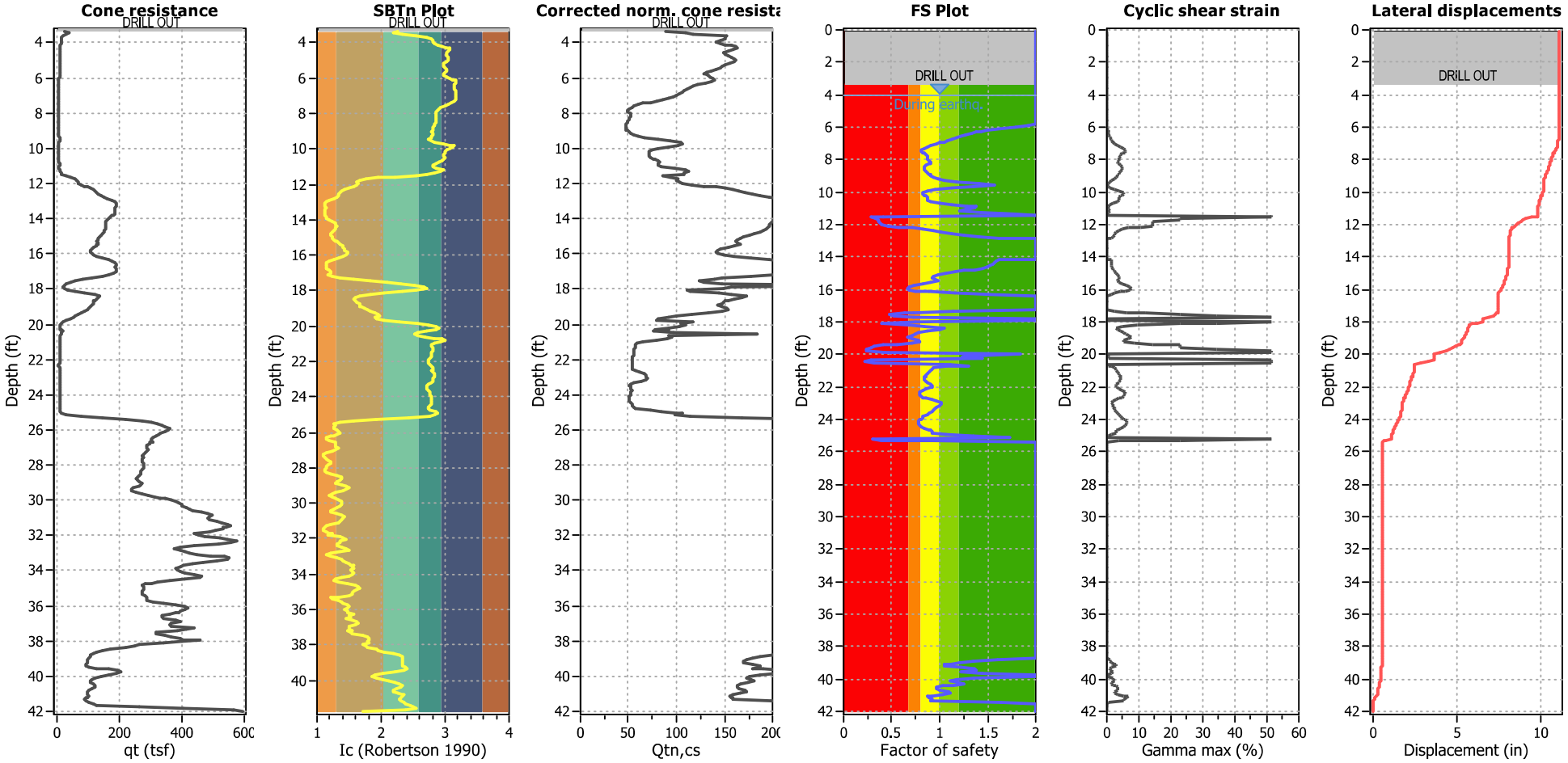
Total estimated settlement: 1.26

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

Estimation of post-earthquake lateral Displacements

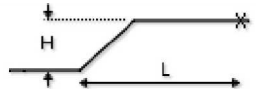
Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 5.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
4.02	12.58	23.32	4.65	145.60	2.00	18.95	0.05	0.00
4.10	11.87	21.98	5.09	151.08	2.00	16.99	0.06	0.00
4.18	10.69	19.73	5.82	157.64	2.00	13.43	0.06	0.00
4.27	9.49	17.46	6.62	162.32	2.00	9.40	0.07	0.00
4.35	8.71	15.98	7.12	163.41	2.00	6.47	0.07	0.00
4.43	8.54	15.65	6.90	159.37	2.00	5.78	0.07	0.00
4.51	8.61	15.77	6.40	153.47	2.00	6.05	0.07	0.00
4.59	8.75	16.03	6.05	149.78	2.00	6.58	0.07	0.00
4.68	8.83	16.16	6.12	151.18	2.00	6.85	0.07	0.00
4.76	8.99	16.46	6.24	153.92	2.00	7.45	0.07	0.00
4.84	9.07	16.60	6.43	156.97	2.00	7.72	0.07	0.00
4.92	9.16	16.76	6.60	159.83	2.00	8.04	0.07	0.00
5.00	9.26	16.95	6.67	161.53	2.00	8.42	0.07	0.00
5.09	9.57	17.53	6.44	160.47	2.00	9.52	0.07	0.00
5.17	9.97	18.27	5.95	155.70	2.00	10.89	0.06	0.00
5.25	10.00	18.32	5.64	151.27	2.00	10.99	0.06	0.00
5.33	9.57	17.49	5.59	148.19	2.00	9.45	0.07	0.00
5.41	8.91	16.23	5.67	145.52	2.00	6.99	0.07	0.00
5.50	8.48	15.43	5.57	141.54	2.00	5.31	0.07	0.00
5.58	8.32	15.11	5.27	136.40	2.00	4.63	0.07	0.00
5.66	8.35	15.16	4.90	131.35	2.00	4.74	0.07	0.00
5.74	8.40	15.25	4.74	129.27	2.00	4.93	0.07	0.00
5.82	8.37	15.17	4.82	130.22	2.00	4.76	0.07	0.00
5.91	8.12	14.69	5.11	132.98	1.92	3.69	0.09	0.00
5.99	7.63	13.77	5.52	135.66	1.79	1.56	0.12	0.00
6.07	7.02	12.61	6.08	138.26	1.63	0.00	0.20	0.00
6.15	6.52	11.65	6.58	139.93	1.50	0.00	0.30	0.00
6.23	6.26	11.15	6.47	136.46	1.43	0.00	0.38	0.00
6.32	6.10	10.84	6.00	130.06	1.38	0.00	0.45	0.00
6.40	5.93	10.51	5.43	122.40	1.33	0.00	0.54	0.00
6.48	5.72	10.10	5.15	117.67	1.27	0.00	0.67	0.00
6.56	5.55	9.77	4.92	113.82	1.22	0.00	0.81	0.01
6.64	5.39	9.47	4.78	111.06	1.18	0.00	0.97	0.01
6.73	5.17	9.04	4.72	108.64	1.12	0.00	1.24	0.01
6.81	5.03	8.76	4.58	106.03	1.08	0.00	1.48	0.01
6.89	4.91	8.53	4.43	103.44	1.05	0.00	1.73	0.01
6.97	4.75	8.22	4.27	100.54	1.00	0.00	2.12	0.02
7.05	4.61	7.94	4.04	96.87	0.96	0.00	2.56	0.02
7.14	4.41	7.56	3.71	91.72	0.91	0.00	3.33	0.02
7.22	4.26	7.26	3.32	86.28	0.87	0.00	4.12	0.03
7.30	4.12	6.99	2.86	79.89	0.84	0.00	5.07	0.04
7.38	4.02	6.81	2.36	73.07	0.81	0.00	5.90	0.04
7.46	4.05	6.84	1.82	65.65	0.81	0.00	5.88	0.04
7.55	4.11	6.96	1.44	59.83	0.82	0.00	5.54	0.04
7.63	4.22	7.15	1.19	55.77	0.84	0.00	4.95	0.04
7.71	4.31	7.32	1.04	53.31	0.85	0.00	4.52	0.03
7.79	4.40	7.49	0.92	50.89	0.87	0.00	4.12	0.03
7.87	4.44	7.55	0.86	49.67	0.87	0.00	4.04	0.03

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
7.96	4.47	7.60	0.85	49.60	0.88	0.00	3.99	0.03
8.04	4.52	7.70	0.94	51.73	0.88	0.00	3.84	0.03
8.12	4.62	7.87	0.99	52.88	0.90	0.00	3.50	0.03
8.20	4.66	7.95	0.99	52.94	0.90	0.00	3.41	0.02
8.28	4.59	7.81	0.92	51.42	0.88	0.00	3.79	0.03
8.37	4.51	7.65	0.89	50.52	0.86	0.00	4.28	0.03
8.45	4.45	7.52	0.85	49.55	0.84	0.00	4.74	0.03
8.53	4.43	7.49	0.81	48.75	0.84	0.00	4.92	0.04
8.61	4.46	7.53	0.78	48.02	0.84	0.00	4.88	0.03
8.69	4.56	7.70	0.77	47.97	0.85	0.00	4.44	0.03
8.78	4.68	7.93	0.77	48.18	0.88	0.00	3.92	0.03
8.86	4.78	8.12	0.76	48.11	0.89	0.00	3.57	0.03
8.94	4.86	8.26	0.76	48.25	0.90	0.00	3.34	0.02
9.02	4.92	8.36	0.77	48.61	0.91	0.00	3.20	0.02
9.10	5.06	8.62	0.84	50.34	0.94	0.00	2.80	0.02
9.19	5.28	9.03	0.92	52.65	0.98	0.00	2.27	0.02
9.27	5.67	9.77	1.03	55.68	1.05	0.00	1.57	0.01
9.35	6.32	10.99	1.22	61.10	1.18	0.00	0.89	0.01
9.43	7.52	13.25	1.42	67.44	1.42	0.28	0.36	0.00
9.51	8.28	14.68	1.99	81.31	1.57	3.66	0.22	0.00
9.60	8.34	14.77	2.59	93.72	1.57	3.87	0.21	0.00
9.68	7.24	12.68	3.49	105.29	1.34	0.00	0.46	0.00
9.76	6.17	10.66	3.96	106.64	1.13	0.00	1.11	0.01
9.84	5.31	9.02	4.00	101.79	0.95	0.00	2.56	0.02
9.92	4.92	8.28	3.39	91.80	0.87	0.00	3.96	0.03
10.01	4.72	7.88	2.65	80.97	0.83	0.00	5.08	0.04
10.09	4.72	7.88	2.16	74.00	0.82	0.00	5.16	0.04
10.17	4.82	8.06	1.98	71.61	0.84	0.00	4.69	0.03
10.25	4.96	8.31	1.95	71.70	0.86	0.00	4.09	0.03
10.33	5.02	8.43	1.92	71.43	0.87	0.00	3.87	0.03
10.42	5.02	8.42	1.92	71.54	0.87	0.00	3.94	0.03
10.50	5.07	8.51	2.01	73.14	0.88	0.00	3.79	0.03
10.58	5.28	8.89	2.12	75.73	0.91	0.00	3.10	0.02
10.66	5.74	9.75	2.19	78.55	1.00	0.00	2.00	0.01
10.74	6.40	10.99	2.20	80.91	1.12	0.00	1.12	0.01
10.83	7.25	12.59	2.13	82.14	1.28	0.00	0.58	0.00
10.91	7.75	13.54	2.02	81.11	1.37	1.00	0.41	0.00
10.99	7.75	13.53	2.04	81.56	1.37	0.98	0.41	0.00
11.07	7.24	12.56	2.25	84.30	1.27	0.00	0.61	0.00
11.15	6.94	11.97	3.17	99.20	1.21	0.00	0.78	0.01
11.24	8.15	14.26	3.51	109.73	1.43	2.71	0.33	0.00
11.32	10.06	17.86	3.29	112.44	1.79	10.15	0.11	0.00
11.40	12.30	22.09	2.83	108.35	2.00	17.16	0.05	0.00
11.48	16.41	29.85	2.15	107.56	0.41	27.10	51.20	0.37
11.56	27.66	51.10	1.32	85.11	0.29	44.84	51.20	0.37
11.65	42.95	73.73	0.79	93.93	0.33	56.94	22.70	0.16
11.73	57.70	92.19	0.50	102.13	0.37	64.32	22.70	0.16
11.81	65.13	100.19	0.37	100.19	0.36	67.06	14.50	0.10

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
11.89	68.14	103.14	0.32	103.14	0.38	68.02	14.50	0.10
11.98	70.56	106.73	0.35	106.73	0.40	69.15	14.50	0.10
12.06	77.24	116.01	0.38	116.01	0.47	71.90	14.50	0.10
12.14	87.06	128.57	0.38	128.57	0.57	75.29	10.28	0.07
12.22	98.79	141.87	0.32	141.87	0.71	78.54	6.54	0.05
12.30	108.42	151.27	0.25	151.27	0.83	80.66	4.80	0.03
12.39	116.33	159.01	0.21	159.01	0.93	82.31	3.74	0.03
12.47	122.33	165.09	0.19	165.09	1.02	83.55	3.09	0.02
12.55	127.66	171.52	0.20	171.52	1.12	84.81	2.53	0.02
12.63	134.08	179.00	0.20	179.00	1.25	86.22	2.18	0.02
12.71	141.80	187.70	0.20	187.70	1.42	87.78	1.74	0.01
12.80	151.92	197.15	0.17	197.15	1.61	89.40	1.38	0.01
12.88	163.38	207.91	0.13	207.91	2.00	91.16	0.00	0.00
12.96	175.02	218.70	0.10	218.70	2.00	92.83	0.00	0.00
13.04	185.29	229.56	0.10	229.56	2.00	94.43	0.00	0.00
13.12	190.46	235.26	0.10	235.26	2.00	95.24	0.00	0.00
13.21	190.85	235.78	0.11	235.78	2.00	95.31	0.00	0.00
13.29	188.49	232.97	0.11	232.97	2.00	94.91	0.00	0.00
13.37	187.10	230.24	0.10	230.24	2.00	94.53	0.00	0.00
13.45	186.37	228.82	0.09	228.82	2.00	94.32	0.00	0.00
13.53	186.12	227.89	0.08	227.89	2.00	94.19	0.00	0.00
13.62	184.93	226.23	0.07	226.23	2.00	93.95	0.00	0.00
13.70	183.80	224.57	0.07	224.57	2.00	93.70	0.00	0.00
13.78	180.39	220.64	0.06	220.64	2.00	93.12	0.00	0.00
13.86	176.69	216.46	0.06	216.46	2.00	92.49	0.00	0.00
13.94	171.69	210.96	0.07	210.96	2.00	91.64	0.00	0.00
14.03	166.60	206.74	0.11	206.74	2.00	90.97	0.00	0.00
14.11	161.20	202.33	0.15	202.33	2.00	90.26	0.00	0.00
14.19	156.72	199.66	0.20	199.66	1.63	89.82	1.36	0.01
14.27	154.79	198.03	0.21	198.03	1.59	89.55	1.42	0.01
14.35	154.22	197.25	0.22	197.25	1.57	89.42	1.45	0.01
14.44	154.29	196.49	0.20	196.49	1.55	89.29	1.48	0.01
14.52	154.24	195.46	0.19	195.46	1.53	89.12	1.52	0.01
14.60	154.34	194.18	0.17	194.18	1.50	88.90	1.57	0.01
14.68	153.36	191.20	0.13	191.20	1.44	88.39	1.70	0.01
14.76	151.08	187.40	0.11	187.40	1.36	87.73	1.87	0.01
14.85	146.61	181.57	0.09	181.57	1.25	86.69	2.18	0.02
14.93	142.13	176.30	0.08	176.30	1.16	85.72	2.51	0.02
15.01	137.22	170.61	0.08	170.61	1.06	84.63	2.85	0.02
15.09	133.01	165.95	0.09	165.95	0.99	83.72	3.31	0.02
15.17	130.08	162.71	0.10	162.71	0.94	83.07	3.67	0.03
15.26	128.45	161.68	0.13	161.68	0.92	82.86	3.81	0.03
15.34	129.50	163.72	0.16	163.72	0.95	83.27	3.57	0.03
15.42	130.21	166.31	0.21	166.31	0.99	83.79	3.30	0.02
15.50	128.87	165.90	0.25	165.90	0.98	83.71	3.35	0.02
15.58	124.78	161.06	0.25	161.06	0.91	82.73	3.92	0.03
15.67	119.34	154.29	0.25	154.29	0.82	81.31	4.89	0.03
15.75	113.42	146.64	0.23	146.64	0.72	79.64	6.31	0.05

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
15.83	109.42	142.77	0.27	142.77	0.68	78.75	7.20	0.05
15.91	107.96	141.06	0.28	141.06	0.66	78.35	7.65	0.05
15.99	110.80	143.49	0.25	143.49	0.69	78.92	7.06	0.05
16.08	116.89	148.73	0.20	148.73	0.75	80.10	5.94	0.04
16.16	128.19	159.68	0.15	159.68	0.88	82.45	4.16	0.03
16.24	145.29	177.27	0.12	177.27	1.15	85.90	2.53	0.02
16.32	164.17	196.71	0.09	196.71	1.52	89.33	1.54	0.01
16.40	177.76	210.53	0.07	210.53	2.00	91.57	0.00	0.00
16.49	187.19	220.35	0.08	220.35	2.00	93.08	0.00	0.00
16.57	190.04	223.60	0.09	223.60	2.00	93.56	0.00	0.00
16.65	190.52	224.31	0.10	224.31	2.00	93.66	0.00	0.00
16.73	187.42	220.92	0.11	220.92	2.00	93.16	0.00	0.00
16.81	188.25	224.34	0.16	224.34	2.00	93.67	0.00	0.00
16.90	191.63	228.51	0.17	228.51	2.00	94.28	0.00	0.00
16.98	192.15	228.87	0.18	228.87	2.00	94.33	0.00	0.00
17.06	189.36	223.21	0.13	223.21	2.00	93.50	0.00	0.00
17.14	182.22	214.71	0.12	214.71	2.00	92.22	0.00	0.00
17.22	168.28	200.83	0.14	200.83	2.00	90.01	0.00	0.00
17.31	144.39	177.82	0.23	177.82	1.15	86.00	2.54	0.02
17.39	113.53	147.79	0.47	147.79	0.72	79.89	6.31	0.05
17.47	85.10	117.92	0.92	140.05	0.64	72.44	11.72	0.08
17.55	59.63	87.67	1.59	123.30	0.48	62.66	22.70	0.16
17.63	42.45	65.40	2.41	128.21	0.52	52.98	34.10	0.24
17.72	29.33	47.01	3.37	147.85	0.72	42.08	51.20	0.37
17.80	22.07	36.21	4.16	297.51	2.00	33.47	0.00	0.00
17.88	19.97	32.83	4.29	157.00	2.00	30.24	0.04	0.00
17.96	25.28	40.13	3.09	149.96	0.75	36.86	51.20	0.37
18.04	36.27	54.95	2.08	110.66	0.39	47.24	34.10	0.24
18.13	58.63	83.74	1.34	113.96	0.41	61.14	22.70	0.16
18.21	90.22	122.28	0.94	144.76	0.69	73.64	9.54	0.07
18.29	120.62	157.44	0.73	157.44	0.84	81.98	4.65	0.03
18.37	134.83	172.52	0.62	172.52	1.05	85.00	2.89	0.02
18.45	132.86	168.61	0.55	168.61	0.99	84.24	3.26	0.02
18.54	126.09	160.11	0.54	160.11	0.87	82.53	4.28	0.03
18.62	120.18	153.43	0.58	153.43	0.79	81.13	5.32	0.04
18.70	117.24	150.79	0.66	150.79	0.75	80.56	5.81	0.04
18.78	116.34	149.68	0.68	149.68	0.74	80.31	6.04	0.04
18.86	114.70	147.30	0.67	147.30	0.71	79.78	6.54	0.05
18.95	111.45	143.38	0.69	143.38	0.67	78.89	7.46	0.05
19.03	107.65	139.58	0.78	147.32	0.71	78.01	6.54	0.05
19.11	103.55	135.39	0.89	153.05	0.78	77.00	5.42	0.04
19.19	97.49	128.88	1.04	153.96	0.79	75.37	5.26	0.04
19.27	88.68	118.68	1.21	147.72	0.71	72.65	8.44	0.06
19.36	77.40	104.18	1.22	132.80	0.56	68.35	14.50	0.10
19.44	66.76	89.73	1.07	115.29	0.42	63.42	22.70	0.16
19.52	60.77	80.25	0.73	99.76	0.32	59.74	22.70	0.16
19.60	55.40	73.08	0.67	91.47	0.28	56.65	22.70	0.16
19.69	44.91	60.34	0.81	80.89	0.24	50.33	34.10	0.24

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
19.77	30.90	43.16	1.29	79.36	0.24	39.26	51.20	0.37
19.85	18.95	27.44	2.08	116.91	0.43	24.32	51.20	0.37
19.93	14.06	20.63	2.70	105.30	1.84	14.91	0.08	0.00
20.01	11.03	16.20	3.15	109.11	1.45	6.91	0.29	0.00
20.10	9.85	14.33	3.02	103.74	1.28	2.87	0.54	0.00
20.18	9.65	13.84	2.45	92.16	1.23	1.72	0.64	0.00
20.26	11.41	16.14	1.72	78.50	1.44	6.79	0.30	0.00
20.34	15.23	21.37	1.44	91.35	0.28	16.06	51.20	0.37
20.42	17.22	24.08	1.44	76.67	0.23	20.01	51.20	0.37
20.51	16.55	23.22	1.62	97.49	0.31	18.81	51.20	0.37
20.59	13.02	18.37	1.97	184.62	1.12	11.06	0.00	0.00
20.67	10.34	14.59	2.40	92.10	1.30	3.46	0.50	0.00
20.75	8.61	12.07	2.79	95.73	1.07	0.00	1.30	0.01
20.83	7.70	10.56	2.70	91.22	0.94	0.00	2.54	0.02
20.92	7.59	10.32	2.02	79.03	0.91	0.00	2.84	0.02
21.00	7.69	10.26	1.35	65.30	0.91	0.00	2.94	0.02
21.08	7.63	10.05	1.05	58.20	0.89	0.00	3.27	0.02
21.16	7.52	9.85	1.00	56.83	0.87	0.00	3.63	0.03
21.24	7.44	9.72	1.00	56.78	0.86	0.00	3.89	0.03
21.33	7.41	9.65	0.99	56.40	0.85	0.00	4.06	0.03
21.41	7.40	9.60	0.97	56.08	0.85	0.00	4.16	0.03
21.49	7.40	9.58	0.96	55.73	0.84	0.00	4.23	0.03
21.57	7.45	9.61	0.94	55.28	0.85	0.00	4.18	0.03
21.65	7.54	9.71	0.93	55.06	0.85	0.00	3.99	0.03
21.74	7.69	9.90	0.91	54.80	0.87	0.00	3.64	0.03
21.82	7.99	10.28	0.89	54.33	0.90	0.00	3.03	0.02
21.90	8.16	10.49	0.87	53.82	0.92	0.00	2.76	0.02
21.98	8.23	10.55	0.86	53.67	0.92	0.00	2.69	0.02
22.06	8.03	10.26	0.87	53.78	0.90	0.00	3.10	0.02
22.15	7.76	9.87	0.88	54.04	0.86	0.00	3.77	0.03
22.23	7.42	9.37	0.90	54.14	0.82	0.00	4.88	0.03
22.31	7.25	9.11	0.91	54.30	0.80	0.00	5.61	0.04
22.39	7.22	9.06	0.92	54.47	0.79	0.00	5.82	0.04
22.47	7.32	9.18	0.92	54.68	0.80	0.00	5.46	0.04
22.56	7.43	9.30	0.90	54.09	0.81	0.00	5.15	0.04
22.64	7.55	9.47	1.00	56.69	0.82	0.00	4.72	0.03
22.72	7.77	9.81	1.18	61.13	0.85	0.00	3.98	0.03
22.80	8.27	10.55	1.38	66.41	0.92	0.00	2.79	0.02
22.88	8.73	11.18	1.45	68.60	0.97	0.00	2.11	0.02
22.97	9.20	11.80	1.45	68.99	1.02	0.00	1.61	0.01
23.05	9.14	11.71	1.52	70.45	1.02	0.00	1.68	0.01
23.13	9.05	11.53	1.44	68.48	1.00	0.00	1.82	0.01
23.21	8.85	11.17	1.24	63.54	0.97	0.00	2.14	0.02
23.29	8.89	11.08	0.93	55.74	0.96	0.00	2.23	0.02
23.38	8.86	10.96	0.79	52.10	0.95	0.00	2.36	0.02
23.46	8.80	10.85	0.78	51.58	0.94	0.00	2.49	0.02
23.54	8.73	10.74	0.79	51.95	0.93	0.00	2.64	0.02
23.62	8.46	10.37	0.82	52.50	0.89	0.00	3.14	0.02

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
23.70	8.24	10.05	0.84	52.98	0.87	0.00	3.68	0.03
23.79	7.95	9.65	0.86	53.36	0.83	0.00	4.50	0.03
23.87	7.94	9.61	0.85	53.05	0.83	0.00	4.61	0.03
23.95	7.80	9.38	0.84	52.70	0.81	0.00	5.19	0.04
24.03	7.66	9.18	0.83	52.30	0.79	0.00	5.81	0.04
24.11	7.57	9.02	0.80	51.58	0.77	0.00	6.34	0.05
24.20	7.58	9.02	0.80	51.44	0.77	0.00	6.38	0.05
24.28	7.64	9.08	0.79	51.19	0.78	0.00	6.20	0.04
24.36	7.75	9.20	0.80	51.53	0.79	0.00	5.81	0.04
24.44	7.92	9.42	0.83	52.50	0.81	0.00	5.18	0.04
24.52	8.28	9.88	0.86	53.59	0.85	0.00	4.11	0.03
24.61	8.69	10.43	0.89	54.46	0.89	0.00	3.17	0.02
24.69	8.87	10.64	0.89	54.78	0.91	0.00	2.88	0.02
24.77	8.93	10.73	0.99	57.29	0.92	0.00	2.77	0.02
24.85	8.91	10.84	1.64	72.39	0.93	0.00	2.63	0.02
24.93	10.00	12.38	2.11	83.84	1.06	0.00	1.36	0.01
25.02	12.51	15.85	2.70	100.30	1.35	6.21	0.40	0.00
25.10	15.89	20.31	2.77	107.09	1.73	14.39	0.11	0.00
25.18	31.27	39.53	1.96	97.94	0.30	36.37	51.20	0.37
25.26	76.44	91.55	0.93	114.76	0.39	64.09	22.70	0.16
25.34	147.95	168.57	0.53	168.57	0.94	84.24	3.67	0.03
25.43	221.18	244.78	0.41	244.78	2.00	96.55	0.00	0.00
25.51	272.75	296.92	0.35	296.92	2.00	100.00	0.00	0.00
25.59	303.58	331.08	0.43	331.08	2.00	100.00	0.00	0.00
25.67	321.41	349.06	0.42	349.06	2.00	100.00	0.00	0.00
25.75	338.01	367.49	0.47	367.49	2.00	100.00	0.00	0.00
25.84	347.73	379.17	0.53	379.17	2.00	100.00	0.00	0.00
25.92	359.17	392.70	0.60	392.70	2.00	100.00	0.00	0.00
26.00	354.72	388.31	0.63	388.31	2.00	100.00	0.00	0.00
26.08	347.51	377.64	0.54	377.64	2.00	100.00	0.00	0.00
26.16	334.14	360.51	0.45	360.51	2.00	100.00	0.00	0.00
26.25	325.43	347.82	0.36	347.82	2.00	100.00	0.00	0.00
26.33	317.10	334.90	0.25	334.90	2.00	100.00	0.00	0.00
26.41	308.39	325.86	0.25	325.86	2.00	100.00	0.00	0.00
26.49	303.51	322.56	0.31	322.56	2.00	100.00	0.00	0.00
26.57	301.09	323.64	0.43	323.64	2.00	100.00	0.00	0.00
26.66	305.45	327.48	0.42	327.48	2.00	100.00	0.00	0.00
26.74	297.99	319.37	0.42	319.37	2.00	100.00	0.00	0.00
26.82	295.63	316.23	0.41	316.23	2.00	100.00	0.00	0.00
26.90	286.58	308.02	0.47	308.02	2.00	100.00	0.00	0.00
26.98	290.29	310.27	0.42	310.27	2.00	100.00	0.00	0.00
27.07	288.84	306.07	0.34	306.07	2.00	100.00	0.00	0.00
27.15	290.63	303.68	0.22	303.68	2.00	100.00	0.00	0.00
27.23	289.61	300.88	0.18	300.88	2.00	100.00	0.00	0.00
27.31	284.08	294.62	0.16	294.62	2.00	100.00	0.00	0.00
27.40	278.93	289.94	0.18	289.94	2.00	100.00	0.00	0.00
27.48	275.24	286.41	0.19	286.41	2.00	100.00	0.00	0.00
27.56	276.25	288.40	0.23	288.40	2.00	100.00	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
27.64	273.29	286.38	0.27	286.38	2.00	100.00	0.00	0.00
27.72	273.94	286.95	0.28	286.95	2.00	100.00	0.00	0.00
27.81	274.81	286.16	0.23	286.16	2.00	100.00	0.00	0.00
27.89	279.57	289.84	0.21	289.84	2.00	100.00	0.00	0.00
27.97	279.55	289.15	0.19	289.15	2.00	100.00	0.00	0.00
28.05	279.48	288.97	0.20	288.97	2.00	100.00	0.00	0.00
28.13	278.68	287.56	0.19	287.56	2.00	100.00	0.00	0.00
28.22	275.11	283.18	0.17	283.18	2.00	100.00	0.00	0.00
28.30	270.40	279.20	0.20	279.20	2.00	100.00	0.00	0.00
28.38	267.51	277.94	0.27	277.94	2.00	100.00	0.00	0.00
28.46	269.19	282.07	0.39	282.07	2.00	100.00	0.00	0.00
28.54	267.45	281.87	0.50	281.87	2.00	100.00	0.00	0.00
28.63	264.31	278.52	0.51	278.52	2.00	100.00	0.00	0.00
28.71	259.63	272.38	0.45	272.38	2.00	100.00	0.00	0.00
28.79	255.57	266.49	0.37	266.49	2.00	99.35	0.00	0.00
28.87	260.50	270.90	0.35	270.90	2.00	99.89	0.00	0.00
28.95	261.38	273.84	0.49	273.84	2.00	100.00	0.00	0.00
29.04	272.23	286.73	0.64	286.73	2.00	100.00	0.00	0.00
29.12	268.23	283.55	0.75	283.55	2.00	100.00	0.00	0.00
29.20	262.12	275.59	0.64	275.59	2.00	100.00	0.00	0.00
29.28	246.20	257.03	0.49	257.03	2.00	98.16	0.00	0.00
29.36	239.04	246.49	0.30	246.49	2.00	96.78	0.00	0.00
29.45	239.44	245.78	0.25	245.78	2.00	96.68	0.00	0.00
29.53	253.30	258.42	0.21	258.42	2.00	98.34	0.00	0.00
29.61	271.51	278.14	0.30	278.14	2.00	100.00	0.00	0.00
29.69	294.18	302.44	0.40	302.44	2.00	100.00	0.00	0.00
29.77	312.56	322.58	0.52	322.58	2.00	100.00	0.00	0.00
29.86	331.69	342.85	0.60	342.85	2.00	100.00	0.00	0.00
29.94	346.14	357.61	0.64	357.61	2.00	100.00	0.00	0.00
30.02	365.08	376.88	0.68	376.88	2.00	100.00	0.00	0.00
30.10	381.24	392.88	0.69	392.88	2.00	100.00	0.00	0.00
30.18	391.80	402.44	0.65	402.44	2.00	100.00	0.00	0.00
30.27	398.98	408.27	0.60	408.27	2.00	100.00	0.00	0.00
30.35	401.66	408.68	0.51	408.68	2.00	100.00	0.00	0.00
30.43	414.40	419.33	0.43	419.33	2.00	100.00	0.00	0.00
30.51	426.09	431.02	0.46	431.02	2.00	100.00	0.00	0.00
30.59	436.33	444.27	0.64	444.27	2.00	100.00	0.00	0.00
30.68	462.98	473.33	0.82	473.33	2.00	100.00	0.00	0.00
30.76	485.08	496.67	0.93	496.67	2.00	100.00	0.00	0.00
30.84	496.55	506.72	0.88	506.72	2.00	100.00	0.00	0.00
30.92	486.98	496.11	0.86	496.11	2.00	100.00	0.00	0.00
31.00	483.72	490.89	0.78	490.89	2.00	100.00	0.00	0.00
31.09	489.21	494.59	0.71	494.59	2.00	100.00	0.00	0.00
31.17	512.03	513.19	0.52	513.19	2.00	100.00	0.00	0.00
31.25	527.67	525.94	0.43	525.94	2.00	100.00	0.00	0.00
31.33	547.71	544.85	0.43	544.85	2.00	100.00	0.00	0.00
31.41	554.37	550.07	0.40	550.07	2.00	100.00	0.00	0.00
31.50	542.38	537.70	0.39	537.70	2.00	100.00	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
31.58	530.13	526.00	0.42	526.00	2.00	100.00	0.00	0.00
31.66	533.19	530.55	0.52	530.55	2.00	100.00	0.00	0.00
31.74	509.71	507.55	0.55	507.55	2.00	100.00	0.00	0.00
31.82	489.37	484.66	0.43	484.66	2.00	100.00	0.00	0.00
31.91	441.30	441.08	0.70	441.08	2.00	100.00	0.00	0.00
31.99	453.05	453.68	0.83	453.68	2.00	100.00	0.00	0.00
32.07	475.30	476.72	1.00	476.72	2.00	100.00	0.00	0.00
32.15	520.78	519.38	0.83	519.38	2.00	100.00	0.00	0.00
32.23	546.69	544.13	0.82	544.13	2.00	100.00	0.00	0.00
32.32	577.36	572.96	0.77	572.96	2.00	100.00	0.00	0.00
32.40	557.93	552.57	0.73	552.57	2.00	100.00	0.00	0.00
32.48	518.03	513.85	0.83	513.85	2.00	100.00	0.00	0.00
32.56	440.67	437.89	0.93	437.89	2.00	100.00	0.00	0.00
32.64	395.68	393.13	0.96	393.13	2.00	100.00	0.00	0.00
32.73	373.89	368.70	0.61	368.70	2.00	100.00	0.00	0.00
32.81	393.80	385.79	0.42	385.79	2.00	100.00	0.00	0.00
32.89	410.46	400.50	0.34	400.50	2.00	100.00	0.00	0.00
32.97	423.75	414.41	0.45	414.41	2.00	100.00	0.00	0.00
33.05	447.80	439.08	0.62	439.08	2.00	100.00	0.00	0.00
33.14	490.69	482.16	0.84	482.16	2.00	100.00	0.00	0.00
33.22	539.15	529.49	0.92	529.49	2.00	100.00	0.00	0.00
33.30	550.82	541.18	1.07	541.18	2.00	100.00	0.00	0.00
33.38	547.41	537.81	1.18	537.81	2.00	100.00	0.00	0.00
33.46	514.85	505.37	1.22	505.37	2.00	100.00	0.00	0.00
33.55	466.95	458.21	1.31	458.21	2.00	100.00	0.00	0.00
33.63	432.70	423.59	1.19	423.59	2.00	100.00	0.00	0.00
33.71	405.29	396.27	1.20	396.27	2.00	100.00	0.00	0.00
33.79	397.55	387.61	1.05	387.61	2.00	100.00	0.00	0.00
33.87	382.48	372.62	1.11	372.62	2.00	100.00	0.00	0.00
33.96	386.38	376.06	1.18	376.06	2.00	100.00	0.00	0.00
34.04	397.16	385.75	1.11	385.75	2.00	100.00	0.00	0.00
34.12	410.46	397.60	0.97	397.60	2.00	100.00	0.00	0.00
34.20	440.27	424.96	0.74	424.96	2.00	100.00	0.00	0.00
34.28	461.91	444.55	0.60	444.55	2.00	100.00	0.00	0.00
34.37	457.97	439.88	0.52	439.88	2.00	100.00	0.00	0.00
34.45	410.83	394.66	0.62	394.66	2.00	100.00	0.00	0.00
34.53	362.28	348.28	0.84	348.28	2.00	100.00	0.00	0.00
34.61	322.49	310.05	1.09	310.05	2.00	100.00	0.00	0.00
34.69	303.32	291.32	1.20	291.32	2.00	100.00	0.00	0.00
34.78	284.42	272.74	1.22	272.74	2.00	100.00	0.00	0.00
34.86	274.78	262.85	1.02	262.85	2.00	98.90	0.00	0.00
34.94	278.06	265.44	0.87	265.44	2.00	99.22	0.00	0.00
35.02	277.18	264.16	0.81	264.16	2.00	99.06	0.00	0.00
35.10	277.04	263.72	0.85	263.72	2.00	99.01	0.00	0.00
35.19	271.79	258.18	0.68	258.18	2.00	98.31	0.00	0.00
35.27	271.98	257.68	0.39	257.68	2.00	98.24	0.00	0.00
35.35	273.99	259.10	0.25	259.10	2.00	98.42	0.00	0.00
35.43	283.73	268.20	0.29	268.20	2.00	99.56	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
35.52	287.59	271.74	0.40	271.74	2.00	100.00	0.00	0.00
35.60	285.68	269.74	0.49	269.74	2.00	99.75	0.00	0.00
35.68	286.47	270.23	0.54	270.23	2.00	99.81	0.00	0.00
35.76	308.09	290.49	0.71	290.49	2.00	100.00	0.00	0.00
35.84	340.67	321.02	0.82	321.02	2.00	100.00	0.00	0.00
35.93	379.43	357.29	0.87	357.29	2.00	100.00	0.00	0.00
36.01	408.13	383.96	0.81	383.96	2.00	100.00	0.00	0.00
36.09	421.42	396.01	0.93	396.01	2.00	100.00	0.00	0.00
36.17	409.34	384.09	0.94	384.09	2.00	100.00	0.00	0.00
36.25	395.37	370.34	1.14	370.34	2.00	100.00	0.00	0.00
36.34	389.54	364.44	0.93	364.44	2.00	100.00	0.00	0.00
36.42	378.60	353.66	0.95	353.66	2.00	100.00	0.00	0.00
36.50	363.00	338.69	0.77	338.69	2.00	100.00	0.00	0.00
36.58	335.19	311.98	0.97	311.98	2.00	100.00	0.00	0.00
36.66	338.85	314.81	1.19	314.81	2.00	100.00	0.00	0.00
36.75	344.05	319.11	1.31	319.11	2.00	100.00	0.00	0.00
36.83	380.68	353.00	1.17	353.00	2.00	100.00	0.00	0.00
36.91	394.90	366.08	0.97	366.08	2.00	100.00	0.00	0.00
36.99	366.64	339.31	0.90	339.31	2.00	100.00	0.00	0.00
37.07	360.64	333.35	0.86	333.35	2.00	100.00	0.00	0.00
37.16	366.79	338.42	0.99	338.42	2.00	100.00	0.00	0.00
37.24	437.35	403.79	0.93	403.79	2.00	100.00	0.00	0.00
37.32	416.12	383.31	1.02	383.31	2.00	100.00	0.00	0.00
37.40	383.12	352.15	1.02	352.15	2.00	100.00	0.00	0.00
37.48	317.72	290.37	1.47	296.23	2.00	100.00	0.00	0.00
37.57	318.89	290.62	1.76	328.50	2.00	100.00	0.00	0.00
37.65	344.64	313.57	2.00	364.11	2.00	100.00	0.00	0.00
37.73	366.21	332.80	2.04	384.53	2.00	100.00	0.00	0.00
37.81	393.61	357.33	2.09	409.61	2.00	100.00	0.00	0.00
37.89	405.97	367.89	2.21	427.88	2.00	100.00	0.00	0.00
37.98	460.10	417.51	1.84	423.75	2.00	100.00	0.00	0.00
38.06	398.67	360.52	1.91	395.93	2.00	100.00	0.00	0.00
38.14	340.53	306.99	1.83	346.71	2.00	100.00	0.00	0.00
38.22	263.09	235.36	2.33	296.22	2.00	95.25	0.00	0.00
38.30	250.57	223.50	2.41	285.04	2.00	93.55	0.00	0.00
38.39	221.28	196.33	2.76	263.73	2.00	89.27	0.00	0.00
38.47	170.86	150.17	3.46	238.04	2.00	80.42	0.00	0.00
38.55	145.32	126.83	3.90	232.23	2.00	74.84	0.00	0.00
38.63	125.32	108.65	4.18	226.81	2.00	69.74	0.00	0.00
38.71	117.25	101.31	3.97	212.08	2.00	67.43	0.00	0.00
38.80	109.77	94.52	3.78	199.21	1.60	65.14	0.82	0.01
38.88	104.97	90.14	3.54	186.71	1.35	63.58	0.96	0.01
38.96	100.07	85.66	3.44	179.28	1.21	61.89	1.53	0.01
39.04	97.58	83.32	3.32	173.36	1.11	60.98	2.24	0.02
39.12	96.80	82.50	3.24	169.78	1.05	60.65	2.83	0.02
39.21	95.23	80.94	3.27	169.67	1.05	60.02	2.84	0.02
39.29	94.41	79.96	3.59	180.09	1.23	59.62	1.43	0.01
39.37	94.78	80.07	3.80	187.55	1.37	59.66	0.89	0.01

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
39.45	103.02	87.16	3.65	188.03	1.38	62.46	0.86	0.01
39.53	127.96	109.20	2.86	179.07	1.22	69.91	1.82	0.01
39.62	165.69	142.81	2.12	191.20	1.45	78.76	1.50	0.01
39.70	197.23	171.11	1.66	211.86	2.00	84.73	0.00	0.00
39.78	205.23	178.20	1.51	215.24	2.00	86.07	0.00	0.00
39.86	188.91	163.15	1.69	204.17	2.00	83.16	0.00	0.00
39.94	164.19	140.65	2.01	186.52	1.36	78.26	1.70	0.01
40.03	142.03	120.58	2.42	176.23	1.17	73.18	2.02	0.01
40.11	123.98	104.36	2.79	172.65	1.11	68.41	2.35	0.02
40.19	112.12	93.66	3.20	177.34	1.19	64.84	1.64	0.01
40.27	105.38	87.55	3.44	180.76	1.26	62.61	1.31	0.01
40.35	107.61	89.40	3.22	174.50	1.15	63.30	1.96	0.01
40.44	116.06	96.73	2.82	167.16	1.03	65.90	2.96	0.02
40.52	122.36	102.18	2.55	163.06	0.97	67.71	3.53	0.03
40.60	121.38	101.13	2.58	162.98	0.97	67.37	3.53	0.03
40.68	110.70	91.54	2.90	165.25	1.00	64.08	3.56	0.03
40.76	100.73	82.65	3.28	171.26	1.10	60.71	2.38	0.02
40.85	95.90	78.31	3.41	172.51	1.12	58.93	2.18	0.02
40.93	97.43	79.55	3.23	166.94	1.03	59.45	3.14	0.02
41.01	99.31	81.12	2.96	159.10	0.91	60.10	5.33	0.04
41.09	100.12	81.72	2.86	155.99	0.87	60.34	6.58	0.05
41.17	96.73	78.63	2.96	156.92	0.89	59.07	6.14	0.04
41.26	91.97	74.38	3.13	159.42	0.92	57.23	5.15	0.04
41.34	88.45	71.24	3.17	158.67	0.91	55.81	5.40	0.04
41.42	92.99	74.47	4.25	198.85	1.64	57.27	0.40	0.00
41.50	103.92	83.04	5.37	246.95	2.00	60.87	0.00	0.00
41.58	116.20	92.61	6.67	349.42	2.00	64.46	0.00	0.00
41.67	125.32	100.88	4.49	231.58	2.00	67.29	0.00	0.00
41.75	264.42	224.57	1.15	224.57	2.00	93.70	0.00	0.00
41.83	406.50	320.45	0.00	320.45	2.00	100.00	0.00	0.00
41.91	568.35	448.44	0.00	448.44	2.00	100.00	0.00	0.00
41.99	595.38	469.48	0.00	469.48	2.00	100.00	0.00	0.00

Total estimated displacement: 11.09

Abbreviations

q_t: Total cone resistance
Q_{tn}: Adjusted cone resistance to an effective overburden stress of 1 atm
R_f: Friction ration
$Q_{tn,cs}$: Adjusted and corrected cone resistance due to fines
FS: Calculated factor of safety against liquefaction
D_r: Calculated relative density
$Gamma_{max}$: Calculated maximum cyclic shear strain
Lat. disp.: Lateral displacement

:: Strength loss calculation (Robertson (2009) ::

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
0.08	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.16	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.25	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.33	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.41	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.49	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.57	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.66	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.74	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.82	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.90	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.98	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.07	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.15	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.23	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.31	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.39	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.48	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.56	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.64	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.72	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.80	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.89	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.97	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.05	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.13	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.21	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.30	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.38	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.46	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.54	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.62	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.71	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.79	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.87	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.95	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
3.03	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
3.12	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
3.20	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
3.28	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
3.36	26.72	50.13	1.78	89.32	2.26	0.73	0.73
3.44	36.78	69.13	1.59	109.81	2.19	0.77	0.77
3.53	29.77	55.87	2.09	116.82	2.34	0.78	0.78
3.61	21.75	40.70	3.30	134.19	2.54	0.83	0.83
3.69	16.35	30.49	4.93	150.38	2.72	3.27	5.19
3.77	14.45	26.89	5.59	150.26	2.78	3.08	4.49
3.85	13.28	24.67	5.93	146.25	2.81	2.40	4.03
3.94	12.87	23.89	5.93	141.63	2.81	2.39	3.83

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
4.02	12.58	23.32	6.24	145.60	2.83	2.41	3.68
4.10	11.87	21.98	6.87	151.08	2.88	2.53	3.43
4.18	10.69	19.73	7.99	157.64	2.95	2.56	3.06
4.27	9.49	17.46	9.30	162.32	3.03	2.57	2.68
4.35	8.71	15.98	10.23	163.41	3.08	2.54	2.44
4.43	8.54	15.65	10.19	159.37	3.08	2.40	2.37
4.51	8.61	15.77	9.73	153.47	3.05	2.14	2.37
4.59	8.75	16.03	9.34	149.78	3.03	2.04	2.39
4.68	8.83	16.16	9.35	151.18	3.03	2.09	2.39
4.76	8.99	16.46	9.35	153.92	3.03	2.21	2.41
4.84	9.07	16.60	9.46	156.97	3.04	2.23	2.41
4.92	9.16	16.76	9.54	159.83	3.04	2.29	2.42
5.00	9.26	16.95	9.53	161.53	3.04	2.39	2.43
5.09	9.57	17.53	9.16	160.47	3.02	2.33	2.49
5.17	9.97	18.27	8.52	155.70	2.98	2.23	2.57
5.25	10.00	18.32	8.26	151.27	2.97	2.07	2.56
5.33	9.57	17.49	8.47	148.19	2.98	1.97	2.43
5.41	8.91	16.23	8.96	145.52	3.01	1.86	2.24
5.50	8.48	15.43	9.17	141.54	3.02	1.70	2.11
5.58	8.32	15.11	9.02	136.40	3.01	1.57	2.05
5.66	8.35	15.16	8.66	131.35	2.99	1.46	2.05
5.74	8.40	15.25	8.48	129.27	2.98	1.36	2.04
5.82	8.37	15.17	8.58	130.22	2.99	1.42	2.02
5.91	8.12	14.69	9.05	132.98	3.02	1.48	1.94
5.99	7.63	13.77	9.85	135.66	3.06	1.45	1.81
6.07	7.02	12.61	10.97	138.26	3.12	1.47	1.65
6.15	6.52	11.65	12.01	139.93	3.17	1.50	1.51
6.23	6.26	11.15	12.24	136.46	3.18	1.45	1.44
6.32	6.10	10.84	12.00	130.06	3.17	1.20	1.39
6.40	5.93	10.51	11.64	122.40	3.15	1.08	1.34
6.48	5.72	10.10	11.65	117.67	3.15	0.98	1.28
6.56	5.55	9.77	11.65	113.82	3.15	0.90	1.23
6.64	5.39	9.47	11.73	111.06	3.15	0.85	1.18
6.73	5.17	9.04	12.02	108.64	3.17	0.81	1.12
6.81	5.03	8.76	12.10	106.03	3.17	0.75	1.08
6.89	4.91	8.53	12.13	103.44	3.17	0.70	1.05
6.97	4.75	8.22	12.23	100.54	3.18	0.67	1.01
7.05	4.61	7.94	12.20	96.87	3.18	0.60	0.97
7.14	4.41	7.56	12.14	91.72	3.17	0.53	0.92
7.22	4.26	7.26	11.88	86.28	3.16	0.44	0.88
7.30	4.12	6.99	11.43	79.89	3.14	0.38	0.84
7.38	4.02	6.81	10.73	73.07	3.11	0.30	0.81
7.46	4.05	6.84	9.60	65.65	3.05	0.22	0.81
7.55	4.11	6.96	8.60	59.83	2.99	0.18	0.82
7.63	4.22	7.15	7.80	55.77	2.94	0.16	0.84
7.71	4.31	7.32	7.29	53.31	2.91	0.14	0.86
7.79	4.40	7.49	6.79	50.89	2.87	0.13	0.88
7.87	4.44	7.55	6.58	49.67	2.86	0.11	0.88

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
7.96	4.47	7.60	6.52	49.60	2.85	0.11	0.88
8.04	4.52	7.70	6.72	51.73	2.87	0.13	0.89
8.12	4.62	7.87	6.72	52.88	2.87	0.15	0.91
8.20	4.66	7.95	6.66	52.94	2.86	0.14	0.91
8.28	4.59	7.81	6.59	51.42	2.86	0.13	0.90
8.37	4.51	7.65	6.61	50.52	2.86	0.12	0.87
8.45	4.45	7.52	6.59	49.55	2.86	0.12	0.86
8.53	4.43	7.49	6.51	48.75	2.85	0.11	0.85
8.61	4.46	7.53	6.38	48.02	2.84	0.10	0.85
8.69	4.56	7.70	6.23	47.97	2.83	0.10	0.87
8.78	4.68	7.93	6.07	48.18	2.82	0.11	0.89
8.86	4.78	8.12	5.93	48.11	2.81	0.11	0.91
8.94	4.86	8.26	5.84	48.25	2.80	0.11	0.92
9.02	4.92	8.36	5.81	48.61	2.80	0.11	0.93
9.10	5.06	8.62	5.84	50.34	2.80	0.12	0.96
9.19	5.28	9.03	5.83	52.65	2.80	0.14	1.00
9.27	5.67	9.77	5.70	55.68	2.79	0.17	1.08
9.35	6.32	10.99	5.56	61.10	2.78	0.20	1.20
9.43	7.52	13.25	5.09	67.44	2.74	0.31	1.45
9.51	8.28	14.68	5.54	81.31	2.77	0.42	1.59
9.60	8.34	14.77	6.35	93.72	2.84	0.69	1.60
9.68	7.24	12.68	8.30	105.29	2.97	0.74	1.36
9.76	6.17	10.66	10.00	106.64	3.07	0.72	1.14
9.84	5.31	9.02	11.28	101.79	3.13	0.61	0.96
9.92	4.92	8.28	11.09	91.80	3.12	0.46	0.88
10.01	4.72	7.88	10.27	80.97	3.08	0.33	0.83
10.09	4.72	7.88	9.39	74.00	3.03	0.26	0.83
10.17	4.82	8.06	8.88	71.61	3.01	0.27	0.84
10.25	4.96	8.31	8.62	71.70	2.99	0.27	0.87
10.33	5.02	8.43	8.47	71.43	2.98	0.26	0.88
10.42	5.02	8.42	8.49	71.54	2.98	0.26	0.87
10.50	5.07	8.51	8.59	73.14	2.99	0.27	0.88
10.58	5.28	8.89	8.51	75.73	2.98	0.30	0.91
10.66	5.74	9.75	8.05	78.55	2.96	0.34	1.00
10.74	6.40	10.99	7.36	80.91	2.91	0.38	1.12
10.83	7.25	12.59	6.52	82.14	2.85	0.42	1.28
10.91	7.75	13.54	5.99	81.11	2.81	0.45	1.37
10.99	7.75	13.53	6.03	81.56	2.81	0.39	1.36
11.07	7.24	12.56	6.71	84.30	2.87	0.43	1.26
11.15	6.94	11.97	8.29	99.20	2.97	0.47	1.19
11.24	8.15	14.26	7.69	109.73	2.93	0.84	1.42
11.32	10.06	17.86	6.29	112.44	2.83	0.94	1.76
11.40	12.30	22.09	4.90	108.35	2.72	0.82	2.17
11.48	16.41	29.85	3.25	97.03	2.54	0.76	0.76
11.56	27.66	51.10	1.67	85.11	2.22	0.72	0.72
11.65	42.95	73.73	1.27	93.93	1.96	0.74	0.74
11.73	57.70	92.19	1.11	102.13	1.76	0.75	0.75
11.81	65.13	100.19	1.00	100.19	1.67	0.75	0.75

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
11.89	68.14	103.14	1.00	103.14	1.63	0.75	0.75
11.98	70.56	106.73	1.00	106.73	1.63	0.76	0.76
12.06	77.24	116.01	1.00	116.01	1.62	0.78	0.78
12.14	87.06	128.57	1.00	128.57	1.58	0.80	0.80
12.22	98.79	141.87	1.00	141.87	1.51	0.82	0.82
12.30	108.42	151.27	1.00	151.27	1.43	0.83	0.83
12.39	116.33	159.01	1.00	159.01	1.38	0.84	0.84
12.47	122.33	165.09	1.00	165.09	1.35	0.85	0.85
12.55	127.66	171.52	1.00	171.52	1.34	0.85	0.85
12.63	134.08	179.00	1.00	179.00	1.33	0.86	0.86
12.71	141.80	187.70	1.00	187.70	1.31	0.87	0.87
12.80	151.92	197.15	1.00	197.15	1.26	0.88	0.88
12.88	163.38	207.91	1.00	207.91	1.20	0.90	0.90
12.96	175.02	218.70	1.00	218.70	1.15	0.91	0.91
13.04	185.29	229.56	1.00	229.56	1.13	0.92	0.92
13.12	190.46	235.26	1.00	235.26	1.12	0.92	0.92
13.21	190.85	235.78	1.00	235.78	1.13	0.92	0.92
13.29	188.49	232.97	1.00	232.97	1.13	0.92	0.92
13.37	187.10	230.24	1.00	230.24	1.13	0.92	0.92
13.45	186.37	228.82	1.00	228.82	1.12	0.92	0.92
13.53	186.12	227.89	1.00	227.89	1.12	0.92	0.92
13.62	184.93	226.23	1.00	226.23	1.12	0.91	0.91
13.70	183.80	224.57	1.00	224.57	1.12	0.91	0.91
13.78	180.39	220.64	1.00	220.64	1.13	0.91	0.91
13.86	176.69	216.46	1.00	216.46	1.13	0.90	0.90
13.94	171.69	210.96	1.00	210.96	1.15	0.90	0.90
14.03	166.60	206.74	1.00	206.74	1.18	0.89	0.89
14.11	161.20	202.33	1.00	202.33	1.23	0.89	0.89
14.19	156.72	199.66	1.00	199.66	1.28	0.89	0.89
14.27	154.79	198.03	1.00	198.03	1.30	0.88	0.88
14.35	154.22	197.25	1.00	197.25	1.30	0.88	0.88
14.44	154.29	196.49	1.00	196.49	1.29	0.88	0.88
14.52	154.24	195.46	1.00	195.46	1.28	0.88	0.88
14.60	154.34	194.18	1.00	194.18	1.26	0.88	0.88
14.68	153.36	191.20	1.00	191.20	1.24	0.88	0.88
14.76	151.08	187.40	1.00	187.40	1.22	0.87	0.87
14.85	146.61	181.57	1.00	181.57	1.22	0.87	0.87
14.93	142.13	176.30	1.00	176.30	1.23	0.86	0.86
15.01	137.22	170.61	1.00	170.61	1.25	0.85	0.85
15.09	133.01	165.95	1.00	165.95	1.27	0.85	0.85
15.17	130.08	162.71	1.00	162.71	1.28	0.84	0.84
15.26	128.45	161.68	1.00	161.68	1.30	0.84	0.84
15.34	129.50	163.72	1.00	163.72	1.32	0.84	0.84
15.42	130.21	166.31	1.00	166.31	1.36	0.85	0.85
15.50	128.87	165.90	1.00	165.90	1.39	0.85	0.85
15.58	124.78	161.06	1.00	161.06	1.41	0.84	0.84
15.67	119.34	154.29	1.00	154.29	1.42	0.83	0.83
15.75	113.42	146.64	1.00	146.64	1.43	0.82	0.82

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
15.83	109.42	142.77	1.00	142.77	1.47	0.82	0.82
15.91	107.96	141.06	1.00	141.06	1.48	0.81	0.81
15.99	110.80	143.49	1.00	143.49	1.45	0.82	0.82
16.08	116.89	148.73	1.00	148.73	1.40	0.83	0.83
16.16	128.19	159.68	1.00	159.68	1.33	0.84	0.84
16.24	145.29	177.27	1.00	177.27	1.25	0.86	0.86
16.32	164.17	196.71	1.00	196.71	1.19	0.88	0.88
16.40	177.76	210.53	1.00	210.53	1.15	0.90	0.90
16.49	187.19	220.35	1.00	220.35	1.13	0.91	0.91
16.57	190.04	223.60	1.00	223.60	1.13	0.91	0.91
16.65	190.52	224.31	1.00	224.31	1.14	0.91	0.91
16.73	187.42	220.92	1.00	220.92	1.15	0.91	0.91
16.81	188.25	224.34	1.00	224.34	1.20	0.91	0.91
16.90	191.63	228.51	1.00	228.51	1.20	0.92	0.92
16.98	192.15	228.87	1.00	228.87	1.20	0.92	0.92
17.06	189.36	223.21	1.00	223.21	1.17	0.91	0.91
17.14	182.22	214.71	1.00	214.71	1.17	0.90	0.90
17.22	168.28	200.83	1.00	200.83	1.23	0.89	0.89
17.31	144.39	177.82	1.00	177.82	1.35	0.86	0.86
17.39	113.53	147.79	1.00	147.79	1.58	0.82	0.82
17.47	85.10	117.92	1.19	140.05	1.83	0.81	0.81
17.55	59.63	87.67	1.41	123.30	2.09	0.79	0.79
17.63	42.45	65.40	1.96	128.21	2.31	0.80	0.80
17.72	29.33	47.01	3.10	145.70	2.52	0.82	0.82
17.80	22.07	36.21	4.36	157.81	2.67	1.75	2.78
17.88	19.97	32.83	4.78	157.00	2.71	1.51	2.49
17.96	25.28	40.13	3.29	132.10	2.54	0.83	0.83
18.04	36.27	54.95	2.01	110.66	2.32	0.77	0.77
18.13	58.63	83.74	1.36	113.96	2.06	0.77	0.77
18.21	90.22	122.28	1.18	144.76	1.83	0.82	0.82
18.29	120.62	157.44	1.00	157.44	1.68	0.84	0.84
18.37	134.83	172.52	1.00	172.52	1.60	0.86	0.86
18.45	132.86	168.61	1.00	168.61	1.57	0.85	0.85
18.54	126.09	160.11	1.00	160.11	1.59	0.84	0.84
18.62	120.18	153.43	1.00	153.43	1.62	0.83	0.83
18.70	117.24	150.79	1.00	150.79	1.66	0.83	0.83
18.78	116.34	149.68	1.00	149.68	1.67	0.83	0.83
18.86	114.70	147.30	1.00	147.30	1.67	0.82	0.82
18.95	111.45	143.38	1.00	143.38	1.69	0.82	0.82
19.03	107.65	139.58	1.06	147.32	1.73	0.82	0.82
19.11	103.55	135.39	1.13	153.05	1.78	0.83	0.83
19.19	97.49	128.88	1.19	153.96	1.84	0.83	0.83
19.27	88.68	118.68	1.24	147.72	1.91	0.82	0.82
19.36	77.40	104.18	1.27	132.80	1.96	0.80	0.80
19.44	66.76	89.73	1.28	115.29	1.97	0.78	0.78
19.52	60.77	80.25	1.24	99.76	1.91	0.75	0.75
19.60	55.40	73.08	1.25	91.47	1.92	0.73	0.73
19.69	44.91	60.34	1.34	80.89	2.04	0.63	0.71

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
19.77	30.90	43.16	1.84	79.36	2.28	0.55	0.71
19.85	18.95	27.44	3.45	94.61	2.56	0.78	0.78
19.93	14.06	20.63	5.10	105.30	2.74	0.60	1.54
20.01	11.03	16.20	6.74	109.11	2.87	0.62	1.18
20.10	9.85	14.33	7.24	103.74	2.90	0.51	1.03
20.18	9.65	13.84	6.66	92.16	2.86	0.35	1.01
20.26	11.41	16.14	4.87	78.50	2.71	0.31	1.21
20.34	15.23	21.37	3.45	73.75	2.56	0.73	0.73
20.42	17.22	24.08	3.11	74.97	2.52	0.44	0.70
20.51	16.55	23.22	3.43	79.64	2.56	0.74	0.74
20.59	13.02	18.37	4.69	86.04	2.70	0.40	1.38
20.67	10.34	14.59	6.31	92.10	2.84	0.40	1.06
20.75	8.61	12.07	7.93	95.73	2.95	0.41	0.86
20.83	7.70	10.56	8.64	91.22	2.99	0.36	0.75
20.92	7.59	10.32	7.66	79.03	2.93	0.24	0.74
21.00	7.69	10.26	6.36	65.30	2.84	0.14	0.75
21.08	7.63	10.05	5.79	58.20	2.80	0.12	0.74
21.16	7.52	9.85	5.77	56.83	2.79	0.12	0.72
21.24	7.44	9.72	5.84	56.78	2.80	0.12	0.71
21.33	7.41	9.65	5.85	56.40	2.80	0.12	0.71
21.41	7.40	9.60	5.84	56.08	2.80	0.11	0.71
21.49	7.40	9.58	5.82	55.73	2.80	0.11	0.70
21.57	7.45	9.61	5.75	55.28	2.79	0.11	0.71
21.65	7.54	9.71	5.67	55.06	2.79	0.11	0.71
21.74	7.69	9.90	5.53	54.80	2.77	0.11	0.73
21.82	7.99	10.28	5.28	54.33	2.75	0.11	0.76
21.90	8.16	10.49	5.13	53.82	2.74	0.11	0.78
21.98	8.23	10.55	5.09	53.67	2.74	0.11	0.78
22.06	8.03	10.26	5.24	53.78	2.75	0.11	0.76
22.15	7.76	9.87	5.48	54.04	2.77	0.11	0.73
22.23	7.42	9.37	5.78	54.14	2.79	0.10	0.69
22.31	7.25	9.11	5.96	54.30	2.81	0.10	0.67
22.39	7.22	9.06	6.01	54.47	2.81	0.10	0.66
22.47	7.32	9.18	5.96	54.68	2.81	0.10	0.67
22.56	7.43	9.30	5.82	54.09	2.80	0.11	0.68
22.64	7.55	9.47	5.99	56.69	2.81	0.10	0.69
22.72	7.77	9.81	6.23	61.13	2.83	0.14	0.71
22.80	8.27	10.55	6.29	66.41	2.83	0.18	0.77
22.88	8.73	11.18	6.14	68.60	2.82	0.20	0.82
22.97	9.20	11.80	5.85	68.99	2.80	0.20	0.86
23.05	9.14	11.71	6.01	70.45	2.81	0.21	0.86
23.13	9.05	11.53	5.94	68.48	2.81	0.22	0.84
23.21	8.85	11.17	5.69	63.54	2.79	0.16	0.82
23.29	8.89	11.08	5.03	55.74	2.73	0.11	0.82
23.38	8.86	10.96	4.75	52.10	2.70	0.10	0.82
23.46	8.80	10.85	4.75	51.58	2.70	0.11	0.81
23.54	8.73	10.74	4.84	51.95	2.71	0.10	0.80
23.62	8.46	10.37	5.06	52.50	2.73	0.10	0.77

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
23.70	8.24	10.05	5.27	52.98	2.75	0.10	0.74
23.79	7.95	9.65	5.53	53.36	2.77	0.10	0.71
23.87	7.94	9.61	5.52	53.05	2.77	0.10	0.71
23.95	7.80	9.38	5.62	52.70	2.78	0.10	0.69
24.03	7.66	9.18	5.70	52.30	2.79	0.09	0.67
24.11	7.57	9.02	5.72	51.58	2.79	0.09	0.66
24.20	7.58	9.02	5.71	51.44	2.79	0.09	0.66
24.28	7.64	9.08	5.64	51.19	2.78	0.09	0.66
24.36	7.75	9.20	5.60	51.53	2.78	0.09	0.67
24.44	7.92	9.42	5.57	52.50	2.78	0.09	0.69
24.52	8.28	9.88	5.42	53.59	2.76	0.11	0.73
24.61	8.69	10.43	5.22	54.46	2.75	0.11	0.77
24.69	8.87	10.64	5.15	54.78	2.74	0.12	0.78
24.77	8.93	10.73	5.34	57.29	2.76	0.12	0.79
24.85	8.91	10.84	6.68	72.39	2.86	0.15	0.78
24.93	10.00	12.38	6.77	83.84	2.87	0.37	0.89
25.02	12.51	15.85	6.33	100.30	2.84	0.40	1.15
25.10	15.89	20.31	5.27	107.09	2.75	0.70	1.49
25.18	31.27	39.53	2.48	97.94	2.42	0.74	0.74
25.26	76.44	91.55	1.25	114.76	1.93	0.77	0.77
25.34	147.95	168.57	1.00	168.57	1.56	0.85	0.85
25.43	221.18	244.78	1.00	244.78	1.37	0.93	0.93
25.51	272.75	296.92	1.00	296.92	1.26	0.98	0.98
25.59	303.58	331.08	1.00	331.08	1.28	1.00	1.00
25.67	321.41	349.06	1.00	349.06	1.26	1.01	1.01
25.75	338.01	367.49	1.00	367.49	1.27	1.03	1.03
25.84	347.73	379.17	1.00	379.17	1.30	1.03	1.03
25.92	359.17	392.70	1.00	392.70	1.33	1.04	1.04
26.00	354.72	388.31	1.00	388.31	1.35	1.04	1.04
26.08	347.51	377.64	1.00	377.64	1.31	1.03	1.03
26.16	334.14	360.51	1.00	360.51	1.27	1.02	1.02
26.25	325.43	347.82	1.00	347.82	1.21	1.01	1.01
26.33	317.10	334.90	1.00	334.90	1.13	1.00	1.00
26.41	308.39	325.86	1.00	325.86	1.14	1.00	1.00
26.49	303.51	322.56	1.00	322.56	1.19	1.00	1.00
26.57	301.09	323.64	1.00	323.64	1.29	1.00	1.00
26.66	305.45	327.48	1.00	327.48	1.28	1.00	1.00
26.74	297.99	319.37	1.00	319.37	1.29	0.99	0.99
26.82	295.63	316.23	1.00	316.23	1.28	0.99	0.99
26.90	286.58	308.02	1.00	308.02	1.33	0.98	0.98
26.98	290.29	310.27	1.00	310.27	1.29	0.99	0.99
27.07	288.84	306.07	1.00	306.07	1.24	0.98	0.98
27.15	290.63	303.68	1.00	303.68	1.13	0.98	0.98
27.23	289.61	300.88	1.00	300.88	1.10	0.98	0.98
27.31	284.08	294.62	1.00	294.62	1.09	0.97	0.97
27.40	278.93	289.94	1.00	289.94	1.12	0.97	0.97
27.48	275.24	286.41	1.00	286.41	1.13	0.97	0.97
27.56	276.25	288.40	1.00	288.40	1.17	0.97	0.97

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
27.64	273.29	286.38	1.00	286.38	1.21	0.97	0.97
27.72	273.94	286.95	1.00	286.95	1.22	0.97	0.97
27.81	274.81	286.16	1.00	286.16	1.17	0.97	0.97
27.89	279.57	289.84	1.00	289.84	1.14	0.97	0.97
27.97	279.55	289.15	1.00	289.15	1.13	0.97	0.97
28.05	279.48	288.97	1.00	288.97	1.14	0.97	0.97
28.13	278.68	287.56	1.00	287.56	1.13	0.97	0.97
28.22	275.11	283.18	1.00	283.18	1.11	0.96	0.96
28.30	270.40	279.20	1.00	279.20	1.15	0.96	0.96
28.38	267.51	277.94	1.00	277.94	1.22	0.96	0.96
28.46	269.19	282.07	1.00	282.07	1.31	0.96	0.96
28.54	267.45	281.87	1.00	281.87	1.37	0.96	0.96
28.63	264.31	278.52	1.00	278.52	1.38	0.96	0.96
28.71	259.63	272.38	1.00	272.38	1.36	0.96	0.96
28.79	255.57	266.49	1.00	266.49	1.31	0.95	0.95
28.87	260.50	270.90	1.00	270.90	1.29	0.95	0.95
28.95	261.38	273.84	1.00	273.84	1.38	0.96	0.96
29.04	272.23	286.73	1.00	286.73	1.44	0.97	0.97
29.12	268.23	283.55	1.00	283.55	1.50	0.96	0.96
29.20	262.12	275.59	1.00	275.59	1.46	0.96	0.96
29.28	246.20	257.03	1.00	257.03	1.40	0.94	0.94
29.36	239.04	246.49	1.00	246.49	1.29	0.93	0.93
29.45	239.44	245.78	1.00	245.78	1.25	0.93	0.93
29.53	253.30	258.42	1.00	258.42	1.19	0.94	0.94
29.61	271.51	278.14	1.00	278.14	1.24	0.96	0.96
29.69	294.18	302.44	1.00	302.44	1.29	0.98	0.98
29.77	312.56	322.58	1.00	322.58	1.34	1.00	1.00
29.86	331.69	342.85	1.00	342.85	1.37	1.01	1.01
29.94	346.14	357.61	1.00	357.61	1.38	1.02	1.02
30.02	365.08	376.88	1.00	376.88	1.38	1.03	1.03
30.10	381.24	392.88	1.00	392.88	1.37	1.04	1.04
30.18	391.80	402.44	1.00	402.44	1.35	1.05	1.05
30.27	398.98	408.27	1.00	408.27	1.32	1.05	1.05
30.35	401.66	408.68	1.00	408.68	1.26	1.05	1.05
30.43	414.40	419.33	1.00	419.33	1.21	1.06	1.06
30.51	426.09	431.02	1.00	431.02	1.22	1.07	1.07
30.59	436.33	444.27	1.00	444.27	1.31	1.07	1.07
30.68	462.98	473.33	1.00	473.33	1.38	1.09	1.09
30.76	485.08	496.67	1.00	496.67	1.42	1.10	1.10
30.84	496.55	506.72	1.00	506.72	1.39	1.11	1.11
30.92	486.98	496.11	1.00	496.11	1.39	1.10	1.10
31.00	483.72	490.89	1.00	490.89	1.36	1.10	1.10
31.09	489.21	494.59	1.00	494.59	1.32	1.10	1.10
31.17	512.03	513.19	1.00	513.19	1.21	1.11	1.11
31.25	527.67	525.94	1.00	525.94	1.14	1.12	1.12
31.33	547.71	544.85	1.00	544.85	1.12	1.13	1.13
31.41	554.37	550.07	1.00	550.07	1.10	1.13	1.13
31.50	542.38	537.70	1.00	537.70	1.10	1.13	1.13

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
31.58	530.13	526.00	1.00	526.00	1.13	1.12	1.12
31.66	533.19	530.55	1.00	530.55	1.20	1.12	1.12
31.74	509.71	507.55	1.00	507.55	1.23	1.11	1.11
31.82	489.37	484.66	1.00	484.66	1.16	1.10	1.10
31.91	441.30	441.08	1.00	441.08	1.35	1.07	1.07
31.99	453.05	453.68	1.00	453.68	1.40	1.08	1.08
32.07	475.30	476.72	1.00	476.72	1.46	1.09	1.09
32.15	520.78	519.38	1.00	519.38	1.37	1.12	1.12
32.23	546.69	544.13	1.00	544.13	1.35	1.13	1.13
32.32	577.36	572.96	1.00	572.96	1.32	1.14	1.14
32.40	557.93	552.57	1.00	552.57	1.30	1.13	1.13
32.48	518.03	513.85	1.00	513.85	1.37	1.11	1.11
32.56	440.67	437.89	1.00	437.89	1.45	1.07	1.07
32.64	395.68	393.13	1.00	393.13	1.49	1.04	1.04
32.73	373.89	368.70	1.00	368.70	1.35	1.03	1.03
32.81	393.80	385.79	1.00	385.79	1.22	1.04	1.04
32.89	410.46	400.50	1.00	400.50	1.15	1.05	1.05
32.97	423.75	414.41	1.00	414.41	1.22	1.06	1.06
33.05	447.80	439.08	1.00	439.08	1.31	1.07	1.07
33.14	490.69	482.16	1.00	482.16	1.39	1.10	1.10
33.22	539.15	529.49	1.00	529.49	1.40	1.12	1.12
33.30	550.82	541.18	1.00	541.18	1.45	1.13	1.13
33.38	547.41	537.81	1.00	537.81	1.49	1.13	1.13
33.46	514.85	505.37	1.00	505.37	1.51	1.11	1.11
33.55	466.95	458.21	1.00	458.21	1.56	1.08	1.08
33.63	432.70	423.59	1.00	423.59	1.55	1.06	1.06
33.71	405.29	396.27	1.00	396.27	1.57	1.05	1.05
33.79	397.55	387.61	1.00	387.61	1.52	1.04	1.04
33.87	382.48	372.62	1.00	372.62	1.55	1.03	1.03
33.96	386.38	376.06	1.00	376.06	1.57	1.03	1.03
34.04	397.16	385.75	1.00	385.75	1.55	1.04	1.04
34.12	410.46	397.60	1.00	397.60	1.49	1.05	1.05
34.20	440.27	424.96	1.00	424.96	1.38	1.06	1.06
34.28	461.91	444.55	1.00	444.55	1.29	1.07	1.07
34.37	457.97	439.88	1.00	439.88	1.25	1.07	1.07
34.45	410.83	394.66	1.00	394.66	1.34	1.04	1.04
34.53	362.28	348.28	1.00	348.28	1.48	1.01	1.01
34.61	322.49	310.05	1.00	310.05	1.60	0.99	0.99
34.69	303.32	291.32	1.00	291.32	1.65	0.97	0.97
34.78	284.42	272.74	1.00	272.74	1.67	0.96	0.96
34.86	274.78	262.85	1.00	262.85	1.62	0.95	0.95
34.94	278.06	265.44	1.00	265.44	1.56	0.95	0.95
35.02	277.18	264.16	1.00	264.16	1.54	0.95	0.95
35.10	277.04	263.72	1.00	263.72	1.56	0.95	0.95
35.19	271.79	258.18	1.00	258.18	1.50	0.94	0.94
35.27	271.98	257.68	1.00	257.68	1.34	0.94	0.94
35.35	273.99	259.10	1.00	259.10	1.22	0.94	0.94
35.43	283.73	268.20	1.00	268.20	1.25	0.95	0.95

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
35.52	287.59	271.74	1.00	271.74	1.32	0.95	0.95
35.60	285.68	269.74	1.00	269.74	1.39	0.95	0.95
35.68	286.47	270.23	1.00	270.23	1.41	0.95	0.95
35.76	308.09	290.49	1.00	290.49	1.47	0.97	0.97
35.84	340.67	321.02	1.00	321.02	1.49	0.99	0.99
35.93	379.43	357.29	1.00	357.29	1.48	1.02	1.02
36.01	408.13	383.96	1.00	383.96	1.44	1.04	1.04
36.09	421.42	396.01	1.00	396.01	1.48	1.05	1.05
36.17	409.34	384.09	1.00	384.09	1.49	1.04	1.04
36.25	395.37	370.34	1.00	370.34	1.57	1.03	1.03
36.34	389.54	364.44	1.00	364.44	1.50	1.02	1.02
36.42	378.60	353.66	1.00	353.66	1.51	1.02	1.02
36.50	363.00	338.69	1.00	338.69	1.46	1.01	1.01
36.58	335.19	311.98	1.00	311.98	1.55	0.99	0.99
36.66	338.85	314.81	1.00	314.81	1.62	0.99	0.99
36.75	344.05	319.11	1.00	319.11	1.65	0.99	0.99
36.83	380.68	353.00	1.00	353.00	1.59	1.02	1.02
36.91	394.90	366.08	1.00	366.08	1.51	1.03	1.03
36.99	366.64	339.31	1.00	339.31	1.51	1.01	1.01
37.07	360.64	333.35	1.00	333.35	1.50	1.00	1.00
37.16	366.79	338.42	1.00	338.42	1.54	1.01	1.01
37.24	437.35	403.79	1.00	403.79	1.47	1.05	1.05
37.32	416.12	383.31	1.00	383.31	1.52	1.04	1.04
37.40	383.12	352.15	1.00	352.15	1.54	1.02	1.02
37.48	317.72	290.37	1.02	296.23	1.72	0.97	0.97
37.57	318.89	290.62	1.13	328.50	1.78	1.00	1.00
37.65	344.64	313.57	1.16	364.11	1.81	1.02	1.02
37.73	366.21	332.80	1.16	384.53	1.80	1.04	1.04
37.81	393.61	357.33	1.15	409.61	1.79	1.05	1.05
37.89	405.97	367.89	1.16	427.88	1.81	1.06	1.06
37.98	460.10	417.51	1.01	423.75	1.71	1.06	1.06
38.06	398.67	360.52	1.10	395.93	1.76	1.05	1.05
38.14	340.53	306.99	1.13	346.71	1.78	1.01	1.01
38.22	263.09	235.36	1.26	296.22	1.93	0.97	0.97
38.30	250.57	223.50	1.28	285.04	1.96	0.97	0.97
38.39	221.28	196.33	1.34	263.73	2.04	0.95	0.95
38.47	170.86	150.17	1.59	238.04	2.19	0.92	0.92
38.55	145.32	126.83	1.83	232.23	2.27	0.92	0.92
38.63	125.32	108.65	2.09	226.81	2.34	0.91	0.91
38.71	117.25	101.31	2.09	212.08	2.34	0.90	0.90
38.80	109.77	94.52	2.11	199.21	2.34	0.89	0.89
38.88	104.97	90.14	2.07	186.71	2.34	0.87	0.87
38.96	100.07	85.66	2.09	179.28	2.34	0.86	0.86
39.04	97.58	83.32	2.08	173.36	2.34	0.86	0.86
39.12	96.80	82.50	2.06	169.78	2.33	0.85	0.85
39.21	95.23	80.94	2.10	169.67	2.34	0.85	0.85
39.29	94.41	79.96	2.25	180.09	2.38	0.86	0.86
39.37	94.78	80.07	2.34	187.55	2.39	0.87	0.87

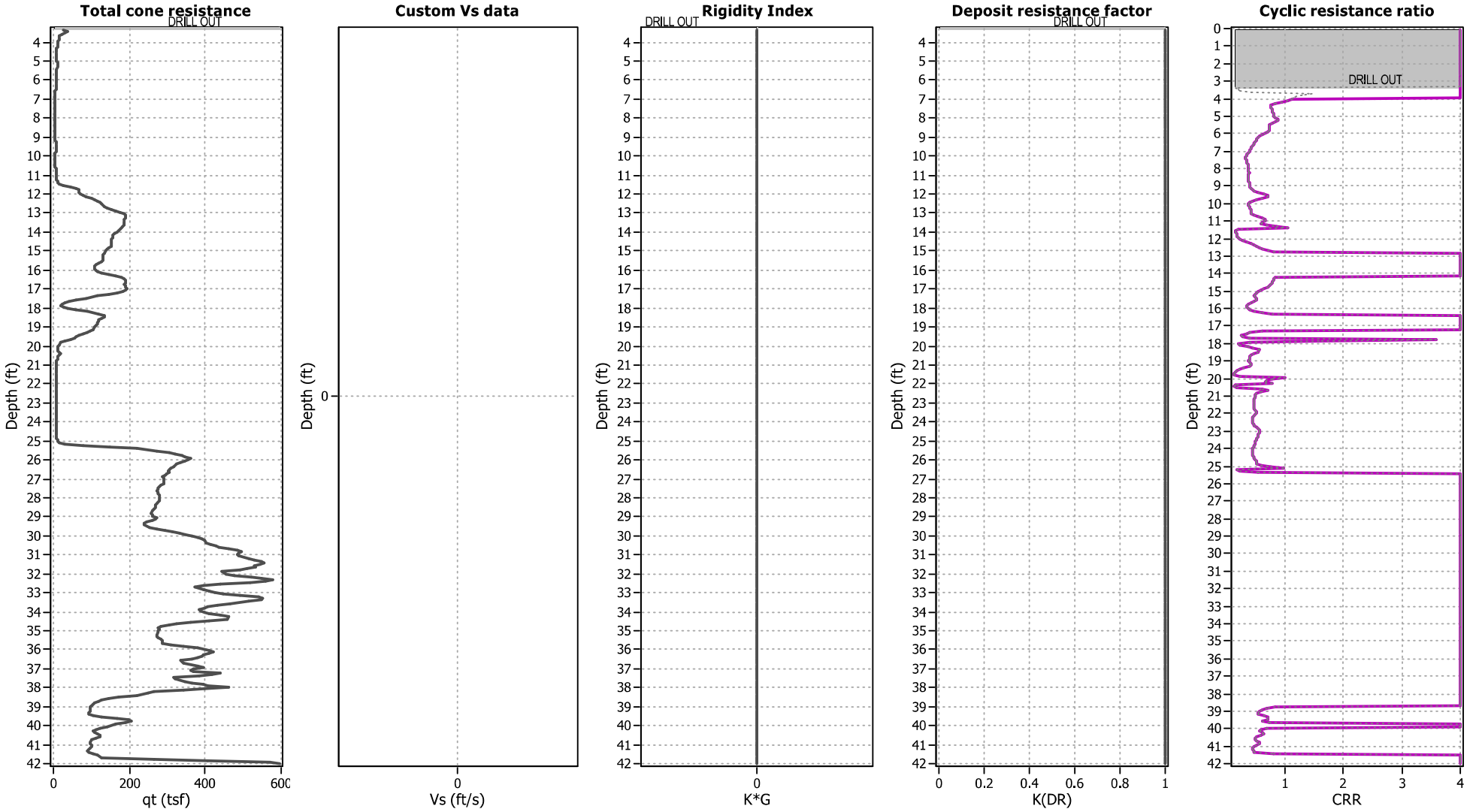
:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
39.45	103.02	87.16	2.16	188.03	2.36	0.87	0.87
39.53	127.96	109.20	1.64	179.07	2.21	0.86	0.86
39.62	165.69	142.81	1.34	191.20	2.03	0.88	0.88
39.70	197.23	171.11	1.24	211.86	1.90	0.90	0.90
39.78	205.23	178.20	1.21	215.24	1.86	0.90	0.90
39.86	188.91	163.15	1.25	204.17	1.92	0.89	0.89
39.94	164.19	140.65	1.33	186.52	2.02	0.87	0.87
40.03	142.03	120.58	1.46	176.23	2.13	0.86	0.86
40.11	123.98	104.36	1.65	172.65	2.22	0.86	0.86
40.19	112.12	93.66	1.89	177.34	2.29	0.86	0.86
40.27	105.38	87.55	2.06	180.76	2.33	0.87	0.87
40.35	107.61	89.40	1.95	174.50	2.31	0.86	0.86
40.44	116.06	96.73	1.73	167.16	2.24	0.85	0.85
40.52	122.36	102.18	1.60	163.06	2.19	0.84	0.84
40.60	121.38	101.13	1.61	162.98	2.20	0.84	0.84
40.68	110.70	91.54	1.81	165.25	2.27	0.85	0.85
40.76	100.73	82.65	2.07	171.26	2.34	0.85	0.85
40.85	95.90	78.31	2.20	172.51	2.37	0.86	0.86
40.93	97.43	79.55	2.10	166.94	2.34	0.85	0.85
41.01	99.31	81.12	1.96	159.10	2.31	0.84	0.84
41.09	100.12	81.72	1.91	155.99	2.30	0.83	0.83
41.17	96.73	78.63	2.00	156.92	2.32	0.84	0.84
41.26	91.97	74.38	2.14	159.42	2.35	0.84	0.84
41.34	88.45	71.24	2.23	158.67	2.37	0.84	0.84
41.42	92.99	74.47	2.67	198.85	2.45	0.89	0.89
41.50	103.92	83.04	2.97	246.95	2.50	0.93	0.93
41.58	116.20	92.61	3.30	305.89	2.54	1.01	1.01
41.67	125.32	100.88	2.30	231.58	2.38	0.92	0.92
41.75	264.42	224.57	1.00	224.57	1.70	0.91	0.91
41.83	406.50	320.45	1.00	320.45	-1.00	0.99	0.99
41.91	568.35	448.44	1.00	448.44	-1.00	1.08	1.08
41.99	595.38	469.48	1.00	469.48	-1.00	1.09	1.09

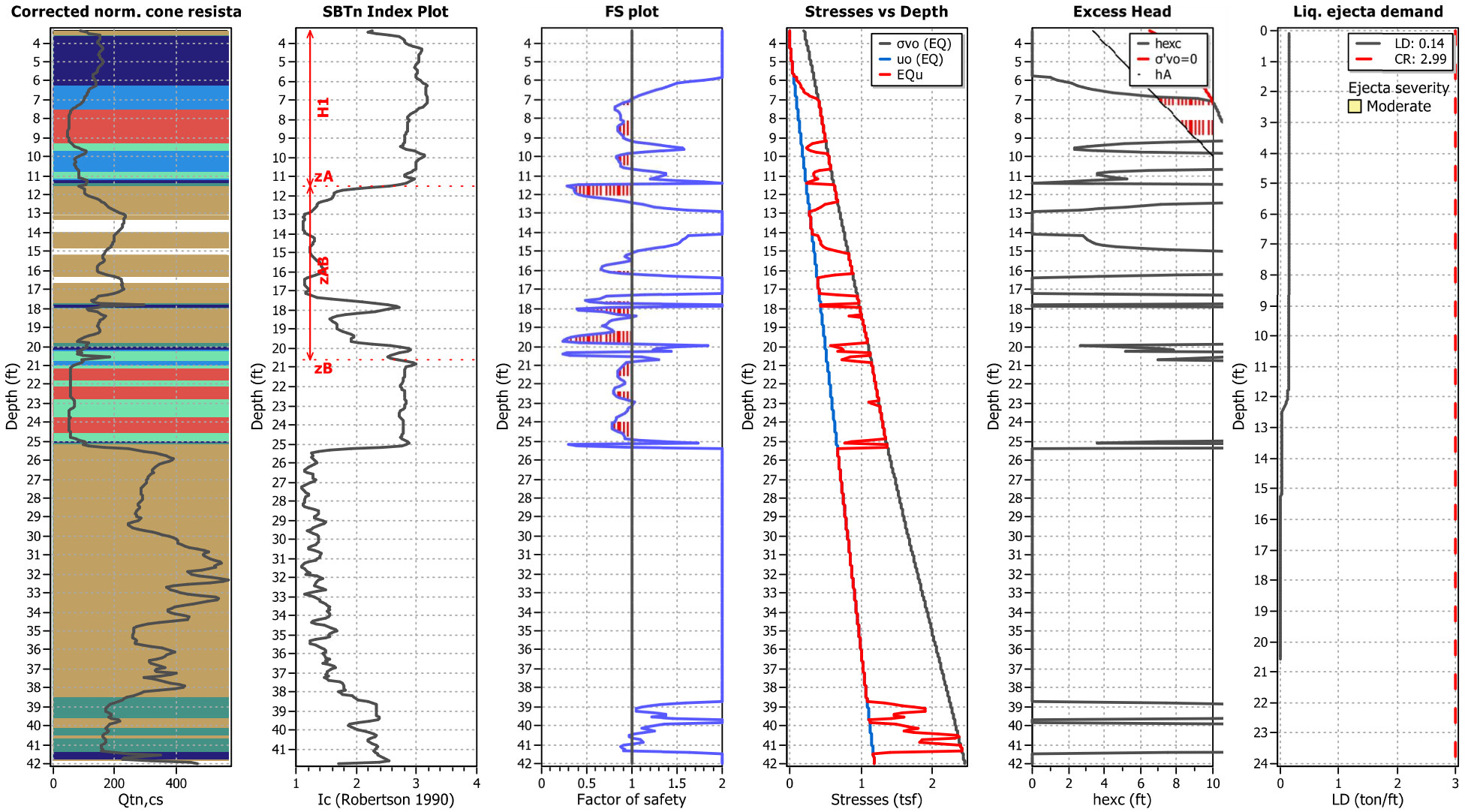
Abbreviations

q_t: Total cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Adjusted and corrected cone resistance due to fines
I_c: Soil behavior type index
$S_{u(liq)}/\sigma'_v$: Calculated liquefied undrained strength ratio
$S_{u(peak)}/\sigma'_v$: Calculated peak undrained strength ratio

Aging Calculation Estimation



Ejecta Severity Estimation



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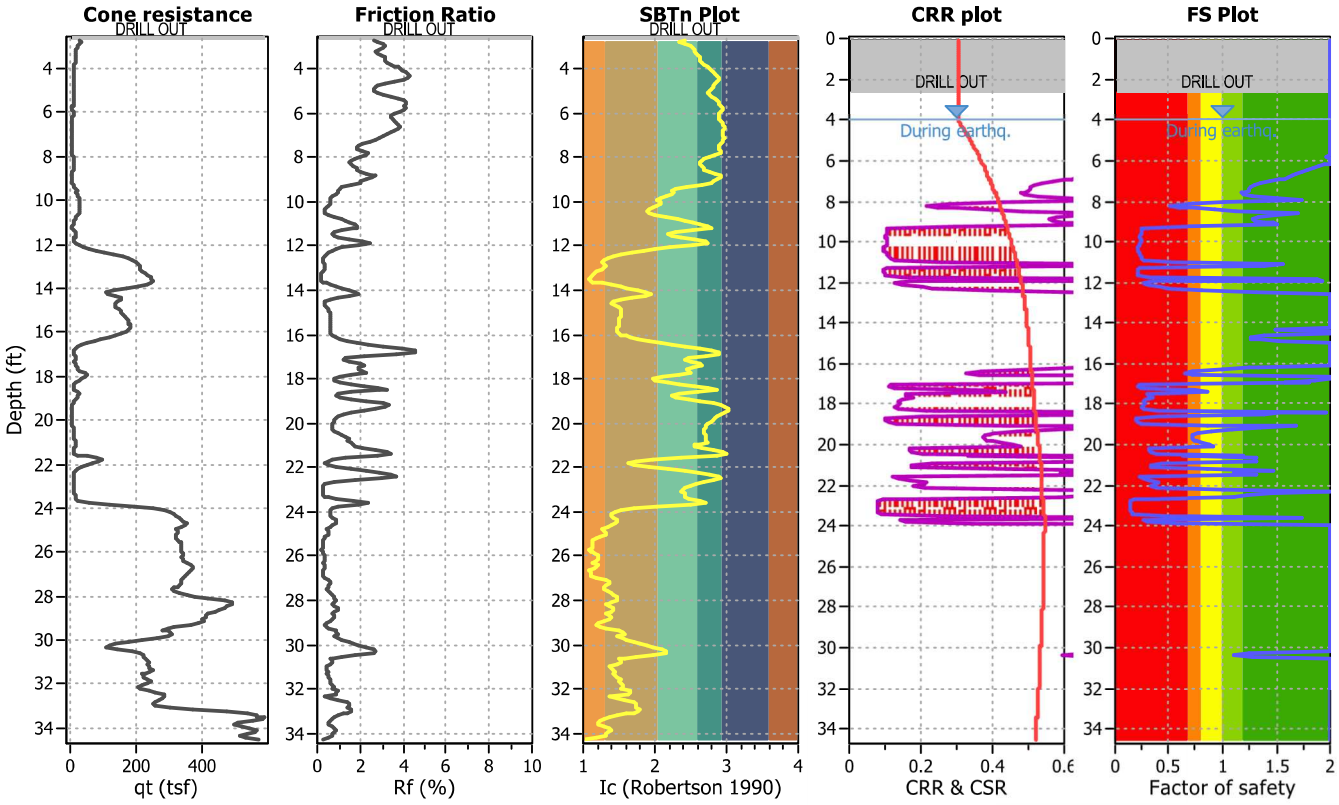
LIQUEFACTION ANALYSIS REPORT

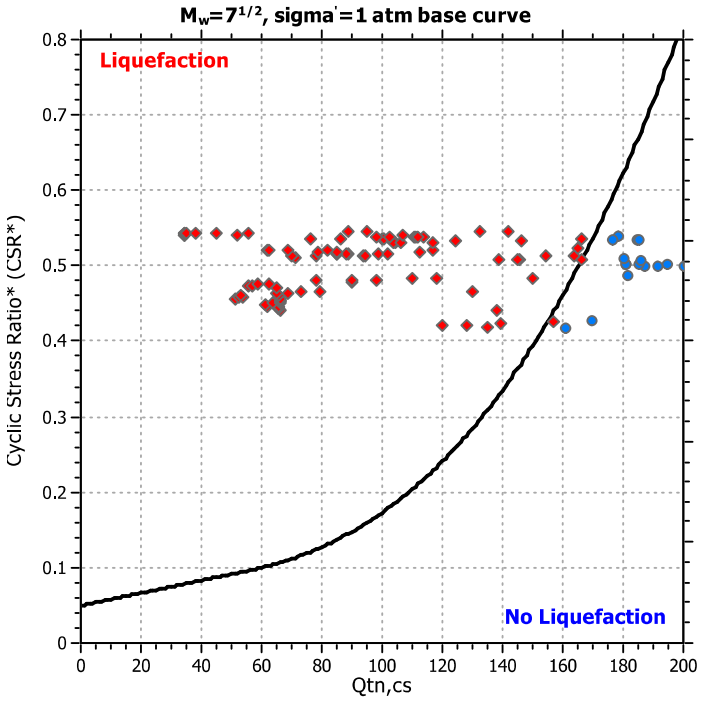
Project title : Fire Station #32 - Site Evaluation **Location : 19959 Oaks St, Monroe, WA**

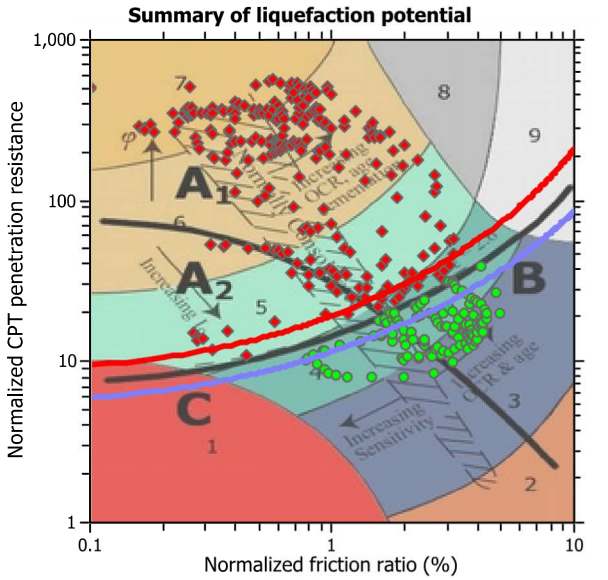
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	Robertson (2009)	G.W.T. (in-situ):	4.00 ft	Use fill:	No	Clay like behavior applied:	All soils
Fines correction method:	Robertson (2009)	G.W.T. (earthq.):	4.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.54	Unit weight calculation:	Based on SBT	K_σ applied:	No	MSF method:	Method based

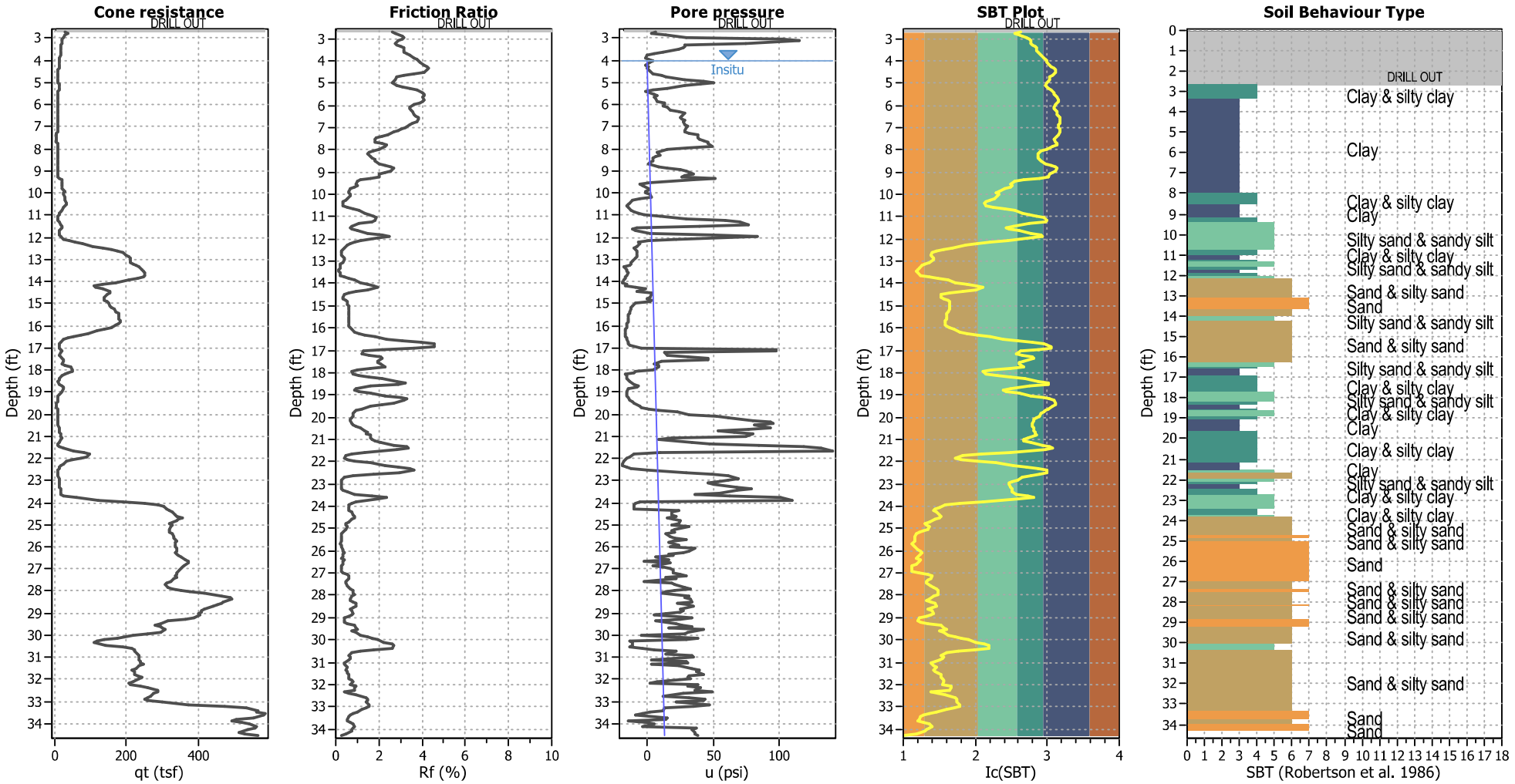






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and grounc geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



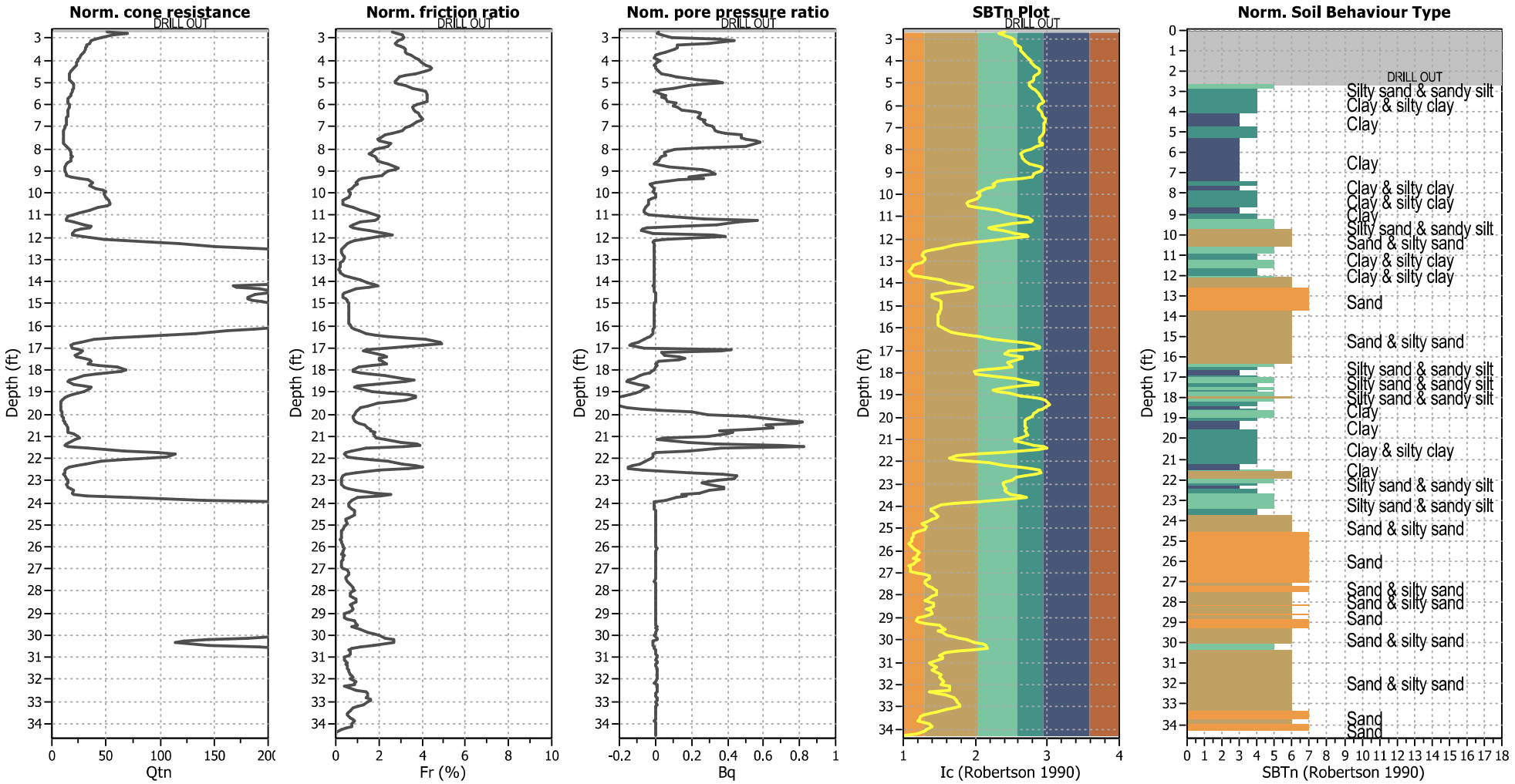
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

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

CPT basic interpretation plots (normalized)



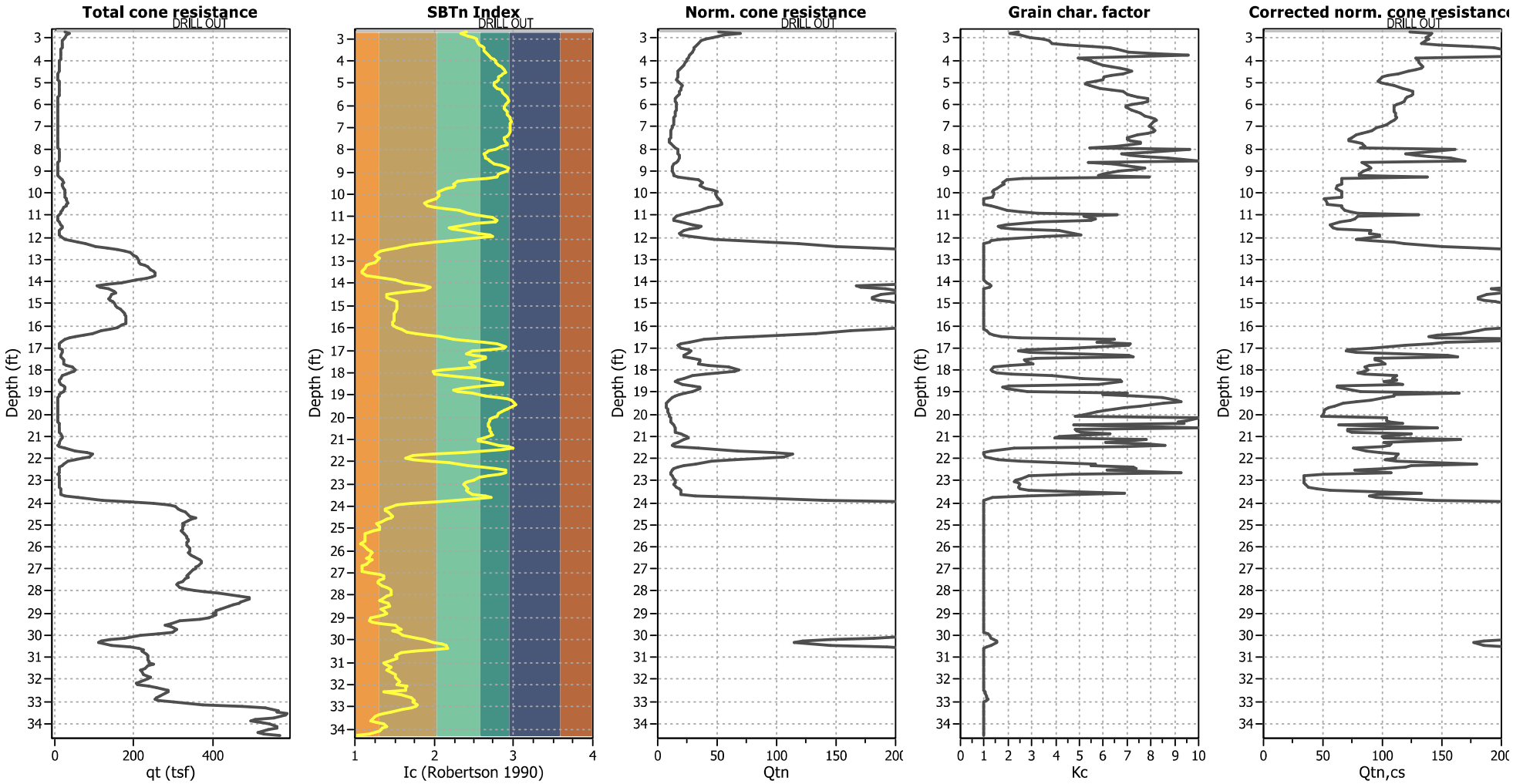
Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

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

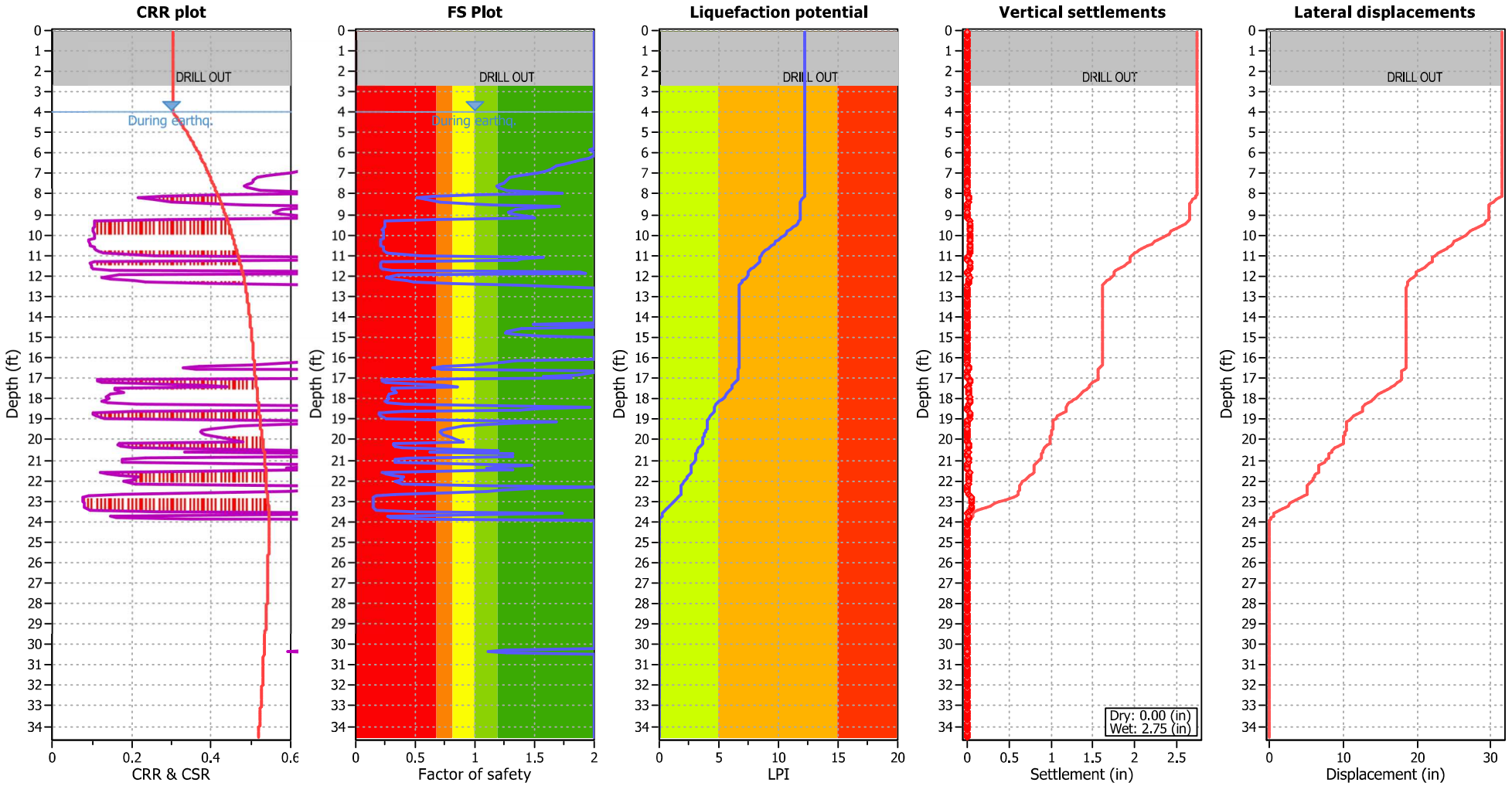
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

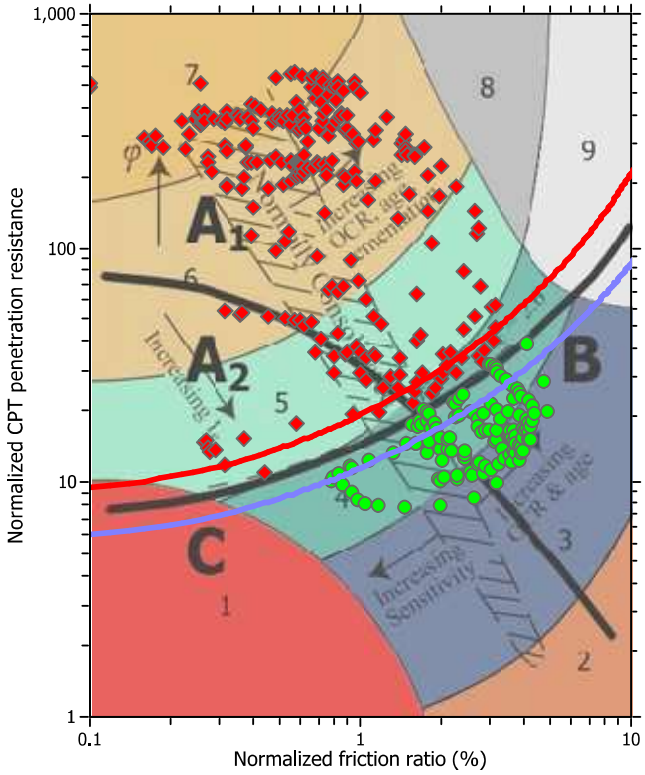
F.S. color scheme

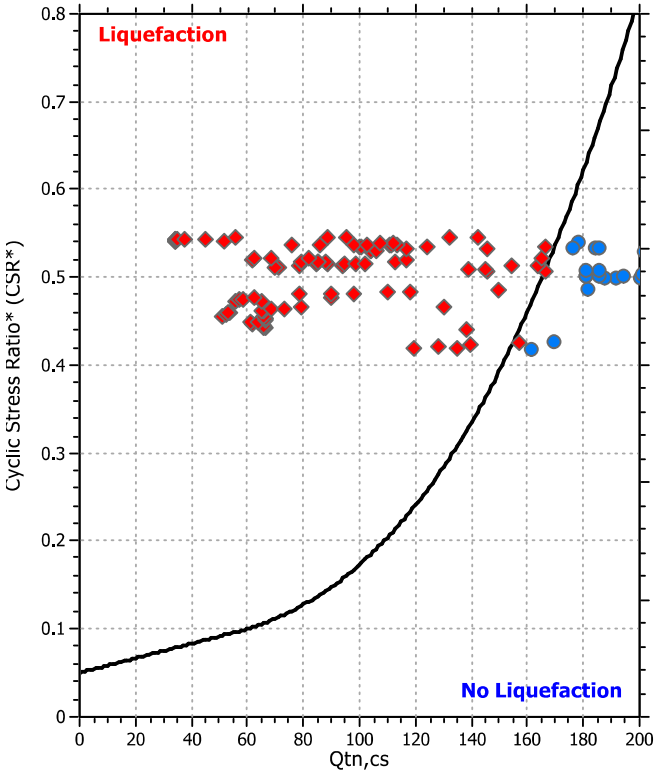
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

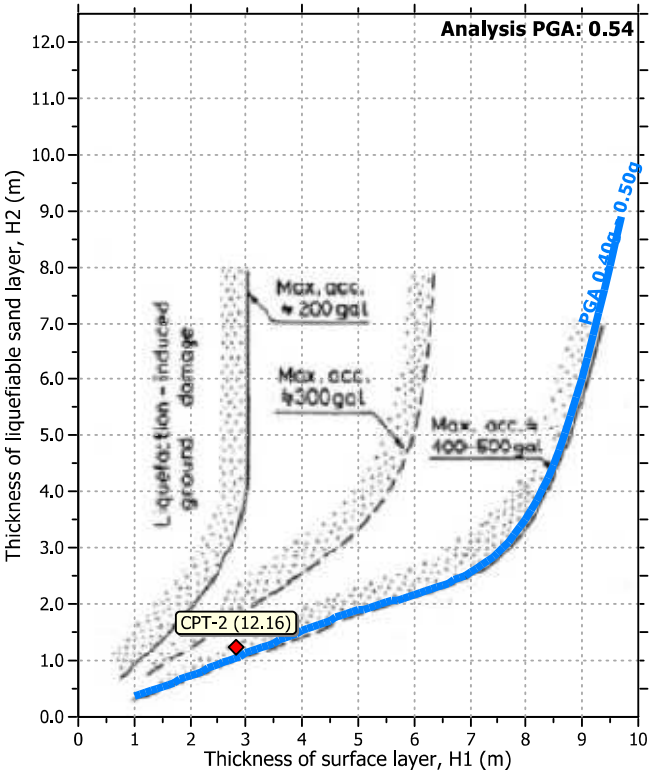
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



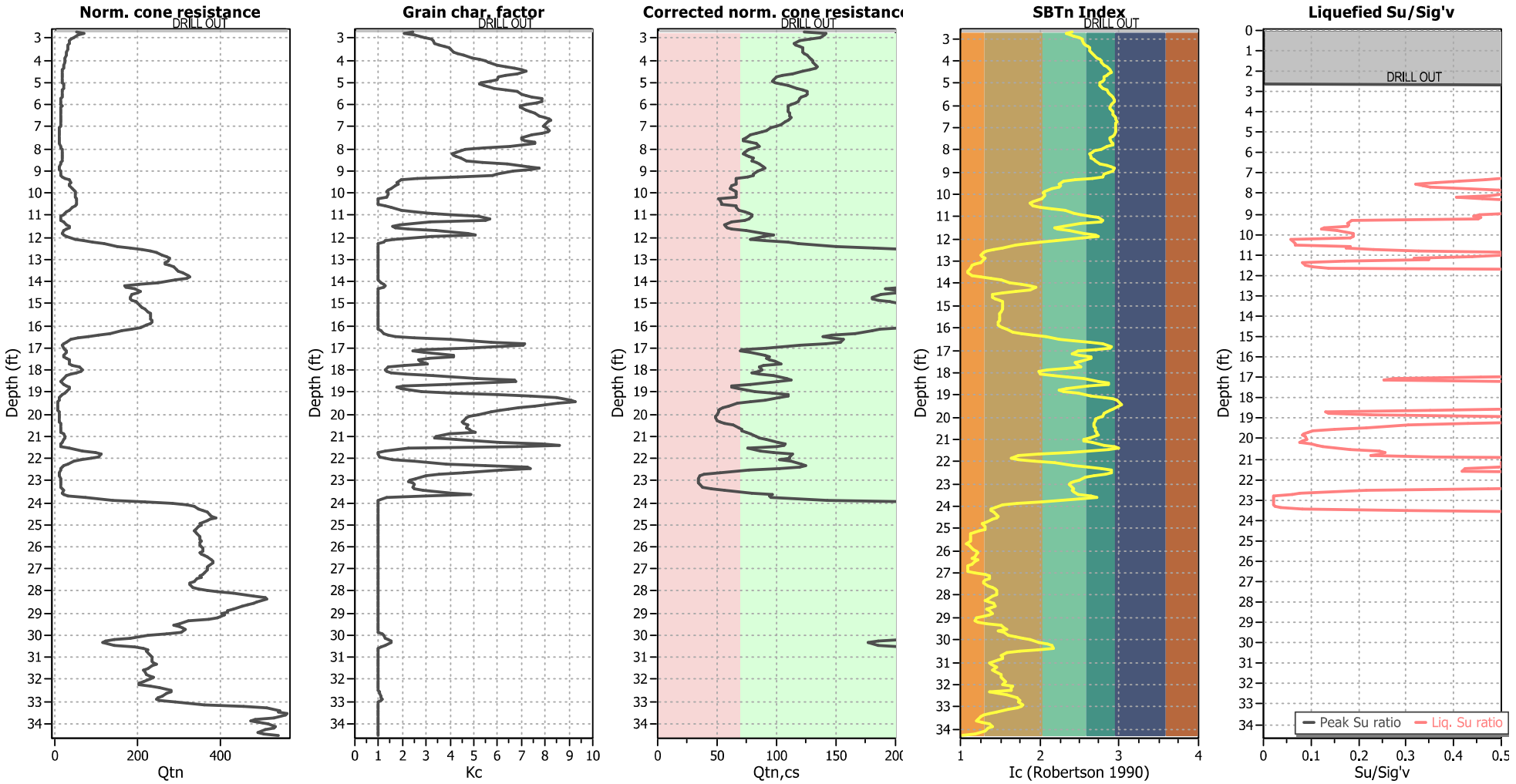




Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method:	Robertson (2009)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	Robertson (2009)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	No
Earthquake magnitude M_w:	7.10	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):	4.00 ft	Fill height:	N/A	Limit depth:	N/A

:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
1	0.08	-8888.00	-8888.00	-8888.00	N/A	120.90
2	0.16	-8888.00	-8888.00	-8888.00	N/A	120.90
3	0.25	-8888.00	-8888.00	-8888.00	N/A	120.90
4	0.33	-8888.00	-8888.00	-8888.00	N/A	120.90
5	0.41	-8888.00	-8888.00	-8888.00	N/A	120.90
6	0.49	-8888.00	-8888.00	-8888.00	N/A	120.90
7	0.57	-8888.00	-8888.00	-8888.00	N/A	120.90
8	0.66	-8888.00	-8888.00	-8888.00	N/A	120.90
9	0.74	-8888.00	-8888.00	-8888.00	N/A	120.90
10	0.82	-8888.00	-8888.00	-8888.00	N/A	120.90
11	0.90	-8888.00	-8888.00	-8888.00	N/A	120.90
12	0.98	-8888.00	-8888.00	-8888.00	N/A	120.90
13	1.07	-8888.00	-8888.00	-8888.00	N/A	120.90
14	1.15	-8888.00	-8888.00	-8888.00	N/A	120.90
15	1.23	-8888.00	-8888.00	-8888.00	N/A	120.90
16	1.31	-8888.00	-8888.00	-8888.00	N/A	120.90
17	1.39	-8888.00	-8888.00	-8888.00	N/A	120.90
18	1.48	-8888.00	-8888.00	-8888.00	N/A	120.90
19	1.56	-8888.00	-8888.00	-8888.00	N/A	120.90
20	1.64	-8888.00	-8888.00	-8888.00	N/A	120.90
21	1.72	-8888.00	-8888.00	-8888.00	N/A	120.90
22	1.80	-8888.00	-8888.00	-8888.00	N/A	120.90
23	1.89	-8888.00	-8888.00	-8888.00	N/A	120.90
24	1.97	-8888.00	-8888.00	-8888.00	N/A	120.90
25	2.05	-8888.00	-8888.00	-8888.00	N/A	120.90
26	2.13	-8888.00	-8888.00	-8888.00	N/A	120.90
27	2.21	-8888.00	-8888.00	-8888.00	N/A	120.90
28	2.30	-8888.00	-8888.00	-8888.00	N/A	120.90
29	2.38	-8888.00	-8888.00	-8888.00	N/A	120.90
30	2.46	-8888.00	-8888.00	-8888.00	N/A	120.90
31	2.54	-8888.00	-8888.00	-8888.00	N/A	120.90
32	2.62	-8888.00	-8888.00	-8888.00	N/A	120.90
33	2.71	45.01	1.09	6.67	26.82	115.86
34	2.79	36.22	1.05	2.76	23.65	119.21
35	2.87	28.77	0.92	14.31	27.45	117.87
36	2.95	23.74	0.77	29.26	30.47	116.23
37	3.03	19.17	0.64	102.47	32.15	114.62
38	3.12	17.53	0.55	115.86	32.67	113.23
39	3.20	17.44	0.48	74.65	32.86	112.33
40	3.28	17.13	0.48	28.53	34.00	112.05
41	3.36	16.16	0.52	28.19	35.55	112.18
42	3.44	16.17	0.53	27.36	36.49	112.30
43	3.53	16.20	0.51	24.49	36.84	112.21
44	3.61	15.68	0.50	11.87	37.45	112.01
45	3.69	15.13	0.50	5.19	38.61	111.81
46	3.77	14.58	0.49	0.26	39.93	111.71
47	3.85	14.07	0.50	-0.93	41.73	111.64
48	3.94	13.04	0.51	1.02	43.11	111.52

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
49	4.02	12.83	0.49	4.57	44.21	111.34
50	4.10	12.57	0.48	2.27	44.90	111.24
51	4.18	12.22	0.50	-0.99	46.52	111.19
52	4.27	11.36	0.50	0.54	48.27	110.89
53	4.35	10.60	0.45	-0.04	49.94	110.37
54	4.43	10.00	0.43	1.31	51.21	109.54
55	4.51	9.11	0.38	2.01	51.99	108.53
56	4.59	8.52	0.32	4.41	50.39	107.47
57	4.68	9.36	0.28	10.38	48.34	106.35
58	4.76	8.68	0.25	13.91	46.84	105.69
59	4.84	8.26	0.24	28.15	46.55	105.32
60	4.92	8.58	0.25	43.27	45.15	105.49
61	5.00	9.33	0.25	50.74	43.49	106.20
62	5.09	10.33	0.30	40.17	43.09	107.24
63	5.17	10.74	0.35	28.55	44.09	108.26
64	5.25	10.73	0.38	15.19	46.06	108.91
65	5.33	10.39	0.40	4.02	48.26	109.16
66	5.41	9.93	0.40	-0.83	50.27	109.28
67	5.50	9.67	0.41	5.45	51.14	109.16
68	5.58	9.57	0.39	8.08	52.02	108.79
69	5.66	8.74	0.36	4.90	53.06	108.13
70	5.74	8.09	0.33	6.88	54.65	107.62
71	5.82	8.01	0.34	8.04	54.79	107.39
72	5.91	8.26	0.33	13.17	53.64	107.26
73	5.99	8.47	0.31	12.90	51.86	107.04
74	6.07	8.68	0.30	12.31	50.91	106.76
75	6.15	8.43	0.29	14.72	50.91	106.63
76	6.23	8.24	0.30	17.80	51.96	106.55
77	6.32	7.81	0.30	24.56	52.76	106.46
78	6.40	7.70	0.29	28.20	53.56	106.39
79	6.48	7.60	0.29	26.43	54.28	106.34
80	6.56	7.38	0.30	25.50	55.37	106.32
81	6.64	7.17	0.29	26.46	56.11	106.15
82	6.73	7.03	0.28	28.16	56.27	105.84
83	6.81	6.95	0.27	27.51	55.66	105.39
84	6.89	6.94	0.25	28.21	55.22	104.85
85	6.97	6.63	0.23	30.20	55.07	104.14
86	7.05	6.25	0.20	29.62	55.44	103.29
87	7.14	5.95	0.18	28.94	55.90	102.40
88	7.22	5.64	0.17	28.80	55.70	101.48
89	7.30	5.51	0.14	31.74	54.67	100.59
90	7.38	5.48	0.13	38.38	52.88	99.66
91	7.46	5.46	0.11	38.55	51.30	98.77
92	7.55	5.33	0.10	39.09	51.25	98.23
93	7.63	5.03	0.11	43.03	51.74	98.12
94	7.71	5.10	0.11	45.59	53.55	99.37
95	7.79	5.50	0.16	46.39	53.53	100.79
96	7.87	6.11	0.18	49.53	48.91	102.12

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
97	7.96	8.66	0.17	30.34	44.13	102.50
98	8.04	9.08	0.16	14.85	39.98	102.43
99	8.12	9.48	0.15	7.55	38.29	101.89
100	8.20	9.59	0.13	8.14	37.11	101.78
101	8.28	9.96	0.15	9.65	37.48	102.45
102	8.37	10.11	0.19	6.00	38.10	103.00
103	8.45	9.90	0.17	4.76	39.17	103.34
104	8.53	9.66	0.18	4.12	40.30	102.87
105	8.61	8.65	0.17	2.38	43.81	102.67
106	8.69	7.28	0.17	1.40	48.38	102.44
107	8.78	6.69	0.18	8.72	52.52	102.34
108	8.86	6.36	0.18	15.61	54.15	102.34
109	8.94	6.24	0.18	24.87	52.74	102.01
110	9.02	6.71	0.16	29.65	49.66	101.78
111	9.10	7.29	0.15	35.05	46.64	101.64
112	9.19	7.63	0.16	28.05	45.80	101.71
113	9.27	7.30	0.16	26.61	38.36	102.31
114	9.35	12.76	0.16	52.03	28.20	103.39
115	9.43	20.05	0.17	35.31	22.56	105.14
116	9.51	21.36	0.23	1.91	20.56	105.65
117	9.60	19.65	0.18	-5.48	21.35	105.45
118	9.68	18.13	0.17	-3.48	20.53	104.28
119	9.76	20.22	0.15	0.51	17.34	104.11
120	9.84	27.74	0.14	0.92	14.92	104.39
121	9.92	27.24	0.16	-1.73	13.91	104.73
122	10.01	25.64	0.16	-0.94	14.83	105.22
123	10.09	25.46	0.18	1.78	14.80	105.17
124	10.17	27.13	0.16	2.79	13.71	104.61
125	10.25	29.02	0.12	-5.14	5.00	103.40
126	10.33	30.24	0.10	-11.58	5.00	102.15
127	10.42	31.53	0.10	-13.90	5.00	101.63
128	10.50	32.86	0.09	-14.88	5.00	102.56
129	10.58	29.20	0.15	-15.13	13.02	104.33
130	10.66	23.46	0.20	-14.61	17.64	105.64
131	10.74	17.84	0.21	-12.68	23.02	106.05
132	10.83	16.24	0.22	-10.39	27.55	105.69
133	10.91	14.03	0.21	-6.54	31.67	105.06
134	10.99	10.56	0.19	-2.52	36.89	103.96
135	11.07	8.50	0.17	9.40	42.68	102.25
136	11.15	6.68	0.12	30.08	45.05	101.06
137	11.24	6.93	0.14	58.76	44.17	100.13
138	11.32	7.17	0.12	70.64	31.73	100.80
139	11.40	16.40	0.11	76.54	22.36	101.69
140	11.48	22.02	0.14	39.15	18.50	102.63
141	11.56	19.11	0.14	-7.84	20.18	103.28
142	11.65	15.07	0.15	-10.85	25.64	103.11
143	11.73	11.63	0.16	-9.14	33.35	103.82
144	11.81	10.05	0.23	1.56	40.66	105.14

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
145	11.89	9.46	0.29	49.08	42.09	106.53
146	11.98	11.29	0.29	83.23	32.27	107.96
147	12.06	22.97	0.30	21.72	19.35	109.56
148	12.14	43.05	0.33	1.34	13.01	111.56
149	12.22	55.43	0.42	-6.98	8.96	113.33
150	12.30	75.15	0.44	-6.10	6.02	114.61
151	12.39	103.25	0.42	-7.86	3.34	115.19
152	12.47	134.98	0.39	-9.82	1.69	115.95
153	12.55	159.18	0.47	-8.61	0.72	116.75
154	12.63	180.58	0.48	-7.58	0.29	117.57
155	12.71	189.23	0.50	-7.37	0.05	118.28
156	12.80	199.64	0.57	-7.72	0.21	119.86
157	12.88	209.49	0.83	-8.41	0.46	121.38
158	12.96	211.97	0.91	-9.35	0.41	121.61
159	13.04	212.03	0.63	-10.91	0.00	120.32
160	13.12	211.80	0.45	-12.35	0.00	117.95
161	13.21	214.85	0.36	-12.65	0.00	116.72
162	13.29	225.70	0.40	-13.63	0.00	116.44
163	13.37	239.41	0.38	-17.43	0.00	116.79
164	13.45	243.29	0.40	-16.08	0.00	116.74
165	13.53	248.45	0.38	-15.26	0.00	117.65
166	13.62	253.94	0.53	-14.88	0.00	119.87
167	13.70	256.50	0.85	-15.48	0.06	123.82
168	13.78	249.59	1.64	-16.21	1.31	126.55
169	13.86	236.33	1.93	-16.96	3.04	128.74
170	13.94	209.93	2.52	-17.77	4.66	129.41
171	14.03	175.83	2.48	-18.87	7.29	129.56
172	14.11	123.19	2.56	-15.08	9.79	128.47
173	14.19	101.46	2.02	-16.13	11.88	127.10
174	14.27	99.21	1.70	-8.99	9.67	125.67
175	14.35	138.77	1.37	-1.59	5.98	124.15
176	14.44	166.90	0.83	-7.78	3.18	121.73
177	14.52	151.64	0.49	2.92	1.66	118.46
178	14.60	143.51	0.39	2.66	1.51	116.73
179	14.68	139.85	0.50	2.55	2.04	117.21
180	14.76	131.82	0.61	0.16	2.78	118.70
181	14.85	137.52	0.74	2.83	3.16	119.87
182	14.93	147.85	0.81	1.73	3.18	120.87
183	15.01	153.54	0.88	-8.85	3.22	121.57
184	15.09	153.40	0.95	-10.98	3.28	122.08
185	15.17	158.22	0.98	-11.94	3.26	122.48
186	15.26	165.59	1.01	-12.28	3.01	122.73
187	15.34	173.55	1.02	-13.04	2.80	123.01
188	15.42	177.89	1.05	-13.53	2.70	123.26
189	15.50	178.79	1.09	-14.07	2.73	123.46
190	15.58	178.78	1.09	-14.48	2.72	123.49
191	15.67	179.86	1.06	-14.62	2.63	123.42
192	15.75	182.45	1.05	-14.73	2.51	123.35

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
193	15.83	183.92	1.05	-14.82	2.52	123.35
194	15.91	179.92	1.06	-15.22	2.78	123.49
195	15.99	171.90	1.13	-15.55	3.40	123.63
196	16.08	154.94	1.17	-16.04	4.24	123.71
197	16.16	142.65	1.19	-16.29	5.50	123.60
198	16.24	120.12	1.22	-16.49	7.52	123.48
199	16.32	92.04	1.31	-16.63	10.68	123.19
200	16.40	71.20	1.32	-16.46	15.02	122.65
201	16.49	52.89	1.28	-16.25	20.43	121.60
202	16.57	34.61	1.16	-15.99	27.51	119.92
203	16.65	22.54	0.94	-15.76	36.70	117.65
204	16.73	15.27	0.75	-14.97	45.44	114.79
205	16.81	11.30	0.50	-14.27	51.60	111.86
206	16.90	9.94	0.37	-13.12	51.43	108.80
207	16.98	10.17	0.25	-4.05	40.54	106.66
208	17.06	15.48	0.17	97.28	29.60	105.90
209	17.14	21.38	0.23	97.23	27.01	106.78
210	17.22	17.09	0.30	13.59	30.35	107.67
211	17.31	12.53	0.28	14.84	37.41	107.70
212	17.39	11.98	0.29	30.95	37.66	108.33
213	17.47	17.66	0.37	46.09	31.57	110.24
214	17.55	26.28	0.45	45.71	28.59	112.13
215	17.63	24.78	0.53	11.25	29.17	112.78
216	17.72	19.28	0.49	5.68	31.19	112.77
217	17.80	22.23	0.48	8.71	23.94	112.98
218	17.88	45.53	0.44	8.43	15.69	113.38
219	17.96	60.62	0.39	3.74	12.38	112.84
220	18.04	44.21	0.33	-9.50	13.24	112.56
221	18.13	36.80	0.42	-10.61	18.09	112.22
222	18.21	28.10	0.44	-16.17	24.37	112.15
223	18.29	18.73	0.43	-16.02	32.83	111.30
224	18.37	13.20	0.41	-15.82	42.43	109.99
225	18.45	10.99	0.36	-14.68	49.87	108.55
226	18.54	9.28	0.30	-13.89	50.02	106.77
227	18.62	10.42	0.21	-10.18	35.90	105.64
228	18.70	22.24	0.16	-7.04	24.16	105.86
229	18.78	30.51	0.23	-7.57	20.61	107.18
230	18.86	25.02	0.28	-14.98	22.61	108.65
231	18.95	21.04	0.31	-16.09	29.56	109.49
232	19.03	15.73	0.40	-16.08	37.36	109.64
233	19.11	12.24	0.38	-15.87	46.62	109.29
234	19.19	9.97	0.35	-15.54	52.74	107.80
235	19.27	8.61	0.26	-14.81	57.31	105.73
236	19.36	7.05	0.18	-13.62	59.67	102.94
237	19.44	6.10	0.13	-11.34	60.30	100.09
238	19.52	6.00	0.09	-9.54	57.58	97.37
239	19.60	5.96	0.06	-6.10	53.61	95.17
240	19.69	5.98	0.06	-4.07	50.52	93.72

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
241	19.77	6.18	0.05	1.20	48.84	93.20
242	19.85	6.17	0.05	8.62	46.99	93.17
243	19.93	6.44	0.05	22.90	45.30	93.49
244	20.01	6.80	0.06	32.17	42.75	93.72
245	20.10	7.12	0.05	52.21	40.89	93.50
246	20.18	6.87	0.05	61.81	40.33	93.90
247	20.26	6.82	0.06	79.81	39.90	94.83
248	20.34	7.62	0.07	93.25	39.57	96.13
249	20.42	7.83	0.08	95.42	39.79	97.89
250	20.51	8.41	0.12	81.80	40.59	100.05
251	20.59	9.43	0.15	93.16	40.37	101.79
252	20.67	10.50	0.16	77.12	41.06	102.47
253	20.75	9.16	0.15	54.09	41.18	102.29
254	20.83	9.53	0.14	65.44	42.25	103.34
255	20.92	11.01	0.23	80.57	36.52	106.22
256	21.00	19.69	0.34	74.40	33.41	108.49
257	21.08	19.78	0.34	18.79	33.07	109.33
258	21.16	14.85	0.32	8.73	38.22	108.77
259	21.24	11.21	0.32	34.38	47.10	108.12
260	21.33	8.72	0.34	47.58	54.82	107.65
261	21.41	7.40	0.32	84.59	57.72	107.08
262	21.49	7.70	0.27	118.17	50.30	107.40
263	21.57	12.62	0.32	131.38	25.33	110.36
264	21.65	50.95	0.43	140.67	12.45	113.12
265	21.74	90.96	0.42	9.89	5.00	114.12
266	21.82	98.84	0.32	-10.51	4.95	114.21
267	21.90	96.77	0.39	-13.31	6.56	115.54
268	21.98	70.28	0.68	-15.40	11.10	117.45
269	22.06	47.14	0.86	-16.67	18.74	118.02
270	22.15	32.37	0.81	-17.88	27.17	117.11
271	22.23	23.54	0.69	-18.39	35.71	115.16
272	22.31	15.29	0.55	-18.76	44.41	113.07
273	22.39	12.03	0.48	-15.95	52.10	110.56
274	22.47	10.35	0.32	-11.72	52.71	107.57
275	22.56	9.77	0.15	-0.62	47.34	102.92
276	22.64	8.91	0.05	29.07	39.66	96.84
277	22.72	8.35	0.03	49.29	34.29	91.22
278	22.80	8.28	0.03	61.94	30.90	89.51
279	22.88	10.33	0.03	68.87	27.67	89.93
280	22.97	12.40	0.03	61.35	25.85	90.67
281	23.05	11.72	0.03	54.19	25.60	90.87
282	23.13	11.28	0.03	46.28	26.88	90.39
283	23.21	10.22	0.03	50.31	27.55	90.58
284	23.29	10.80	0.03	68.33	27.08	93.40
285	23.38	14.35	0.07	79.04	27.46	98.05
286	23.46	15.58	0.13	67.70	29.91	102.32
287	23.54	14.38	0.21	54.97	37.21	106.83
288	23.62	13.43	0.42	36.48	41.45	109.55

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
289	23.70	16.21	0.47	62.94	30.69	112.84
290	23.79	41.66	0.58	100.79	13.43	116.09
291	23.87	115.78	0.66	109.83	6.27	121.03
292	23.95	203.14	1.40	-6.20	3.22	124.53
293	24.03	255.72	1.59	-8.85	2.08	127.16
294	24.11	296.41	1.79	-9.59	1.34	127.89
295	24.20	307.86	1.67	-10.40	1.34	128.86
296	24.28	307.43	2.20	-9.89	1.83	130.22
297	24.36	320.33	2.89	24.02	2.35	131.55
298	24.44	333.24	2.95	18.51	2.55	132.33
299	24.52	335.22	3.01	18.12	2.25	132.13
300	24.61	340.21	2.60	21.77	1.55	131.15
301	24.69	350.85	1.83	15.19	0.72	130.07
302	24.77	374.64	1.91	20.02	0.09	128.14
303	24.85	312.96	1.17	25.49	0.31	128.33
304	24.93	328.55	1.99	24.04	0.57	128.09
305	25.02	324.81	1.84	18.61	0.44	127.99
306	25.10	325.74	1.08	31.33	0.00	126.16
307	25.18	322.38	0.91	20.98	0.00	124.40
308	25.26	317.29	1.03	18.82	0.00	122.81
309	25.34	317.29	0.50	21.25	0.00	122.95
310	25.43	332.04	0.95	13.99	0.00	123.24
311	25.51	334.73	1.11	17.38	0.00	123.57
312	25.59	333.56	0.60	21.08	0.00	123.47
313	25.67	333.83	0.91	30.00	0.00	122.19
314	25.75	341.03	0.69	19.70	0.00	123.04
315	25.84	340.73	0.87	15.87	0.00	123.48
316	25.92	321.40	1.07	24.48	0.00	124.63
317	26.00	344.73	1.13	17.53	0.00	125.86
318	26.08	346.89	1.42	36.53	0.00	126.45
319	26.16	331.46	1.37	31.84	0.00	125.90
320	26.25	341.99	0.84	26.94	0.00	125.06
321	26.33	336.99	1.04	16.82	0.00	124.31
322	26.41	342.19	1.04	19.59	0.00	126.50
323	26.49	354.40	1.85	6.24	0.00	126.08
324	26.57	361.86	0.79	16.31	0.00	125.82
325	26.66	383.94	0.87	-2.35	0.00	124.30
326	26.74	372.56	1.18	17.83	0.00	124.55
327	26.82	357.96	0.89	3.74	0.00	123.97
328	26.90	357.58	0.66	11.45	0.00	123.78
329	26.98	355.36	1.12	17.07	0.00	126.18
330	27.07	350.74	1.94	19.44	0.53	129.13
331	27.15	343.08	2.54	19.53	1.09	130.00
332	27.23	333.47	1.87	25.21	1.06	129.75
333	27.31	339.12	1.75	30.06	0.59	128.53
334	27.40	332.27	1.62	14.31	0.35	128.15
335	27.48	345.23	1.58	21.62	0.33	127.66
336	27.56	314.40	1.47	-2.56	0.88	128.58

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
337	27.64	312.03	2.28	18.98	1.51	129.20
338	27.72	307.33	2.13	20.49	1.93	129.86
339	27.81	307.25	2.04	27.97	2.33	130.94
340	27.89	333.86	3.25	33.31	2.33	131.60
341	27.97	348.39	2.72	20.57	2.33	132.57
342	28.05	371.88	2.99	13.62	1.56	132.34
343	28.13	410.65	2.77	10.65	0.90	132.65
344	28.22	467.26	2.79	31.58	0.47	133.55
345	28.30	525.30	3.74	27.94	1.08	135.47
346	28.38	481.06	5.36	32.63	1.79	136.72
347	28.46	471.14	5.00	33.44	1.93	136.29
348	28.54	460.64	3.14	22.40	1.32	135.13
349	28.63	469.10	3.41	31.94	0.71	133.52
350	28.71	430.02	2.81	35.28	1.20	134.00
351	28.79	420.48	3.87	24.83	1.55	133.88
352	28.87	405.78	3.41	27.33	1.17	132.81
353	28.95	400.46	1.51	24.80	0.41	131.23
354	29.04	419.58	2.17	14.58	0.00	128.48
355	29.12	380.63	1.22	5.86	0.00	128.39
356	29.20	419.71	1.43	34.13	0.00	128.55
357	29.28	364.01	2.36	25.24	0.66	129.94
358	29.36	313.71	2.39	6.03	3.01	131.82
359	29.45	268.94	3.64	21.83	3.45	131.36
360	29.53	300.26	2.03	26.23	4.04	131.33
361	29.61	265.73	2.51	33.93	2.56	130.01
362	29.69	320.34	2.15	16.31	3.51	131.77
363	29.77	315.40	3.80	42.81	4.37	133.39
364	29.86	291.62	4.51	31.17	6.12	134.87
365	29.94	282.25	4.66	28.51	7.89	134.79
366	30.02	208.49	4.22	-4.46	10.05	134.03
367	30.10	159.77	3.96	38.38	12.59	132.85
368	30.18	155.33	3.56	29.33	15.88	131.80
369	30.27	101.95	3.46	-13.90	17.58	130.28
370	30.35	94.96	2.42	-11.11	17.98	129.58
371	30.43	135.60	2.87	-11.43	12.07	128.99
372	30.51	194.78	2.15	-13.05	6.91	128.62
373	30.59	240.09	1.39	-3.62	4.01	126.74
374	30.68	207.32	1.22	5.37	2.90	125.74
375	30.76	226.57	1.47	21.73	3.40	126.32
376	30.84	229.22	1.75	13.69	3.39	126.99
377	30.92	233.79	1.59	34.48	2.57	125.85
378	31.00	238.36	0.75	34.79	1.20	123.14
379	31.09	238.12	0.48	3.51	1.34	123.45
380	31.17	232.79	1.71	29.52	1.68	124.28
381	31.25	240.92	1.10	30.23	2.26	125.72
382	31.33	247.56	1.17	2.72	1.64	125.03
383	31.41	256.56	1.31	23.72	2.01	124.91
384	31.50	206.08	1.10	34.31	2.57	125.17

:: Field input data :: (continued)

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	u (tsf)	Fines content (%)	Unit weight (pcf)
385	31.58	216.08	1.36	39.07	3.11	125.24
386	31.66	222.89	1.41	36.83	2.91	125.36
387	31.74	223.36	1.13	42.55	3.20	126.06
388	31.82	223.66	1.73	32.00	3.60	127.41
389	31.91	249.97	2.21	30.31	3.76	128.39
390	31.99	254.17	1.77	33.36	3.29	127.16
391	32.07	204.93	0.89	7.13	5.26	128.64
392	32.15	193.61	3.48	2.40	5.18	127.61
393	32.23	219.76	1.06	38.29	5.00	127.62
394	32.32	214.85	0.88	30.27	1.13	122.84
395	32.40	277.15	0.77	40.20	2.45	127.25
396	32.48	283.88	3.15	36.64	4.06	131.50
397	32.56	298.17	4.37	49.49	6.31	134.31
398	32.64	278.81	4.63	27.67	6.68	134.18
399	32.73	255.32	3.08	12.14	7.00	133.86
400	32.81	262.88	4.01	31.67	6.90	133.24
401	32.89	253.42	3.79	43.59	7.79	133.82
402	32.97	237.93	4.07	43.17	7.62	134.10
403	33.05	285.82	4.35	21.82	6.26	134.91
404	33.14	378.41	4.57	47.09	4.38	135.92
405	33.22	454.56	4.96	35.48	2.32	136.63
406	33.30	590.72	4.59	12.69	1.11	136.38
407	33.38	557.88	3.56	11.97	0.26	135.62
408	33.46	552.73	3.44	2.57	0.00	134.76
409	33.55	580.60	3.33	-3.90	0.00	134.62
410	33.63	631.41	3.21	-8.81	0.00	134.35
411	33.71	540.88	3.10	15.54	0.23	135.22
412	33.79	494.08	4.73	13.90	1.15	135.68
413	33.87	491.44	4.27	-14.62	1.57	136.04
414	33.96	503.67	3.82	-0.54	0.97	135.74
415	34.04	572.12	4.01	4.79	0.62	135.68
416	34.12	556.86	4.01	-3.27	0.51	135.98
417	34.20	560.37	4.17	37.60	0.00	133.05
418	34.28	563.88	0.00	34.30	0.00	128.02
419	34.37	491.01	0.00	35.85	N/A	87.36
420	34.45	491.01	0.00	35.85	N/A	87.36
421	34.53	607.27	0.00	38.32	N/A	87.36

Abbreviations

Depth:	Depth from free surface, at which CPT was performed (ft)
q_c:	Measured cone resistance (tsf)
f_s:	Sleeve friction resistance (tsf)
u:	Pore pressure (tsf)
Fines content:	Percentage of fines in soil (%)
Unit weight:	Bulk soil unit weight (pcf)

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data ::

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
1	0.08	0.00	0.00	0.00	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
2	0.16	0.01	0.00	0.01	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
3	0.25	0.01	0.00	0.01	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
4	0.33	0.02	0.00	0.02	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
5	0.41	0.02	0.00	0.02	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
6	0.49	0.03	0.00	0.03	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
7	0.57	0.03	0.00	0.03	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
8	0.66	0.04	0.00	0.04	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
9	0.74	0.04	0.00	0.04	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
10	0.82	0.05	0.00	0.05	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
11	0.90	0.05	0.00	0.05	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
12	0.98	0.06	0.00	0.06	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
13	1.07	0.06	0.00	0.06	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
14	1.15	0.07	0.00	0.07	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
15	1.23	0.07	0.00	0.07	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
16	1.31	0.08	0.00	0.08	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
17	1.39	0.08	0.00	0.08	1.00	0.351	1.15	0.305	1.00	1.00	2.000	No
18	1.48	0.09	0.00	0.09	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
19	1.56	0.09	0.00	0.09	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
20	1.64	0.10	0.00	0.10	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
21	1.72	0.10	0.00	0.10	1.00	0.350	1.15	0.305	1.00	1.00	2.000	No
22	1.80	0.11	0.00	0.11	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
23	1.89	0.11	0.00	0.11	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
24	1.97	0.12	0.00	0.12	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
25	2.05	0.12	0.00	0.12	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
26	2.13	0.13	0.00	0.13	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
27	2.21	0.13	0.00	0.13	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
28	2.30	0.14	0.00	0.14	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
29	2.38	0.14	0.00	0.14	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
30	2.46	0.15	0.00	0.15	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
31	2.54	0.15	0.00	0.15	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
32	2.62	0.16	0.00	0.16	1.00	0.350	1.15	0.304	1.00	1.00	2.000	No
33	2.71	0.16	0.00	0.16	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
34	2.79	0.17	0.00	0.17	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
35	2.87	0.17	0.00	0.17	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
36	2.95	0.18	0.00	0.18	1.00	0.349	1.15	0.304	1.00	1.00	2.000	No
37	3.03	0.18	0.00	0.18	0.99	0.349	1.15	0.304	1.00	1.00	2.000	No
38	3.12	0.19	0.00	0.19	0.99	0.349	1.15	0.304	1.00	1.00	2.000	No
39	3.20	0.19	0.00	0.19	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
40	3.28	0.20	0.00	0.20	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
41	3.36	0.20	0.00	0.20	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
42	3.44	0.21	0.00	0.21	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
43	3.53	0.21	0.00	0.21	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
44	3.61	0.21	0.00	0.21	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
45	3.69	0.22	0.00	0.22	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
46	3.77	0.22	0.00	0.22	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
47	3.85	0.23	0.00	0.23	0.99	0.349	1.15	0.303	1.00	1.00	2.000	No
48	3.94	0.23	0.00	0.23	0.99	0.348	1.15	0.303	1.00	1.00	2.000	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
49	4.02	0.24	0.00	0.24	0.99	0.349	1.15	0.304	1.00	1.00	0.304	No
50	4.10	0.24	0.00	0.24	0.99	0.353	1.15	0.307	1.00	1.00	0.307	No
51	4.18	0.25	0.01	0.24	0.99	0.356	1.15	0.310	1.00	1.00	0.310	No
52	4.27	0.25	0.01	0.24	0.99	0.360	1.15	0.313	1.00	1.00	0.313	No
53	4.35	0.26	0.01	0.25	0.99	0.363	1.15	0.316	1.00	1.00	0.316	No
54	4.43	0.26	0.01	0.25	0.99	0.367	1.15	0.319	1.00	1.00	0.319	No
55	4.51	0.26	0.02	0.25	0.99	0.370	1.15	0.322	1.00	1.00	0.322	No
56	4.59	0.27	0.02	0.25	0.99	0.374	1.15	0.325	1.00	1.00	0.325	No
57	4.68	0.27	0.02	0.25	0.99	0.377	1.15	0.328	1.00	1.00	0.328	No
58	4.76	0.28	0.02	0.25	0.99	0.380	1.15	0.330	1.00	1.00	0.330	No
59	4.84	0.28	0.03	0.26	0.99	0.383	1.15	0.333	1.00	1.00	0.333	No
60	4.92	0.29	0.03	0.26	0.99	0.386	1.15	0.336	1.00	1.00	0.336	No
61	5.00	0.29	0.03	0.26	0.99	0.389	1.15	0.339	1.00	1.00	0.339	No
62	5.09	0.30	0.03	0.26	0.99	0.392	1.15	0.341	1.00	1.00	0.341	No
63	5.17	0.30	0.04	0.26	0.99	0.395	1.15	0.344	1.00	1.00	0.344	No
64	5.25	0.30	0.04	0.27	0.99	0.398	1.15	0.346	1.00	1.00	0.346	No
65	5.33	0.31	0.04	0.27	0.99	0.401	1.15	0.349	1.00	1.00	0.349	No
66	5.41	0.31	0.04	0.27	0.99	0.404	1.15	0.351	1.00	1.00	0.351	No
67	5.50	0.32	0.05	0.27	0.99	0.407	1.15	0.354	1.00	1.00	0.354	No
68	5.58	0.32	0.05	0.27	0.99	0.410	1.15	0.356	1.00	1.00	0.356	No
69	5.66	0.33	0.05	0.27	0.99	0.412	1.15	0.359	1.00	1.00	0.359	No
70	5.74	0.33	0.05	0.28	0.99	0.415	1.15	0.361	1.00	1.00	0.361	No
71	5.82	0.34	0.06	0.28	0.99	0.418	1.15	0.363	1.00	1.00	0.363	No
72	5.91	0.34	0.06	0.28	0.99	0.420	1.15	0.365	1.00	1.00	0.365	No
73	5.99	0.34	0.06	0.28	0.99	0.423	1.15	0.368	1.00	1.00	0.368	No
74	6.07	0.35	0.06	0.28	0.99	0.426	1.15	0.370	1.00	1.00	0.370	No
75	6.15	0.35	0.07	0.29	0.99	0.428	1.15	0.372	1.00	1.00	0.372	No
76	6.23	0.36	0.07	0.29	0.99	0.431	1.15	0.374	1.00	1.00	0.374	No
77	6.32	0.36	0.07	0.29	0.99	0.433	1.15	0.376	1.00	1.00	0.376	No
78	6.40	0.37	0.07	0.29	0.99	0.435	1.15	0.379	1.00	1.00	0.379	No
79	6.48	0.37	0.08	0.29	0.99	0.438	1.15	0.381	1.00	1.00	0.381	No
80	6.56	0.37	0.08	0.29	0.99	0.440	1.15	0.383	1.00	1.00	0.383	No
81	6.64	0.38	0.08	0.30	0.99	0.443	1.15	0.385	1.00	1.00	0.385	No
82	6.73	0.38	0.09	0.30	0.99	0.445	1.15	0.387	1.00	1.00	0.387	No
83	6.81	0.39	0.09	0.30	0.99	0.447	1.15	0.389	1.00	1.00	0.389	No
84	6.89	0.39	0.09	0.30	0.99	0.449	1.15	0.391	1.00	1.00	0.391	No
85	6.97	0.40	0.09	0.30	0.99	0.452	1.15	0.393	1.00	1.00	0.393	No
86	7.05	0.40	0.10	0.31	0.99	0.454	1.15	0.395	1.00	1.00	0.395	No
87	7.14	0.40	0.10	0.31	0.99	0.456	1.15	0.397	1.00	1.00	0.397	No
88	7.22	0.41	0.10	0.31	0.99	0.458	1.15	0.398	1.00	1.00	0.398	No
89	7.30	0.41	0.10	0.31	0.99	0.461	1.15	0.400	1.00	1.00	0.400	No
90	7.38	0.42	0.11	0.31	0.98	0.463	1.15	0.402	1.00	1.00	0.402	No
91	7.46	0.42	0.11	0.31	0.98	0.465	1.15	0.404	1.00	1.00	0.404	No
92	7.55	0.43	0.11	0.31	0.98	0.467	1.15	0.406	1.00	1.00	0.406	No
93	7.63	0.43	0.11	0.32	0.98	0.469	1.15	0.408	1.00	1.00	0.408	No
94	7.71	0.43	0.12	0.32	0.98	0.471	1.15	0.410	1.00	1.00	0.410	No
95	7.79	0.44	0.12	0.32	0.98	0.473	1.15	0.412	1.00	1.00	0.412	No
96	7.87	0.44	0.12	0.32	0.98	0.475	1.15	0.413	1.00	1.00	0.413	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
97	7.96	0.45	0.12	0.32	0.98	0.477	1.15	0.415	1.00	1.00	0.415	No
98	8.04	0.45	0.13	0.32	0.98	0.479	1.15	0.417	1.00	1.00	0.417	No
99	8.12	0.45	0.13	0.33	0.98	0.481	1.15	0.418	1.00	1.00	0.418	No
100	8.20	0.46	0.13	0.33	0.98	0.483	1.15	0.420	1.00	1.00	0.420	No
101	8.28	0.46	0.13	0.33	0.98	0.485	1.15	0.422	1.00	1.00	0.422	No
102	8.37	0.47	0.14	0.33	0.98	0.487	1.15	0.423	1.00	1.00	0.423	No
103	8.45	0.47	0.14	0.33	0.98	0.489	1.15	0.425	1.00	1.00	0.425	No
104	8.53	0.48	0.14	0.33	0.98	0.491	1.15	0.427	1.00	1.00	0.427	No
105	8.61	0.48	0.14	0.34	0.98	0.493	1.15	0.428	1.00	1.00	0.428	No
106	8.69	0.48	0.15	0.34	0.98	0.494	1.15	0.430	1.00	1.00	0.430	No
107	8.78	0.49	0.15	0.34	0.98	0.496	1.15	0.431	1.00	1.00	0.431	No
108	8.86	0.49	0.15	0.34	0.98	0.498	1.15	0.433	1.00	1.00	0.433	No
109	8.94	0.50	0.15	0.34	0.98	0.500	1.15	0.434	1.00	1.00	0.434	No
110	9.02	0.50	0.16	0.34	0.98	0.501	1.15	0.436	1.00	1.00	0.436	No
111	9.10	0.50	0.16	0.35	0.98	0.503	1.15	0.437	1.00	1.00	0.437	No
112	9.19	0.51	0.16	0.35	0.98	0.505	1.15	0.439	1.00	1.00	0.439	No
113	9.27	0.51	0.16	0.35	0.98	0.507	1.15	0.440	1.00	1.00	0.440	No
114	9.35	0.52	0.17	0.35	0.98	0.508	1.15	0.442	1.00	1.00	0.442	No
115	9.43	0.52	0.17	0.35	0.98	0.510	1.15	0.443	1.00	1.00	0.443	No
116	9.51	0.53	0.17	0.35	0.98	0.511	1.15	0.445	1.00	1.00	0.445	No
117	9.60	0.53	0.17	0.36	0.98	0.513	1.15	0.446	1.00	1.00	0.446	No
118	9.68	0.53	0.18	0.36	0.98	0.514	1.15	0.447	1.00	1.00	0.447	No
119	9.76	0.54	0.18	0.36	0.98	0.516	1.15	0.449	1.00	1.00	0.449	No
120	9.84	0.54	0.18	0.36	0.98	0.518	1.15	0.450	1.00	1.00	0.450	No
121	9.92	0.55	0.18	0.36	0.98	0.519	1.15	0.451	1.00	1.00	0.451	No
122	10.01	0.55	0.19	0.36	0.98	0.520	1.15	0.453	1.00	1.00	0.453	No
123	10.09	0.56	0.19	0.37	0.98	0.522	1.15	0.454	1.00	1.00	0.454	No
124	10.17	0.56	0.19	0.37	0.98	0.523	1.15	0.455	1.00	1.00	0.455	No
125	10.25	0.56	0.20	0.37	0.98	0.525	1.15	0.456	1.00	1.00	0.456	No
126	10.33	0.57	0.20	0.37	0.98	0.526	1.15	0.458	1.00	1.00	0.458	No
127	10.42	0.57	0.20	0.37	0.98	0.528	1.15	0.459	1.00	1.00	0.459	No
128	10.50	0.58	0.20	0.37	0.98	0.529	1.15	0.460	1.00	1.00	0.460	No
129	10.58	0.58	0.21	0.38	0.98	0.531	1.15	0.461	1.00	1.00	0.461	No
130	10.66	0.59	0.21	0.38	0.98	0.532	1.15	0.463	1.00	1.00	0.463	No
131	10.74	0.59	0.21	0.38	0.98	0.533	1.15	0.464	1.00	1.00	0.464	No
132	10.83	0.59	0.21	0.38	0.98	0.535	1.15	0.465	1.00	1.00	0.465	No
133	10.91	0.60	0.22	0.38	0.98	0.536	1.15	0.466	1.00	1.00	0.466	No
134	10.99	0.60	0.22	0.38	0.98	0.537	1.15	0.467	1.00	1.00	0.467	No
135	11.07	0.61	0.22	0.39	0.98	0.539	1.15	0.468	1.00	1.00	0.468	No
136	11.15	0.61	0.22	0.39	0.98	0.540	1.15	0.470	1.00	1.00	0.470	No
137	11.24	0.62	0.23	0.39	0.98	0.541	1.15	0.471	1.00	1.00	0.471	No
138	11.32	0.62	0.23	0.39	0.98	0.543	1.15	0.472	1.00	1.00	0.472	No
139	11.40	0.62	0.23	0.39	0.98	0.544	1.15	0.473	1.00	1.00	0.473	No
140	11.48	0.63	0.23	0.39	0.98	0.545	1.15	0.474	1.00	1.00	0.474	No
141	11.56	0.63	0.24	0.40	0.98	0.547	1.15	0.475	1.00	1.00	0.475	No
142	11.65	0.64	0.24	0.40	0.98	0.548	1.15	0.476	1.00	1.00	0.476	No
143	11.73	0.64	0.24	0.40	0.98	0.549	1.15	0.477	1.00	1.00	0.477	No
144	11.81	0.64	0.24	0.40	0.98	0.550	1.15	0.478	1.00	1.00	0.478	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
145	11.89	0.65	0.25	0.40	0.98	0.551	1.15	0.479	1.00	1.00	0.479	No
146	11.98	0.65	0.25	0.40	0.97	0.553	1.15	0.480	1.00	1.00	0.480	No
147	12.06	0.66	0.25	0.41	0.97	0.554	1.15	0.481	1.00	1.00	0.481	No
148	12.14	0.66	0.25	0.41	0.97	0.555	1.15	0.482	1.00	1.00	0.482	No
149	12.22	0.67	0.26	0.41	0.97	0.556	1.15	0.483	1.00	1.00	0.483	No
150	12.30	0.67	0.26	0.41	0.97	0.556	1.15	0.484	1.00	1.00	0.484	No
151	12.39	0.68	0.26	0.42	0.97	0.557	1.15	0.485	1.00	1.00	0.485	No
152	12.47	0.68	0.26	0.42	0.97	0.558	1.15	0.485	1.00	1.00	0.485	No
153	12.55	0.69	0.27	0.42	0.97	0.559	1.15	0.486	1.00	1.00	0.486	No
154	12.63	0.69	0.27	0.42	0.97	0.560	1.15	0.487	1.00	1.00	0.487	No
155	12.71	0.70	0.27	0.42	0.97	0.561	1.15	0.487	1.00	1.00	0.487	No
156	12.80	0.70	0.27	0.43	0.97	0.561	1.15	0.488	1.00	1.00	0.488	No
157	12.88	0.71	0.28	0.43	0.97	0.562	1.15	0.489	1.00	1.00	0.489	No
158	12.96	0.71	0.28	0.43	0.97	0.563	1.15	0.489	1.00	1.00	0.489	No
159	13.04	0.72	0.28	0.43	0.97	0.563	1.15	0.490	1.00	1.00	0.490	No
160	13.12	0.72	0.28	0.44	0.97	0.564	1.15	0.491	1.00	1.00	0.491	No
161	13.21	0.73	0.29	0.44	0.97	0.565	1.15	0.491	1.00	1.00	0.491	No
162	13.29	0.73	0.29	0.44	0.97	0.566	1.15	0.492	1.00	1.00	0.492	No
163	13.37	0.74	0.29	0.44	0.97	0.566	1.15	0.492	1.00	1.00	0.492	No
164	13.45	0.74	0.29	0.44	0.97	0.567	1.15	0.493	1.00	1.00	0.493	No
165	13.53	0.74	0.30	0.45	0.97	0.568	1.15	0.494	1.00	1.00	0.494	No
166	13.62	0.75	0.30	0.45	0.97	0.569	1.15	0.494	1.00	1.00	0.494	No
167	13.70	0.75	0.30	0.45	0.97	0.569	1.15	0.495	1.00	1.00	0.495	No
168	13.78	0.76	0.31	0.45	0.97	0.570	1.15	0.495	1.00	1.00	0.495	No
169	13.86	0.77	0.31	0.46	0.97	0.570	1.15	0.496	1.00	1.00	0.496	No
170	13.94	0.77	0.31	0.46	0.97	0.570	1.15	0.496	1.00	1.00	0.496	No
171	14.03	0.78	0.31	0.46	0.97	0.571	1.15	0.496	1.00	1.00	0.496	No
172	14.11	0.78	0.32	0.47	0.97	0.571	1.15	0.497	1.00	1.00	0.497	No
173	14.19	0.79	0.32	0.47	0.97	0.572	1.15	0.497	1.00	1.00	0.497	No
174	14.27	0.79	0.32	0.47	0.97	0.572	1.15	0.497	1.00	1.00	0.497	No
175	14.35	0.80	0.32	0.47	0.97	0.573	1.15	0.498	1.00	1.00	0.498	No
176	14.44	0.80	0.33	0.48	0.97	0.573	1.15	0.498	1.00	1.00	0.498	No
177	14.52	0.81	0.33	0.48	0.97	0.574	1.15	0.499	1.00	1.00	0.499	No
178	14.60	0.81	0.33	0.48	0.97	0.574	1.15	0.499	1.00	1.00	0.499	No
179	14.68	0.82	0.33	0.48	0.97	0.575	1.15	0.500	1.00	1.00	0.500	No
180	14.76	0.82	0.34	0.48	0.97	0.576	1.15	0.500	1.00	1.00	0.500	No
181	14.85	0.83	0.34	0.49	0.97	0.576	1.15	0.501	1.00	1.00	0.501	No
182	14.93	0.83	0.34	0.49	0.97	0.577	1.15	0.501	1.00	1.00	0.501	No
183	15.01	0.84	0.34	0.49	0.97	0.577	1.15	0.502	1.00	1.00	0.502	No
184	15.09	0.84	0.35	0.49	0.97	0.578	1.15	0.502	1.00	1.00	0.502	No
185	15.17	0.85	0.35	0.50	0.97	0.578	1.15	0.503	1.00	1.00	0.503	No
186	15.26	0.85	0.35	0.50	0.97	0.579	1.15	0.503	1.00	1.00	0.503	No
187	15.34	0.86	0.35	0.50	0.97	0.579	1.15	0.503	1.00	1.00	0.503	No
188	15.42	0.86	0.36	0.50	0.97	0.579	1.15	0.504	1.00	1.00	0.504	No
189	15.50	0.87	0.36	0.51	0.97	0.580	1.15	0.504	1.00	1.00	0.504	No
190	15.58	0.87	0.36	0.51	0.97	0.580	1.15	0.505	1.00	1.00	0.505	No
191	15.67	0.88	0.36	0.51	0.97	0.581	1.15	0.505	1.00	1.00	0.505	No
192	15.75	0.88	0.37	0.51	0.97	0.581	1.15	0.505	1.00	1.00	0.505	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
193	15.83	0.89	0.37	0.52	0.97	0.582	1.15	0.506	1.00	1.00	0.506	No
194	15.91	0.89	0.37	0.52	0.97	0.582	1.15	0.506	1.00	1.00	0.506	No
195	15.99	0.90	0.37	0.52	0.97	0.582	1.15	0.506	1.00	1.00	0.506	No
196	16.08	0.90	0.38	0.52	0.97	0.583	1.15	0.507	1.00	1.00	0.507	No
197	16.16	0.91	0.38	0.53	0.97	0.583	1.15	0.507	1.00	1.00	0.507	No
198	16.24	0.91	0.38	0.53	0.97	0.583	1.15	0.507	1.00	1.00	0.507	No
199	16.32	0.92	0.38	0.53	0.97	0.584	1.15	0.508	1.00	1.00	0.508	No
200	16.40	0.92	0.39	0.53	0.97	0.584	1.15	0.508	1.00	1.00	0.508	No
201	16.49	0.93	0.39	0.54	0.97	0.585	1.15	0.508	1.00	1.00	0.508	No
202	16.57	0.93	0.39	0.54	0.97	0.585	1.15	0.509	1.00	1.00	0.509	No
203	16.65	0.94	0.39	0.54	0.96	0.585	1.15	0.509	1.00	1.00	0.509	No
204	16.73	0.94	0.40	0.54	0.96	0.586	1.15	0.509	1.00	1.00	0.509	No
205	16.81	0.95	0.40	0.55	0.96	0.587	1.15	0.510	1.00	1.00	0.510	No
206	16.90	0.95	0.40	0.55	0.96	0.587	1.15	0.510	1.00	1.00	0.510	No
207	16.98	0.95	0.40	0.55	0.96	0.588	1.15	0.511	1.00	1.00	0.511	No
208	17.06	0.96	0.41	0.55	0.96	0.588	1.15	0.512	1.00	1.00	0.512	No
209	17.14	0.96	0.41	0.55	0.96	0.589	1.15	0.512	1.00	1.00	0.512	No
210	17.22	0.97	0.41	0.55	0.96	0.590	1.15	0.513	1.00	1.00	0.513	No
211	17.31	0.97	0.42	0.56	0.96	0.590	1.15	0.513	1.00	1.00	0.513	No
212	17.39	0.98	0.42	0.56	0.96	0.591	1.15	0.514	1.00	1.00	0.514	No
213	17.47	0.98	0.42	0.56	0.96	0.591	1.15	0.514	1.00	1.00	0.514	No
214	17.55	0.99	0.42	0.56	0.96	0.592	1.15	0.515	1.00	1.00	0.515	No
215	17.63	0.99	0.43	0.56	0.96	0.592	1.15	0.515	1.00	1.00	0.515	No
216	17.72	0.99	0.43	0.57	0.96	0.593	1.15	0.515	1.00	1.00	0.515	No
217	17.80	1.00	0.43	0.57	0.96	0.593	1.15	0.516	1.00	1.00	0.516	No
218	17.88	1.00	0.43	0.57	0.96	0.594	1.15	0.516	1.00	1.00	0.516	No
219	17.96	1.01	0.44	0.57	0.96	0.594	1.15	0.517	1.00	1.00	0.517	No
220	18.04	1.01	0.44	0.58	0.96	0.595	1.15	0.517	1.00	1.00	0.517	No
221	18.13	1.02	0.44	0.58	0.96	0.595	1.15	0.517	1.00	1.00	0.517	No
222	18.21	1.02	0.44	0.58	0.96	0.596	1.15	0.518	1.00	1.00	0.518	No
223	18.29	1.03	0.45	0.58	0.96	0.596	1.15	0.518	1.00	1.00	0.518	No
224	18.37	1.03	0.45	0.58	0.96	0.597	1.15	0.519	1.00	1.00	0.519	No
225	18.45	1.04	0.45	0.59	0.96	0.597	1.15	0.519	1.00	1.00	0.519	No
226	18.54	1.04	0.45	0.59	0.96	0.598	1.15	0.520	1.00	1.00	0.520	No
227	18.62	1.04	0.46	0.59	0.96	0.598	1.15	0.520	1.00	1.00	0.520	No
228	18.70	1.05	0.46	0.59	0.96	0.599	1.15	0.521	1.00	1.00	0.521	No
229	18.78	1.05	0.46	0.59	0.96	0.599	1.15	0.521	1.00	1.00	0.521	No
230	18.86	1.06	0.46	0.59	0.96	0.600	1.15	0.521	1.00	1.00	0.521	No
231	18.95	1.06	0.47	0.60	0.96	0.600	1.15	0.522	1.00	1.00	0.522	No
232	19.03	1.07	0.47	0.60	0.96	0.601	1.15	0.522	1.00	1.00	0.522	No
233	19.11	1.07	0.47	0.60	0.96	0.601	1.15	0.523	1.00	1.00	0.523	No
234	19.19	1.08	0.47	0.60	0.96	0.602	1.15	0.523	1.00	1.00	0.523	No
235	19.27	1.08	0.48	0.60	0.96	0.602	1.15	0.524	1.00	1.00	0.524	No
236	19.36	1.08	0.48	0.61	0.96	0.603	1.15	0.524	1.00	1.00	0.524	No
237	19.44	1.09	0.48	0.61	0.96	0.603	1.15	0.525	1.00	1.00	0.525	No
238	19.52	1.09	0.48	0.61	0.96	0.604	1.15	0.525	1.00	1.00	0.525	No
239	19.60	1.10	0.49	0.61	0.96	0.605	1.15	0.526	1.00	1.00	0.526	No
240	19.69	1.10	0.49	0.61	0.96	0.605	1.15	0.526	1.00	1.00	0.526	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
241	19.77	1.10	0.49	0.61	0.96	0.606	1.15	0.527	1.00	1.00	0.527	No
242	19.85	1.11	0.49	0.61	0.96	0.607	1.15	0.528	1.00	1.00	0.528	No
243	19.93	1.11	0.50	0.61	0.96	0.608	1.15	0.528	1.00	1.00	0.528	No
244	20.01	1.12	0.50	0.62	0.96	0.608	1.15	0.529	1.00	1.00	0.529	No
245	20.10	1.12	0.50	0.62	0.96	0.609	1.15	0.529	1.00	1.00	0.529	No
246	20.18	1.12	0.50	0.62	0.96	0.610	1.15	0.530	1.00	1.00	0.530	No
247	20.26	1.13	0.51	0.62	0.96	0.610	1.15	0.531	1.00	1.00	0.531	No
248	20.34	1.13	0.51	0.62	0.96	0.611	1.15	0.531	1.00	1.00	0.531	No
249	20.42	1.14	0.51	0.62	0.96	0.612	1.15	0.532	1.00	1.00	0.532	No
250	20.51	1.14	0.51	0.62	0.96	0.612	1.15	0.532	1.00	1.00	0.532	No
251	20.59	1.14	0.52	0.63	0.96	0.613	1.15	0.533	1.00	1.00	0.533	No
252	20.67	1.15	0.52	0.63	0.96	0.613	1.15	0.533	1.00	1.00	0.533	No
253	20.75	1.15	0.52	0.63	0.95	0.614	1.15	0.533	1.00	1.00	0.533	No
254	20.83	1.16	0.53	0.63	0.95	0.614	1.15	0.534	1.00	1.00	0.534	No
255	20.92	1.16	0.53	0.63	0.95	0.615	1.15	0.534	1.00	1.00	0.534	No
256	21.00	1.16	0.53	0.63	0.95	0.615	1.15	0.535	1.00	1.00	0.535	No
257	21.08	1.17	0.53	0.64	0.95	0.615	1.15	0.535	1.00	1.00	0.535	No
258	21.16	1.17	0.54	0.64	0.95	0.616	1.15	0.535	1.00	1.00	0.535	No
259	21.24	1.18	0.54	0.64	0.95	0.616	1.15	0.536	1.00	1.00	0.536	No
260	21.33	1.18	0.54	0.64	0.95	0.616	1.15	0.536	1.00	1.00	0.536	No
261	21.41	1.19	0.54	0.64	0.95	0.617	1.15	0.536	1.00	1.00	0.536	No
262	21.49	1.19	0.55	0.65	0.95	0.617	1.15	0.537	1.00	1.00	0.537	No
263	21.57	1.20	0.55	0.65	0.95	0.617	1.15	0.537	1.00	1.00	0.537	No
264	21.65	1.20	0.55	0.65	0.95	0.618	1.15	0.537	1.00	1.00	0.537	No
265	21.74	1.21	0.55	0.65	0.95	0.618	1.15	0.537	1.00	1.00	0.537	No
266	21.82	1.21	0.56	0.65	0.95	0.618	1.15	0.537	1.00	1.00	0.537	No
267	21.90	1.21	0.56	0.66	0.95	0.618	1.15	0.538	1.00	1.00	0.538	No
268	21.98	1.22	0.56	0.66	0.95	0.619	1.15	0.538	1.00	1.00	0.538	No
269	22.06	1.22	0.56	0.66	0.95	0.619	1.15	0.538	1.00	1.00	0.538	No
270	22.15	1.23	0.57	0.66	0.95	0.619	1.15	0.538	1.00	1.00	0.538	No
271	22.23	1.23	0.57	0.67	0.95	0.619	1.15	0.538	1.00	1.00	0.538	No
272	22.31	1.24	0.57	0.67	0.95	0.619	1.15	0.538	1.00	1.00	0.538	No
273	22.39	1.24	0.57	0.67	0.95	0.620	1.15	0.539	1.00	1.00	0.539	No
274	22.47	1.25	0.58	0.67	0.95	0.620	1.15	0.539	1.00	1.00	0.539	No
275	22.56	1.25	0.58	0.67	0.95	0.620	1.15	0.539	1.00	1.00	0.539	No
276	22.64	1.26	0.58	0.67	0.95	0.621	1.15	0.540	1.00	1.00	0.540	No
277	22.72	1.26	0.58	0.68	0.95	0.621	1.15	0.540	1.00	1.00	0.540	No
278	22.80	1.26	0.59	0.68	0.95	0.622	1.15	0.541	1.00	1.00	0.541	No
279	22.88	1.27	0.59	0.68	0.95	0.623	1.15	0.541	1.00	1.00	0.541	No
280	22.97	1.27	0.59	0.68	0.95	0.623	1.15	0.542	1.00	1.00	0.542	No
281	23.05	1.27	0.59	0.68	0.95	0.624	1.15	0.542	1.00	1.00	0.542	No
282	23.13	1.28	0.60	0.68	0.95	0.624	1.15	0.543	1.00	1.00	0.543	No
283	23.21	1.28	0.60	0.68	0.95	0.625	1.15	0.543	1.00	1.00	0.543	No
284	23.29	1.29	0.60	0.68	0.95	0.626	1.15	0.544	1.00	1.00	0.544	No
285	23.38	1.29	0.60	0.68	0.95	0.626	1.15	0.544	1.00	1.00	0.544	No
286	23.46	1.29	0.61	0.69	0.95	0.626	1.15	0.545	1.00	1.00	0.545	No
287	23.54	1.30	0.61	0.69	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
288	23.62	1.30	0.61	0.69	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
289	23.70	1.31	0.61	0.69	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
290	23.79	1.31	0.62	0.69	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
291	23.87	1.32	0.62	0.70	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
292	23.95	1.32	0.62	0.70	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
293	24.03	1.33	0.63	0.70	0.95	0.627	1.15	0.545	1.00	1.00	0.545	No
294	24.11	1.33	0.63	0.70	0.94	0.627	1.15	0.545	1.00	1.00	0.545	No
295	24.20	1.34	0.63	0.71	0.94	0.627	1.15	0.545	1.00	1.00	0.545	No
296	24.28	1.34	0.63	0.71	0.94	0.627	1.15	0.545	1.00	1.00	0.545	No
297	24.36	1.35	0.64	0.71	0.94	0.626	1.15	0.545	1.00	1.00	0.545	No
298	24.44	1.35	0.64	0.72	0.94	0.626	1.15	0.545	1.00	1.00	0.545	No
299	24.52	1.36	0.64	0.72	0.94	0.626	1.15	0.544	1.00	1.00	0.544	No
300	24.61	1.36	0.64	0.72	0.94	0.626	1.15	0.544	1.00	1.00	0.544	No
301	24.69	1.37	0.65	0.72	0.94	0.626	1.15	0.544	1.00	1.00	0.544	No
302	24.77	1.38	0.65	0.73	0.94	0.626	1.15	0.544	1.00	1.00	0.544	No
303	24.85	1.38	0.65	0.73	0.94	0.626	1.15	0.544	1.00	1.00	0.544	No
304	24.93	1.39	0.65	0.73	0.94	0.625	1.15	0.544	1.00	1.00	0.544	No
305	25.02	1.39	0.66	0.74	0.94	0.625	1.15	0.544	1.00	1.00	0.544	No
306	25.10	1.40	0.66	0.74	0.94	0.625	1.15	0.544	1.00	1.00	0.544	No
307	25.18	1.40	0.66	0.74	0.94	0.625	1.15	0.544	1.00	1.00	0.544	No
308	25.26	1.41	0.66	0.74	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
309	25.34	1.41	0.67	0.75	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
310	25.43	1.42	0.67	0.75	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
311	25.51	1.42	0.67	0.75	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
312	25.59	1.43	0.67	0.75	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
313	25.67	1.43	0.68	0.76	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
314	25.75	1.44	0.68	0.76	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
315	25.84	1.44	0.68	0.76	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
316	25.92	1.45	0.68	0.76	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
317	26.00	1.45	0.69	0.77	0.94	0.625	1.15	0.543	1.00	1.00	0.543	No
318	26.08	1.46	0.69	0.77	0.94	0.624	1.15	0.543	1.00	1.00	0.543	No
319	26.16	1.46	0.69	0.77	0.94	0.624	1.15	0.543	1.00	1.00	0.543	No
320	26.25	1.47	0.69	0.77	0.94	0.624	1.15	0.543	1.00	1.00	0.543	No
321	26.33	1.47	0.70	0.78	0.94	0.624	1.15	0.543	1.00	1.00	0.543	No
322	26.41	1.48	0.70	0.78	0.94	0.624	1.15	0.543	1.00	1.00	0.543	No
323	26.49	1.48	0.70	0.78	0.94	0.624	1.15	0.542	1.00	1.00	0.542	No
324	26.57	1.49	0.70	0.78	0.94	0.624	1.15	0.542	1.00	1.00	0.542	No
325	26.66	1.49	0.71	0.79	0.94	0.624	1.15	0.542	1.00	1.00	0.542	No
326	26.74	1.50	0.71	0.79	0.94	0.624	1.15	0.542	1.00	1.00	0.542	No
327	26.82	1.50	0.71	0.79	0.93	0.623	1.15	0.542	1.00	1.00	0.542	No
328	26.90	1.51	0.71	0.79	0.93	0.623	1.15	0.542	1.00	1.00	0.542	No
329	26.98	1.51	0.72	0.80	0.93	0.623	1.15	0.542	1.00	1.00	0.542	No
330	27.07	1.52	0.72	0.80	0.93	0.623	1.15	0.542	1.00	1.00	0.542	No
331	27.15	1.52	0.72	0.80	0.93	0.623	1.15	0.541	1.00	1.00	0.541	No
332	27.23	1.53	0.72	0.80	0.93	0.623	1.15	0.541	1.00	1.00	0.541	No
333	27.31	1.53	0.73	0.81	0.93	0.622	1.15	0.541	1.00	1.00	0.541	No
334	27.40	1.54	0.73	0.81	0.93	0.622	1.15	0.541	1.00	1.00	0.541	No
335	27.48	1.55	0.73	0.81	0.93	0.622	1.15	0.541	1.00	1.00	0.541	No
336	27.56	1.55	0.74	0.82	0.93	0.622	1.15	0.541	1.00	1.00	0.541	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
337	27.64	1.56	0.74	0.82	0.93	0.622	1.15	0.541	1.00	1.00	0.541	No
338	27.72	1.56	0.74	0.82	0.93	0.622	1.15	0.540	1.00	1.00	0.540	No
339	27.81	1.57	0.74	0.82	0.93	0.621	1.15	0.540	1.00	1.00	0.540	No
340	27.89	1.57	0.75	0.83	0.93	0.621	1.15	0.540	1.00	1.00	0.540	No
341	27.97	1.58	0.75	0.83	0.93	0.621	1.15	0.540	1.00	1.00	0.540	No
342	28.05	1.58	0.75	0.83	0.93	0.621	1.15	0.539	1.00	1.00	0.539	No
343	28.13	1.59	0.75	0.84	0.93	0.620	1.15	0.539	1.00	1.00	0.539	No
344	28.22	1.59	0.76	0.84	0.93	0.620	1.15	0.539	1.00	1.00	0.539	No
345	28.30	1.60	0.76	0.84	0.93	0.620	1.15	0.539	1.00	1.00	0.539	No
346	28.38	1.60	0.76	0.84	0.93	0.619	1.15	0.539	1.00	1.00	0.539	No
347	28.46	1.61	0.76	0.85	0.93	0.619	1.15	0.538	1.00	1.00	0.538	No
348	28.54	1.62	0.77	0.85	0.93	0.619	1.15	0.538	1.00	1.00	0.538	No
349	28.63	1.62	0.77	0.85	0.93	0.619	1.15	0.538	1.00	1.00	0.538	No
350	28.71	1.63	0.77	0.86	0.93	0.618	1.15	0.537	1.00	1.00	0.537	No
351	28.79	1.63	0.77	0.86	0.93	0.618	1.15	0.537	1.00	1.00	0.537	No
352	28.87	1.64	0.78	0.86	0.93	0.618	1.15	0.537	1.00	1.00	0.537	No
353	28.95	1.64	0.78	0.86	0.93	0.617	1.15	0.537	1.00	1.00	0.537	No
354	29.04	1.65	0.78	0.87	0.93	0.617	1.15	0.537	1.00	1.00	0.537	No
355	29.12	1.65	0.78	0.87	0.92	0.617	1.15	0.536	1.00	1.00	0.536	No
356	29.20	1.66	0.79	0.87	0.92	0.617	1.15	0.536	1.00	1.00	0.536	No
357	29.28	1.66	0.79	0.88	0.92	0.617	1.15	0.536	1.00	1.00	0.536	No
358	29.36	1.67	0.79	0.88	0.92	0.616	1.15	0.536	1.00	1.00	0.536	No
359	29.45	1.68	0.79	0.88	0.92	0.616	1.15	0.536	1.00	1.00	0.536	No
360	29.53	1.68	0.80	0.88	0.92	0.616	1.15	0.535	1.00	1.00	0.535	No
361	29.61	1.69	0.80	0.89	0.92	0.616	1.15	0.535	1.00	1.00	0.535	No
362	29.69	1.69	0.80	0.89	0.92	0.615	1.15	0.535	1.00	1.00	0.535	No
363	29.77	1.70	0.80	0.89	0.92	0.615	1.15	0.535	1.00	1.00	0.535	No
364	29.86	1.70	0.81	0.90	0.92	0.615	1.15	0.534	1.00	1.00	0.534	No
365	29.94	1.71	0.81	0.90	0.92	0.614	1.15	0.534	1.00	1.00	0.534	No
366	30.02	1.71	0.81	0.90	0.92	0.614	1.15	0.534	1.00	1.00	0.534	No
367	30.10	1.72	0.81	0.90	0.92	0.614	1.15	0.534	1.00	1.00	0.534	No
368	30.18	1.72	0.82	0.91	0.92	0.613	1.15	0.533	1.00	1.00	0.533	No
369	30.27	1.73	0.82	0.91	0.92	0.613	1.15	0.533	1.00	1.00	0.533	No
370	30.35	1.73	0.82	0.91	0.92	0.613	1.15	0.533	1.00	1.00	0.533	No
371	30.43	1.74	0.82	0.92	0.92	0.613	1.15	0.533	1.00	1.00	0.533	No
372	30.51	1.75	0.83	0.92	0.92	0.612	1.15	0.532	1.00	1.00	0.532	No
373	30.59	1.75	0.83	0.92	0.92	0.612	1.15	0.532	1.00	1.00	0.532	No
374	30.68	1.76	0.83	0.92	0.92	0.612	1.15	0.532	1.00	1.00	0.532	No
375	30.76	1.76	0.83	0.93	0.92	0.612	1.15	0.532	1.00	1.00	0.532	No
376	30.84	1.77	0.84	0.93	0.92	0.612	1.15	0.532	1.00	1.00	0.532	No
377	30.92	1.77	0.84	0.93	0.92	0.611	1.15	0.531	1.00	1.00	0.531	No
378	31.00	1.78	0.84	0.93	0.92	0.611	1.15	0.531	1.00	1.00	0.531	No
379	31.09	1.78	0.85	0.94	0.91	0.611	1.15	0.531	1.00	1.00	0.531	No
380	31.17	1.79	0.85	0.94	0.91	0.611	1.15	0.531	1.00	1.00	0.531	No
381	31.25	1.79	0.85	0.94	0.91	0.610	1.15	0.531	1.00	1.00	0.531	No
382	31.33	1.80	0.85	0.94	0.91	0.610	1.15	0.531	1.00	1.00	0.531	No
383	31.41	1.80	0.86	0.95	0.91	0.610	1.15	0.530	1.00	1.00	0.530	No
384	31.50	1.81	0.86	0.95	0.91	0.610	1.15	0.530	1.00	1.00	0.530	No

:: Cyclic Stress Ratio fully adjusted (CSR*) calculation data :: (continued)

Point ID	Depth (ft)	σ_v (tsf)	u_0 (tsf)	σ_v' (tsf)	r_d	CSR	MSF	CSR_{eq}	K_σ	User FS	CSR^*	Belongs to transition
385	31.58	1.81	0.86	0.95	0.91	0.610	1.15	0.530	1.00	1.00	0.530	No
386	31.66	1.82	0.86	0.95	0.91	0.609	1.15	0.530	1.00	1.00	0.530	No
387	31.74	1.82	0.87	0.96	0.91	0.609	1.15	0.530	1.00	1.00	0.530	No
388	31.82	1.83	0.87	0.96	0.91	0.609	1.15	0.529	1.00	1.00	0.529	No
389	31.91	1.83	0.87	0.96	0.91	0.609	1.15	0.529	1.00	1.00	0.529	No
390	31.99	1.84	0.87	0.97	0.91	0.608	1.15	0.529	1.00	1.00	0.529	No
391	32.07	1.84	0.88	0.97	0.91	0.608	1.15	0.529	1.00	1.00	0.529	No
392	32.15	1.85	0.88	0.97	0.91	0.608	1.15	0.528	1.00	1.00	0.528	No
393	32.23	1.85	0.88	0.97	0.91	0.607	1.15	0.528	1.00	1.00	0.528	No
394	32.32	1.86	0.88	0.98	0.91	0.607	1.15	0.528	1.00	1.00	0.528	No
395	32.40	1.86	0.89	0.98	0.91	0.607	1.15	0.528	1.00	1.00	0.528	No
396	32.48	1.87	0.89	0.98	0.91	0.607	1.15	0.527	1.00	1.00	0.527	No
397	32.56	1.88	0.89	0.98	0.91	0.606	1.15	0.527	1.00	1.00	0.527	No
398	32.64	1.88	0.89	0.99	0.91	0.606	1.15	0.527	1.00	1.00	0.527	No
399	32.73	1.89	0.90	0.99	0.91	0.606	1.15	0.526	1.00	1.00	0.526	No
400	32.81	1.89	0.90	0.99	0.90	0.605	1.15	0.526	1.00	1.00	0.526	No
401	32.89	1.90	0.90	1.00	0.90	0.605	1.15	0.526	1.00	1.00	0.526	No
402	32.97	1.90	0.90	1.00	0.90	0.604	1.15	0.526	1.00	1.00	0.526	No
403	33.05	1.91	0.91	1.00	0.90	0.604	1.15	0.525	1.00	1.00	0.525	No
404	33.14	1.91	0.91	1.00	0.90	0.604	1.15	0.525	1.00	1.00	0.525	No
405	33.22	1.92	0.91	1.01	0.90	0.603	1.15	0.524	1.00	1.00	0.524	No
406	33.30	1.92	0.91	1.01	0.90	0.603	1.15	0.524	1.00	1.00	0.524	No
407	33.38	1.93	0.92	1.01	0.90	0.602	1.15	0.524	1.00	1.00	0.524	No
408	33.46	1.94	0.92	1.02	0.90	0.602	1.15	0.523	1.00	1.00	0.523	No
409	33.55	1.94	0.92	1.02	0.90	0.602	1.15	0.523	1.00	1.00	0.523	No
410	33.63	1.95	0.92	1.02	0.90	0.601	1.15	0.523	1.00	1.00	0.523	No
411	33.71	1.95	0.93	1.03	0.90	0.601	1.15	0.522	1.00	1.00	0.522	No
412	33.79	1.96	0.93	1.03	0.90	0.601	1.15	0.522	1.00	1.00	0.522	No
413	33.87	1.96	0.93	1.03	0.90	0.600	1.15	0.522	1.00	1.00	0.522	No
414	33.96	1.97	0.93	1.03	0.90	0.600	1.15	0.521	1.00	1.00	0.521	No
415	34.04	1.97	0.94	1.04	0.90	0.599	1.15	0.521	1.00	1.00	0.521	No
416	34.12	1.98	0.94	1.04	0.90	0.599	1.15	0.521	1.00	1.00	0.521	No
417	34.20	1.99	0.94	1.04	0.90	0.599	1.15	0.520	1.00	1.00	0.520	No
418	34.28	1.99	0.94	1.05	0.90	0.598	1.15	0.520	1.00	1.00	0.520	No
419	34.37	1.99	0.95	1.05	0.89	0.598	1.15	0.520	1.00	1.00	2.000	No
420	34.45	2.00	0.95	1.05	0.89	0.598	1.15	0.520	1.00	1.00	2.000	No
421	34.53	2.00	0.95	1.05	0.89	0.599	1.15	0.520	1.00	1.00	2.000	No

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
σ_v: Total overburden pressure at test point (tsf)
u_0: Water pressure at test point (tsf)
σ_v': Effective overburden pressure based on GWT during earthquake (tsf)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio
MSF: Magnitude Scaling Factor
CSR_{eq}: CSR adjusted for M=7.5
K_σ: Effective overburden stress factor
CSR^*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) calculation data ::

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
1	0.08	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
2	0.16	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
3	0.25	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
4	0.33	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
5	0.41	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
6	0.49	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
7	0.57	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
8	0.66	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
9	0.74	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
10	0.82	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
11	0.90	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
12	0.98	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
13	1.07	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
14	1.15	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
15	1.23	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
16	1.31	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
17	1.39	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
18	1.48	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
19	1.56	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
20	1.64	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
21	1.72	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
22	1.80	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
23	1.89	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
24	1.97	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
25	2.05	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
26	2.13	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
27	2.21	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
28	2.30	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
29	2.38	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
30	2.46	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
31	2.54	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
32	2.62	0.00	N/A	0.00	1.00	-1.00	1.00	N/A	4.000	No	No	2.00
33	2.71	27.12	2.41	2.65	0.78	50.96	2.43	123.67	4.000	No	No	2.00
34	2.79	36.78	2.33	2.79	0.75	69.21	2.04	141.42	4.000	No	No	2.00
35	2.87	29.80	2.43	3.08	0.78	56.00	2.51	140.63	4.000	No	No	2.00
36	2.95	24.60	2.50	3.18	0.81	46.16	2.95	136.00	4.000	No	No	2.00
37	3.03	21.34	2.53	3.09	0.82	39.99	3.48	139.06	4.000	No	No	2.00
38	3.12	19.45	2.54	2.89	0.83	36.42	3.74	136.38	4.000	No	No	2.00
39	3.20	18.42	2.55	2.75	0.83	34.45	3.85	132.63	4.000	No	No	2.00
40	3.28	17.54	2.57	2.83	0.84	32.79	4.51	147.76	4.000	No	No	2.00
41	3.36	16.89	2.60	3.03	0.85	31.55	5.55	175.07	4.000	No	No	2.00
42	3.44	16.56	2.62	3.17	0.86	30.92	6.27	193.86	4.000	No	No	2.00
43	3.53	16.32	2.63	3.19	0.86	30.46	6.56	199.66	4.000	No	No	2.00
44	3.61	15.87	2.64	3.22	0.87	29.60	7.08	209.62	4.000	No	No	2.00
45	3.69	15.22	2.66	3.32	0.88	28.35	8.17	231.61	4.000	No	No	2.00
46	3.77	14.62	2.69	3.46	0.89	27.21	9.57	260.47	4.000	No	No	2.00
47	3.85	13.90	2.72	3.67	0.90	25.84	4.96	128.20	4.000	No	Yes	2.00
48	3.94	13.34	2.75	3.82	0.91	24.77	5.24	129.87	4.000	No	Yes	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
49	4.02	12.85	2.77	3.92	0.92	23.84	5.47	130.48	1.137	No	Yes	2.00
50	4.10	12.57	2.78	3.98	0.92	23.30	5.62	130.90	1.111	No	Yes	2.00
51	4.18	12.06	2.81	4.18	0.93	22.33	5.97	133.23	1.065	No	Yes	2.00
52	4.27	11.39	2.84	4.34	0.94	21.05	6.35	133.76	1.004	No	Yes	2.00
53	4.35	10.66	2.87	4.42	0.95	19.67	6.73	132.35	0.938	No	Yes	2.00
54	4.43	9.92	2.89	4.36	0.96	18.26	7.02	128.18	0.871	No	Yes	2.00
55	4.51	9.25	2.90	4.18	0.97	16.98	7.20	122.29	0.810	No	Yes	2.00
56	4.59	9.08	2.87	3.71	0.96	16.65	6.83	113.73	0.794	No	Yes	2.00
57	4.68	8.99	2.84	3.23	0.94	16.48	6.37	104.92	0.786	No	Yes	2.00
58	4.76	9.02	2.81	2.94	0.93	16.52	6.04	99.74	0.788	No	Yes	2.00
59	4.84	8.92	2.81	2.84	0.93	16.32	5.97	97.49	0.779	No	Yes	2.00
60	4.92	9.31	2.79	2.74	0.92	17.06	5.67	96.73	0.814	No	Yes	2.00
61	5.00	10.06	2.76	2.72	0.91	18.46	5.32	98.23	0.881	No	Yes	2.00
62	5.09	10.71	2.75	2.88	0.91	19.68	5.24	103.08	0.939	No	Yes	2.00
63	5.17	11.00	2.77	3.19	0.92	20.23	5.45	110.20	0.965	No	Yes	2.00
64	5.25	10.85	2.80	3.56	0.93	19.94	5.87	116.97	0.951	No	Yes	2.00
65	5.33	10.44	2.84	3.88	0.94	19.15	6.35	121.61	0.913	No	Yes	2.00
66	5.41	10.04	2.87	4.16	0.96	18.38	6.81	125.10	0.877	No	Yes	2.00
67	5.50	9.78	2.89	4.24	0.96	17.89	7.01	125.37	0.854	No	Yes	2.00
68	5.58	9.42	2.90	4.25	0.97	17.19	7.21	123.97	0.820	No	Yes	2.00
69	5.66	8.90	2.92	4.20	0.97	16.20	7.46	120.81	0.773	No	Yes	2.00
70	5.74	8.38	2.94	4.26	0.98	15.21	7.84	119.18	0.726	No	Yes	2.00
71	5.82	8.26	2.94	4.21	0.98	14.98	7.87	117.87	0.714	No	Yes	1.97
72	5.91	8.41	2.93	4.03	0.98	15.26	7.59	115.86	0.728	No	Yes	1.99
73	5.99	8.65	2.90	3.77	0.97	15.71	7.17	112.69	0.749	No	Yes	2.00
74	6.07	8.72	2.88	3.59	0.96	15.82	6.95	109.99	0.755	No	Yes	2.00
75	6.15	8.66	2.88	3.56	0.96	15.71	6.95	109.24	0.749	No	Yes	2.00
76	6.23	8.43	2.90	3.66	0.97	15.27	7.20	109.86	0.728	No	Yes	1.95
77	6.32	8.26	2.91	3.72	0.97	14.92	7.38	110.18	0.712	No	Yes	1.89
78	6.40	8.09	2.92	3.80	0.98	14.59	7.58	110.53	0.696	No	Yes	1.84
79	6.48	7.95	2.94	3.86	0.98	14.32	7.75	110.92	0.683	No	Yes	1.79
80	6.56	7.76	2.95	3.98	0.99	13.96	8.01	111.85	0.666	No	Yes	1.74
81	6.64	7.58	2.96	4.02	0.99	13.61	8.19	111.49	0.649	No	Yes	1.69
82	6.73	7.45	2.97	3.96	0.99	13.35	8.23	109.87	0.637	No	Yes	1.65
83	6.81	7.38	2.96	3.77	0.99	13.21	8.08	106.77	0.630	No	Yes	1.62
84	6.89	7.25	2.95	3.59	0.99	12.97	7.98	103.45	0.619	No	Yes	1.58
85	6.97	7.03	2.95	3.40	0.99	12.54	7.94	99.57	0.598	No	Yes	1.52
86	7.05	6.70	2.95	3.24	0.99	11.92	8.03	95.66	0.568	No	Yes	1.44
87	7.14	6.37	2.96	3.09	0.99	11.27	8.14	91.78	0.538	No	Yes	1.36
88	7.22	6.13	2.96	2.87	0.99	10.82	8.09	87.53	0.516	No	Yes	1.29
89	7.30	6.02	2.94	2.61	0.99	10.60	7.84	83.09	0.505	No	Yes	1.26
90	7.38	6.00	2.91	2.31	0.97	10.56	7.41	78.28	0.504	No	Yes	1.25
91	7.46	5.98	2.89	2.06	0.97	10.51	7.04	74.02	0.501	No	Yes	1.24
92	7.55	5.85	2.89	1.97	0.97	10.26	7.03	72.14	0.489	No	Yes	1.21
93	7.63	5.77	2.90	1.99	0.97	10.09	7.15	72.09	0.481	No	Yes	1.18
94	7.71	5.86	2.92	2.31	0.98	10.25	7.57	77.60	0.489	No	Yes	1.19
95	7.79	6.25	2.92	2.56	0.98	10.98	7.57	83.12	0.524	No	Yes	1.27
96	7.87	7.36	2.85	2.44	0.95	13.08	6.50	84.99	0.624	No	Yes	1.51

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
97	7.96	8.40	2.77	2.14	0.92	15.04	5.46	82.07	0.717	No	Yes	1.73
98	8.04	9.32	2.69	1.83	0.89	16.77	9.63	161.54	0.425	No	No	1.02
99	8.12	9.53	2.66	1.65	0.88	17.15	7.86	134.70	0.277	No	No	0.66
100	8.20	9.80	2.64	1.57	0.87	17.65	6.78	119.72	0.216	No	No	0.51
101	8.28	10.00	2.64	1.67	0.87	18.03	7.11	128.13	0.248	No	No	0.59
102	8.37	10.09	2.65	1.78	0.88	18.19	7.67	139.52	0.299	No	No	0.71
103	8.45	9.96	2.68	1.90	0.89	17.94	8.74	156.79	0.395	No	No	0.93
104	8.53	9.46	2.70	1.91	0.89	16.98	10.00	169.79	0.482	No	No	1.13
105	8.61	8.57	2.76	2.14	0.92	15.29	5.39	82.41	0.729	No	Yes	1.70
106	8.69	7.60	2.84	2.45	0.95	13.46	6.38	85.81	0.642	No	Yes	1.49
107	8.78	6.90	2.91	2.77	0.97	12.12	7.33	88.85	0.578	No	Yes	1.34
108	8.86	6.67	2.93	2.91	0.98	11.67	7.72	90.07	0.557	No	Yes	1.29
109	8.94	6.77	2.91	2.72	0.98	11.87	7.38	87.58	0.566	No	Yes	1.30
110	9.02	7.18	2.86	2.43	0.96	12.62	6.67	84.11	0.602	No	Yes	1.38
111	9.10	7.65	2.81	2.18	0.94	13.51	5.99	80.97	0.645	No	Yes	1.47
112	9.19	7.84	2.80	2.13	0.93	13.85	5.81	80.50	0.661	No	Yes	1.51
113	9.27	9.74	2.66	1.71	0.88	17.45	7.92	138.24	0.293	No	No	0.67
114	9.35	13.92	2.44	1.21	0.80	25.33	2.61	66.21	0.107	No	No	0.24
115	9.43	18.48	2.30	1.04	0.74	33.95	1.93	65.49	0.106	No	No	0.24
116	9.51	20.50	2.25	0.97	0.72	37.76	1.74	65.69	0.106	No	No	0.24
117	9.60	19.68	2.27	1.00	0.73	36.19	1.81	65.52	0.106	No	No	0.24
118	9.68	19.29	2.24	0.88	0.72	35.45	1.74	61.60	0.102	No	No	0.23
119	9.76	22.02	2.15	0.72	0.69	40.60	1.50	61.00	0.101	No	No	0.23
120	9.84	25.07	2.07	0.62	0.66	46.35	1.38	63.88	0.104	No	No	0.23
121	9.92	26.87	2.03	0.60	0.64	49.51	1.34	66.30	0.107	No	No	0.24
122	10.01	26.11	2.07	0.66	0.65	48.31	1.37	66.40	0.107	No	No	0.24
123	10.09	26.10	2.07	0.66	0.65	48.28	1.37	66.30	0.107	No	No	0.24
124	10.17	27.20	2.03	0.58	0.64	49.54	1.33	65.98	0.107	No	No	0.23
125	10.25	28.73	1.97	0.45	0.62	51.03	1.00	51.03	0.092	No	No	0.20
126	10.33	30.12	1.92	0.36	0.60	52.21	1.00	52.21	0.093	No	No	0.20
127	10.42	31.35	1.88	0.32	0.59	53.56	1.00	53.56	0.094	No	No	0.21
128	10.50	30.99	1.91	0.37	0.60	53.35	1.00	53.35	0.094	No	No	0.20
129	10.58	28.29	2.00	0.53	0.63	50.35	1.31	65.93	0.107	No	No	0.23
130	10.66	23.30	2.16	0.82	0.69	42.93	1.52	65.29	0.106	No	No	0.23
131	10.74	19.00	2.31	1.14	0.75	34.80	1.98	68.77	0.110	No	No	0.24
132	10.83	15.89	2.43	1.39	0.79	28.92	2.52	73.00	0.116	No	No	0.25
133	10.91	13.52	2.52	1.59	0.83	24.42	3.24	79.21	0.126	No	No	0.27
134	10.99	11.03	2.63	1.82	0.87	19.71	6.60	129.99	0.256	No	No	0.55
135	11.07	8.76	2.74	1.99	0.91	15.40	5.16	79.42	0.735	No	Yes	1.57
136	11.15	7.84	2.78	1.98	0.93	13.67	5.65	77.22	0.652	No	Yes	1.39
137	11.24	7.69	2.77	1.79	0.92	13.38	5.46	73.09	0.638	No	Yes	1.36
138	11.32	11.15	2.52	1.16	0.83	19.91	3.27	65.19	0.106	No	No	0.22
139	11.40	16.09	2.30	0.79	0.74	29.23	1.91	55.77	0.096	No	No	0.20
140	11.48	19.69	2.19	0.68	0.70	35.99	1.58	56.82	0.097	No	No	0.20
141	11.56	18.83	2.23	0.79	0.72	34.40	1.71	58.72	0.099	No	No	0.21
142	11.65	15.13	2.38	1.05	0.78	27.40	2.28	62.38	0.103	No	No	0.22
143	11.73	12.16	2.56	1.56	0.84	21.78	4.12	89.75	0.147	No	No	0.31
144	11.81	10.58	2.70	2.28	0.90	18.78	4.75	89.14	0.896	No	Yes	1.87

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
145	11.89	10.91	2.73	2.63	0.91	19.39	5.03	97.61	0.925	No	Yes	1.93
146	11.98	15.31	2.54	2.00	0.83	27.71	3.54	98.05	0.168	No	No	0.35
147	12.06	26.28	2.21	1.19	0.71	47.81	1.64	78.43	0.125	No	No	0.26
148	12.14	40.56	2.00	0.87	0.63	68.77	1.31	90.03	0.148	No	No	0.31
149	12.22	57.82	1.84	0.69	0.57	92.55	1.19	110.20	0.204	No	No	0.42
150	12.30	77.84	1.69	0.55	0.51	118.35	1.00	118.35	0.234	No	No	0.48
151	12.39	104.35	1.53	0.40	0.45	149.74	1.00	149.74	0.392	No	No	0.81
152	12.47	132.35	1.41	0.32	0.41	181.77	1.00	181.77	0.639	No	No	1.32
153	12.55	158.12	1.33	0.28	0.38	210.60	1.00	210.60	4.000	No	No	2.00
154	12.63	176.22	1.29	0.28	0.36	230.94	1.00	230.94	4.000	No	No	2.00
155	12.71	189.71	1.26	0.27	0.35	246.14	1.00	246.14	4.000	No	No	2.00
156	12.80	199.34	1.28	0.32	0.36	259.68	1.00	259.68	4.000	No	No	2.00
157	12.88	206.91	1.31	0.37	0.37	271.38	1.00	271.38	4.000	No	No	2.00
158	12.96	211.03	1.30	0.38	0.37	275.83	1.00	275.83	4.000	No	No	2.00
159	13.04	211.78	1.26	0.31	0.35	272.35	1.00	272.35	4.000	No	No	2.00
160	13.12	212.72	1.19	0.23	0.32	266.85	1.00	266.85	4.000	No	No	2.00
161	13.21	217.26	1.15	0.19	0.31	268.39	1.00	268.39	4.000	No	No	2.00
162	13.29	226.44	1.12	0.17	0.30	276.65	1.00	276.65	4.000	No	No	2.00
163	13.37	235.91	1.11	0.17	0.29	286.43	1.00	286.43	4.000	No	No	2.00
164	13.45	243.48	1.09	0.16	0.28	293.47	1.00	293.47	4.000	No	No	2.00
165	13.53	248.34	1.10	0.18	0.29	299.81	1.00	299.81	4.000	No	No	2.00
166	13.62	252.74	1.14	0.23	0.31	309.31	1.00	309.31	4.000	No	No	2.00
167	13.70	253.12	1.26	0.40	0.35	321.90	1.00	321.90	4.000	No	No	2.00
168	13.78	247.24	1.38	0.60	0.40	325.87	1.00	325.87	4.000	No	No	2.00
169	13.86	231.70	1.51	0.88	0.45	317.82	1.00	317.82	4.000	No	No	2.00
170	13.94	207.10	1.62	1.12	0.49	292.75	1.00	292.75	4.000	No	No	2.00
171	14.03	169.40	1.76	1.50	0.54	249.47	1.10	274.44	4.000	No	No	2.00
172	14.11	133.25	1.87	1.78	0.59	202.53	1.22	246.97	4.000	No	No	2.00
173	14.19	107.76	1.96	1.96	0.62	167.37	1.28	213.65	4.000	No	No	2.00
174	14.27	113.02	1.87	1.51	0.58	170.20	1.22	206.89	4.000	No	No	2.00
175	14.35	134.87	1.69	0.97	0.52	192.01	1.00	192.01	0.738	No	No	1.48
176	14.44	152.40	1.52	0.59	0.45	205.70	1.00	205.70	4.000	No	No	2.00
177	14.52	154.01	1.41	0.37	0.41	200.43	1.00	200.43	4.000	No	No	2.00
178	14.60	145.04	1.40	0.32	0.40	187.64	1.00	187.64	0.694	No	No	1.39
179	14.68	138.42	1.44	0.36	0.42	181.01	1.00	181.01	0.632	No	No	1.26
180	14.76	136.42	1.50	0.45	0.44	180.97	1.00	180.97	0.631	No	No	1.26
181	14.85	139.09	1.52	0.52	0.45	185.57	1.00	185.57	0.674	No	No	1.35
182	14.93	146.28	1.52	0.56	0.45	194.92	1.00	194.92	0.769	No	No	1.53
183	15.01	151.51	1.53	0.58	0.45	201.63	1.00	201.63	4.000	No	No	2.00
184	15.09	154.90	1.53	0.61	0.46	205.98	1.00	205.98	4.000	No	No	2.00
185	15.17	158.90	1.53	0.62	0.46	210.75	1.00	210.75	4.000	No	No	2.00
186	15.26	165.61	1.51	0.61	0.45	218.14	1.00	218.14	4.000	No	No	2.00
187	15.34	172.15	1.50	0.60	0.44	225.38	1.00	225.38	4.000	No	No	2.00
188	15.42	176.55	1.49	0.60	0.44	230.23	1.00	230.23	4.000	No	No	2.00
189	15.50	178.28	1.49	0.61	0.44	232.11	1.00	232.11	4.000	No	No	2.00
190	15.58	178.94	1.49	0.61	0.44	232.44	1.00	232.44	4.000	No	No	2.00
191	15.67	180.15	1.49	0.60	0.44	233.13	1.00	233.13	4.000	No	No	2.00
192	15.75	181.86	1.48	0.58	0.44	234.32	1.00	234.32	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
193	15.83	181.88	1.48	0.58	0.44	233.90	1.00	233.90	4.000	No	No	2.00
194	15.91	178.36	1.50	0.61	0.44	230.04	1.00	230.04	4.000	No	No	2.00
195	15.99	168.69	1.54	0.67	0.46	219.56	1.00	219.56	4.000	No	No	2.00
196	16.08	156.27	1.59	0.75	0.48	205.80	1.00	205.80	4.000	No	No	2.00
197	16.16	139.00	1.67	0.86	0.51	186.15	1.00	186.15	0.680	No	No	1.34
198	16.24	118.03	1.77	1.06	0.55	161.93	1.12	180.90	0.631	No	No	1.24
199	16.32	94.22	1.91	1.38	0.60	133.49	1.24	166.16	0.507	No	No	1.00
200	16.40	71.81	2.07	1.84	0.67	105.50	1.38	145.88	0.369	No	No	0.73
201	16.49	52.67	2.24	2.42	0.73	80.20	1.73	138.63	0.328	No	No	0.64
202	16.57	36.45	2.43	3.17	0.80	57.55	2.52	144.95	0.363	No	No	0.71
203	16.65	23.92	2.63	4.14	0.88	39.06	6.44	251.60	3.600	No	No	2.00
204	16.73	16.15	2.79	4.82	0.94	26.87	5.73	154.07	1.282	No	Yes	2.00
205	16.81	11.96	2.89	4.93	0.98	19.90	7.11	141.55	0.949	No	Yes	1.86
206	16.90	10.32	2.89	4.01	0.98	16.85	7.07	119.17	0.804	No	Yes	1.57
207	16.98	12.25	2.70	2.35	0.91	19.32	4.72	91.29	0.922	No	Yes	1.80
208	17.06	16.59	2.48	1.38	0.82	25.20	2.82	70.95	0.113	No	No	0.22
209	17.14	18.98	2.41	1.29	0.80	28.54	2.45	69.97	0.112	No	No	0.22
210	17.22	17.60	2.49	1.62	0.83	26.79	2.93	78.43	0.125	No	No	0.24
211	17.31	14.15	2.64	2.21	0.88	21.95	7.04	154.64	0.382	No	No	0.74
212	17.39	14.50	2.65	2.32	0.88	22.48	7.27	163.49	0.438	No	No	0.85
213	17.47	19.23	2.52	2.04	0.84	29.33	3.19	93.70	0.157	No	No	0.30
214	17.55	23.40	2.45	2.01	0.81	35.35	2.67	94.34	0.158	No	No	0.31
215	17.63	23.75	2.47	2.15	0.82	35.89	2.75	98.79	0.170	No	No	0.33
216	17.72	22.22	2.51	2.36	0.83	33.75	3.02	101.96	0.179	No	No	0.35
217	17.80	29.12	2.34	1.67	0.77	42.79	2.08	88.85	0.145	No	No	0.28
218	17.88	42.89	2.10	1.04	0.68	60.05	1.41	84.86	0.137	No	No	0.27
219	17.96	50.13	1.98	0.78	0.63	68.35	1.29	88.20	0.144	No	No	0.28
220	18.04	47.13	2.01	0.82	0.64	64.50	1.32	84.91	0.137	No	No	0.26
221	18.13	36.19	2.17	1.12	0.70	50.96	1.55	79.00	0.126	No	No	0.24
222	18.21	27.67	2.35	1.60	0.77	40.10	2.12	85.19	0.138	No	No	0.27
223	18.29	19.78	2.55	2.27	0.85	29.45	3.83	112.80	0.213	No	No	0.41
224	18.37	14.08	2.74	3.05	0.92	21.35	5.10	108.95	1.018	No	Yes	1.96
225	18.45	10.94	2.87	3.59	0.97	16.63	6.71	111.66	0.793	No	Yes	1.53
226	18.54	10.04	2.87	3.19	0.97	15.07	6.75	101.71	0.719	No	Yes	1.38
227	18.62	13.83	2.61	1.73	0.87	20.15	5.81	116.99	0.206	No	No	0.40
228	18.70	20.93	2.34	1.00	0.77	29.46	2.10	61.88	0.102	No	No	0.20
229	18.78	25.78	2.25	0.90	0.73	35.77	1.74	62.39	0.103	No	No	0.20
230	18.86	25.34	2.30	1.12	0.76	35.48	1.93	68.58	0.110	No	No	0.21
231	18.95	20.37	2.47	1.70	0.82	29.23	2.81	82.11	0.131	No	No	0.25
232	19.03	16.11	2.64	2.42	0.88	23.55	7.00	164.88	0.447	No	No	0.86
233	19.11	12.42	2.81	3.33	0.95	18.38	5.99	110.05	0.877	No	Yes	1.68
234	19.19	10.05	2.91	3.68	0.99	14.81	7.38	109.29	0.706	No	Yes	1.35
235	19.27	8.33	2.98	3.66	1.00	12.01	8.49	101.96	0.573	No	Yes	1.09
236	19.36	7.06	3.02	3.20	1.00	9.87	9.09	89.70	0.471	No	Yes	0.90
237	19.44	6.22	3.03	2.64	1.00	8.45	9.25	78.16	0.403	No	Yes	0.77
238	19.52	5.89	2.99	1.98	1.00	7.89	8.56	67.52	0.376	No	Yes	0.72
239	19.60	5.89	2.93	1.47	0.99	7.83	7.59	59.42	0.374	No	Yes	0.71
240	19.69	6.00	2.88	1.17	0.97	7.91	6.86	54.32	0.377	No	Yes	0.72

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
241	19.77	6.14	2.85	1.05	0.96	8.07	6.48	52.28	0.385	No	Yes	0.73
242	19.85	6.42	2.82	0.98	0.95	8.44	6.07	51.22	0.403	No	Yes	0.76
243	19.93	6.77	2.79	0.94	0.94	8.93	5.70	50.91	0.426	No	Yes	0.81
244	20.01	7.30	2.74	0.87	0.92	9.64	5.17	49.84	0.460	No	Yes	0.87
245	20.10	7.63	2.71	0.79	0.91	10.06	4.79	48.23	0.480	No	Yes	0.91
246	20.18	7.87	2.70	0.80	0.91	10.38	10.04	104.16	0.167	No	No	0.31
247	20.26	8.23	2.69	0.84	0.90	10.89	9.54	103.91	0.166	No	No	0.31
248	20.34	8.71	2.68	0.93	0.90	11.58	9.17	106.25	0.172	No	No	0.32
249	20.42	9.25	2.69	1.08	0.90	12.38	9.41	116.58	0.205	No	No	0.38
250	20.51	9.85	2.70	1.32	0.91	13.31	4.73	62.99	0.635	No	Yes	1.19
251	20.59	10.66	2.70	1.50	0.91	14.48	10.08	145.96	0.332	No	No	0.62
252	20.67	10.77	2.71	1.62	0.91	14.66	4.83	70.77	0.699	No	Yes	1.31
253	20.75	10.68	2.71	1.60	0.91	14.48	4.85	70.21	0.691	No	Yes	1.29
254	20.83	10.86	2.73	1.80	0.92	14.78	5.07	74.85	0.705	No	Yes	1.32
255	20.92	14.47	2.62	1.77	0.88	19.78	6.29	124.40	0.233	No	No	0.44
256	21.00	17.66	2.56	1.82	0.86	24.14	4.15	100.30	0.174	No	No	0.33
257	21.08	18.59	2.55	1.90	0.85	25.40	3.96	100.63	0.175	No	No	0.33
258	21.16	15.57	2.66	2.26	0.89	21.37	7.79	166.40	0.458	No	No	0.86
259	21.24	12.02	2.82	3.00	0.95	16.56	6.09	100.90	0.790	No	Yes	1.47
260	21.33	9.91	2.94	3.73	1.00	13.59	7.88	107.07	0.648	No	Yes	1.21
261	21.41	9.14	2.99	3.89	1.00	12.35	8.59	106.13	0.589	No	Yes	1.10
262	21.49	10.84	2.87	3.16	0.98	14.76	6.81	100.56	0.704	No	Yes	1.31
263	21.57	25.63	2.37	1.41	0.78	33.94	2.24	75.96	0.121	No	No	0.22
264	21.65	52.86	1.98	0.76	0.64	66.56	1.29	86.02	0.139	No	No	0.26
265	21.74	80.92	1.74	0.49	0.54	97.97	1.00	97.97	0.167	No	No	0.31
266	21.82	95.46	1.64	0.40	0.50	113.49	1.00	113.49	0.216	No	No	0.40
267	21.90	88.44	1.72	0.53	0.54	106.57	1.04	110.41	0.205	No	No	0.38
268	21.98	71.18	1.93	0.92	0.62	88.55	1.26	111.22	0.208	No	No	0.39
269	22.06	49.69	2.19	1.62	0.72	64.18	1.60	102.39	0.180	No	No	0.33
270	22.15	34.10	2.42	2.39	0.80	45.20	2.47	111.79	0.210	No	No	0.39
271	22.23	23.47	2.61	3.07	0.88	31.54	5.67	178.73	0.550	No	No	1.02
272	22.31	16.70	2.77	3.71	0.94	22.51	5.51	124.16	1.074	No	Yes	1.99
273	22.39	12.34	2.90	4.06	0.99	16.48	7.23	119.14	0.786	No	Yes	1.46
274	22.47	10.58	2.91	3.37	0.99	13.85	7.37	102.13	0.661	No	Yes	1.23
275	22.56	9.76	2.82	2.01	0.96	12.41	6.15	76.25	0.592	No	Yes	1.10
276	22.64	9.38	2.68	0.93	0.91	11.55	9.27	107.08	0.175	No	No	0.32
277	22.72	9.18	2.58	0.45	0.86	11.04	4.69	51.78	0.093	No	No	0.17
278	22.80	9.85	2.50	0.32	0.84	11.80	2.90	34.16	0.078	No	No	0.15
279	22.88	11.26	2.43	0.28	0.81	13.54	2.54	34.40	0.079	No	No	0.15
280	22.97	12.37	2.39	0.27	0.79	14.90	2.30	34.31	0.079	No	No	0.15
281	23.05	12.58	2.38	0.27	0.79	15.14	2.27	34.40	0.079	No	No	0.15
282	23.13	11.80	2.41	0.28	0.80	14.15	2.43	34.45	0.079	No	No	0.14
283	23.21	11.56	2.43	0.29	0.81	13.84	2.52	34.94	0.079	No	No	0.15
284	23.29	12.74	2.42	0.37	0.80	15.38	2.46	37.85	0.082	No	No	0.15
285	23.38	14.61	2.43	0.58	0.81	17.88	2.51	44.90	0.087	No	No	0.16
286	23.46	15.74	2.48	0.93	0.83	19.54	2.86	55.91	0.096	No	No	0.18
287	23.54	15.23	2.64	1.81	0.89	19.28	6.87	132.54	0.267	No	No	0.49
288	23.62	15.41	2.72	2.58	0.92	19.75	4.90	96.83	0.942	No	Yes	1.73

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
289	23.70	24.73	2.50	2.08	0.84	31.55	2.81	88.55	0.145	No	No	0.27
290	23.79	59.20	2.02	0.98	0.65	71.97	1.32	95.18	0.160	No	No	0.29
291	23.87	121.18	1.71	0.73	0.53	141.55	1.00	142.08	0.347	No	No	0.64
292	23.95	192.00	1.53	0.64	0.46	218.40	1.00	218.40	4.000	No	No	2.00
293	24.03	251.64	1.44	0.64	0.43	282.57	1.00	282.57	4.000	No	No	2.00
294	24.11	286.52	1.38	0.59	0.41	318.49	1.00	318.49	4.000	No	No	2.00
295	24.20	303.76	1.38	0.62	0.41	337.21	1.00	337.21	4.000	No	No	2.00
296	24.28	311.89	1.42	0.73	0.43	347.84	1.00	347.84	4.000	No	No	2.00
297	24.36	320.49	1.46	0.84	0.44	359.02	1.00	359.02	4.000	No	No	2.00
298	24.44	329.89	1.48	0.90	0.45	369.78	1.00	369.78	4.000	No	No	2.00
299	24.52	336.50	1.46	0.85	0.44	375.34	1.00	375.34	4.000	No	No	2.00
300	24.61	342.35	1.40	0.73	0.42	378.18	1.00	378.18	4.000	No	No	2.00
301	24.69	355.51	1.33	0.60	0.39	388.07	1.00	388.07	4.000	No	No	2.00
302	24.77	346.44	1.27	0.47	0.37	374.29	1.00	374.29	4.000	No	No	2.00
303	24.85	339.05	1.29	0.50	0.38	366.95	1.00	366.95	4.000	No	No	2.00
304	24.93	322.43	1.32	0.52	0.39	349.67	1.00	349.67	4.000	No	No	2.00
305	25.02	326.72	1.30	0.50	0.38	353.24	1.00	353.24	4.000	No	No	2.00
306	25.10	324.65	1.24	0.39	0.36	347.34	1.00	347.34	4.000	No	No	2.00
307	25.18	322.15	1.18	0.31	0.33	341.54	1.00	341.54	4.000	No	No	2.00
308	25.26	319.28	1.13	0.26	0.32	336.01	1.00	336.01	4.000	No	No	2.00
309	25.34	322.46	1.13	0.26	0.32	338.95	1.00	338.95	4.000	No	No	2.00
310	25.43	328.27	1.13	0.26	0.32	344.64	1.00	344.64	4.000	No	No	2.00
311	25.51	333.69	1.13	0.27	0.32	350.00	1.00	350.00	4.000	No	No	2.00
312	25.59	334.37	1.13	0.26	0.31	350.16	1.00	350.16	4.000	No	No	2.00
313	25.67	336.48	1.08	0.22	0.30	350.08	1.00	350.08	4.000	No	No	2.00
314	25.75	338.84	1.10	0.24	0.31	353.18	1.00	353.18	4.000	No	No	2.00
315	25.84	334.67	1.13	0.26	0.31	349.46	1.00	349.46	4.000	No	No	2.00
316	25.92	335.89	1.16	0.31	0.33	351.97	1.00	351.97	4.000	No	No	2.00
317	26.00	338.05	1.20	0.36	0.34	355.59	1.00	355.59	4.000	No	No	2.00
318	26.08	341.44	1.22	0.38	0.35	359.45	1.00	359.45	4.000	No	No	2.00
319	26.16	340.57	1.20	0.36	0.34	357.32	1.00	357.32	4.000	No	No	2.00
320	26.25	337.18	1.18	0.32	0.33	352.37	1.00	352.37	4.000	No	No	2.00
321	26.33	340.69	1.14	0.29	0.32	354.31	1.00	354.31	4.000	No	No	2.00
322	26.41	344.74	1.21	0.38	0.35	361.13	1.00	361.13	4.000	No	No	2.00
323	26.49	353.02	1.18	0.35	0.34	368.08	1.00	368.08	4.000	No	No	2.00
324	26.57	366.83	1.15	0.32	0.32	380.58	1.00	380.58	4.000	No	No	2.00
325	26.66	372.94	1.08	0.25	0.30	383.78	1.00	383.78	4.000	No	No	2.00
326	26.74	371.58	1.10	0.26	0.30	382.50	1.00	382.50	4.000	No	No	2.00
327	26.82	362.86	1.09	0.25	0.30	373.00	1.00	373.00	4.000	No	No	2.00
328	26.90	357.12	1.10	0.25	0.31	366.92	1.00	366.92	4.000	No	No	2.00
329	26.98	354.79	1.19	0.35	0.34	367.64	1.00	367.64	4.000	No	No	2.00
330	27.07	349.99	1.31	0.54	0.39	367.17	1.00	367.17	4.000	No	No	2.00
331	27.15	342.74	1.36	0.62	0.41	361.02	1.00	361.02	4.000	No	No	2.00
332	27.23	338.92	1.36	0.61	0.41	356.39	1.00	356.39	4.000	No	No	2.00
333	27.31	335.29	1.32	0.52	0.39	350.52	1.00	350.52	4.000	No	No	2.00
334	27.40	339.19	1.29	0.49	0.38	353.33	1.00	353.33	4.000	No	No	2.00
335	27.48	330.79	1.29	0.47	0.38	344.05	1.00	344.05	4.000	No	No	2.00
336	27.56	324.07	1.34	0.55	0.40	338.34	1.00	338.34	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
337	27.64	311.43	1.40	0.63	0.42	326.38	1.00	326.38	4.000	No	No	2.00
338	27.72	309.19	1.43	0.70	0.43	324.61	1.00	324.61	4.000	No	No	2.00
339	27.81	316.54	1.46	0.79	0.45	332.86	1.00	332.86	4.000	No	No	2.00
340	27.89	330.23	1.46	0.81	0.45	346.79	1.00	346.79	4.000	No	No	2.00
341	27.97	351.70	1.46	0.85	0.45	368.87	1.00	368.87	4.000	No	No	2.00
342	28.05	377.19	1.40	0.75	0.42	392.97	1.00	392.97	4.000	No	No	2.00
343	28.13	416.87	1.35	0.69	0.40	431.65	1.00	431.65	4.000	No	No	2.00
344	28.22	468.07	1.31	0.66	0.39	482.47	1.00	482.47	4.000	No	No	2.00
345	28.30	491.65	1.36	0.81	0.41	508.66	1.00	508.66	4.000	No	No	2.00
346	28.38	492.95	1.42	0.96	0.43	511.87	1.00	511.87	4.000	No	No	2.00
347	28.46	471.37	1.43	0.96	0.44	489.11	1.00	489.11	4.000	No	No	2.00
348	28.54	467.38	1.38	0.83	0.42	482.21	1.00	482.21	4.000	No	No	2.00
349	28.63	453.68	1.33	0.69	0.40	465.30	1.00	465.30	4.000	No	No	2.00
350	28.71	440.31	1.37	0.77	0.41	452.52	1.00	452.52	4.000	No	No	2.00
351	28.79	419.18	1.40	0.81	0.42	431.15	1.00	431.15	4.000	No	No	2.00
352	28.87	409.28	1.37	0.72	0.41	419.28	1.00	419.28	4.000	No	No	2.00
353	28.95	408.93	1.30	0.58	0.39	416.12	1.00	416.12	4.000	No	No	2.00
354	29.04	400.44	1.20	0.41	0.35	403.87	1.00	403.87	4.000	No	No	2.00
355	29.12	406.90	1.19	0.40	0.34	409.53	1.00	409.53	4.000	No	No	2.00
356	29.20	388.43	1.22	0.43	0.36	391.58	1.00	391.58	4.000	No	No	2.00
357	29.28	366.12	1.32	0.56	0.40	371.25	1.00	371.25	4.000	No	No	2.00
358	29.36	315.81	1.51	0.89	0.47	323.87	1.00	323.87	4.000	No	No	2.00
359	29.45	294.56	1.54	0.92	0.48	302.13	1.00	302.13	4.000	No	No	2.00
360	29.53	278.70	1.58	0.98	0.49	286.09	1.00	286.09	4.000	No	No	2.00
361	29.61	295.81	1.48	0.76	0.46	301.25	1.00	301.25	4.000	No	No	2.00
362	29.69	300.94	1.55	0.94	0.48	307.40	1.00	307.40	4.000	No	No	2.00
363	29.77	309.55	1.60	1.13	0.50	316.87	1.00	316.87	4.000	No	No	2.00
364	29.86	296.92	1.70	1.46	0.54	305.28	1.00	305.28	4.000	No	No	2.00
365	29.94	261.05	1.79	1.72	0.57	269.20	1.14	306.85	4.000	No	No	2.00
366	30.02	217.14	1.89	1.99	0.61	224.52	1.23	275.52	4.000	No	No	2.00
367	30.10	174.84	1.99	2.26	0.65	181.16	1.30	234.85	4.000	No	No	2.00
368	30.18	139.27	2.10	2.66	0.69	144.63	1.42	205.72	4.000	No	No	2.00
369	30.27	117.43	2.16	2.72	0.71	121.78	1.52	184.82	0.667	No	No	1.25
370	30.35	110.66	2.17	2.67	0.72	114.48	1.54	176.63	0.592	No	No	1.11
371	30.43	141.61	1.97	1.77	0.64	145.07	1.28	185.93	0.678	No	No	1.27
372	30.51	190.02	1.74	1.13	0.56	192.54	1.07	205.83	4.000	No	No	2.00
373	30.59	214.01	1.58	0.75	0.50	214.87	1.00	214.87	4.000	No	No	2.00
374	30.68	224.77	1.50	0.61	0.47	224.59	1.00	224.59	4.000	No	No	2.00
375	30.76	221.23	1.54	0.68	0.48	221.12	1.00	221.12	4.000	No	No	2.00
376	30.84	230.20	1.54	0.70	0.48	229.82	1.00	229.82	4.000	No	No	2.00
377	30.92	234.19	1.48	0.59	0.46	232.87	1.00	232.87	4.000	No	No	2.00
378	31.00	237.11	1.37	0.40	0.42	234.30	1.00	234.30	4.000	No	No	2.00
379	31.09	236.75	1.38	0.42	0.42	233.82	1.00	233.82	4.000	No	No	2.00
380	31.17	237.58	1.41	0.46	0.43	234.67	1.00	234.67	4.000	No	No	2.00
381	31.25	240.72	1.46	0.56	0.45	237.99	1.00	237.99	4.000	No	No	2.00
382	31.33	248.62	1.41	0.48	0.43	245.03	1.00	245.03	4.000	No	No	2.00
383	31.41	237.02	1.44	0.51	0.44	233.53	1.00	233.53	4.000	No	No	2.00
384	31.50	226.70	1.48	0.56	0.46	223.40	1.00	223.40	4.000	No	No	2.00

:: Cyclic Resistance Ratio (CRR) calculation data :: (continued)

Point ID	Depth (ft)	q_t (tsf)	I_c	Fr (%)	n	Q_{tn}	K_c	$Q_{tn,cs}$	$CRR_{7.5}$	Belongs to trans. layer	Clay-like behaviour	FS
385	31.58	215.54	1.52	0.60	0.47	212.38	1.00	212.38	4.000	No	No	2.00
386	31.66	221.35	1.51	0.59	0.47	217.75	1.00	217.75	4.000	No	No	2.00
387	31.74	223.84	1.53	0.64	0.48	220.10	1.00	220.10	4.000	No	No	2.00
388	31.82	232.84	1.55	0.73	0.49	228.94	1.00	228.94	4.000	No	No	2.00
389	31.91	243.06	1.56	0.79	0.49	238.84	1.00	238.84	4.000	No	No	2.00
390	31.99	236.70	1.53	0.69	0.48	231.97	1.00	231.97	4.000	No	No	2.00
391	32.07	217.78	1.65	0.95	0.53	213.87	1.00	213.87	4.000	No	No	2.00
392	32.15	206.33	1.65	0.89	0.52	202.21	1.00	202.21	4.000	No	No	2.00
393	32.23	209.75	1.64	0.87	0.52	205.22	1.00	205.22	4.000	No	No	2.00
394	32.32	237.77	1.37	0.38	0.42	230.63	1.00	230.63	4.000	No	No	2.00
395	32.40	259.14	1.47	0.62	0.46	252.02	1.00	252.02	4.000	No	No	2.00
396	32.48	287.00	1.58	0.97	0.50	279.83	1.00	279.83	4.000	No	No	2.00
397	32.56	287.50	1.71	1.42	0.55	280.89	1.01	283.16	4.000	No	No	2.00
398	32.64	277.86	1.73	1.46	0.56	271.10	1.05	283.97	4.000	No	No	2.00
399	32.73	266.02	1.75	1.48	0.56	259.14	1.08	279.25	4.000	No	No	2.00
400	32.81	257.63	1.74	1.42	0.56	250.47	1.07	267.54	4.000	No	No	2.00
401	32.89	251.98	1.78	1.58	0.58	244.78	1.13	277.58	4.000	No	No	2.00
402	32.97	259.58	1.78	1.58	0.57	251.74	1.12	282.85	4.000	No	No	2.00
403	33.05	301.26	1.71	1.45	0.55	291.53	1.00	292.27	4.000	No	No	2.00
404	33.14	373.43	1.60	1.25	0.51	360.47	1.00	360.47	4.000	No	No	2.00
405	33.22	475.02	1.46	0.99	0.45	457.15	1.00	457.15	4.000	No	No	2.00
406	33.30	534.68	1.36	0.82	0.42	513.21	1.00	513.21	4.000	No	No	2.00
407	33.38	567.24	1.29	0.68	0.39	543.20	1.00	543.20	4.000	No	No	2.00
408	33.46	563.79	1.25	0.61	0.37	538.97	1.00	538.97	4.000	No	No	2.00
409	33.55	588.20	1.21	0.57	0.36	561.48	1.00	561.48	4.000	No	No	2.00
410	33.63	584.31	1.20	0.55	0.36	557.12	1.00	557.12	4.000	No	No	2.00
411	33.71	555.56	1.28	0.67	0.39	529.55	1.00	529.55	4.000	No	No	2.00
412	33.79	508.87	1.37	0.80	0.42	484.79	1.00	484.79	4.000	No	No	2.00
413	33.87	496.39	1.40	0.86	0.43	472.43	1.00	472.43	4.000	No	No	2.00
414	33.96	522.36	1.35	0.78	0.41	496.39	1.00	496.39	4.000	No	No	2.00
415	34.04	544.22	1.32	0.73	0.40	516.50	1.00	516.50	4.000	No	No	2.00
416	34.12	563.30	1.31	0.72	0.40	534.01	1.00	534.01	4.000	No	No	2.00
417	34.20	560.70	1.17	0.49	0.35	530.56	1.00	530.56	4.000	No	No	2.00
418	34.28	538.94	0.99	0.26	0.28	509.04	1.00	509.04	4.000	No	No	2.00
419	34.37	515.81	N/A	0.00	1.00	490.60	1.00	490.60	4.000	No	No	2.00
420	34.45	530.29	N/A	0.00	1.00	503.93	1.00	503.93	4.000	No	No	2.00
421	34.53	569.06	N/A	0.00	1.00	540.38	1.00	540.38	4.000	No	No	2.00

Abbreviations

Depth: Depth from free surface, at which CPT was performed (ft)
q_t: Total cone resistance
I_c: Soil behavior type index
Fr: Normalized friction ratio (%)
n: Stress exponent
Q_{tn}: Normalized cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for M_w=7.5
FS: Factor of safety against soil liquefaction

:: Liquefaction Potential Index calculation data ::

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
0.08	2.00	0.00	0.00	0.00	0.00	0.16	2.00	0.00	0.00	0.00	0.00
0.25	2.00	0.00	0.00	0.00	0.00	0.33	2.00	0.00	0.00	0.00	0.00
0.41	2.00	0.00	0.00	0.00	0.00	0.49	2.00	0.00	0.00	0.00	0.00
0.57	2.00	0.00	0.00	0.00	0.00	0.66	2.00	0.00	0.00	0.00	0.00
0.74	2.00	0.00	0.00	0.00	0.00	0.82	2.00	0.00	0.00	0.00	0.00
0.90	2.00	0.00	0.00	0.00	0.00	0.98	2.00	0.00	0.00	0.00	0.00
1.07	2.00	0.00	0.00	0.00	0.00	1.15	2.00	0.00	0.00	0.00	0.00
1.23	2.00	0.00	0.00	0.00	0.00	1.31	2.00	0.00	0.00	0.00	0.00
1.39	2.00	0.00	0.00	0.00	0.00	1.48	2.00	0.00	0.00	0.00	0.00
1.56	2.00	0.00	0.00	0.00	0.00	1.64	2.00	0.00	0.00	0.00	0.00
1.72	2.00	0.00	0.00	0.00	0.00	1.80	2.00	0.00	0.00	0.00	0.00
1.89	2.00	0.00	0.00	0.00	0.00	1.97	2.00	0.00	0.00	0.00	0.00
2.05	2.00	0.00	0.00	0.00	0.00	2.13	2.00	0.00	0.00	0.00	0.00
2.21	2.00	0.00	0.00	0.00	0.00	2.30	2.00	0.00	0.00	0.00	0.00
2.38	2.00	0.00	0.00	0.00	0.00	2.46	2.00	0.00	0.00	0.00	0.00
2.54	2.00	0.00	0.00	0.00	0.00	2.62	2.00	0.00	0.00	0.00	0.00
2.71	2.00	0.00	0.00	0.08	0.00	2.79	2.00	0.00	0.00	0.08	0.00
2.87	2.00	0.00	0.00	0.08	0.00	2.95	2.00	0.00	0.00	0.08	0.00
3.03	2.00	0.00	0.00	0.08	0.00	3.12	2.00	0.00	0.00	0.08	0.00
3.20	2.00	0.00	0.00	0.08	0.00	3.28	2.00	0.00	0.00	0.08	0.00
3.36	2.00	0.00	0.00	0.08	0.00	3.44	2.00	0.00	0.00	0.08	0.00
3.53	2.00	0.00	0.00	0.08	0.00	3.61	2.00	0.00	0.00	0.08	0.00
3.69	2.00	0.00	0.00	0.08	0.00	3.77	2.00	0.00	0.00	0.08	0.00
3.85	2.00	0.00	0.00	0.08	0.00	3.94	2.00	0.00	0.00	0.08	0.00
4.02	2.00	0.00	0.00	0.08	0.00	4.10	2.00	0.00	0.00	0.08	0.00
4.18	2.00	0.00	0.00	0.08	0.00	4.27	2.00	0.00	0.00	0.08	0.00
4.35	2.00	0.00	0.00	0.08	0.00	4.43	2.00	0.00	0.00	0.08	0.00
4.51	2.00	0.00	0.00	0.08	0.00	4.59	2.00	0.00	0.00	0.08	0.00
4.68	2.00	0.00	0.00	0.08	0.00	4.76	2.00	0.00	0.00	0.08	0.00
4.84	2.00	0.00	0.00	0.08	0.00	4.92	2.00	0.00	0.00	0.08	0.00
5.00	2.00	0.00	0.00	0.08	0.00	5.09	2.00	0.00	0.00	0.08	0.00
5.17	2.00	0.00	0.00	0.08	0.00	5.25	2.00	0.00	0.00	0.08	0.00
5.33	2.00	0.00	0.00	0.08	0.00	5.41	2.00	0.00	0.00	0.08	0.00
5.50	2.00	0.00	0.00	0.08	0.00	5.58	2.00	0.00	0.00	0.08	0.00
5.66	2.00	0.00	0.00	0.08	0.00	5.74	2.00	0.00	0.00	0.08	0.00
5.82	1.97	0.00	0.00	0.08	0.00	5.91	1.99	0.00	0.00	0.08	0.00
5.99	2.00	0.00	0.00	0.08	0.00	6.07	2.00	0.00	0.00	0.08	0.00
6.15	2.00	0.00	0.00	0.08	0.00	6.23	1.95	0.00	0.00	0.08	0.00
6.32	1.89	0.00	0.00	0.08	0.00	6.40	1.84	0.00	0.00	0.08	0.00
6.48	1.79	0.00	0.00	0.08	0.00	6.56	1.74	0.00	0.00	0.08	0.00
6.64	1.69	0.00	0.00	0.08	0.00	6.73	1.65	0.00	0.00	0.08	0.00
6.81	1.62	0.00	0.00	0.08	0.00	6.89	1.58	0.00	0.00	0.08	0.00
6.97	1.52	0.00	0.00	0.08	0.00	7.05	1.44	0.00	0.00	0.08	0.00
7.14	1.36	0.00	0.00	0.08	0.00	7.22	1.29	0.00	0.00	0.08	0.00
7.30	1.26	0.00	0.00	0.08	0.00	7.38	1.25	0.00	0.00	0.08	0.00
7.46	1.24	0.00	0.00	0.08	0.00	7.55	1.21	0.00	0.00	0.08	0.00
7.63	1.18	0.00	0.00	0.08	0.00	7.71	1.19	0.00	0.00	0.08	0.00
7.79	1.27	0.00	0.00	0.08	0.00	7.87	1.51	0.00	0.00	0.08	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
7.96	1.73	0.00	0.00	0.08	0.00	8.04	1.02	0.00	0.00	0.08	0.00
8.12	0.66	0.00	0.00	0.08	0.07	8.20	0.51	0.00	0.00	0.08	0.11
8.28	0.59	0.00	0.00	0.08	0.09	8.37	0.71	0.00	0.00	0.08	0.06
8.45	0.93	0.00	0.00	0.08	0.02	8.53	1.13	0.00	0.00	0.08	0.00
8.61	1.70	0.00	0.00	0.08	0.00	8.69	1.49	0.00	0.00	0.08	0.00
8.78	1.34	0.00	0.00	0.08	0.00	8.86	1.29	0.00	0.00	0.08	0.00
8.94	1.30	0.00	0.00	0.08	0.00	9.02	1.38	0.00	0.00	0.08	0.00
9.10	1.47	0.00	0.00	0.08	0.00	9.19	1.51	0.00	0.00	0.08	0.00
9.27	0.67	0.33	0.80	0.08	0.07	9.35	0.24	0.76	0.29	0.08	0.16
9.43	0.24	0.76	0.29	0.08	0.16	9.51	0.24	0.76	0.29	0.08	0.16
9.60	0.24	0.76	0.29	0.08	0.16	9.68	0.23	0.77	0.29	0.08	0.16
9.76	0.23	0.77	0.29	0.08	0.16	9.84	0.23	0.77	0.29	0.08	0.16
9.92	0.24	0.76	0.29	0.08	0.16	10.01	0.24	0.76	0.29	0.08	0.16
10.09	0.24	0.76	0.29	0.08	0.16	10.17	0.23	0.77	0.29	0.08	0.16
10.25	0.20	0.80	0.28	0.08	0.17	10.33	0.20	0.80	0.28	0.08	0.17
10.42	0.21	0.79	0.28	0.08	0.17	10.50	0.20	0.80	0.28	0.08	0.17
10.58	0.23	0.77	0.29	0.08	0.16	10.66	0.23	0.77	0.29	0.08	0.16
10.74	0.24	0.76	0.29	0.08	0.16	10.83	0.25	0.75	0.30	0.08	0.16
10.91	0.27	0.73	0.31	0.08	0.15	10.99	0.55	0.45	0.54	0.08	0.09
11.07	1.57	0.00	0.00	0.08	0.00	11.15	1.39	0.00	0.00	0.08	0.00
11.24	1.36	0.00	0.00	0.08	0.00	11.32	0.22	0.78	0.29	0.08	0.16
11.40	0.20	0.80	0.28	0.08	0.16	11.48	0.20	0.80	0.28	0.08	0.16
11.56	0.21	0.79	0.28	0.08	0.16	11.65	0.22	0.78	0.28	0.08	0.16
11.73	0.31	0.69	0.33	0.08	0.14	11.81	1.87	0.00	0.00	0.08	0.00
11.89	1.93	0.00	0.00	0.08	0.00	11.98	0.35	0.65	0.35	0.08	0.13
12.06	0.26	0.74	0.30	0.08	0.15	12.14	0.31	0.69	0.33	0.08	0.14
12.22	0.42	0.58	0.40	0.08	0.12	12.30	0.48	0.52	0.46	0.08	0.10
12.39	0.81	0.00	0.00	0.08	0.04	12.47	1.32	0.00	0.00	0.08	0.00
12.55	2.00	0.00	0.00	0.08	0.00	12.63	2.00	0.00	0.00	0.08	0.00
12.71	2.00	0.00	0.00	0.08	0.00	12.80	2.00	0.00	0.00	0.08	0.00
12.88	2.00	0.00	0.00	0.08	0.00	12.96	2.00	0.00	0.00	0.08	0.00
13.04	2.00	0.00	0.00	0.08	0.00	13.12	2.00	0.00	0.00	0.08	0.00
13.21	2.00	0.00	0.00	0.08	0.00	13.29	2.00	0.00	0.00	0.08	0.00
13.37	2.00	0.00	0.00	0.08	0.00	13.45	2.00	0.00	0.00	0.08	0.00
13.53	2.00	0.00	0.00	0.08	0.00	13.62	2.00	0.00	0.00	0.08	0.00
13.70	2.00	0.00	0.00	0.08	0.00	13.78	2.00	0.00	0.00	0.08	0.00
13.86	2.00	0.00	0.00	0.08	0.00	13.94	2.00	0.00	0.00	0.08	0.00
14.03	2.00	0.00	0.00	0.08	0.00	14.11	2.00	0.00	0.00	0.08	0.00
14.19	2.00	0.00	0.00	0.08	0.00	14.27	2.00	0.00	0.00	0.08	0.00
14.35	1.48	0.00	0.00	0.08	0.00	14.44	2.00	0.00	0.00	0.08	0.00
14.52	2.00	0.00	0.00	0.08	0.00	14.60	1.39	0.00	0.00	0.08	0.00
14.68	1.26	0.00	0.00	0.08	0.00	14.76	1.26	0.00	0.00	0.08	0.00
14.85	1.35	0.00	0.00	0.08	0.00	14.93	1.53	0.00	0.00	0.08	0.00
15.01	2.00	0.00	0.00	0.08	0.00	15.09	2.00	0.00	0.00	0.08	0.00
15.17	2.00	0.00	0.00	0.08	0.00	15.26	2.00	0.00	0.00	0.08	0.00
15.34	2.00	0.00	0.00	0.08	0.00	15.42	2.00	0.00	0.00	0.08	0.00
15.50	2.00	0.00	0.00	0.08	0.00	15.58	2.00	0.00	0.00	0.08	0.00
15.67	2.00	0.00	0.00	0.08	0.00	15.75	2.00	0.00	0.00	0.08	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
15.83	2.00	0.00	0.00	0.08	0.00	15.91	2.00	0.00	0.00	0.08	0.00
15.99	2.00	0.00	0.00	0.08	0.00	16.08	2.00	0.00	0.00	0.08	0.00
16.16	1.34	0.00	0.00	0.08	0.00	16.24	1.24	0.00	0.00	0.08	0.00
16.32	1.00	0.00	0.00	0.08	0.00	16.40	0.73	0.27	1.04	0.08	0.05
16.49	0.64	0.36	0.73	0.08	0.07	16.57	0.71	0.29	0.98	0.08	0.05
16.65	2.00	0.00	0.00	0.08	0.00	16.73	2.00	0.00	0.00	0.08	0.00
16.81	1.86	0.00	0.00	0.08	0.00	16.90	1.57	0.00	0.00	0.08	0.00
16.98	1.80	0.00	0.00	0.08	0.00	17.06	0.22	0.78	0.29	0.08	0.14
17.14	0.22	0.78	0.28	0.08	0.14	17.22	0.24	0.76	0.30	0.08	0.14
17.31	0.74	0.00	0.00	0.08	0.05	17.39	0.85	0.00	0.00	0.08	0.03
17.47	0.30	0.70	0.32	0.08	0.13	17.55	0.31	0.69	0.33	0.08	0.13
17.63	0.33	0.67	0.34	0.08	0.12	17.72	0.35	0.65	0.35	0.08	0.12
17.80	0.28	0.72	0.31	0.08	0.13	17.88	0.27	0.73	0.30	0.08	0.13
17.96	0.28	0.72	0.31	0.08	0.13	18.04	0.26	0.74	0.30	0.08	0.13
18.13	0.24	0.76	0.29	0.08	0.14	18.21	0.27	0.73	0.31	0.08	0.13
18.29	0.41	0.59	0.39	0.08	0.11	18.37	1.96	0.00	0.00	0.08	0.00
18.45	1.53	0.00	0.00	0.08	0.00	18.54	1.38	0.00	0.00	0.08	0.00
18.62	0.40	0.60	0.38	0.08	0.11	18.70	0.20	0.80	0.28	0.08	0.14
18.78	0.20	0.80	0.28	0.08	0.14	18.86	0.21	0.79	0.28	0.08	0.14
18.95	0.25	0.75	0.30	0.08	0.13	19.03	0.86	0.00	0.00	0.08	0.03
19.11	1.68	0.00	0.00	0.08	0.00	19.19	1.35	0.00	0.00	0.08	0.00
19.27	1.09	0.00	0.00	0.08	0.00	19.36	0.90	0.00	0.00	0.08	0.02
19.44	0.77	0.00	0.00	0.08	0.04	19.52	0.72	0.28	1.00	0.08	0.05
19.60	0.71	0.29	0.97	0.08	0.05	19.69	0.72	0.28	1.00	0.08	0.05
19.77	0.73	0.00	0.00	0.08	0.05	19.85	0.76	0.00	0.00	0.08	0.04
19.93	0.81	0.00	0.00	0.08	0.03	20.01	0.87	0.00	0.00	0.08	0.02
20.10	0.91	0.00	0.00	0.08	0.02	20.18	0.31	0.69	0.33	0.08	0.12
20.26	0.31	0.69	0.33	0.08	0.12	20.34	0.32	0.68	0.34	0.08	0.12
20.42	0.38	0.62	0.37	0.08	0.11	20.51	1.19	0.00	0.00	0.08	0.00
20.59	0.62	0.38	0.68	0.08	0.06	20.67	1.31	0.00	0.00	0.08	0.00
20.75	1.29	0.00	0.00	0.08	0.00	20.83	1.32	0.00	0.00	0.08	0.00
20.92	0.44	0.56	0.41	0.08	0.10	21.00	0.33	0.67	0.34	0.08	0.11
21.08	0.33	0.67	0.34	0.08	0.11	21.16	0.86	0.00	0.00	0.08	0.02
21.24	1.47	0.00	0.00	0.08	0.00	21.33	1.21	0.00	0.00	0.08	0.00
21.41	1.10	0.00	0.00	0.08	0.00	21.49	1.31	0.00	0.00	0.08	0.00
21.57	0.22	0.78	0.29	0.08	0.13	21.65	0.26	0.74	0.30	0.08	0.12
21.74	0.31	0.69	0.33	0.08	0.12	21.82	0.40	0.60	0.39	0.08	0.10
21.90	0.38	0.62	0.37	0.08	0.10	21.98	0.39	0.61	0.38	0.08	0.10
22.06	0.33	0.67	0.34	0.08	0.11	22.15	0.39	0.61	0.38	0.08	0.10
22.23	1.02	0.00	0.00	0.08	0.00	22.31	1.99	0.00	0.00	0.08	0.00
22.39	1.46	0.00	0.00	0.08	0.00	22.47	1.23	0.00	0.00	0.08	0.00
22.56	1.10	0.00	0.00	0.08	0.00	22.64	0.32	0.68	0.34	0.08	0.11
22.72	0.17	0.83	0.27	0.08	0.14	22.80	0.15	0.85	0.26	0.08	0.14
22.88	0.15	0.85	0.26	0.08	0.14	22.97	0.15	0.85	0.26	0.08	0.14
23.05	0.15	0.85	0.26	0.08	0.14	23.13	0.14	0.86	0.26	0.08	0.14
23.21	0.15	0.85	0.26	0.08	0.14	23.29	0.15	0.85	0.26	0.08	0.14
23.38	0.16	0.84	0.26	0.08	0.14	23.46	0.18	0.82	0.27	0.08	0.13
23.54	0.49	0.51	0.47	0.08	0.08	23.62	1.73	0.00	0.00	0.08	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
23.70	0.27	0.73	0.31	0.08	0.12	23.79	0.29	0.71	0.32	0.08	0.11
23.87	0.64	0.36	0.71	0.08	0.06	23.95	2.00	0.00	0.00	0.08	0.00
24.03	2.00	0.00	0.00	0.08	0.00	24.11	2.00	0.00	0.00	0.08	0.00
24.20	2.00	0.00	0.00	0.08	0.00	24.28	2.00	0.00	0.00	0.08	0.00
24.36	2.00	0.00	0.00	0.08	0.00	24.44	2.00	0.00	0.00	0.08	0.00
24.52	2.00	0.00	0.00	0.08	0.00	24.61	2.00	0.00	0.00	0.08	0.00
24.69	2.00	0.00	0.00	0.08	0.00	24.77	2.00	0.00	0.00	0.08	0.00
24.85	2.00	0.00	0.00	0.08	0.00	24.93	2.00	0.00	0.00	0.08	0.00
25.02	2.00	0.00	0.00	0.08	0.00	25.10	2.00	0.00	0.00	0.08	0.00
25.18	2.00	0.00	0.00	0.08	0.00	25.26	2.00	0.00	0.00	0.08	0.00
25.34	2.00	0.00	0.00	0.08	0.00	25.43	2.00	0.00	0.00	0.08	0.00
25.51	2.00	0.00	0.00	0.08	0.00	25.59	2.00	0.00	0.00	0.08	0.00
25.67	2.00	0.00	0.00	0.08	0.00	25.75	2.00	0.00	0.00	0.08	0.00
25.84	2.00	0.00	0.00	0.08	0.00	25.92	2.00	0.00	0.00	0.08	0.00
26.00	2.00	0.00	0.00	0.08	0.00	26.08	2.00	0.00	0.00	0.08	0.00
26.16	2.00	0.00	0.00	0.08	0.00	26.25	2.00	0.00	0.00	0.08	0.00
26.33	2.00	0.00	0.00	0.08	0.00	26.41	2.00	0.00	0.00	0.08	0.00
26.49	2.00	0.00	0.00	0.08	0.00	26.57	2.00	0.00	0.00	0.08	0.00
26.66	2.00	0.00	0.00	0.08	0.00	26.74	2.00	0.00	0.00	0.08	0.00
26.82	2.00	0.00	0.00	0.08	0.00	26.90	2.00	0.00	0.00	0.08	0.00
26.98	2.00	0.00	0.00	0.08	0.00	27.07	2.00	0.00	0.00	0.08	0.00
27.15	2.00	0.00	0.00	0.08	0.00	27.23	2.00	0.00	0.00	0.08	0.00
27.31	2.00	0.00	0.00	0.08	0.00	27.40	2.00	0.00	0.00	0.08	0.00
27.48	2.00	0.00	0.00	0.08	0.00	27.56	2.00	0.00	0.00	0.08	0.00
27.64	2.00	0.00	0.00	0.08	0.00	27.72	2.00	0.00	0.00	0.08	0.00
27.81	2.00	0.00	0.00	0.08	0.00	27.89	2.00	0.00	0.00	0.08	0.00
27.97	2.00	0.00	0.00	0.08	0.00	28.05	2.00	0.00	0.00	0.08	0.00
28.13	2.00	0.00	0.00	0.08	0.00	28.22	2.00	0.00	0.00	0.08	0.00
28.30	2.00	0.00	0.00	0.08	0.00	28.38	2.00	0.00	0.00	0.08	0.00
28.46	2.00	0.00	0.00	0.08	0.00	28.54	2.00	0.00	0.00	0.08	0.00
28.63	2.00	0.00	0.00	0.08	0.00	28.71	2.00	0.00	0.00	0.08	0.00
28.79	2.00	0.00	0.00	0.08	0.00	28.87	2.00	0.00	0.00	0.08	0.00
28.95	2.00	0.00	0.00	0.08	0.00	29.04	2.00	0.00	0.00	0.08	0.00
29.12	2.00	0.00	0.00	0.08	0.00	29.20	2.00	0.00	0.00	0.08	0.00
29.28	2.00	0.00	0.00	0.08	0.00	29.36	2.00	0.00	0.00	0.08	0.00
29.45	2.00	0.00	0.00	0.08	0.00	29.53	2.00	0.00	0.00	0.08	0.00
29.61	2.00	0.00	0.00	0.08	0.00	29.69	2.00	0.00	0.00	0.08	0.00
29.77	2.00	0.00	0.00	0.08	0.00	29.86	2.00	0.00	0.00	0.08	0.00
29.94	2.00	0.00	0.00	0.08	0.00	30.02	2.00	0.00	0.00	0.08	0.00
30.10	2.00	0.00	0.00	0.08	0.00	30.18	2.00	0.00	0.00	0.08	0.00
30.27	1.25	0.00	0.00	0.08	0.00	30.35	1.11	0.00	0.00	0.08	0.00
30.43	1.27	0.00	0.00	0.08	0.00	30.51	2.00	0.00	0.00	0.08	0.00
30.59	2.00	0.00	0.00	0.08	0.00	30.68	2.00	0.00	0.00	0.08	0.00
30.76	2.00	0.00	0.00	0.08	0.00	30.84	2.00	0.00	0.00	0.08	0.00
30.92	2.00	0.00	0.00	0.08	0.00	31.00	2.00	0.00	0.00	0.08	0.00
31.09	2.00	0.00	0.00	0.08	0.00	31.17	2.00	0.00	0.00	0.08	0.00
31.25	2.00	0.00	0.00	0.08	0.00	31.33	2.00	0.00	0.00	0.08	0.00
31.41	2.00	0.00	0.00	0.08	0.00	31.50	2.00	0.00	0.00	0.08	0.00

:: Liquefaction Potential Index calculation data :: (continued)

Depth (ft)	FS	F_L	w_z	d_z	LPI	Depth (ft)	FS	F_L	w_z	d_z	LPI
31.58	2.00	0.00	0.00	0.08	0.00	31.66	2.00	0.00	0.00	0.08	0.00
31.74	2.00	0.00	0.00	0.08	0.00	31.82	2.00	0.00	0.00	0.08	0.00
31.91	2.00	0.00	0.00	0.08	0.00	31.99	2.00	0.00	0.00	0.08	0.00
32.07	2.00	0.00	0.00	0.08	0.00	32.15	2.00	0.00	0.00	0.08	0.00
32.23	2.00	0.00	0.00	0.08	0.00	32.32	2.00	0.00	0.00	0.08	0.00
32.40	2.00	0.00	0.00	0.08	0.00	32.48	2.00	0.00	0.00	0.08	0.00
32.56	2.00	0.00	0.00	0.08	0.00	32.64	2.00	0.00	0.00	0.08	0.00
32.73	2.00	0.00	0.00	0.08	0.00	32.81	2.00	0.00	0.00	0.08	0.00
32.89	2.00	0.00	0.00	0.08	0.00	32.97	2.00	0.00	0.00	0.08	0.00
33.05	2.00	0.00	0.00	0.08	0.00	33.14	2.00	0.00	0.00	0.08	0.00
33.22	2.00	0.00	0.00	0.08	0.00	33.30	2.00	0.00	0.00	0.08	0.00
33.38	2.00	0.00	0.00	0.08	0.00	33.46	2.00	0.00	0.00	0.08	0.00
33.55	2.00	0.00	0.00	0.08	0.00	33.63	2.00	0.00	0.00	0.08	0.00
33.71	2.00	0.00	0.00	0.08	0.00	33.79	2.00	0.00	0.00	0.08	0.00
33.87	2.00	0.00	0.00	0.08	0.00	33.96	2.00	0.00	0.00	0.08	0.00
34.04	2.00	0.00	0.00	0.08	0.00	34.12	2.00	0.00	0.00	0.08	0.00
34.20	2.00	0.00	0.00	0.08	0.00	34.28	2.00	0.00	0.00	0.08	0.00
34.37	2.00	0.00	0.00	0.08	0.00	34.45	2.00	0.00	0.00	0.08	0.00
34.53	2.00	0.00	0.00	0.08	0.00						

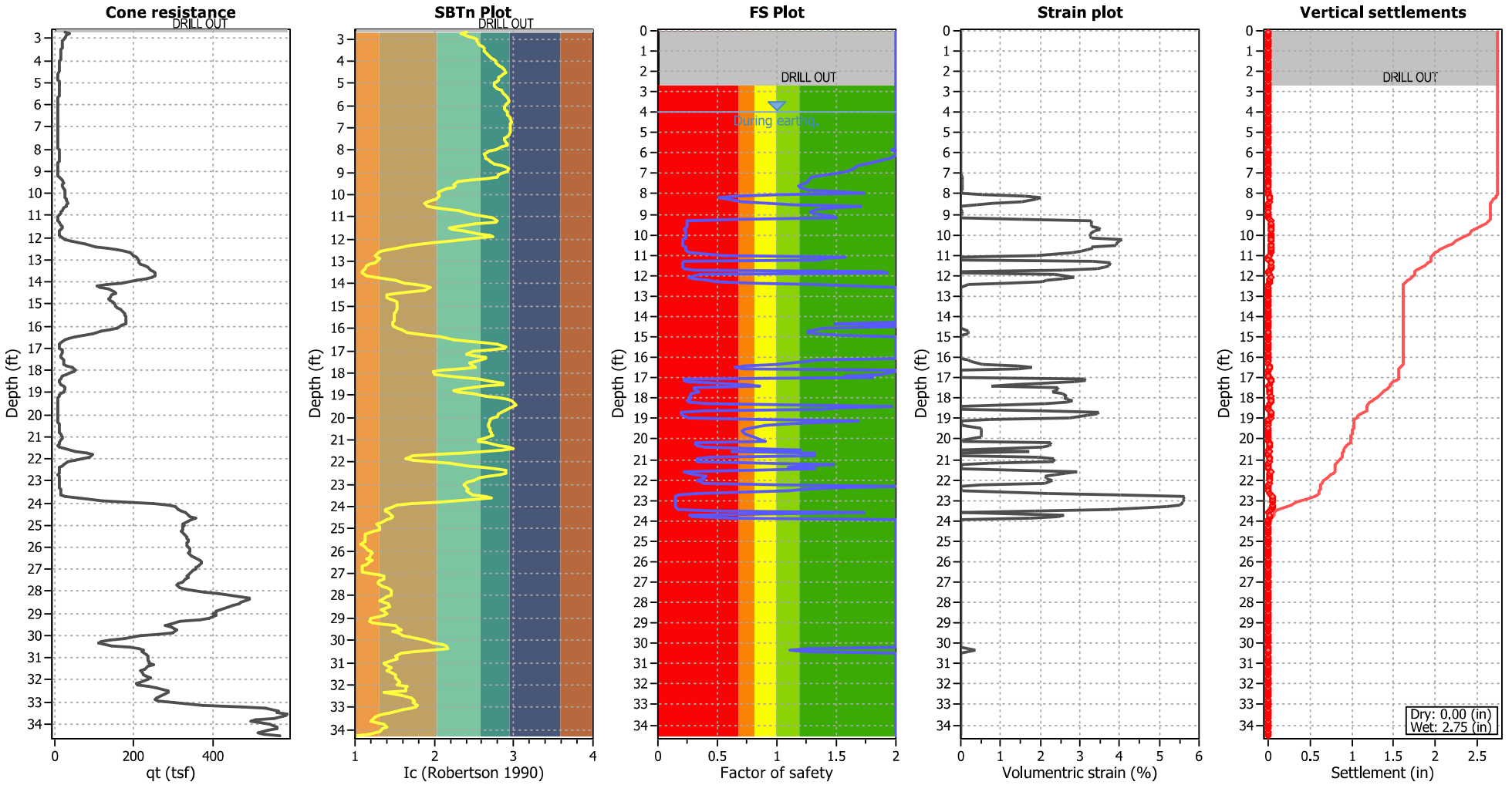
Overall liquefaction potential: 12.16

LPI = 0.00 - Liquefaction risk very low
LPI between 0.00 and 5.00 - Liquefaction risk low
LPI between 5.00 and 15.00 - Liquefaction risk high
LPI > 15.00 - Liquefaction risk very high

Abbreviations

FS: Calculated factor of safety for test point
F_L: 1 - FS
w_z: Function value of the extend of soil liquefaction according to depth
d_z: Layer thickness (ft)
LPI: Liquefaction potential index value for test point

Estimation of post-earthquake settlements



Abbreviations

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

:: Post-earthquake settlement due to soil liquefaction ::

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
4.02	130.48	2.00	0.00	1.00	0.00	4.10	130.90	2.00	0.00	1.00	0.00
4.18	133.23	2.00	0.00	1.00	0.00	4.27	133.76	2.00	0.00	1.00	0.00
4.35	132.35	2.00	0.00	1.00	0.00	4.43	128.18	2.00	0.00	1.00	0.00
4.51	122.29	2.00	0.00	1.00	0.00	4.59	113.73	2.00	0.00	1.00	0.00
4.68	104.92	2.00	0.00	1.00	0.00	4.76	99.74	2.00	0.00	1.00	0.00
4.84	97.49	2.00	0.00	1.00	0.00	4.92	96.73	2.00	0.00	1.00	0.00
5.00	98.23	2.00	0.00	1.00	0.00	5.09	103.08	2.00	0.00	1.00	0.00
5.17	110.20	2.00	0.00	1.00	0.00	5.25	116.97	2.00	0.00	1.00	0.00
5.33	121.61	2.00	0.00	1.00	0.00	5.41	125.10	2.00	0.00	1.00	0.00
5.50	125.37	2.00	0.00	1.00	0.00	5.58	123.97	2.00	0.00	1.00	0.00
5.66	120.81	2.00	0.00	1.00	0.00	5.74	119.18	2.00	0.00	1.00	0.00
5.82	117.87	1.97	0.00	1.00	0.00	5.91	115.86	1.99	0.00	1.00	0.00
5.99	112.69	2.00	0.00	1.00	0.00	6.07	109.99	2.00	0.00	1.00	0.00
6.15	109.24	2.00	0.00	1.00	0.00	6.23	109.86	1.95	0.00	1.00	0.00
6.32	110.18	1.89	0.00	1.00	0.00	6.40	110.53	1.84	0.00	1.00	0.00
6.48	110.92	1.79	0.00	1.00	0.00	6.56	111.85	1.74	0.00	1.00	0.00
6.64	111.49	1.69	0.01	1.00	0.00	6.73	109.87	1.65	0.01	1.00	0.00
6.81	106.77	1.62	0.01	1.00	0.00	6.89	103.45	1.58	0.01	1.00	0.00
6.97	99.57	1.52	0.01	1.00	0.00	7.05	95.66	1.44	0.01	1.00	0.00
7.14	91.78	1.36	0.02	1.00	0.00	7.22	87.53	1.29	0.02	1.00	0.00
7.30	83.09	1.26	0.03	1.00	0.00	7.38	78.28	1.25	0.03	1.00	0.00
7.46	74.02	1.24	0.03	1.00	0.00	7.55	72.14	1.21	0.03	1.00	0.00
7.63	72.09	1.18	0.03	1.00	0.00	7.71	77.60	1.19	0.03	1.00	0.00
7.79	83.12	1.27	0.02	1.00	0.00	7.87	84.99	1.51	0.01	1.00	0.00
7.96	82.07	1.73	0.00	1.00	0.00	8.04	161.54	1.02	0.57	1.00	0.01
8.12	134.70	0.66	1.61	1.00	0.02	8.20	119.72	0.51	2.02	1.00	0.02
8.28	128.13	0.59	1.91	1.00	0.02	8.37	139.52	0.71	1.53	1.00	0.02
8.45	156.79	0.93	0.81	1.00	0.01	8.53	169.79	1.13	0.39	1.00	0.00
8.61	82.41	1.70	0.00	1.00	0.00	8.69	85.81	1.49	0.01	1.00	0.00
8.78	88.85	1.34	0.02	1.00	0.00	8.86	90.07	1.29	0.02	1.00	0.00
8.94	87.58	1.30	0.02	1.00	0.00	9.02	84.11	1.38	0.01	1.00	0.00
9.10	80.97	1.47	0.01	1.00	0.00	9.19	80.50	1.51	0.01	1.00	0.00
9.27	138.24	0.67	1.55	1.00	0.02	9.35	66.21	0.24	3.28	1.00	0.03
9.43	65.49	0.24	3.31	1.00	0.03	9.51	65.69	0.24	3.30	1.00	0.03
9.60	65.52	0.24	3.30	1.00	0.03	9.68	61.60	0.23	3.48	1.00	0.03
9.76	61.00	0.23	3.50	1.00	0.03	9.84	63.88	0.23	3.37	1.00	0.03
9.92	66.30	0.24	3.27	1.00	0.03	10.01	66.40	0.24	3.27	1.00	0.03
10.09	66.30	0.24	3.27	1.00	0.03	10.17	65.98	0.23	3.29	1.00	0.03
10.25	51.03	0.20	4.06	1.00	0.04	10.33	52.21	0.20	3.98	1.00	0.04
10.42	53.56	0.21	3.90	1.00	0.04	10.50	53.35	0.20	3.91	1.00	0.04
10.58	65.93	0.23	3.29	1.00	0.03	10.66	65.29	0.23	3.31	1.00	0.03
10.74	68.77	0.24	3.18	1.00	0.03	10.83	73.00	0.25	3.02	1.00	0.03
10.91	79.21	0.27	2.83	1.00	0.03	10.99	129.99	0.55	1.88	1.00	0.02
11.07	79.42	1.57	0.01	1.00	0.00	11.15	77.22	1.39	0.01	1.00	0.00
11.24	73.09	1.36	0.01	1.00	0.00	11.32	65.19	0.22	3.32	1.00	0.03
11.40	55.77	0.20	3.77	1.00	0.04	11.48	56.82	0.20	3.71	1.00	0.04
11.56	58.72	0.21	3.62	1.00	0.04	11.65	62.38	0.22	3.44	1.00	0.03
11.73	89.75	0.31	2.55	1.00	0.03	11.81	89.14	1.87	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
11.89	97.61	1.93	0.00	1.00	0.00	11.98	98.05	0.35	2.37	1.00	0.02
12.06	78.43	0.26	2.85	1.00	0.03	12.14	90.03	0.31	2.55	1.00	0.03
12.22	110.20	0.42	2.16	1.00	0.02	12.30	118.35	0.48	2.04	1.00	0.02
12.39	149.74	0.81	1.13	1.00	0.01	12.47	181.77	1.32	0.19	1.00	0.00
12.55	210.60	2.00	0.00	1.00	0.00	12.63	230.94	2.00	0.00	1.00	0.00
12.71	246.14	2.00	0.00	1.00	0.00	12.80	259.68	2.00	0.00	1.00	0.00
12.88	271.38	2.00	0.00	1.00	0.00	12.96	275.83	2.00	0.00	1.00	0.00
13.04	272.35	2.00	0.00	1.00	0.00	13.12	266.85	2.00	0.00	1.00	0.00
13.21	268.39	2.00	0.00	1.00	0.00	13.29	276.65	2.00	0.00	1.00	0.00
13.37	286.43	2.00	0.00	1.00	0.00	13.45	293.47	2.00	0.00	1.00	0.00
13.53	299.81	2.00	0.00	1.00	0.00	13.62	309.31	2.00	0.00	1.00	0.00
13.70	321.90	2.00	0.00	1.00	0.00	13.78	325.87	2.00	0.00	1.00	0.00
13.86	317.82	2.00	0.00	1.00	0.00	13.94	292.75	2.00	0.00	1.00	0.00
14.03	274.44	2.00	0.00	1.00	0.00	14.11	246.97	2.00	0.00	1.00	0.00
14.19	213.65	2.00	0.00	1.00	0.00	14.27	206.89	2.00	0.00	1.00	0.00
14.35	192.01	1.48	0.00	1.00	0.00	14.44	205.70	2.00	0.00	1.00	0.00
14.52	200.43	2.00	0.00	1.00	0.00	14.60	187.64	1.39	0.00	1.00	0.00
14.68	181.01	1.26	0.19	1.00	0.00	14.76	180.97	1.26	0.19	1.00	0.00
14.85	185.57	1.35	0.19	1.00	0.00	14.93	194.92	1.53	0.00	1.00	0.00
15.01	201.63	2.00	0.00	1.00	0.00	15.09	205.98	2.00	0.00	1.00	0.00
15.17	210.75	2.00	0.00	1.00	0.00	15.26	218.14	2.00	0.00	1.00	0.00
15.34	225.38	2.00	0.00	1.00	0.00	15.42	230.23	2.00	0.00	1.00	0.00
15.50	232.11	2.00	0.00	1.00	0.00	15.58	232.44	2.00	0.00	1.00	0.00
15.67	233.13	2.00	0.00	1.00	0.00	15.75	234.32	2.00	0.00	1.00	0.00
15.83	233.90	2.00	0.00	1.00	0.00	15.91	230.04	2.00	0.00	1.00	0.00
15.99	219.56	2.00	0.00	1.00	0.00	16.08	205.80	2.00	0.00	1.00	0.00
16.16	186.15	1.34	0.19	1.00	0.00	16.24	180.90	1.24	0.27	1.00	0.00
16.32	166.16	1.00	0.55	1.00	0.01	16.40	145.88	0.73	1.44	1.00	0.01
16.49	138.63	0.64	1.79	1.00	0.02	16.57	144.95	0.71	1.45	1.00	0.01
16.65	251.60	2.00	0.00	1.00	0.00	16.73	154.07	2.00	0.00	1.00	0.00
16.81	141.55	1.86	0.00	1.00	0.00	16.90	119.17	1.57	0.01	1.00	0.00
16.98	91.29	1.80	0.00	1.00	0.00	17.06	70.95	0.22	3.10	1.00	0.03
17.14	69.97	0.22	3.13	1.00	0.03	17.22	78.43	0.24	2.85	1.00	0.03
17.31	154.64	0.74	1.32	1.00	0.01	17.39	163.49	0.85	0.76	1.00	0.01
17.47	93.70	0.30	2.46	1.00	0.02	17.55	94.34	0.31	2.45	1.00	0.02
17.63	98.79	0.33	2.36	1.00	0.02	17.72	101.96	0.35	2.30	1.00	0.02
17.80	88.85	0.28	2.57	1.00	0.03	17.88	84.86	0.27	2.67	1.00	0.03
17.96	88.20	0.28	2.59	1.00	0.03	18.04	84.91	0.26	2.67	1.00	0.03
18.13	79.00	0.24	2.83	1.00	0.03	18.21	85.19	0.27	2.66	1.00	0.03
18.29	112.80	0.41	2.12	1.00	0.02	18.37	108.95	1.96	0.00	1.00	0.00
18.45	111.66	1.53	0.01	1.00	0.00	18.54	101.71	1.38	0.01	1.00	0.00
18.62	116.99	0.40	2.05	1.00	0.02	18.70	61.88	0.20	3.46	1.00	0.03
18.78	62.39	0.20	3.44	1.00	0.03	18.86	68.58	0.21	3.18	1.00	0.03
18.95	82.11	0.25	2.75	1.00	0.03	19.03	164.88	0.86	0.75	1.00	0.01
19.11	110.05	1.68	0.00	1.00	0.00	19.19	109.29	1.35	0.01	1.00	0.00
19.27	101.96	1.09	0.03	1.00	0.00	19.36	89.70	0.90	0.05	1.00	0.00
19.44	78.16	0.77	0.50	1.00	0.00	19.52	67.52	0.72	0.50	1.00	0.00
19.60	59.42	0.71	0.50	1.00	0.00	19.69	54.32	0.72	0.50	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
19.77	52.28	0.73	0.50	1.00	0.00	19.85	51.22	0.76	0.50	1.00	0.00
19.93	50.91	0.81	0.50	1.00	0.00	20.01	49.84	0.87	0.06	1.00	0.00
20.10	48.23	0.91	0.05	1.00	0.00	20.18	104.16	0.31	2.26	1.00	0.02
20.26	103.91	0.31	2.26	1.00	0.02	20.34	106.25	0.32	2.22	1.00	0.02
20.42	116.58	0.38	2.06	1.00	0.02	20.51	62.99	1.19	0.02	1.00	0.00
20.59	145.96	0.62	1.71	1.00	0.02	20.67	70.77	1.31	0.01	1.00	0.00
20.75	70.21	1.29	0.01	1.00	0.00	20.83	74.85	1.32	0.01	1.00	0.00
20.92	124.40	0.44	1.95	1.00	0.02	21.00	100.30	0.33	2.33	1.00	0.02
21.08	100.63	0.33	2.32	1.00	0.02	21.16	166.40	0.86	0.74	1.00	0.01
21.24	100.90	1.47	0.01	1.00	0.00	21.33	107.07	1.21	0.02	1.00	0.00
21.41	106.13	1.10	0.02	1.00	0.00	21.49	100.56	1.31	0.01	1.00	0.00
21.57	75.96	0.22	2.93	1.00	0.03	21.65	86.02	0.26	2.64	1.00	0.03
21.74	97.97	0.31	2.38	1.00	0.02	21.82	113.49	0.40	2.11	1.00	0.02
21.90	110.41	0.38	2.15	1.00	0.02	21.98	111.22	0.39	2.14	1.00	0.02
22.06	102.39	0.33	2.29	1.00	0.02	22.15	111.79	0.39	2.13	1.00	0.02
22.23	178.73	1.02	0.51	1.00	0.01	22.31	124.16	1.99	0.00	1.00	0.00
22.39	119.14	1.46	0.01	1.00	0.00	22.47	102.13	1.23	0.02	1.00	0.00
22.56	76.25	1.10	0.02	1.00	0.00	22.64	107.08	0.32	2.21	1.00	0.02
22.72	51.78	0.17	4.01	1.00	0.04	22.80	34.16	0.15	5.64	1.00	0.06
22.88	34.40	0.15	5.61	1.00	0.06	22.97	34.31	0.15	5.62	1.00	0.06
23.05	34.40	0.15	5.61	1.00	0.06	23.13	34.45	0.14	5.60	1.00	0.06
23.21	34.94	0.15	5.53	1.00	0.05	23.29	37.85	0.15	5.18	1.00	0.05
23.38	44.90	0.16	4.51	1.00	0.04	23.46	55.91	0.18	3.76	1.00	0.04
23.54	132.54	0.49	1.85	1.00	0.02	23.62	96.83	1.73	0.00	1.00	0.00
23.70	88.55	0.27	2.58	1.00	0.03	23.79	95.18	0.29	2.43	1.00	0.02
23.87	142.08	0.64	1.75	1.00	0.02	23.95	218.40	2.00	0.00	1.00	0.00
24.03	282.57	2.00	0.00	1.00	0.00	24.11	318.49	2.00	0.00	1.00	0.00
24.20	337.21	2.00	0.00	1.00	0.00	24.28	347.84	2.00	0.00	1.00	0.00
24.36	359.02	2.00	0.00	1.00	0.00	24.44	369.78	2.00	0.00	1.00	0.00
24.52	375.34	2.00	0.00	1.00	0.00	24.61	378.18	2.00	0.00	1.00	0.00
24.69	388.07	2.00	0.00	1.00	0.00	24.77	374.29	2.00	0.00	1.00	0.00
24.85	366.95	2.00	0.00	1.00	0.00	24.93	349.67	2.00	0.00	1.00	0.00
25.02	353.24	2.00	0.00	1.00	0.00	25.10	347.34	2.00	0.00	1.00	0.00
25.18	341.54	2.00	0.00	1.00	0.00	25.26	336.01	2.00	0.00	1.00	0.00
25.34	338.95	2.00	0.00	1.00	0.00	25.43	344.64	2.00	0.00	1.00	0.00
25.51	350.00	2.00	0.00	1.00	0.00	25.59	350.16	2.00	0.00	1.00	0.00
25.67	350.08	2.00	0.00	1.00	0.00	25.75	353.18	2.00	0.00	1.00	0.00
25.84	349.46	2.00	0.00	1.00	0.00	25.92	351.97	2.00	0.00	1.00	0.00
26.00	355.59	2.00	0.00	1.00	0.00	26.08	359.45	2.00	0.00	1.00	0.00
26.16	357.32	2.00	0.00	1.00	0.00	26.25	352.37	2.00	0.00	1.00	0.00
26.33	354.31	2.00	0.00	1.00	0.00	26.41	361.13	2.00	0.00	1.00	0.00
26.49	368.08	2.00	0.00	1.00	0.00	26.57	380.58	2.00	0.00	1.00	0.00
26.66	383.78	2.00	0.00	1.00	0.00	26.74	382.50	2.00	0.00	1.00	0.00
26.82	373.00	2.00	0.00	1.00	0.00	26.90	366.92	2.00	0.00	1.00	0.00
26.98	367.64	2.00	0.00	1.00	0.00	27.07	367.17	2.00	0.00	1.00	0.00
27.15	361.02	2.00	0.00	1.00	0.00	27.23	356.39	2.00	0.00	1.00	0.00
27.31	350.52	2.00	0.00	1.00	0.00	27.40	353.33	2.00	0.00	1.00	0.00
27.48	344.05	2.00	0.00	1.00	0.00	27.56	338.34	2.00	0.00	1.00	0.00

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)
27.64	326.38	2.00	0.00	1.00	0.00	27.72	324.61	2.00	0.00	1.00	0.00
27.81	332.86	2.00	0.00	1.00	0.00	27.89	346.79	2.00	0.00	1.00	0.00
27.97	368.87	2.00	0.00	1.00	0.00	28.05	392.97	2.00	0.00	1.00	0.00
28.13	431.65	2.00	0.00	1.00	0.00	28.22	482.47	2.00	0.00	1.00	0.00
28.30	508.66	2.00	0.00	1.00	0.00	28.38	511.87	2.00	0.00	1.00	0.00
28.46	489.11	2.00	0.00	1.00	0.00	28.54	482.21	2.00	0.00	1.00	0.00
28.63	465.30	2.00	0.00	1.00	0.00	28.71	452.52	2.00	0.00	1.00	0.00
28.79	431.15	2.00	0.00	1.00	0.00	28.87	419.28	2.00	0.00	1.00	0.00
28.95	416.12	2.00	0.00	1.00	0.00	29.04	403.87	2.00	0.00	1.00	0.00
29.12	409.53	2.00	0.00	1.00	0.00	29.20	391.58	2.00	0.00	1.00	0.00
29.28	371.25	2.00	0.00	1.00	0.00	29.36	323.87	2.00	0.00	1.00	0.00
29.45	302.13	2.00	0.00	1.00	0.00	29.53	286.09	2.00	0.00	1.00	0.00
29.61	301.25	2.00	0.00	1.00	0.00	29.69	307.40	2.00	0.00	1.00	0.00
29.77	316.87	2.00	0.00	1.00	0.00	29.86	305.28	2.00	0.00	1.00	0.00
29.94	306.85	2.00	0.00	1.00	0.00	30.02	275.52	2.00	0.00	1.00	0.00
30.10	234.85	2.00	0.00	1.00	0.00	30.18	205.72	2.00	0.00	1.00	0.00
30.27	184.82	1.25	0.19	1.00	0.00	30.35	176.63	1.11	0.38	1.00	0.00
30.43	185.93	1.27	0.19	1.00	0.00	30.51	205.83	2.00	0.00	1.00	0.00
30.59	214.87	2.00	0.00	1.00	0.00	30.68	224.59	2.00	0.00	1.00	0.00
30.76	221.12	2.00	0.00	1.00	0.00	30.84	229.82	2.00	0.00	1.00	0.00
30.92	232.87	2.00	0.00	1.00	0.00	31.00	234.30	2.00	0.00	1.00	0.00
31.09	233.82	2.00	0.00	1.00	0.00	31.17	234.67	2.00	0.00	1.00	0.00
31.25	237.99	2.00	0.00	1.00	0.00	31.33	245.03	2.00	0.00	1.00	0.00
31.41	233.53	2.00	0.00	1.00	0.00	31.50	223.40	2.00	0.00	1.00	0.00
31.58	212.38	2.00	0.00	1.00	0.00	31.66	217.75	2.00	0.00	1.00	0.00
31.74	220.10	2.00	0.00	1.00	0.00	31.82	228.94	2.00	0.00	1.00	0.00
31.91	238.84	2.00	0.00	1.00	0.00	31.99	231.97	2.00	0.00	1.00	0.00
32.07	213.87	2.00	0.00	1.00	0.00	32.15	202.21	2.00	0.00	1.00	0.00
32.23	205.22	2.00	0.00	1.00	0.00	32.32	230.63	2.00	0.00	1.00	0.00
32.40	252.02	2.00	0.00	1.00	0.00	32.48	279.83	2.00	0.00	1.00	0.00
32.56	283.16	2.00	0.00	1.00	0.00	32.64	283.97	2.00	0.00	1.00	0.00
32.73	279.25	2.00	0.00	1.00	0.00	32.81	267.54	2.00	0.00	1.00	0.00
32.89	277.58	2.00	0.00	1.00	0.00	32.97	282.85	2.00	0.00	1.00	0.00
33.05	292.27	2.00	0.00	1.00	0.00	33.14	360.47	2.00	0.00	1.00	0.00
33.22	457.15	2.00	0.00	1.00	0.00	33.30	513.21	2.00	0.00	1.00	0.00
33.38	543.20	2.00	0.00	1.00	0.00	33.46	538.97	2.00	0.00	1.00	0.00
33.55	561.48	2.00	0.00	1.00	0.00	33.63	557.12	2.00	0.00	1.00	0.00
33.71	529.55	2.00	0.00	1.00	0.00	33.79	484.79	2.00	0.00	1.00	0.00
33.87	472.43	2.00	0.00	1.00	0.00	33.96	496.39	2.00	0.00	1.00	0.00
34.04	516.50	2.00	0.00	1.00	0.00	34.12	534.01	2.00	0.00	1.00	0.00
34.20	530.56	2.00	0.00	1.00	0.00	34.28	509.04	2.00	0.00	1.00	0.00
34.37	490.60	2.00	0.00	1.00	0.00	34.45	503.93	2.00	0.00	1.00	0.00
34.53	540.38	2.00	0.00	1.00	0.00						

:: Post-earthquake settlement due to soil liquefaction :: (continued)

Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)	Depth (ft)	$Q_{tn,cs}$	FS	e_v (%)	DF	Settlement (in)

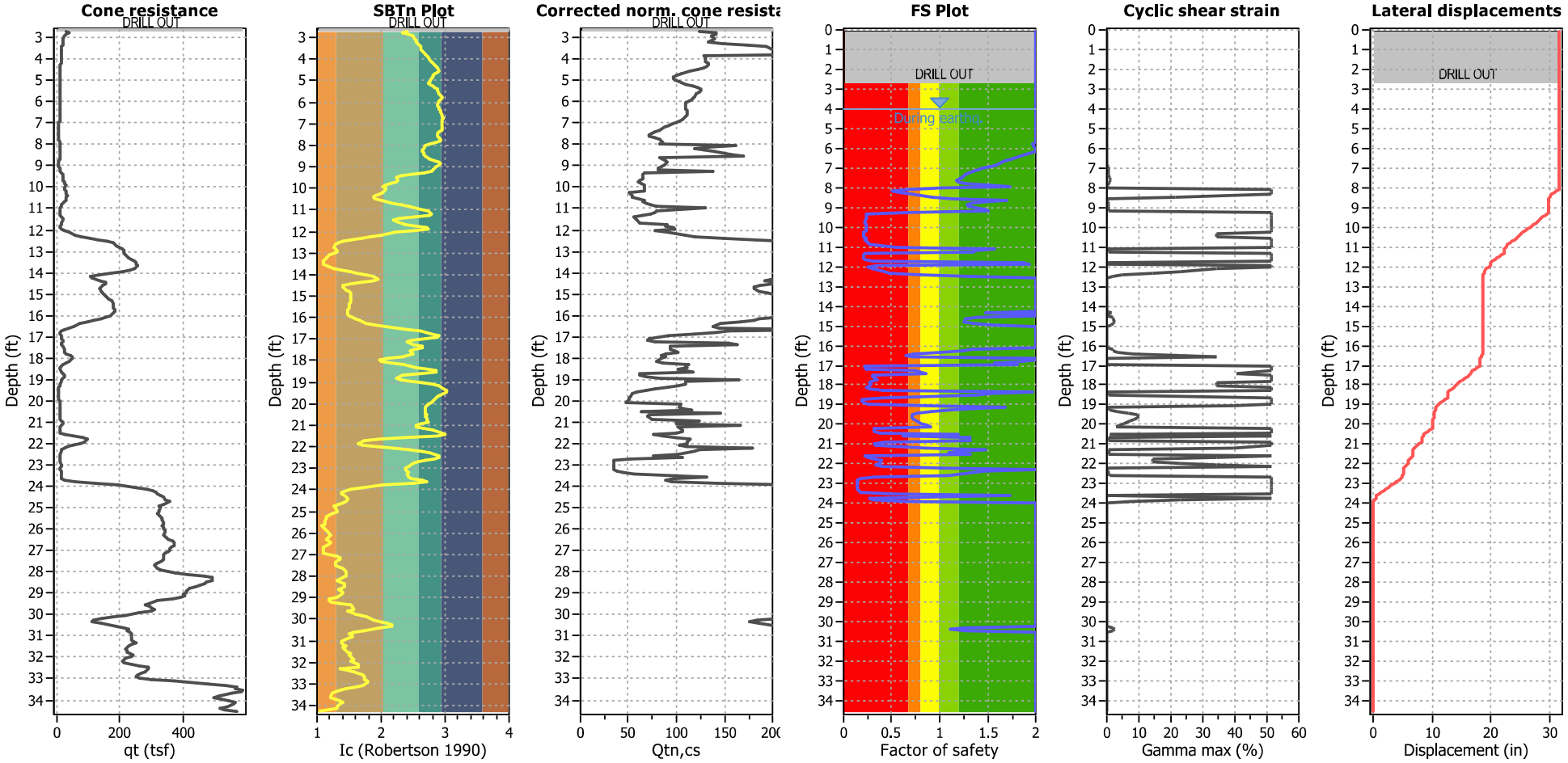
Total estimated settlement: 2.75

Abbreviations

$Q_{tn,cs}$:	Equivalent clean sand normalized cone resistance
FS:	Factor of safety against liquefaction
e_v (%):	Post-liquefaction volumentric strain
DF:	e_v depth weighting factor
Settlement:	Calculated settlement

Estimation of post-earthquake lateral Displacements

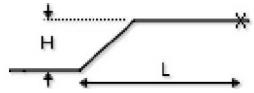
Geometric parameters: Level ground (or gently sloping) with free face (L: 70.00 ft - H: 5.00 ft)



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$Q_{tn,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

Surface condition



:: Lateral displacement index calculation ::

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
4.02	12.85	23.84	3.84	130.48	2.00	19.68	0.05	0.00
4.10	12.57	23.30	3.90	130.90	2.00	18.92	0.05	0.00
4.18	12.06	22.33	4.10	133.23	2.00	17.51	0.05	0.00
4.27	11.39	21.05	4.25	133.76	2.00	15.57	0.06	0.00
4.35	10.66	19.67	4.32	132.35	2.00	13.33	0.06	0.00
4.43	9.92	18.26	4.25	128.18	2.00	10.87	0.06	0.00
4.51	9.25	16.98	4.06	122.29	2.00	8.47	0.07	0.00
4.59	9.08	16.65	3.60	113.73	2.00	7.82	0.07	0.00
4.68	8.99	16.48	3.13	104.92	2.00	7.48	0.07	0.00
4.76	9.02	16.52	2.85	99.74	2.00	7.57	0.07	0.00
4.84	8.92	16.32	2.75	97.49	2.00	7.17	0.07	0.00
4.92	9.31	17.06	2.66	96.73	2.00	8.63	0.07	0.00
5.00	10.06	18.46	2.64	98.23	2.00	11.23	0.06	0.00
5.09	10.71	19.68	2.80	103.08	2.00	13.34	0.06	0.00
5.17	11.00	20.23	3.10	110.20	2.00	14.26	0.06	0.00
5.25	10.85	19.94	3.46	116.97	2.00	13.77	0.06	0.00
5.33	10.44	19.15	3.76	121.61	2.00	12.44	0.06	0.00
5.41	10.04	18.38	4.03	125.10	2.00	11.09	0.06	0.00
5.50	9.78	17.89	4.11	125.37	2.00	10.20	0.06	0.00
5.58	9.42	17.19	4.11	123.97	2.00	8.88	0.07	0.00
5.66	8.90	16.20	4.05	120.81	2.00	6.92	0.07	0.00
5.74	8.38	15.21	4.09	119.18	2.00	4.84	0.07	0.00
5.82	8.26	14.98	4.04	117.87	1.97	4.33	0.08	0.00
5.91	8.41	15.26	3.87	115.86	1.99	4.95	0.07	0.00
5.99	8.65	15.71	3.62	112.69	2.00	5.91	0.07	0.00
6.07	8.72	15.82	3.45	109.99	2.00	6.13	0.07	0.00
6.15	8.66	15.71	3.42	109.24	2.00	5.91	0.07	0.00
6.23	8.43	15.27	3.50	109.86	1.95	4.96	0.08	0.00
6.32	8.26	14.92	3.56	110.18	1.89	4.21	0.09	0.00
6.40	8.09	14.59	3.62	110.53	1.84	3.47	0.11	0.00
6.48	7.95	14.32	3.68	110.92	1.79	2.85	0.12	0.00
6.56	7.76	13.96	3.79	111.85	1.74	2.02	0.14	0.00
6.64	7.58	13.61	3.82	111.49	1.69	1.17	0.16	0.00
6.73	7.45	13.35	3.76	109.87	1.65	0.53	0.18	0.00
6.81	7.38	13.21	3.57	106.77	1.62	0.19	0.20	0.00
6.89	7.25	12.97	3.40	103.45	1.58	0.00	0.22	0.00
6.97	7.03	12.54	3.21	99.57	1.52	0.00	0.27	0.00
7.05	6.70	11.92	3.05	95.66	1.44	0.00	0.35	0.00
7.14	6.37	11.27	2.89	91.78	1.36	0.00	0.48	0.00
7.22	6.13	10.82	2.68	87.53	1.29	0.00	0.60	0.00
7.30	6.02	10.60	2.43	83.09	1.26	0.00	0.68	0.00
7.38	6.00	10.56	2.15	78.28	1.25	0.00	0.70	0.01
7.46	5.98	10.51	1.91	74.02	1.24	0.00	0.73	0.01
7.55	5.85	10.26	1.83	72.14	1.21	0.00	0.84	0.01
7.63	5.77	10.09	1.84	72.09	1.18	0.00	0.94	0.01
7.71	5.86	10.25	2.13	77.60	1.19	0.00	0.88	0.01
7.79	6.25	10.98	2.38	83.12	1.27	0.00	0.64	0.00
7.87	7.36	13.08	2.29	84.99	1.51	0.00	0.27	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
7.96	8.40	15.04	2.02	82.07	1.73	4.47	0.14	0.00
8.04	9.32	16.77	1.74	161.54	1.02	8.07	0.00	0.00
8.12	9.53	17.15	1.57	134.70	0.66	8.80	51.20	0.37
8.20	9.80	17.65	1.49	119.72	0.51	9.76	51.20	0.37
8.28	10.00	18.03	1.59	128.13	0.59	10.45	51.20	0.37
8.37	10.09	18.19	1.70	139.52	0.71	10.74	51.20	0.37
8.45	9.96	17.94	1.81	156.79	0.93	10.28	21.40	0.15
8.53	9.46	16.98	1.82	169.79	1.13	8.47	0.00	0.00
8.61	8.57	15.29	2.02	82.41	1.70	5.02	0.15	0.00
8.69	7.60	13.46	2.29	85.81	1.49	0.80	0.28	0.00
8.78	6.90	12.12	2.57	88.85	1.34	0.00	0.48	0.00
8.86	6.67	11.67	2.69	90.07	1.29	0.00	0.59	0.00
8.94	6.77	11.87	2.52	87.58	1.30	0.00	0.55	0.00
9.02	7.18	12.62	2.26	84.11	1.38	0.00	0.41	0.00
9.10	7.65	13.51	2.04	80.97	1.47	0.94	0.30	0.00
9.19	7.84	13.85	1.99	80.50	1.51	1.76	0.27	0.00
9.27	9.74	17.45	1.62	138.24	0.67	9.37	51.20	0.37
9.35	13.92	25.33	1.17	66.21	0.24	21.68	51.20	0.37
9.43	18.48	33.95	1.02	65.49	0.24	31.35	51.20	0.37
9.51	20.50	37.76	0.95	65.69	0.24	34.85	51.20	0.37
9.60	19.68	36.19	0.97	65.52	0.24	33.45	51.20	0.37
9.68	19.29	35.45	0.85	61.60	0.23	32.77	51.20	0.37
9.76	22.02	40.60	0.70	61.00	0.23	37.25	51.20	0.37
9.84	25.07	46.35	0.61	63.88	0.23	41.62	51.20	0.37
9.92	26.87	49.51	0.58	66.30	0.24	43.80	51.20	0.37
10.01	26.11	48.31	0.65	66.40	0.24	42.99	51.20	0.37
10.09	26.10	48.28	0.64	66.30	0.24	42.96	51.20	0.37
10.17	27.20	49.54	0.56	65.98	0.23	43.81	51.20	0.37
10.25	28.73	51.03	0.44	51.03	0.20	44.79	51.20	0.37
10.33	30.12	52.21	0.35	52.21	0.20	45.55	34.10	0.24
10.42	31.35	53.56	0.31	53.56	0.21	46.39	34.10	0.24
10.50	30.99	53.35	0.36	53.35	0.20	46.26	34.10	0.24
10.58	28.29	50.35	0.51	65.93	0.23	44.35	51.20	0.37
10.66	23.30	42.93	0.80	65.29	0.23	39.09	51.20	0.37
10.74	19.00	34.80	1.11	68.77	0.24	32.16	51.20	0.37
10.83	15.89	28.92	1.34	73.00	0.25	26.05	51.20	0.37
10.91	13.52	24.42	1.52	79.21	0.27	20.47	51.20	0.37
10.99	11.03	19.71	1.72	129.99	0.55	13.40	51.20	0.37
11.07	8.76	15.40	1.85	79.42	1.57	5.26	0.21	0.00
11.15	7.84	13.67	1.82	77.22	1.39	1.31	0.39	0.00
11.24	7.69	13.38	1.65	73.09	1.36	0.61	0.43	0.00
11.32	11.15	19.91	1.10	65.19	0.22	13.73	51.20	0.37
11.40	16.09	29.23	0.76	55.77	0.20	26.41	51.20	0.37
11.48	19.69	35.99	0.66	56.82	0.20	33.27	51.20	0.37
11.56	18.83	34.40	0.77	58.72	0.21	31.78	51.20	0.37
11.65	15.13	27.40	1.00	62.38	0.22	24.27	51.20	0.37
11.73	12.16	21.78	1.48	89.75	0.31	16.69	51.20	0.37
11.81	10.58	18.78	2.14	89.14	1.87	11.79	0.08	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
11.89	10.91	19.39	2.48	97.61	1.93	12.86	0.07	0.00
11.98	15.31	27.71	1.92	98.05	0.35	24.64	51.20	0.37
12.06	26.28	47.81	1.16	78.43	0.26	42.64	51.20	0.37
12.14	40.56	68.77	0.86	90.03	0.31	54.64	34.10	0.24
12.22	57.82	92.55	0.68	110.20	0.42	64.44	22.70	0.16
12.30	77.84	118.35	0.54	118.35	0.48	72.56	14.50	0.10
12.39	104.35	149.74	0.40	149.74	0.81	80.33	5.00	0.04
12.47	132.35	181.77	0.32	181.77	1.32	86.72	1.99	0.01
12.55	158.12	210.60	0.28	210.60	2.00	91.58	0.00	0.00
12.63	176.22	230.94	0.27	230.94	2.00	94.63	0.00	0.00
12.71	189.71	246.14	0.27	246.14	2.00	96.73	0.00	0.00
12.80	199.34	259.68	0.32	259.68	2.00	98.50	0.00	0.00
12.88	206.91	271.38	0.37	271.38	2.00	99.95	0.00	0.00
12.96	211.03	275.83	0.37	275.83	2.00	100.00	0.00	0.00
13.04	211.78	272.35	0.31	272.35	2.00	100.00	0.00	0.00
13.12	212.72	266.85	0.23	266.85	2.00	99.40	0.00	0.00
13.21	217.26	268.39	0.18	268.39	2.00	99.59	0.00	0.00
13.29	226.44	276.65	0.17	276.65	2.00	100.00	0.00	0.00
13.37	235.91	286.43	0.17	286.43	2.00	100.00	0.00	0.00
13.45	243.48	293.47	0.16	293.47	2.00	100.00	0.00	0.00
13.53	248.34	299.81	0.18	299.81	2.00	100.00	0.00	0.00
13.62	252.74	309.31	0.23	309.31	2.00	100.00	0.00	0.00
13.70	253.12	321.90	0.40	321.90	2.00	100.00	0.00	0.00
13.78	247.24	325.87	0.60	325.87	2.00	100.00	0.00	0.00
13.86	231.70	317.82	0.88	317.82	2.00	100.00	0.00	0.00
13.94	207.10	292.75	1.12	292.75	2.00	100.00	0.00	0.00
14.03	169.40	249.47	1.49	274.44	2.00	97.17	0.00	0.00
14.11	133.25	202.53	1.77	246.97	2.00	90.29	0.00	0.00
14.19	107.76	167.37	1.94	213.65	2.00	84.00	0.00	0.00
14.27	113.02	170.20	1.50	206.89	2.00	84.55	0.00	0.00
14.35	134.87	192.01	0.96	192.01	1.48	88.53	1.60	0.01
14.44	152.40	205.70	0.59	205.70	2.00	90.81	0.00	0.00
14.52	154.01	200.43	0.37	200.43	2.00	89.95	0.00	0.00
14.60	145.04	187.64	0.32	187.64	1.39	87.77	1.80	0.01
14.68	138.42	181.01	0.36	181.01	1.26	86.59	2.14	0.02
14.76	136.42	180.97	0.45	180.97	1.26	86.58	2.15	0.02
14.85	139.09	185.57	0.52	185.57	1.35	87.41	1.91	0.01
14.93	146.28	194.92	0.55	194.92	1.53	89.03	1.51	0.01
15.01	151.51	201.63	0.58	201.63	2.00	90.15	0.00	0.00
15.09	154.90	205.98	0.60	205.98	2.00	90.85	0.00	0.00
15.17	158.90	210.75	0.62	210.75	2.00	91.61	0.00	0.00
15.26	165.61	218.14	0.60	218.14	2.00	92.74	0.00	0.00
15.34	172.15	225.38	0.60	225.38	2.00	93.82	0.00	0.00
15.42	176.55	230.23	0.60	230.23	2.00	94.52	0.00	0.00
15.50	178.28	232.11	0.60	232.11	2.00	94.79	0.00	0.00
15.58	178.94	232.44	0.60	232.44	2.00	94.84	0.00	0.00
15.67	180.15	233.13	0.59	233.13	2.00	94.94	0.00	0.00
15.75	181.86	234.32	0.58	234.32	2.00	95.11	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
15.83	181.88	233.90	0.58	233.90	2.00	95.05	0.00	0.00
15.91	178.36	230.04	0.61	230.04	2.00	94.50	0.00	0.00
15.99	168.69	219.56	0.67	219.56	2.00	92.96	0.00	0.00
16.08	156.27	205.80	0.75	205.80	2.00	90.82	0.00	0.00
16.16	139.00	186.15	0.86	186.15	1.34	87.51	1.92	0.01
16.24	118.03	161.93	1.05	180.90	1.24	82.91	2.05	0.01
16.32	94.22	133.49	1.36	166.16	1.00	76.53	3.23	0.02
16.40	71.81	105.50	1.82	145.88	0.73	68.77	8.08	0.06
16.49	52.67	80.20	2.38	138.63	0.64	59.72	22.70	0.16
16.57	36.45	57.55	3.09	144.95	0.71	48.76	34.10	0.24
16.65	23.92	39.06	3.98	251.60	2.00	35.97	0.00	0.00
16.73	16.15	26.87	4.54	154.07	2.00	23.62	0.05	0.00
16.81	11.96	19.90	4.54	141.55	1.86	13.72	0.08	0.00
16.90	10.32	16.85	3.64	119.17	1.57	8.22	0.19	0.00
16.98	12.25	19.32	2.16	91.29	1.80	12.74	0.10	0.00
17.06	16.59	25.20	1.30	70.95	0.22	21.50	51.20	0.37
17.14	18.98	28.54	1.23	69.97	0.22	25.61	51.20	0.37
17.22	17.60	26.79	1.53	78.43	0.24	23.52	51.20	0.37
17.31	14.15	21.95	2.06	154.64	0.74	16.95	51.20	0.37
17.39	14.50	22.48	2.17	163.49	0.85	17.74	40.47	0.29
17.47	19.23	29.33	1.93	93.70	0.30	26.52	51.20	0.37
17.55	23.40	35.35	1.93	94.34	0.31	32.67	51.20	0.37
17.63	23.75	35.89	2.06	98.79	0.33	33.18	51.20	0.37
17.72	22.22	33.75	2.25	101.96	0.35	31.15	51.20	0.37
17.80	29.12	42.79	1.62	88.85	0.28	38.98	51.20	0.37
17.88	42.89	60.05	1.02	84.86	0.27	50.17	34.10	0.24
17.96	50.13	68.35	0.77	88.20	0.28	54.44	34.10	0.24
18.04	47.13	64.50	0.80	84.91	0.26	52.53	34.10	0.24
18.13	36.19	50.96	1.09	79.00	0.24	44.75	51.20	0.37
18.21	27.67	40.10	1.54	85.19	0.27	36.84	51.20	0.37
18.29	19.78	29.45	2.15	112.80	0.41	26.65	51.20	0.37
18.37	14.08	21.35	2.83	108.95	1.96	16.03	0.06	0.00
18.45	10.94	16.63	3.25	111.66	1.53	7.79	0.22	0.00
18.54	10.04	15.07	2.86	101.71	1.38	4.54	0.37	0.00
18.62	13.83	20.15	1.60	116.99	0.40	14.13	51.20	0.37
18.70	20.93	29.46	0.95	61.88	0.20	26.66	51.20	0.37
18.78	25.78	35.77	0.86	62.39	0.20	33.07	51.20	0.37
18.86	25.34	35.48	1.08	68.58	0.21	32.80	51.20	0.37
18.95	20.37	29.23	1.62	82.11	0.25	26.40	51.20	0.37
19.03	16.11	23.55	2.26	164.88	0.86	19.27	39.46	0.28
19.11	12.42	18.38	3.04	110.05	1.68	11.09	0.14	0.00
19.19	10.05	14.81	3.29	109.29	1.35	3.96	0.42	0.00
19.27	8.33	12.01	3.19	101.96	1.09	0.00	1.19	0.01
19.36	7.06	9.87	2.71	89.70	0.90	0.00	3.15	0.02
19.44	6.22	8.45	2.18	78.16	0.77	0.00	6.76	0.05
19.52	5.89	7.89	1.61	67.52	0.72	0.00	9.50	0.07
19.60	5.89	7.83	1.19	59.42	0.71	0.00	9.91	0.07
19.69	6.00	7.91	0.96	54.32	0.72	0.00	9.47	0.07

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
19.77	6.14	8.07	0.86	52.28	0.73	0.00	8.67	0.06
19.85	6.42	8.44	0.81	51.22	0.76	0.00	7.00	0.05
19.93	6.77	8.93	0.79	50.91	0.81	0.00	5.35	0.04
20.01	7.30	9.64	0.73	49.84	0.87	0.00	3.68	0.03
20.10	7.63	10.06	0.67	48.23	0.91	0.00	3.00	0.02
20.18	7.87	10.38	0.68	104.16	0.31	0.00	51.20	0.37
20.26	8.23	10.89	0.73	103.91	0.31	0.00	51.20	0.37
20.34	8.71	11.58	0.81	106.25	0.32	0.00	51.20	0.37
20.42	9.25	12.38	0.95	116.58	0.38	0.00	51.20	0.37
20.51	9.85	13.31	1.17	62.99	1.19	0.43	0.77	0.01
20.59	10.66	14.48	1.34	145.96	0.62	3.22	51.20	0.37
20.67	10.77	14.66	1.45	70.77	1.31	3.63	0.47	0.00
20.75	10.68	14.48	1.43	70.21	1.29	3.21	0.51	0.00
20.83	10.86	14.78	1.61	74.85	1.32	3.88	0.46	0.00
20.92	14.47	19.78	1.63	124.40	0.44	13.51	51.20	0.37
21.00	17.66	24.14	1.70	100.30	0.33	20.09	51.20	0.37
21.08	18.59	25.40	1.78	100.63	0.33	21.77	51.20	0.37
21.16	15.57	21.37	2.09	166.40	0.86	16.07	39.73	0.28
21.24	12.02	16.56	2.71	100.90	1.47	7.65	0.26	0.00
21.33	9.91	13.59	3.28	107.07	1.21	1.12	0.71	0.01
21.41	9.14	12.35	3.38	106.13	1.10	0.00	1.15	0.01
21.49	10.84	14.76	2.81	100.56	1.31	3.86	0.47	0.00
21.57	25.63	33.94	1.34	75.96	0.22	31.33	51.20	0.37
21.65	52.86	66.56	0.74	86.02	0.26	53.56	34.10	0.24
21.74	80.92	97.97	0.48	97.97	0.31	66.32	14.50	0.10
21.82	95.46	113.49	0.39	113.49	0.40	71.18	14.50	0.10
21.90	88.44	106.57	0.52	110.41	0.38	69.10	14.50	0.10
21.98	71.18	88.55	0.90	111.22	0.39	62.99	22.70	0.16
22.06	49.69	64.18	1.58	102.39	0.33	52.36	34.10	0.24
22.15	34.10	45.20	2.30	111.79	0.39	40.79	51.20	0.37
22.23	23.47	31.54	2.90	178.73	1.02	28.92	0.00	0.00
22.31	16.70	22.51	3.43	124.16	1.99	17.79	0.05	0.00
22.39	12.34	16.48	3.65	119.14	1.46	7.48	0.28	0.00
22.47	10.58	13.85	2.97	102.13	1.23	1.76	0.66	0.00
22.56	9.76	12.41	1.76	76.25	1.10	0.00	1.15	0.01
22.64	9.38	11.55	0.81	107.08	0.32	0.00	51.20	0.37
22.72	9.18	11.04	0.38	51.78	0.17	0.00	51.20	0.37
22.80	9.85	11.80	0.28	34.16	0.15	0.00	51.20	0.37
22.88	11.26	13.54	0.25	34.40	0.15	0.99	51.20	0.37
22.97	12.37	14.90	0.24	34.31	0.15	4.17	51.20	0.37
23.05	12.58	15.14	0.24	34.40	0.15	4.70	51.20	0.37
23.13	11.80	14.15	0.25	34.45	0.14	2.46	51.20	0.37
23.21	11.56	13.84	0.26	34.94	0.15	1.73	51.20	0.37
23.29	12.74	15.38	0.33	37.85	0.15	5.20	51.20	0.37
23.38	14.61	17.88	0.53	44.90	0.16	10.18	51.20	0.37
23.46	15.74	19.54	0.86	55.91	0.18	13.10	51.20	0.37
23.54	15.23	19.28	1.65	132.54	0.49	12.68	51.20	0.37
23.62	15.41	19.75	2.36	96.83	1.73	13.45	0.11	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
23.70	24.73	31.55	1.97	88.55	0.27	28.92	51.20	0.37
23.79	59.20	71.97	0.96	95.18	0.29	56.14	22.70	0.16
23.87	121.18	141.55	0.73	142.08	0.64	78.47	8.25	0.06
23.95	192.00	218.40	0.63	218.40	2.00	92.78	0.00	0.00
24.03	251.64	282.57	0.63	282.57	2.00	100.00	0.00	0.00
24.11	286.52	318.49	0.59	318.49	2.00	100.00	0.00	0.00
24.20	303.76	337.21	0.62	337.21	2.00	100.00	0.00	0.00
24.28	311.89	347.84	0.72	347.84	2.00	100.00	0.00	0.00
24.36	320.49	359.02	0.84	359.02	2.00	100.00	0.00	0.00
24.44	329.89	369.78	0.89	369.78	2.00	100.00	0.00	0.00
24.52	336.50	375.34	0.85	375.34	2.00	100.00	0.00	0.00
24.61	342.35	378.18	0.72	378.18	2.00	100.00	0.00	0.00
24.69	355.51	388.07	0.59	388.07	2.00	100.00	0.00	0.00
24.77	346.44	374.29	0.47	374.29	2.00	100.00	0.00	0.00
24.85	339.05	366.95	0.50	366.95	2.00	100.00	0.00	0.00
24.93	322.43	349.67	0.52	349.67	2.00	100.00	0.00	0.00
25.02	326.72	353.24	0.50	353.24	2.00	100.00	0.00	0.00
25.10	324.65	347.34	0.39	347.34	2.00	100.00	0.00	0.00
25.18	322.15	341.54	0.31	341.54	2.00	100.00	0.00	0.00
25.26	319.28	336.01	0.25	336.01	2.00	100.00	0.00	0.00
25.34	322.46	338.95	0.26	338.95	2.00	100.00	0.00	0.00
25.43	328.27	344.64	0.26	344.64	2.00	100.00	0.00	0.00
25.51	333.69	350.00	0.27	350.00	2.00	100.00	0.00	0.00
25.59	334.37	350.16	0.26	350.16	2.00	100.00	0.00	0.00
25.67	336.48	350.08	0.22	350.08	2.00	100.00	0.00	0.00
25.75	338.84	353.18	0.24	353.18	2.00	100.00	0.00	0.00
25.84	334.67	349.46	0.26	349.46	2.00	100.00	0.00	0.00
25.92	335.89	351.97	0.30	351.97	2.00	100.00	0.00	0.00
26.00	338.05	355.59	0.36	355.59	2.00	100.00	0.00	0.00
26.08	341.44	359.45	0.38	359.45	2.00	100.00	0.00	0.00
26.16	340.57	357.32	0.36	357.32	2.00	100.00	0.00	0.00
26.25	337.18	352.37	0.32	352.37	2.00	100.00	0.00	0.00
26.33	340.69	354.31	0.29	354.31	2.00	100.00	0.00	0.00
26.41	344.74	361.13	0.38	361.13	2.00	100.00	0.00	0.00
26.49	353.02	368.08	0.35	368.08	2.00	100.00	0.00	0.00
26.57	366.83	380.58	0.32	380.58	2.00	100.00	0.00	0.00
26.66	372.94	383.78	0.25	383.78	2.00	100.00	0.00	0.00
26.74	371.58	382.50	0.26	382.50	2.00	100.00	0.00	0.00
26.82	362.86	373.00	0.25	373.00	2.00	100.00	0.00	0.00
26.90	357.12	366.92	0.25	366.92	2.00	100.00	0.00	0.00
26.98	354.79	367.64	0.35	367.64	2.00	100.00	0.00	0.00
27.07	349.99	367.17	0.53	367.17	2.00	100.00	0.00	0.00
27.15	342.74	361.02	0.62	361.02	2.00	100.00	0.00	0.00
27.23	338.92	356.39	0.61	356.39	2.00	100.00	0.00	0.00
27.31	335.29	350.52	0.52	350.52	2.00	100.00	0.00	0.00
27.40	339.19	353.33	0.49	353.33	2.00	100.00	0.00	0.00
27.48	330.79	344.05	0.47	344.05	2.00	100.00	0.00	0.00
27.56	324.07	338.34	0.55	338.34	2.00	100.00	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
27.64	311.43	326.38	0.63	326.38	2.00	100.00	0.00	0.00
27.72	309.19	324.61	0.70	324.61	2.00	100.00	0.00	0.00
27.81	316.54	332.86	0.78	332.86	2.00	100.00	0.00	0.00
27.89	330.23	346.79	0.81	346.79	2.00	100.00	0.00	0.00
27.97	351.70	368.87	0.85	368.87	2.00	100.00	0.00	0.00
28.05	377.19	392.97	0.75	392.97	2.00	100.00	0.00	0.00
28.13	416.87	431.65	0.68	431.65	2.00	100.00	0.00	0.00
28.22	468.07	482.47	0.66	482.47	2.00	100.00	0.00	0.00
28.30	491.65	508.66	0.81	508.66	2.00	100.00	0.00	0.00
28.38	492.95	511.87	0.95	511.87	2.00	100.00	0.00	0.00
28.46	471.37	489.11	0.95	489.11	2.00	100.00	0.00	0.00
28.54	467.38	482.21	0.82	482.21	2.00	100.00	0.00	0.00
28.63	453.68	465.30	0.69	465.30	2.00	100.00	0.00	0.00
28.71	440.31	452.52	0.76	452.52	2.00	100.00	0.00	0.00
28.79	419.18	431.15	0.80	431.15	2.00	100.00	0.00	0.00
28.87	409.28	419.28	0.72	419.28	2.00	100.00	0.00	0.00
28.95	408.93	416.12	0.58	416.12	2.00	100.00	0.00	0.00
29.04	400.44	403.87	0.41	403.87	2.00	100.00	0.00	0.00
29.12	406.90	409.53	0.39	409.53	2.00	100.00	0.00	0.00
29.20	388.43	391.58	0.43	391.58	2.00	100.00	0.00	0.00
29.28	366.12	371.25	0.56	371.25	2.00	100.00	0.00	0.00
29.36	315.81	323.87	0.88	323.87	2.00	100.00	0.00	0.00
29.45	294.56	302.13	0.91	302.13	2.00	100.00	0.00	0.00
29.53	278.70	286.09	0.98	286.09	2.00	100.00	0.00	0.00
29.61	295.81	301.25	0.75	301.25	2.00	100.00	0.00	0.00
29.69	300.94	307.40	0.94	307.40	2.00	100.00	0.00	0.00
29.77	309.55	316.87	1.13	316.87	2.00	100.00	0.00	0.00
29.86	296.92	305.28	1.46	305.28	2.00	100.00	0.00	0.00
29.94	261.05	269.20	1.71	306.85	2.00	99.69	0.00	0.00
30.02	217.14	224.52	1.97	275.52	2.00	93.69	0.00	0.00
30.10	174.84	181.16	2.24	234.85	2.00	86.61	0.00	0.00
30.18	139.27	144.63	2.63	205.72	2.00	79.18	0.00	0.00
30.27	117.43	121.78	2.68	184.82	1.25	73.50	1.67	0.01
30.35	110.66	114.48	2.63	176.63	1.11	71.46	2.36	0.02
30.43	141.61	145.07	1.75	185.93	1.27	79.28	1.95	0.01
30.51	190.02	192.54	1.12	205.83	2.00	88.62	0.00	0.00
30.59	214.01	214.87	0.74	214.87	2.00	92.25	0.00	0.00
30.68	224.77	224.59	0.61	224.59	2.00	93.71	0.00	0.00
30.76	221.23	221.12	0.67	221.12	2.00	93.19	0.00	0.00
30.84	230.20	229.82	0.70	229.82	2.00	94.47	0.00	0.00
30.92	234.19	232.87	0.58	232.87	2.00	94.90	0.00	0.00
31.00	237.11	234.30	0.40	234.30	2.00	95.10	0.00	0.00
31.09	236.75	233.82	0.41	233.82	2.00	95.03	0.00	0.00
31.17	237.58	234.67	0.46	234.67	2.00	95.16	0.00	0.00
31.25	240.72	237.99	0.55	237.99	2.00	95.62	0.00	0.00
31.33	248.62	245.03	0.48	245.03	2.00	96.58	0.00	0.00
31.41	237.02	233.53	0.50	233.53	2.00	94.99	0.00	0.00
31.50	226.70	223.40	0.55	223.40	2.00	93.53	0.00	0.00

:: Estimation of post-earthquake lateral Displacements :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	R_f (%)	$Q_{tn,cs}$	FS	D_r	$Gamma_{max}$ (%)	Lat. disp. (in)
31.58	215.54	212.38	0.60	212.38	2.00	91.86	0.00	0.00
31.66	221.35	217.75	0.59	217.75	2.00	92.68	0.00	0.00
31.74	223.84	220.10	0.64	220.10	2.00	93.04	0.00	0.00
31.82	232.84	228.94	0.73	228.94	2.00	94.34	0.00	0.00
31.91	243.06	238.84	0.78	238.84	2.00	95.74	0.00	0.00
31.99	236.70	231.97	0.69	231.97	2.00	94.77	0.00	0.00
32.07	217.78	213.87	0.94	213.87	2.00	92.09	0.00	0.00
32.15	206.33	202.21	0.88	202.21	2.00	90.24	0.00	0.00
32.23	209.75	205.22	0.86	205.22	2.00	90.73	0.00	0.00
32.32	237.77	230.63	0.38	230.63	2.00	94.58	0.00	0.00
32.40	259.14	252.02	0.62	252.02	2.00	97.51	0.00	0.00
32.48	287.00	279.83	0.96	279.83	2.00	100.00	0.00	0.00
32.56	287.50	280.89	1.41	283.16	2.00	100.00	0.00	0.00
32.64	277.86	271.10	1.45	283.97	2.00	99.92	0.00	0.00
32.73	266.02	259.14	1.47	279.25	2.00	98.43	0.00	0.00
32.81	257.63	250.47	1.41	267.54	2.00	97.30	0.00	0.00
32.89	251.98	244.78	1.57	277.58	2.00	96.55	0.00	0.00
32.97	259.58	251.74	1.57	282.85	2.00	97.47	0.00	0.00
33.05	301.26	291.53	1.44	292.27	2.00	100.00	0.00	0.00
33.14	373.43	360.47	1.24	360.47	2.00	100.00	0.00	0.00
33.22	475.02	457.15	0.99	457.15	2.00	100.00	0.00	0.00
33.30	534.68	513.21	0.82	513.21	2.00	100.00	0.00	0.00
33.38	567.24	543.20	0.68	543.20	2.00	100.00	0.00	0.00
33.46	563.79	538.97	0.61	538.97	2.00	100.00	0.00	0.00
33.55	588.20	561.48	0.57	561.48	2.00	100.00	0.00	0.00
33.63	584.31	557.12	0.55	557.12	2.00	100.00	0.00	0.00
33.71	555.56	529.55	0.66	529.55	2.00	100.00	0.00	0.00
33.79	508.87	484.79	0.79	484.79	2.00	100.00	0.00	0.00
33.87	496.39	472.43	0.86	472.43	2.00	100.00	0.00	0.00
33.96	522.36	496.39	0.77	496.39	2.00	100.00	0.00	0.00
34.04	544.22	516.50	0.73	516.50	2.00	100.00	0.00	0.00
34.12	563.30	534.01	0.72	534.01	2.00	100.00	0.00	0.00
34.20	560.70	530.56	0.49	530.56	2.00	100.00	0.00	0.00
34.28	538.94	509.04	0.26	509.04	2.00	100.00	0.00	0.00
34.37	515.81	490.60	0.00	490.60	2.00	100.00	0.00	0.00
34.45	530.29	503.93	0.00	503.93	2.00	100.00	0.00	0.00
34.53	569.06	540.38	0.00	540.38	2.00	100.00	0.00	0.00

Total estimated displacement: 31.50

Abbreviations

q_t: Total cone resistance
Q_{tn}: Adjusted cone resistance to an effective overburden stress of 1 atm
R_f: Friction ration
$Q_{tn,cs}$: Adjusted and corrected cone resistance due to fines
FS: Calculated factor of safety against liquefaction
D_r: Calculated relative density
$Gamma_{max}$: Calculated maximum cyclic shear strain
Lat. disp.: Lateral displacement

:: Strength loss calculation (Robertson (2009) ::

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
0.08	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.16	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.25	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.33	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.41	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.49	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.57	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.66	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.74	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.82	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.90	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
0.98	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.07	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.15	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.23	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.31	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.39	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.48	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.56	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.64	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.72	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.80	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.89	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
1.97	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.05	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.13	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.21	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.30	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.38	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.46	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.54	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.62	0.00	-1.00	1.00	-1.00	-1.00	0.00	0.00
2.71	27.12	50.96	2.43	123.67	2.41	0.79	0.79
2.79	36.78	69.21	2.04	141.42	2.33	0.82	0.82
2.87	29.80	56.00	2.51	140.63	2.43	0.81	0.81
2.95	24.60	46.16	2.95	136.00	2.50	0.81	0.81
3.03	21.34	39.99	3.21	128.36	2.53	0.81	0.81
3.12	19.45	36.42	3.29	119.98	2.54	0.81	0.81
3.20	18.42	34.45	3.33	114.61	2.55	0.80	0.80
3.28	17.54	32.79	3.52	115.31	2.57	0.82	0.82
3.36	16.89	31.55	3.79	119.47	2.60	2.56	5.93
3.44	16.56	30.92	3.96	122.30	2.62	2.56	5.68
3.53	16.32	30.46	4.02	122.41	2.63	2.44	5.47
3.61	15.87	29.60	4.13	122.29	2.64	2.34	5.21
3.69	15.22	28.35	4.35	123.29	2.66	2.26	4.88
3.77	14.62	27.21	4.60	125.26	2.69	2.20	4.59
3.85	13.90	25.84	4.96	128.20	2.72	2.20	4.27
3.94	13.34	24.77	5.24	129.87	2.75	2.18	4.01

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
4.02	12.85	23.84	5.47	130.48	2.77	2.06	3.80
4.10	12.57	23.30	5.62	130.90	2.78	2.03	3.68
4.18	12.06	22.33	5.97	133.23	2.81	2.07	3.50
4.27	11.39	21.05	6.35	133.76	2.84	2.06	3.27
4.35	10.66	19.67	6.73	132.35	2.87	1.85	3.03
4.43	9.92	18.26	7.02	128.18	2.89	1.73	2.79
4.51	9.25	16.98	7.20	122.29	2.90	1.54	2.58
4.59	9.08	16.65	6.83	113.73	2.87	1.26	2.51
4.68	8.99	16.48	6.37	104.92	2.84	1.12	2.47
4.76	9.02	16.52	6.04	99.74	2.81	0.97	2.45
4.84	8.92	16.32	5.97	97.49	2.81	0.95	2.41
4.92	9.31	17.06	5.67	96.73	2.79	0.95	2.50
5.00	10.06	18.46	5.32	98.23	2.76	0.97	2.69
5.09	10.71	19.68	5.24	103.08	2.75	1.14	2.84
5.17	11.00	20.23	5.45	110.20	2.77	1.32	2.90
5.25	10.85	19.94	5.87	116.97	2.80	1.42	2.84
5.33	10.44	19.15	6.35	121.61	2.84	1.49	2.71
5.41	10.04	18.38	6.81	125.10	2.87	1.49	2.58
5.50	9.78	17.89	7.01	125.37	2.89	1.53	2.49
5.58	9.42	17.19	7.21	123.97	2.90	1.43	2.38
5.66	8.90	16.20	7.46	120.81	2.92	1.30	2.23
5.74	8.38	15.21	7.84	119.18	2.94	1.21	2.08
5.82	8.26	14.98	7.87	117.87	2.94	1.21	2.03
5.91	8.41	15.26	7.59	115.86	2.93	1.18	2.06
5.99	8.65	15.71	7.17	112.69	2.90	1.10	2.10
6.07	8.72	15.82	6.95	109.99	2.88	1.05	2.10
6.15	8.66	15.71	6.95	109.24	2.88	1.03	2.08
6.23	8.43	15.27	7.20	109.86	2.90	1.03	2.01
6.32	8.26	14.92	7.38	110.18	2.91	1.03	1.95
6.40	8.09	14.59	7.58	110.53	2.92	0.99	1.89
6.48	7.95	14.32	7.75	110.92	2.94	1.00	1.85
6.56	7.76	13.96	8.01	111.85	2.95	1.00	1.79
6.64	7.58	13.61	8.19	111.49	2.96	0.99	1.73
6.73	7.45	13.35	8.23	109.87	2.97	0.93	1.69
6.81	7.38	13.21	8.08	106.77	2.96	0.89	1.66
6.89	7.25	12.97	7.98	103.45	2.95	0.81	1.62
6.97	7.03	12.54	7.94	99.57	2.95	0.75	1.56
7.05	6.70	11.92	8.03	95.66	2.95	0.67	1.47
7.14	6.37	11.27	8.14	91.78	2.96	0.59	1.39
7.22	6.13	10.82	8.09	87.53	2.96	0.54	1.32
7.30	6.02	10.60	7.84	83.09	2.94	0.47	1.29
7.38	6.00	10.56	7.41	78.28	2.91	0.41	1.28
7.46	5.98	10.51	7.04	74.02	2.89	0.36	1.27
7.55	5.85	10.26	7.03	72.14	2.89	0.32	1.23
7.63	5.77	10.09	7.15	72.09	2.90	0.34	1.21
7.71	5.86	10.25	7.57	77.60	2.92	0.35	1.22
7.79	6.25	10.98	7.57	83.12	2.92	0.50	1.30
7.87	7.36	13.08	6.50	84.99	2.85	0.55	1.54

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
7.96	8.40	15.04	5.46	82.07	2.77	0.53	1.76
8.04	9.32	16.77	4.61	77.38	2.69	0.50	1.96
8.12	9.53	17.15	4.29	73.53	2.66	0.48	1.99
8.20	9.80	17.65	4.07	71.82	2.64	0.41	2.04
8.28	10.00	18.03	4.14	74.58	2.64	0.46	2.07
8.37	10.09	18.19	4.25	77.33	2.65	0.59	2.08
8.45	9.96	17.94	4.46	79.92	2.68	0.51	2.04
8.53	9.46	16.98	4.68	79.40	2.70	0.53	1.92
8.61	8.57	15.29	5.39	82.41	2.76	0.50	1.72
8.69	7.60	13.46	6.38	85.81	2.84	0.51	1.51
8.78	6.90	12.12	7.33	88.85	2.91	0.54	1.35
8.86	6.67	11.67	7.72	90.07	2.93	0.53	1.30
8.94	6.77	11.87	7.38	87.58	2.91	0.52	1.31
9.02	7.18	12.62	6.67	84.11	2.86	0.45	1.39
9.10	7.65	13.51	5.99	80.97	2.81	0.44	1.48
9.19	7.84	13.85	5.81	80.50	2.80	0.46	1.51
9.27	9.74	17.45	4.30	75.05	2.66	0.45	1.89
9.35	13.92	25.33	2.61	66.21	2.44	0.19	0.67
9.43	18.48	33.95	1.93	65.49	2.30	0.18	0.67
9.51	20.50	37.76	1.74	65.69	2.25	0.18	0.67
9.60	19.68	36.19	1.81	65.52	2.27	0.18	0.67
9.68	19.29	35.45	1.74	61.60	2.24	0.13	0.66
9.76	22.02	40.60	1.50	61.00	2.15	0.12	0.66
9.84	25.07	46.35	1.38	63.88	2.07	0.15	0.67
9.92	26.87	49.51	1.34	66.30	2.03	0.19	0.67
10.01	26.11	48.31	1.37	66.40	2.07	0.19	0.67
10.09	26.10	48.28	1.37	66.30	2.07	0.19	0.67
10.17	27.20	49.54	1.33	65.98	2.03	0.18	0.67
10.25	28.73	51.03	1.00	51.03	1.97	0.06	0.63
10.33	30.12	52.21	1.00	52.21	1.92	0.06	0.63
10.42	31.35	53.56	1.00	53.56	1.88	0.07	0.64
10.50	30.99	53.35	1.00	53.35	1.91	0.07	0.64
10.58	28.29	50.35	1.31	65.93	2.00	0.18	0.67
10.66	23.30	42.93	1.52	65.29	2.16	0.17	0.67
10.74	19.00	34.80	1.98	68.77	2.31	0.23	0.68
10.83	15.89	28.92	2.52	73.00	2.43	0.33	0.69
10.91	13.52	24.42	3.13	76.50	2.52	0.55	0.71
10.99	11.03	19.71	4.03	79.39	2.63	0.50	1.94
11.07	8.76	15.40	5.16	79.42	2.74	0.44	1.51
11.15	7.84	13.67	5.65	77.22	2.78	0.32	1.33
11.24	7.69	13.38	5.46	73.09	2.77	0.35	1.30
11.32	11.15	19.91	3.14	62.58	2.52	0.17	0.67
11.40	16.09	29.23	1.91	55.77	2.30	0.08	0.64
11.48	19.69	35.99	1.58	56.82	2.19	0.09	0.65
11.56	18.83	34.40	1.71	58.72	2.23	0.10	0.65
11.65	15.13	27.40	2.28	62.38	2.38	0.14	0.66
11.73	12.16	21.78	3.41	74.20	2.56	0.73	0.73
11.81	10.58	18.78	4.75	89.14	2.70	0.57	1.77

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
11.89	10.91	19.39	5.03	97.61	2.73	0.72	1.82
11.98	15.31	27.71	3.23	89.48	2.54	0.74	0.74
12.06	26.28	47.81	1.64	78.43	2.21	0.51	0.70
12.14	40.56	68.77	1.31	90.03	2.00	0.73	0.73
12.22	57.82	92.55	1.19	110.20	1.84	0.77	0.77
12.30	77.84	118.35	1.00	118.35	1.69	0.78	0.78
12.39	104.35	149.74	1.00	149.74	1.53	0.83	0.83
12.47	132.35	181.77	1.00	181.77	1.41	0.87	0.87
12.55	158.12	210.60	1.00	210.60	1.33	0.90	0.90
12.63	176.22	230.94	1.00	230.94	1.29	0.92	0.92
12.71	189.71	246.14	1.00	246.14	1.26	0.93	0.93
12.80	199.34	259.68	1.00	259.68	1.28	0.94	0.94
12.88	206.91	271.38	1.00	271.38	1.31	0.95	0.95
12.96	211.03	275.83	1.00	275.83	1.30	0.96	0.96
13.04	211.78	272.35	1.00	272.35	1.26	0.96	0.96
13.12	212.72	266.85	1.00	266.85	1.19	0.95	0.95
13.21	217.26	268.39	1.00	268.39	1.15	0.95	0.95
13.29	226.44	276.65	1.00	276.65	1.12	0.96	0.96
13.37	235.91	286.43	1.00	286.43	1.11	0.97	0.97
13.45	243.48	293.47	1.00	293.47	1.09	0.97	0.97
13.53	248.34	299.81	1.00	299.81	1.10	0.98	0.98
13.62	252.74	309.31	1.00	309.31	1.14	0.99	0.99
13.70	253.12	321.90	1.00	321.90	1.26	0.99	0.99
13.78	247.24	325.87	1.00	325.87	1.38	1.00	1.00
13.86	231.70	317.82	1.00	317.82	1.51	0.99	0.99
13.94	207.10	292.75	1.00	292.75	1.62	0.97	0.97
14.03	169.40	249.47	1.10	274.44	1.76	0.96	0.96
14.11	133.25	202.53	1.22	246.97	1.87	0.93	0.93
14.19	107.76	167.37	1.28	213.65	1.96	0.90	0.90
14.27	113.02	170.20	1.22	206.89	1.87	0.89	0.89
14.35	134.87	192.01	1.00	192.01	1.69	0.88	0.88
14.44	152.40	205.70	1.00	205.70	1.52	0.89	0.89
14.52	154.01	200.43	1.00	200.43	1.41	0.89	0.89
14.60	145.04	187.64	1.00	187.64	1.40	0.87	0.87
14.68	138.42	181.01	1.00	181.01	1.44	0.87	0.87
14.76	136.42	180.97	1.00	180.97	1.50	0.87	0.87
14.85	139.09	185.57	1.00	185.57	1.52	0.87	0.87
14.93	146.28	194.92	1.00	194.92	1.52	0.88	0.88
15.01	151.51	201.63	1.00	201.63	1.53	0.89	0.89
15.09	154.90	205.98	1.00	205.98	1.53	0.89	0.89
15.17	158.90	210.75	1.00	210.75	1.53	0.90	0.90
15.26	165.61	218.14	1.00	218.14	1.51	0.91	0.91
15.34	172.15	225.38	1.00	225.38	1.50	0.91	0.91
15.42	176.55	230.23	1.00	230.23	1.49	0.92	0.92
15.50	178.28	232.11	1.00	232.11	1.49	0.92	0.92
15.58	178.94	232.44	1.00	232.44	1.49	0.92	0.92
15.67	180.15	233.13	1.00	233.13	1.49	0.92	0.92
15.75	181.86	234.32	1.00	234.32	1.48	0.92	0.92

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
15.83	181.88	233.90	1.00	233.90	1.48	0.92	0.92
15.91	178.36	230.04	1.00	230.04	1.50	0.92	0.92
15.99	168.69	219.56	1.00	219.56	1.54	0.91	0.91
16.08	156.27	205.80	1.00	205.80	1.59	0.89	0.89
16.16	139.00	186.15	1.00	186.15	1.67	0.87	0.87
16.24	118.03	161.93	1.12	180.90	1.77	0.87	0.87
16.32	94.22	133.49	1.24	166.16	1.91	0.85	0.85
16.40	71.81	105.50	1.38	145.88	2.07	0.82	0.82
16.49	52.67	80.20	1.73	138.63	2.24	0.81	0.81
16.57	36.45	57.55	2.52	144.95	2.43	0.82	0.82
16.65	23.92	39.06	3.99	156.01	2.63	1.74	3.03
16.73	16.15	26.87	5.73	154.07	2.79	1.39	2.00
16.81	11.96	19.90	7.11	141.55	2.89	0.92	1.44
16.90	10.32	16.85	7.07	119.17	2.89	0.68	1.22
16.98	12.25	19.32	4.72	91.29	2.70	0.46	1.47
17.06	16.59	25.20	2.82	70.95	2.48	0.28	0.69
17.14	18.98	28.54	2.45	69.97	2.41	0.25	0.68
17.22	17.60	26.79	2.93	78.43	2.49	0.51	0.70
17.31	14.15	21.95	4.12	90.53	2.64	0.50	1.69
17.39	14.50	22.48	4.17	93.78	2.65	0.52	1.73
17.47	19.23	29.33	3.12	91.41	2.52	0.74	0.74
17.55	23.40	35.35	2.67	94.34	2.45	0.74	0.74
17.63	23.75	35.89	2.75	98.79	2.47	0.75	0.75
17.72	22.22	33.75	3.06	103.16	2.51	0.75	0.75
17.80	29.12	42.79	2.08	88.85	2.34	0.73	0.73
17.88	42.89	60.05	1.41	84.86	2.10	0.72	0.72
17.96	50.13	68.35	1.29	88.20	1.98	0.72	0.72
18.04	47.13	64.50	1.32	84.91	2.01	0.72	0.72
18.13	36.19	50.96	1.55	79.00	2.17	0.54	0.70
18.21	27.67	40.10	2.12	85.19	2.35	0.72	0.72
18.29	19.78	29.45	3.32	97.80	2.55	0.77	0.77
18.37	14.08	21.35	5.10	108.95	2.74	0.71	1.60
18.45	10.94	16.63	6.71	111.66	2.87	0.61	1.21
18.54	10.04	15.07	6.75	101.71	2.87	0.51	1.10
18.62	13.83	20.15	3.85	77.55	2.61	0.35	1.55
18.70	20.93	29.46	2.10	61.88	2.34	0.13	0.66
18.78	25.78	35.77	1.74	62.39	2.25	0.14	0.66
18.86	25.34	35.48	1.93	68.58	2.30	0.23	0.68
18.95	20.37	29.23	2.81	82.11	2.47	0.70	0.71
19.03	16.11	23.55	4.11	96.91	2.64	0.67	1.80
19.11	12.42	18.38	5.99	110.05	2.81	0.63	1.35
19.19	10.05	14.81	7.38	109.29	2.91	0.59	1.07
19.27	8.33	12.01	8.49	101.96	2.98	0.43	0.86
19.36	7.06	9.87	9.09	89.70	3.02	0.30	0.71
19.44	6.22	8.45	9.25	78.16	3.03	0.22	0.60
19.52	5.89	7.89	8.56	67.52	2.99	0.15	0.56
19.60	5.89	7.83	7.59	59.42	2.93	0.10	0.56
19.69	6.00	7.91	6.86	54.32	2.88	0.09	0.57

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
19.77	6.14	8.07	6.48	52.28	2.85	0.08	0.59
19.85	6.42	8.44	6.07	51.22	2.82	0.08	0.62
19.93	6.77	8.93	5.70	50.91	2.79	0.09	0.66
20.01	7.30	9.64	5.17	49.84	2.74	0.09	0.72
20.10	7.63	10.06	4.79	48.23	2.71	0.08	0.75
20.18	7.87	10.38	4.68	48.59	2.70	0.08	0.78
20.26	8.23	10.89	4.60	50.08	2.69	0.10	0.82
20.34	8.71	11.58	4.53	52.51	2.68	0.11	0.87
20.42	9.25	12.38	4.58	56.67	2.69	0.13	0.93
20.51	9.85	13.31	4.73	62.99	2.70	0.18	1.00
20.59	10.66	14.48	4.69	67.91	2.70	0.24	1.09
20.67	10.77	14.66	4.83	70.77	2.71	0.25	1.10
20.75	10.68	14.48	4.85	70.21	2.71	0.25	1.08
20.83	10.86	14.78	5.07	74.85	2.73	0.23	1.10
20.92	14.47	19.78	3.96	78.32	2.62	0.36	1.50
21.00	17.66	24.14	3.42	82.49	2.56	0.75	0.75
21.08	18.59	25.40	3.36	85.35	2.55	0.75	0.75
21.16	15.57	21.37	4.27	91.36	2.66	0.50	1.61
21.24	12.02	16.56	6.09	100.90	2.82	0.50	1.21
21.33	9.91	13.59	7.88	107.07	2.94	0.52	0.97
21.41	9.14	12.35	8.59	106.13	2.99	0.50	0.88
21.49	10.84	14.76	6.81	100.56	2.87	0.42	1.07
21.57	25.63	33.94	2.24	75.96	2.37	0.42	0.70
21.65	52.86	66.56	1.29	86.02	1.98	0.72	0.72
21.74	80.92	97.97	1.00	97.97	1.74	0.74	0.74
21.82	95.46	113.49	1.00	113.49	1.64	0.77	0.77
21.90	88.44	106.57	1.04	110.41	1.72	0.77	0.77
21.98	71.18	88.55	1.26	111.22	1.93	0.77	0.77
22.06	49.69	64.18	1.60	102.39	2.19	0.75	0.75
22.15	34.10	45.20	2.47	111.79	2.42	0.77	0.77
22.23	23.47	31.54	3.82	120.34	2.61	1.03	2.39
22.31	16.70	22.51	5.51	124.16	2.77	0.83	1.65
22.39	12.34	16.48	7.23	119.14	2.90	0.72	1.18
22.47	10.58	13.85	7.37	102.13	2.91	0.47	0.99
22.56	9.76	12.41	6.15	76.25	2.82	0.22	0.90
22.64	9.38	11.55	4.55	52.57	2.68	0.08	0.86
22.72	9.18	11.04	3.57	39.38	2.58	0.06	0.63
22.80	9.85	11.80	3.01	35.53	2.50	0.02	0.62
22.88	11.26	13.54	2.54	34.40	2.43	0.02	0.62
22.97	12.37	14.90	2.30	34.31	2.39	0.02	0.62
23.05	12.58	15.14	2.27	34.40	2.38	0.02	0.62
23.13	11.80	14.15	2.43	34.45	2.41	0.02	0.62
23.21	11.56	13.84	2.52	34.94	2.43	0.02	0.62
23.29	12.74	15.38	2.46	37.85	2.42	0.02	0.62
23.38	14.61	17.88	2.51	44.90	2.43	0.04	0.62
23.46	15.74	19.54	2.86	55.91	2.48	0.08	0.64
23.54	15.23	19.28	4.09	78.83	2.64	0.30	1.45
23.62	15.41	19.75	4.90	96.83	2.72	0.61	1.46

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
23.70	24.73	31.55	2.98	94.02	2.50	0.73	0.73
23.79	59.20	71.97	1.32	95.18	2.02	0.74	0.74
23.87	121.18	141.55	1.00	142.08	1.71	0.82	0.82
23.95	192.00	218.40	1.00	218.40	1.53	0.91	0.91
24.03	251.64	282.57	1.00	282.57	1.44	0.96	0.96
24.11	286.52	318.49	1.00	318.49	1.38	0.99	0.99
24.20	303.76	337.21	1.00	337.21	1.38	1.01	1.01
24.28	311.89	347.84	1.00	347.84	1.42	1.01	1.01
24.36	320.49	359.02	1.00	359.02	1.46	1.02	1.02
24.44	329.89	369.78	1.00	369.78	1.48	1.03	1.03
24.52	336.50	375.34	1.00	375.34	1.46	1.03	1.03
24.61	342.35	378.18	1.00	378.18	1.40	1.03	1.03
24.69	355.51	388.07	1.00	388.07	1.33	1.04	1.04
24.77	346.44	374.29	1.00	374.29	1.27	1.03	1.03
24.85	339.05	366.95	1.00	366.95	1.29	1.03	1.03
24.93	322.43	349.67	1.00	349.67	1.32	1.01	1.01
25.02	326.72	353.24	1.00	353.24	1.30	1.02	1.02
25.10	324.65	347.34	1.00	347.34	1.24	1.01	1.01
25.18	322.15	341.54	1.00	341.54	1.18	1.01	1.01
25.26	319.28	336.01	1.00	336.01	1.13	1.00	1.00
25.34	322.46	338.95	1.00	338.95	1.13	1.01	1.01
25.43	328.27	344.64	1.00	344.64	1.13	1.01	1.01
25.51	333.69	350.00	1.00	350.00	1.13	1.01	1.01
25.59	334.37	350.16	1.00	350.16	1.13	1.01	1.01
25.67	336.48	350.08	1.00	350.08	1.08	1.01	1.01
25.75	338.84	353.18	1.00	353.18	1.10	1.02	1.02
25.84	334.67	349.46	1.00	349.46	1.13	1.01	1.01
25.92	335.89	351.97	1.00	351.97	1.16	1.02	1.02
26.00	338.05	355.59	1.00	355.59	1.20	1.02	1.02
26.08	341.44	359.45	1.00	359.45	1.22	1.02	1.02
26.16	340.57	357.32	1.00	357.32	1.20	1.02	1.02
26.25	337.18	352.37	1.00	352.37	1.18	1.02	1.02
26.33	340.69	354.31	1.00	354.31	1.14	1.02	1.02
26.41	344.74	361.13	1.00	361.13	1.21	1.02	1.02
26.49	353.02	368.08	1.00	368.08	1.18	1.03	1.03
26.57	366.83	380.58	1.00	380.58	1.15	1.04	1.04
26.66	372.94	383.78	1.00	383.78	1.08	1.04	1.04
26.74	371.58	382.50	1.00	382.50	1.10	1.04	1.04
26.82	362.86	373.00	1.00	373.00	1.09	1.03	1.03
26.90	357.12	366.92	1.00	366.92	1.10	1.03	1.03
26.98	354.79	367.64	1.00	367.64	1.19	1.03	1.03
27.07	349.99	367.17	1.00	367.17	1.31	1.03	1.03
27.15	342.74	361.02	1.00	361.02	1.36	1.02	1.02
27.23	338.92	356.39	1.00	356.39	1.36	1.02	1.02
27.31	335.29	350.52	1.00	350.52	1.32	1.02	1.02
27.40	339.19	353.33	1.00	353.33	1.29	1.02	1.02
27.48	330.79	344.05	1.00	344.05	1.29	1.01	1.01
27.56	324.07	338.34	1.00	338.34	1.34	1.01	1.01

:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
27.64	311.43	326.38	1.00	326.38	1.40	1.00	1.00
27.72	309.19	324.61	1.00	324.61	1.43	1.00	1.00
27.81	316.54	332.86	1.00	332.86	1.46	1.00	1.00
27.89	330.23	346.79	1.00	346.79	1.46	1.01	1.01
27.97	351.70	368.87	1.00	368.87	1.46	1.03	1.03
28.05	377.19	392.97	1.00	392.97	1.40	1.04	1.04
28.13	416.87	431.65	1.00	431.65	1.35	1.07	1.07
28.22	468.07	482.47	1.00	482.47	1.31	1.10	1.10
28.30	491.65	508.66	1.00	508.66	1.36	1.11	1.11
28.38	492.95	511.87	1.00	511.87	1.42	1.11	1.11
28.46	471.37	489.11	1.00	489.11	1.43	1.10	1.10
28.54	467.38	482.21	1.00	482.21	1.38	1.10	1.10
28.63	453.68	465.30	1.00	465.30	1.33	1.09	1.09
28.71	440.31	452.52	1.00	452.52	1.37	1.08	1.08
28.79	419.18	431.15	1.00	431.15	1.40	1.07	1.07
28.87	409.28	419.28	1.00	419.28	1.37	1.06	1.06
28.95	408.93	416.12	1.00	416.12	1.30	1.06	1.06
29.04	400.44	403.87	1.00	403.87	1.20	1.05	1.05
29.12	406.90	409.53	1.00	409.53	1.19	1.05	1.05
29.20	388.43	391.58	1.00	391.58	1.22	1.04	1.04
29.28	366.12	371.25	1.00	371.25	1.32	1.03	1.03
29.36	315.81	323.87	1.00	323.87	1.51	1.00	1.00
29.45	294.56	302.13	1.00	302.13	1.54	0.98	0.98
29.53	278.70	286.09	1.00	286.09	1.58	0.97	0.97
29.61	295.81	301.25	1.00	301.25	1.48	0.98	0.98
29.69	300.94	307.40	1.00	307.40	1.55	0.98	0.98
29.77	309.55	316.87	1.00	316.87	1.60	0.99	0.99
29.86	296.92	305.28	1.00	305.28	1.70	0.98	0.98
29.94	261.05	269.20	1.14	306.85	1.79	0.98	0.98
30.02	217.14	224.52	1.23	275.52	1.89	0.96	0.96
30.10	174.84	181.16	1.30	234.85	1.99	0.92	0.92
30.18	139.27	144.63	1.42	205.72	2.10	0.89	0.89
30.27	117.43	121.78	1.52	184.82	2.16	0.87	0.87
30.35	110.66	114.48	1.54	176.63	2.17	0.86	0.86
30.43	141.61	145.07	1.28	185.93	1.97	0.87	0.87
30.51	190.02	192.54	1.07	205.83	1.74	0.89	0.89
30.59	214.01	214.87	1.00	214.87	1.58	0.90	0.90
30.68	224.77	224.59	1.00	224.59	1.50	0.91	0.91
30.76	221.23	221.12	1.00	221.12	1.54	0.91	0.91
30.84	230.20	229.82	1.00	229.82	1.54	0.92	0.92
30.92	234.19	232.87	1.00	232.87	1.48	0.92	0.92
31.00	237.11	234.30	1.00	234.30	1.37	0.92	0.92
31.09	236.75	233.82	1.00	233.82	1.38	0.92	0.92
31.17	237.58	234.67	1.00	234.67	1.41	0.92	0.92
31.25	240.72	237.99	1.00	237.99	1.46	0.92	0.92
31.33	248.62	245.03	1.00	245.03	1.41	0.93	0.93
31.41	237.02	233.53	1.00	233.53	1.44	0.92	0.92
31.50	226.70	223.40	1.00	223.40	1.48	0.91	0.91

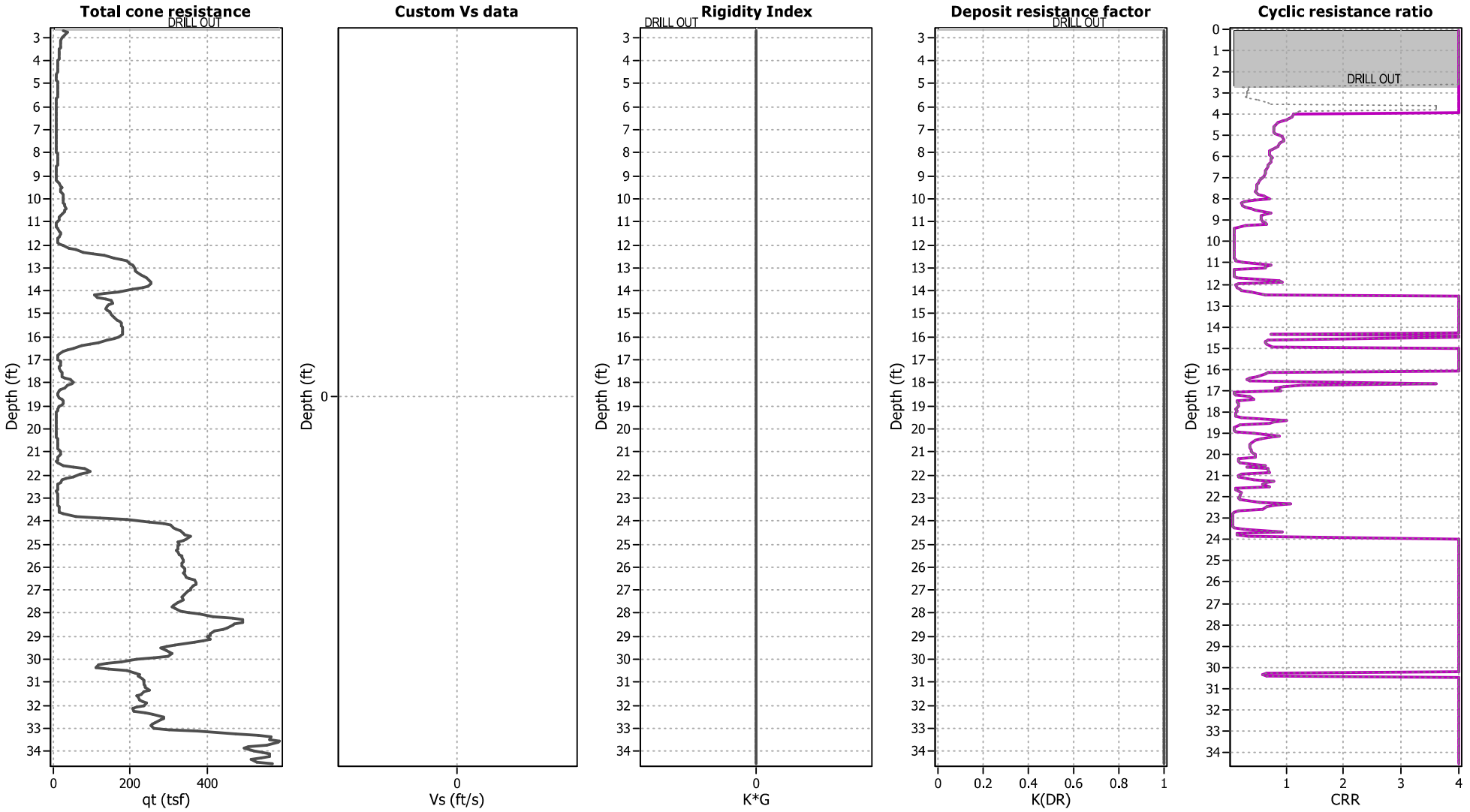
:: Strength loss calculation (Robertson (2009) :: (continued)

Depth (ft)	q_t (tsf)	Q_{tn}	K_c	$Q_{tn,cs}$	I_c	$S_{u(liq)}/\sigma'_v$	$S_{u(peak)}/\sigma'_v$
31.58	215.54	212.38	1.00	212.38	1.52	0.90	0.90
31.66	221.35	217.75	1.00	217.75	1.51	0.91	0.91
31.74	223.84	220.10	1.00	220.10	1.53	0.91	0.91
31.82	232.84	228.94	1.00	228.94	1.55	0.92	0.92
31.91	243.06	238.84	1.00	238.84	1.56	0.93	0.93
31.99	236.70	231.97	1.00	231.97	1.53	0.92	0.92
32.07	217.78	213.87	1.00	213.87	1.65	0.90	0.90
32.15	206.33	202.21	1.00	202.21	1.65	0.89	0.89
32.23	209.75	205.22	1.00	205.22	1.64	0.89	0.89
32.32	237.77	230.63	1.00	230.63	1.37	0.92	0.92
32.40	259.14	252.02	1.00	252.02	1.47	0.94	0.94
32.48	287.00	279.83	1.00	279.83	1.58	0.96	0.96
32.56	287.50	280.89	1.01	283.16	1.71	0.96	0.96
32.64	277.86	271.10	1.05	283.97	1.73	0.97	0.97
32.73	266.02	259.14	1.08	279.25	1.75	0.96	0.96
32.81	257.63	250.47	1.07	267.54	1.74	0.95	0.95
32.89	251.98	244.78	1.13	277.58	1.78	0.96	0.96
32.97	259.58	251.74	1.12	282.85	1.78	0.96	0.96
33.05	301.26	291.53	1.00	292.27	1.71	0.97	0.97
33.14	373.43	360.47	1.00	360.47	1.60	1.02	1.02
33.22	475.02	457.15	1.00	457.15	1.46	1.08	1.08
33.30	534.68	513.21	1.00	513.21	1.36	1.11	1.11
33.38	567.24	543.20	1.00	543.20	1.29	1.13	1.13
33.46	563.79	538.97	1.00	538.97	1.25	1.13	1.13
33.55	588.20	561.48	1.00	561.48	1.21	1.14	1.14
33.63	584.31	557.12	1.00	557.12	1.20	1.13	1.13
33.71	555.56	529.55	1.00	529.55	1.28	1.12	1.12
33.79	508.87	484.79	1.00	484.79	1.37	1.10	1.10
33.87	496.39	472.43	1.00	472.43	1.40	1.09	1.09
33.96	522.36	496.39	1.00	496.39	1.35	1.10	1.10
34.04	544.22	516.50	1.00	516.50	1.32	1.11	1.11
34.12	563.30	534.01	1.00	534.01	1.31	1.12	1.12
34.20	560.70	530.56	1.00	530.56	1.17	1.12	1.12
34.28	538.94	509.04	1.00	509.04	0.99	1.11	1.11
34.37	515.81	490.60	1.00	490.60	-1.00	1.10	1.10
34.45	530.29	503.93	1.00	503.93	-1.00	1.11	1.11
34.53	569.06	540.38	1.00	540.38	-1.00	1.13	1.13

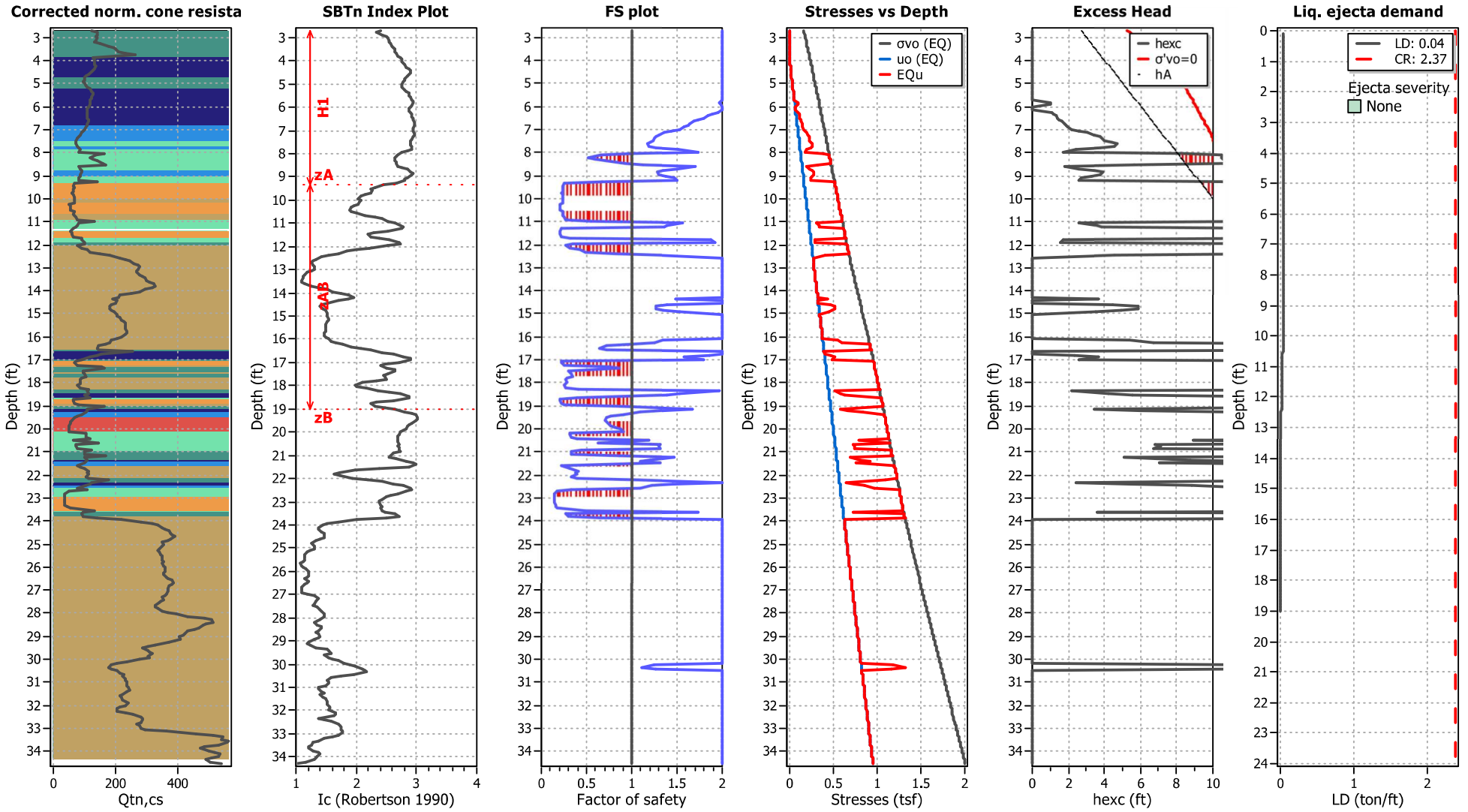
Abbreviations

q_t: Total cone resistance
K_c: Cone resistance correction factor due to fines
$Q_{tn,cs}$: Adjusted and corrected cone resistance due to fines
I_c: Soil behavior type index
$S_{u(liq)}/\sigma'_v$: Calculated liquefied undrained strength ratio
$S_{u(peak)}/\sigma'_v$: Calculated peak undrained strength ratio

Aging Calculation Estimation

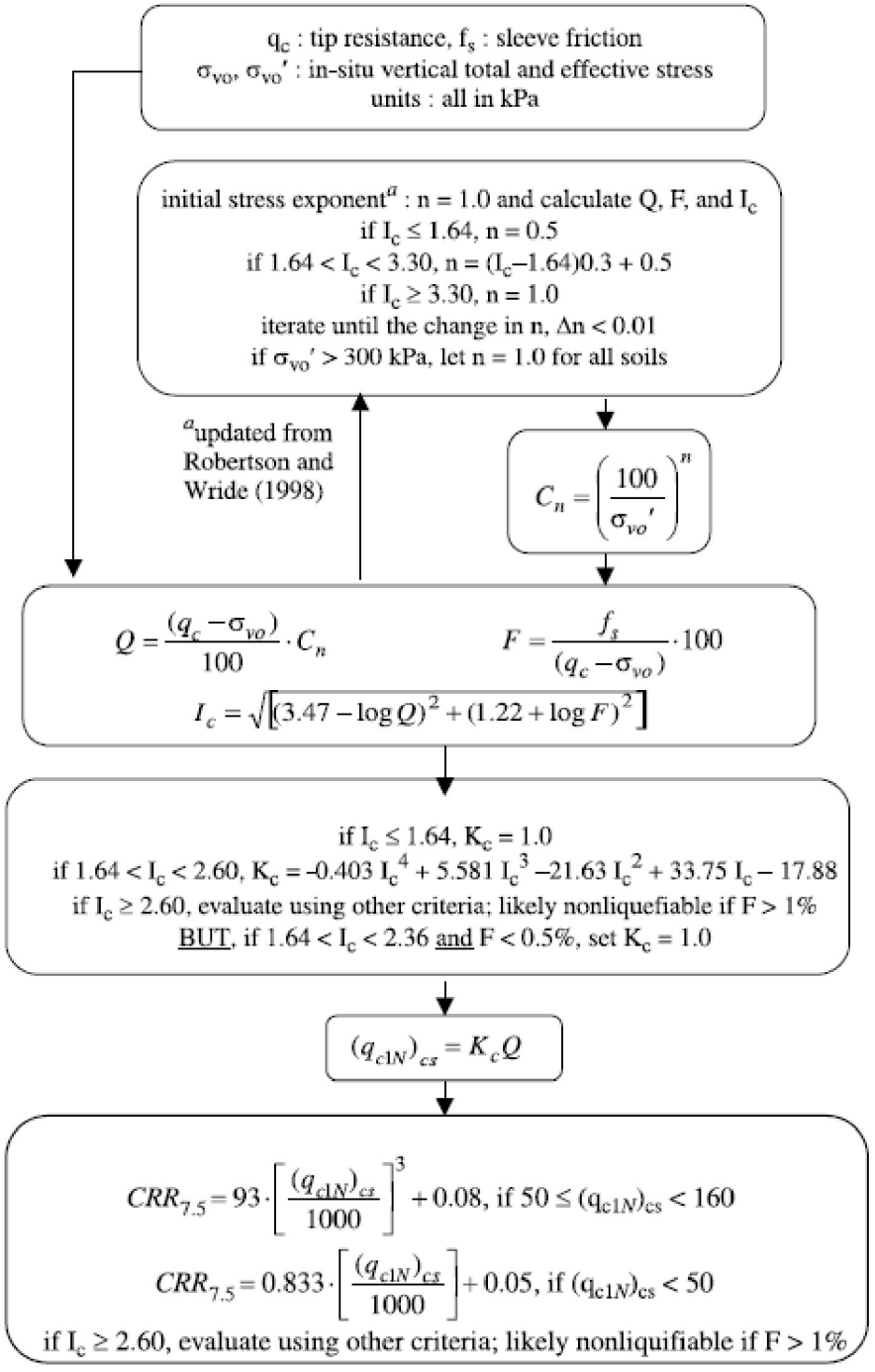


Ejecta Severity Estimation



Procedure for the evaluation of soil liquefaction resistance, NCEER (1998)

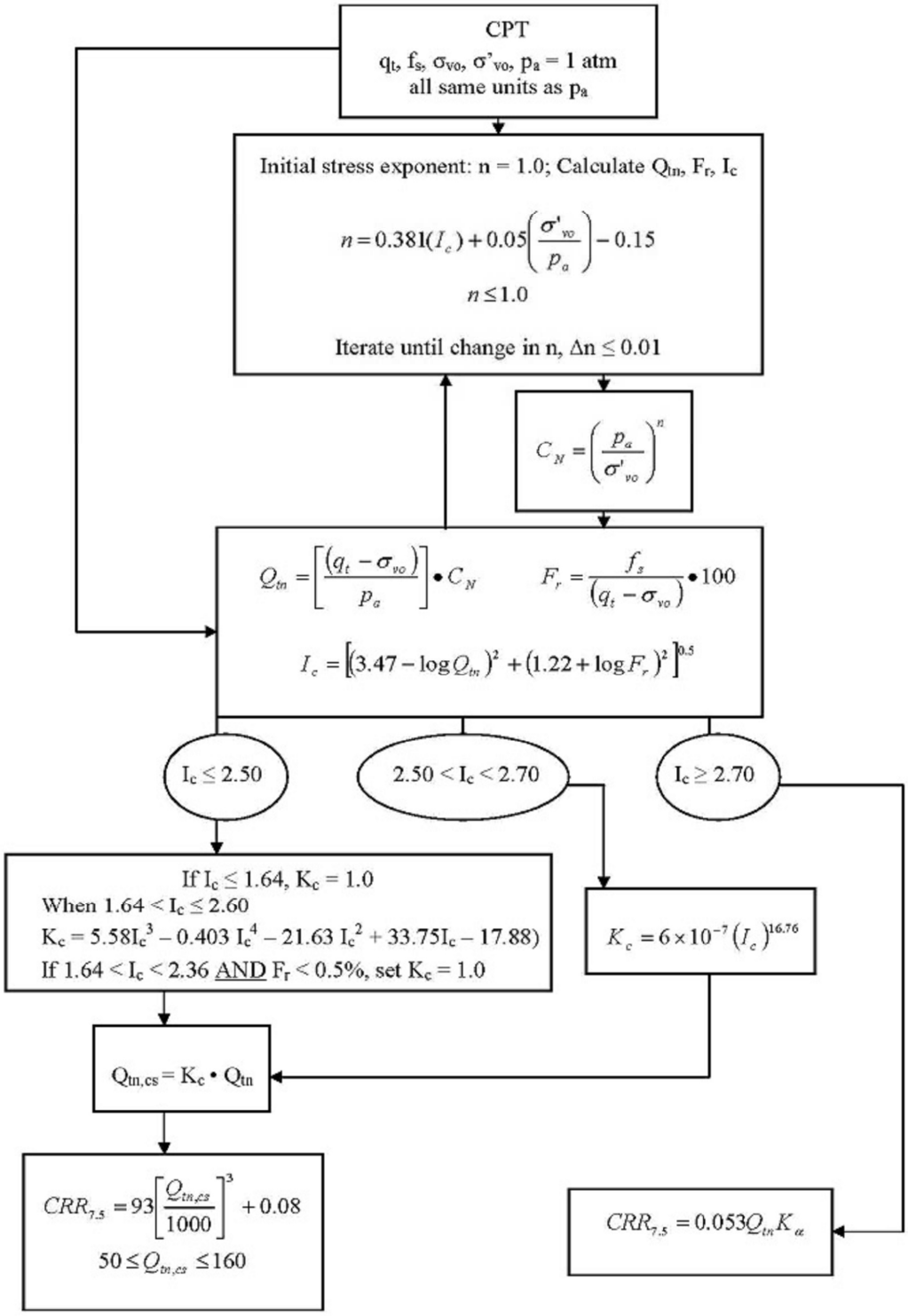
Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. The procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:



[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

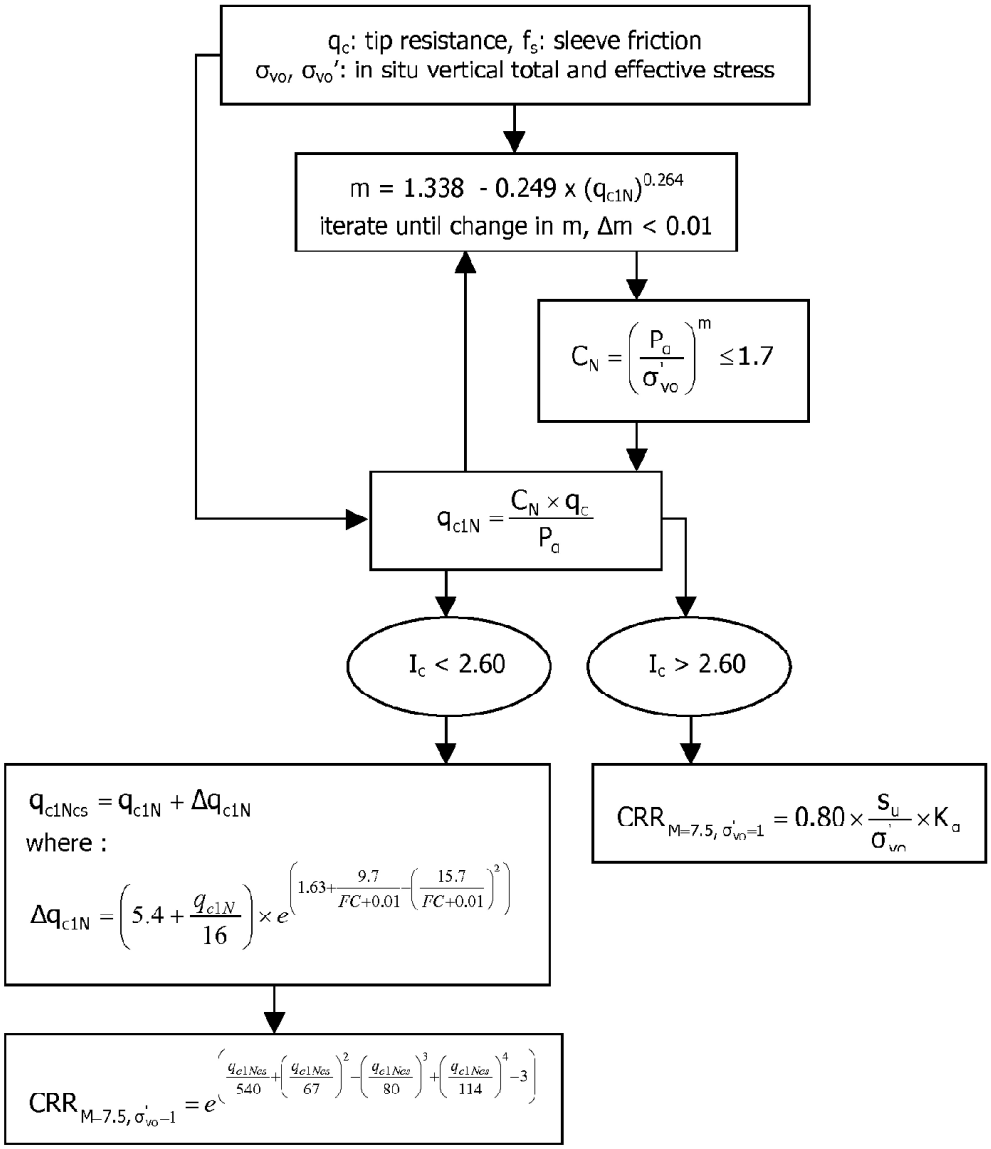
Procedure for the evaluation of soil liquefaction resistance (all soils), Robertson (2010)

Calculation of soil resistance against liquefaction is performed according to the Robertson & Wride (1998) procedure. This procedure used in the software, slightly differs from the one originally published in NCEER-97-0022 (Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils). The revised procedure is presented below in the form of a flowchart[1]:

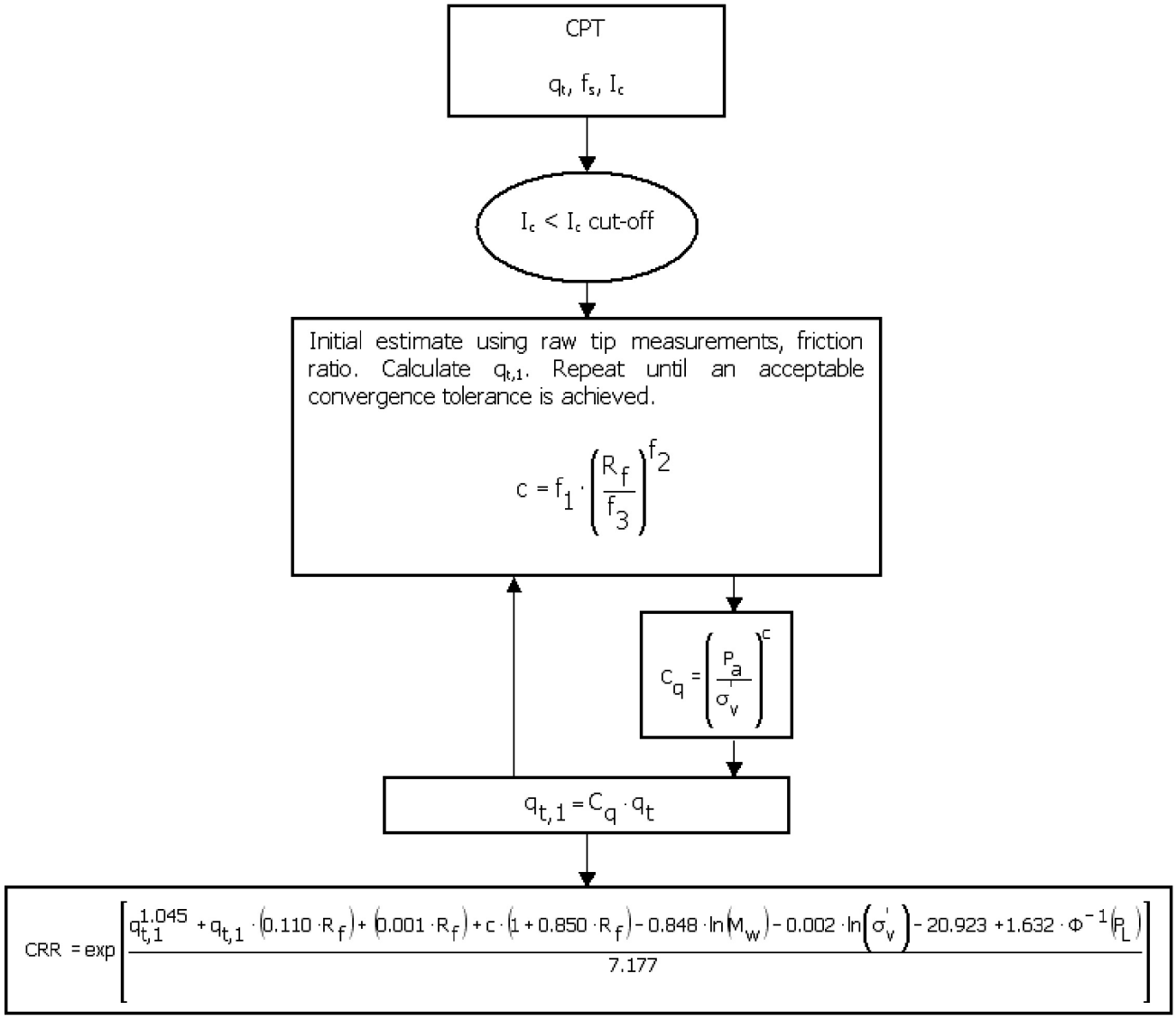


[1] P.K. Robertson, 2009. "Performance based earthquake design using the CPT", Keynote Lecture, International Conference on Performance-based Design in Earthquake Geotechnical Engineering – from case history to practice, IS-Tokyo, June 2009

Procedure for the evaluation of soil liquefaction resistance, Idriss & Boulanger (2008)



Procedure for the evaluation of soil liquefaction resistance (sandy soils), Moss et al. (2006)



Procedure for the evaluation of soil liquefaction resistance, Boulanger & Idriss(2014)

$$FS_{liq} = \frac{CRR_{M=7.5,\sigma'_v=1atm}}{CSR_{M=7.5,\sigma'_v=1atm}}$$

$$CSR_{M=7.5,\sigma'_v=1atm} = 0.65 \frac{\sigma_v}{\sigma'_v} \frac{a_{max}}{g} r_d \frac{1}{MSF} \frac{1}{K_\sigma}$$

$$r_d = \exp\left[\alpha(z) + \beta(z) \cdot M\right]$$

$$\alpha(z) = -1.012 - 1.126 \sin\left(\frac{z}{11.73} + 5.133\right)$$

$$\beta(z) = 0.106 + 0.118 \sin\left(\frac{z}{11.28} + 5.142\right)$$

$$K_\sigma = 1 - C_\sigma \ln\left(\frac{\sigma'_v}{P_a}\right) \leq 1.1$$

$$C_\sigma = \frac{1}{37.3 - 8.27\left(q_{c1Ncs}\right)^{0.264}} \leq 0.3$$

$$MSF = 1 + (MSF_{max} - 1)\left(8.64 \exp\left(\frac{-M}{4}\right) - 1.325\right)$$

$$MSF_{max} = 1.09 + \left(\frac{q_{c1Ncs}}{180}\right)^3 \leq 2.2$$

σ'_v *and* σ_v *at start of earthquake shaking*

$$CRR_{M=7.5,\sigma'_v=1atm} = \exp\left(\frac{q_{c1Ncs}}{113} + \left(\frac{q_{c1Ncs}}{1000}\right)^2 - \left(\frac{q_{c1Ncs}}{140}\right)^3 + \left(\frac{q_{c1Ncs}}{137}\right)^4 - 2.80\right)$$

$$q_{c1Ncs} = q_{c1N} + \Delta q_{c1N}$$

$$\Delta q_{c1N} = \left(11.9 + \frac{q_{c1N}}{14.6}\right) \exp\left(1.63 - \frac{9.7}{FC+2} - \left(\frac{15.7}{FC+2}\right)^2\right)$$

$$q_{c1N} = C_{Ne} \frac{q_c}{P_a}$$

$$C_{Ne} = \left(\frac{P_a}{\sigma'_v}\right)^m \leq 1.7$$

$$m = 1.338 - 0.249\left(q_{c1Ncs}\right)^{0.264} \quad with \quad 0.264 \leq m \leq 0.782$$

$$FC = 80\left(I_C + C_{FC}\right) - 137 \quad with \quad 0\% \leq FC \leq 100\%$$

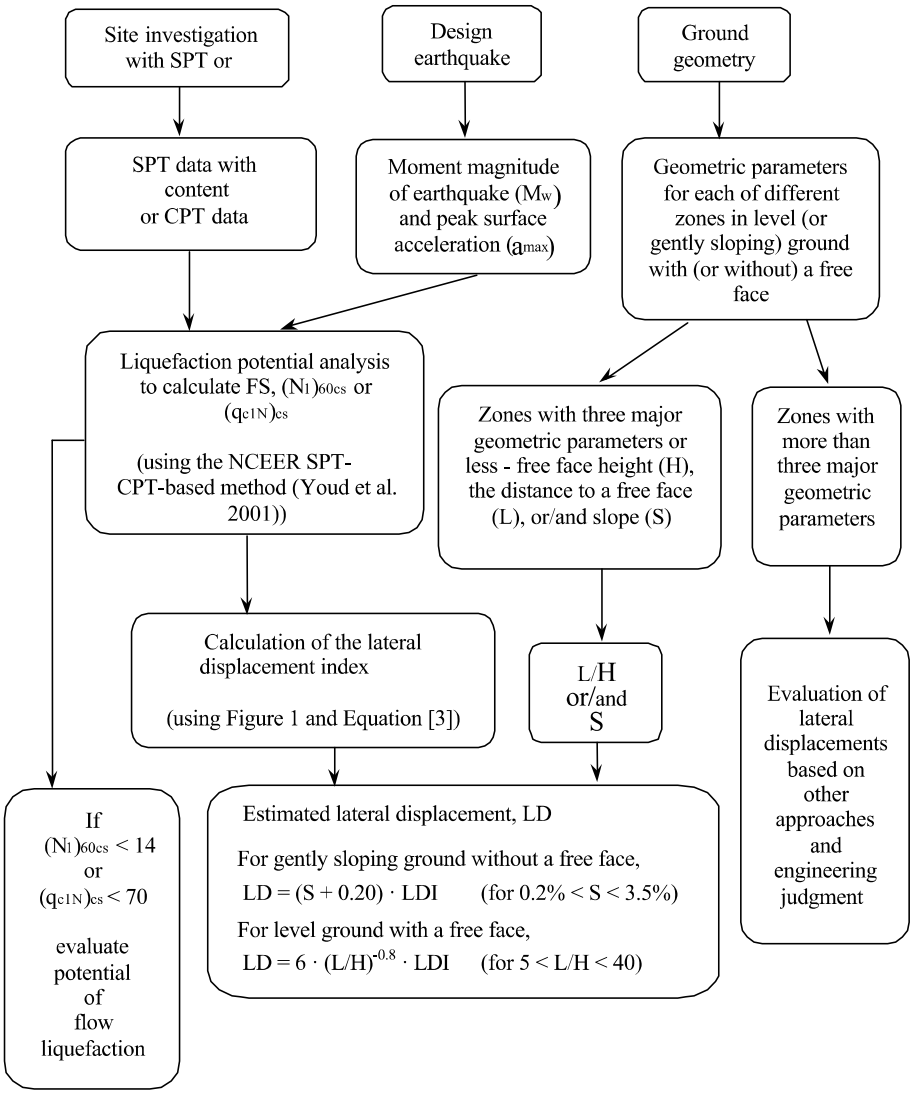
$$I_c = \left[\left(3.47 - \log\left(Q\right)\right)^2 + \left(1.22 + \log\left(F\right)\right)^2\right]^{0.5}$$

$$Q = \left(\frac{q_c - \sigma_{vc}}{P_a}\right)\left(\frac{P_a}{\sigma'_{vc}}\right)^n \; with \; 0.5 \leq n \leq 1.0 \; per \; Robertson \; \& \; Wride \; (1998)$$

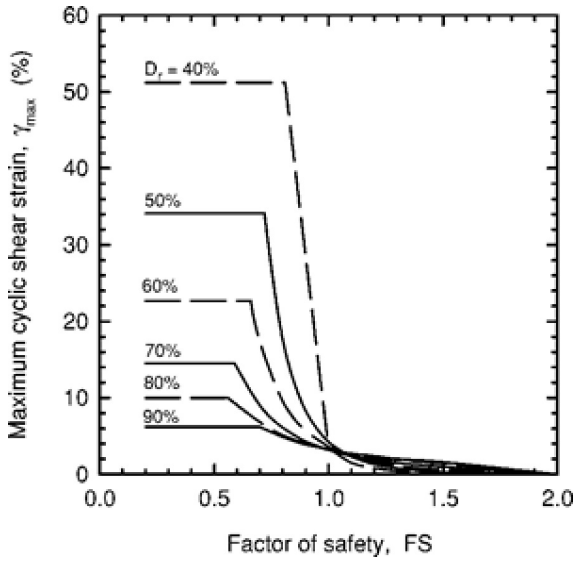
$$F = \left(\frac{f_s}{q_c - \sigma_{vc}}\right) \cdot 100\%$$

σ'_v *at time of CPT sounding*

Procedure for the evaluation of liquefaction-induced lateral spreading displacements



[1] Flow chart illustrating major steps in estimating liquefaction-induced lateral spreading displacements using the proposed approach



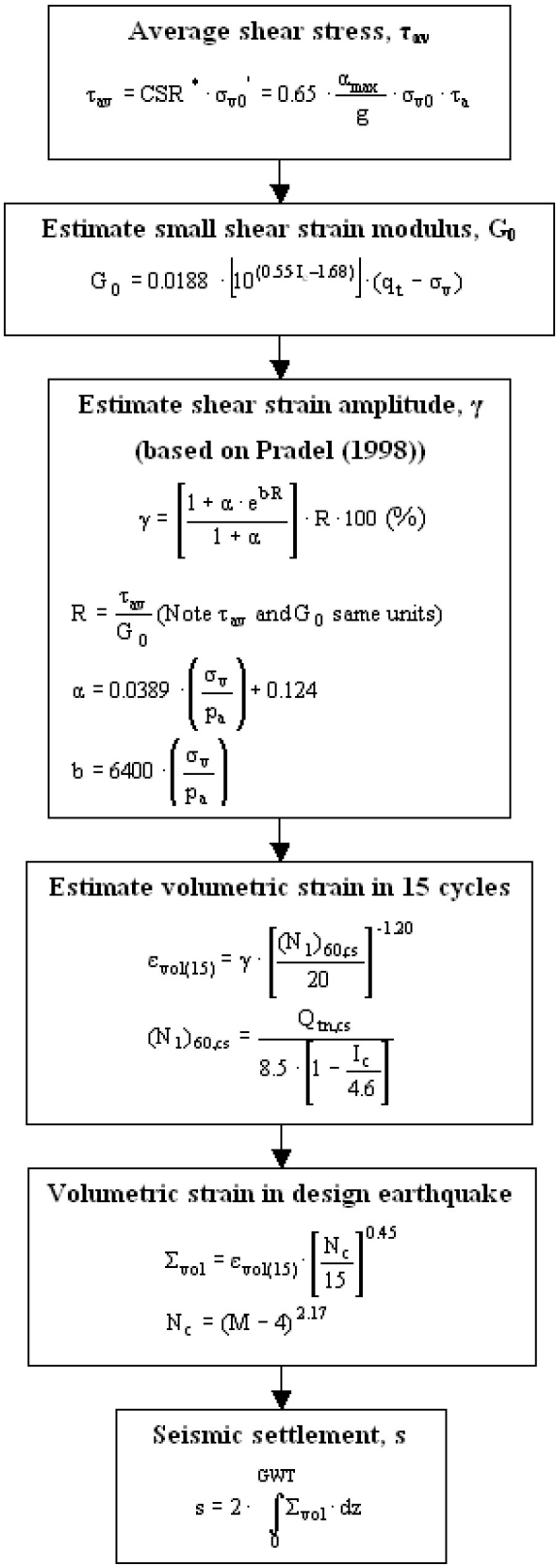
[1] **Figure 1**

$$LDI = \int_0^{z_{max}} \gamma_{max} dz$$

[1] **Equation [3]**

[1] "Estimating liquefaction-induced ground settlements from CPT for level ground", G. Zhang, P.K. Robertson, and R.W.I. Brachman

Procedure for the estimation of seismic induced settlements in dry sands



Robertson, P.K. and Lisheng, S., 2010, "Estimation of seismic compression in dry soils using the CPT" FIFTH INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN GEOTECHNICAL EARTHQUAKE ENGINEERING AND SOIL DYNAMICS, Symposium in honor of professor I. M. Idriss, San Diego, CA

Liquefaction Potential Index (LPI) calculation procedure

Calculation of the Liquefaction Potential Index (LPI) is used to interpret the liquefaction assessment calculations in terms of severity over depth. The calculation procedure is based on the methology developed by Iwasaki (1982) and is adopted by AFPS.

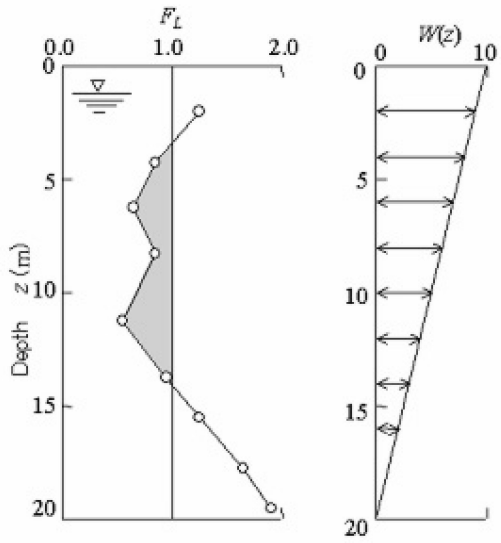
To estimate the severity of liquefaction extent at a given site, LPI is calculated based on the following equation:

$$\mathbf{LPI} = \int_0^{20} (10 - 0{,}5z) \times F_L \times dz$$

where:
F_L = 1 - F.S. when F.S. less than 1
F_L = 0 when F.S. greater than 1
z depth of measurment in meters

Values of LPI range between zero (0) when no test point is characterized as liquefiable and 100 when all points are characterized as susceptible to liquefaction. Iwasaki proposed four (4) discrete categories based on the numeric value of LPI:

- LPI = 0 : Liquefaction risk is very low
- 0 < LPI <= 5 : Liquefaction risk is low
- 5 < LPI <= 15 : Liquefaction risk is high
- LPI > 15 : Liquefaction risk is very high



Graphical presentation of the LPI calculation procedure

Shear-Induced Building Settlement (Ds) calculation procedure

The shear-induced building settlement (Ds) due to liquefaction below the building can be estimated using the relationship developed by Bray and Macedo (2017):

$$Ln(Ds) = c1 + c2 * LBS + 0.58 * Ln\left(Tanh\left(\frac{HL}{6}\right)\right) + 4.59 * Ln(Q) - 0.42 * Ln(Q)^2 - 0.02 * B + 0.84 * Ln(CAVdp) + 0.41 * Ln(Sa1) + \varepsilon$$

where Ds is in the units of mm, c1= -8.35 and c2= 0.072 for LBS ≤ 16, and c1= -7.48 and c2= 0.014 otherwise. Q is the building contact pressure in units of kPa, HL is the cumulative thickness of the liquefiable layers in the units of m, B is the building width in the units of m, CAVdp is a standardized version of the cumulative absolute velocity in the units of g-s, Sa1 is 5%-damped pseudo-acceleration response spectral value at a period of 1 s in the units of g, and ε is a normal random variable with zero mean and 0.50 standard deviation in Ln units. The liquefaction-induced building settlement index (LBS) is:

$$LBS = \sum W * \frac{\varepsilon_{shear}}{z} dz$$

where z (m) is the depth measured from the ground surface > 0, W is a foundation-weighting factor wherein W = 0.0 for z less than Df, which is the embedment depth of the foundation, and W = 1.0 otherwise. The shear strain parameter (ε_shear) is the liquefaction-induced free-field shear strain (in %) estimated using Zhang et al. (2004). It is calculated based on the estimated Dr of the liquefied soil layer and the calculated safety factor against liquefaction triggering (FSL).

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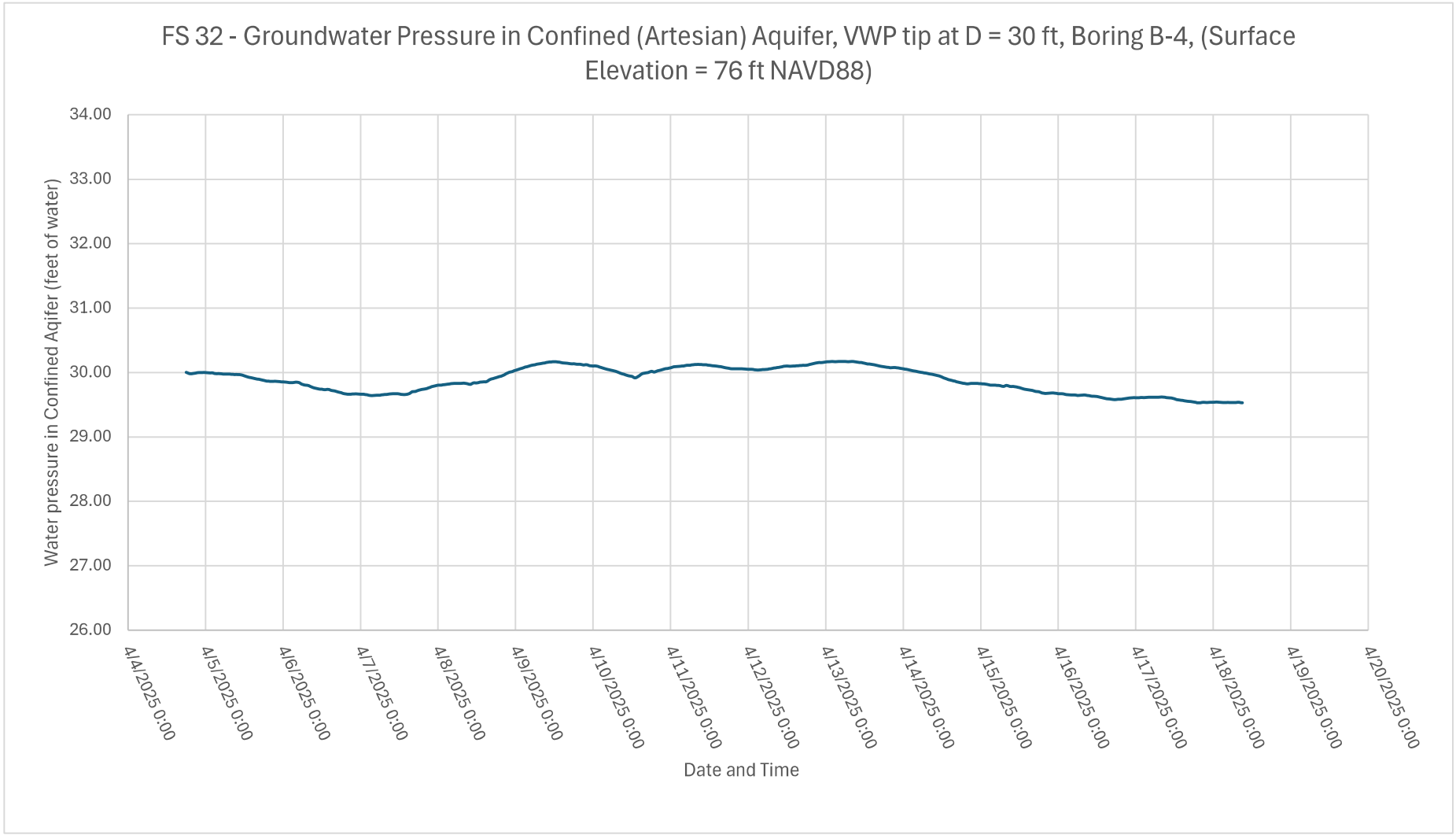
APPENDIX F
GROUNDWATER MONITORING DATA

Groundwater Monitoring Data for B-4 ..... F-1

Groundwater Monitoring Data for B-5 ..... F-2

Groundwater Monitoring Data for B-6 ..... F-3

Groundwater Monitoring Data for B-7 ..... F-4


FS 32 - Groundwater Pressure in Confined (Artesian) Aquifer, VWP tip at D = 30 ft, Boring B-4, (Surface Elevation = 76 ft NAVD88)
Water pressure in Confined Aqifer (feet of water)
34.00
33.00
32.00
31.00
30.00
29.00
28.00
27.00
26.00
4/4/2025 0:00
4/5/2025 0:00
4/6/2025 0:00
4/7/2025 0:00
4/8/2025 0:00
4/9/2025 0:00
4/10/2025 0:00
4/11/2025 0:00
4/12/2025 0:00
4/13/2025 0:00
4/14/2025 0:00
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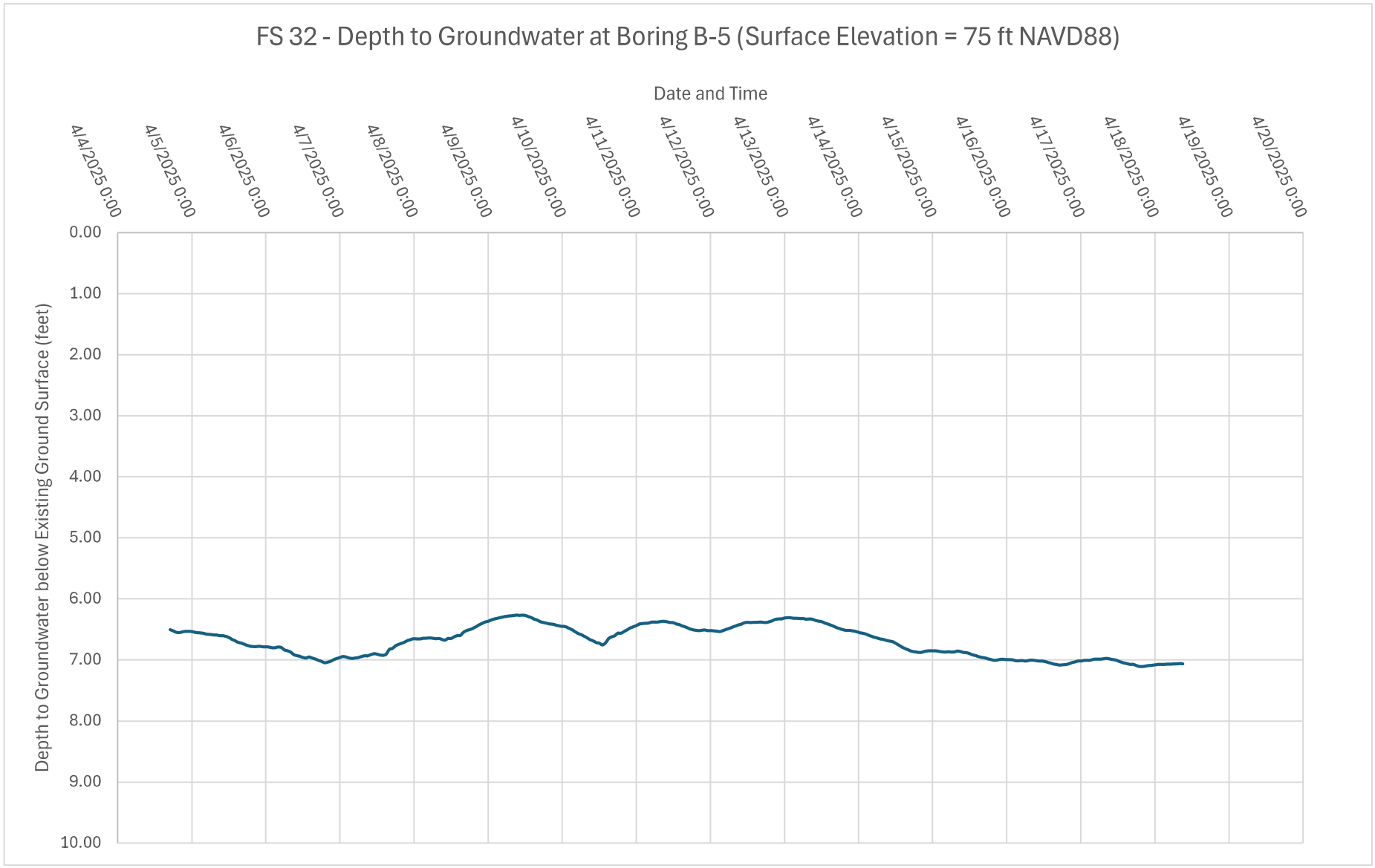
Date and Time


FS 32 - Depth to Groundwater at Boring B-5 (Surface Elevation = 75 ft NAVD88)
Date and Time
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4/5/2025 0:00
4/6/2025 0:00
4/7/2025 0:00
4/8/2025 0:00
4/9/2025 0:00
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4/14/2025 0:00
4/15/2025 0:00
4/16/2025 0:00
4/17/2025 0:00
4/18/2025 0:00
4/19/2025 0:00
4/20/2025 0:00
Depth to Groundwater below Existing Ground Surface (feet)
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1.00
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3.00
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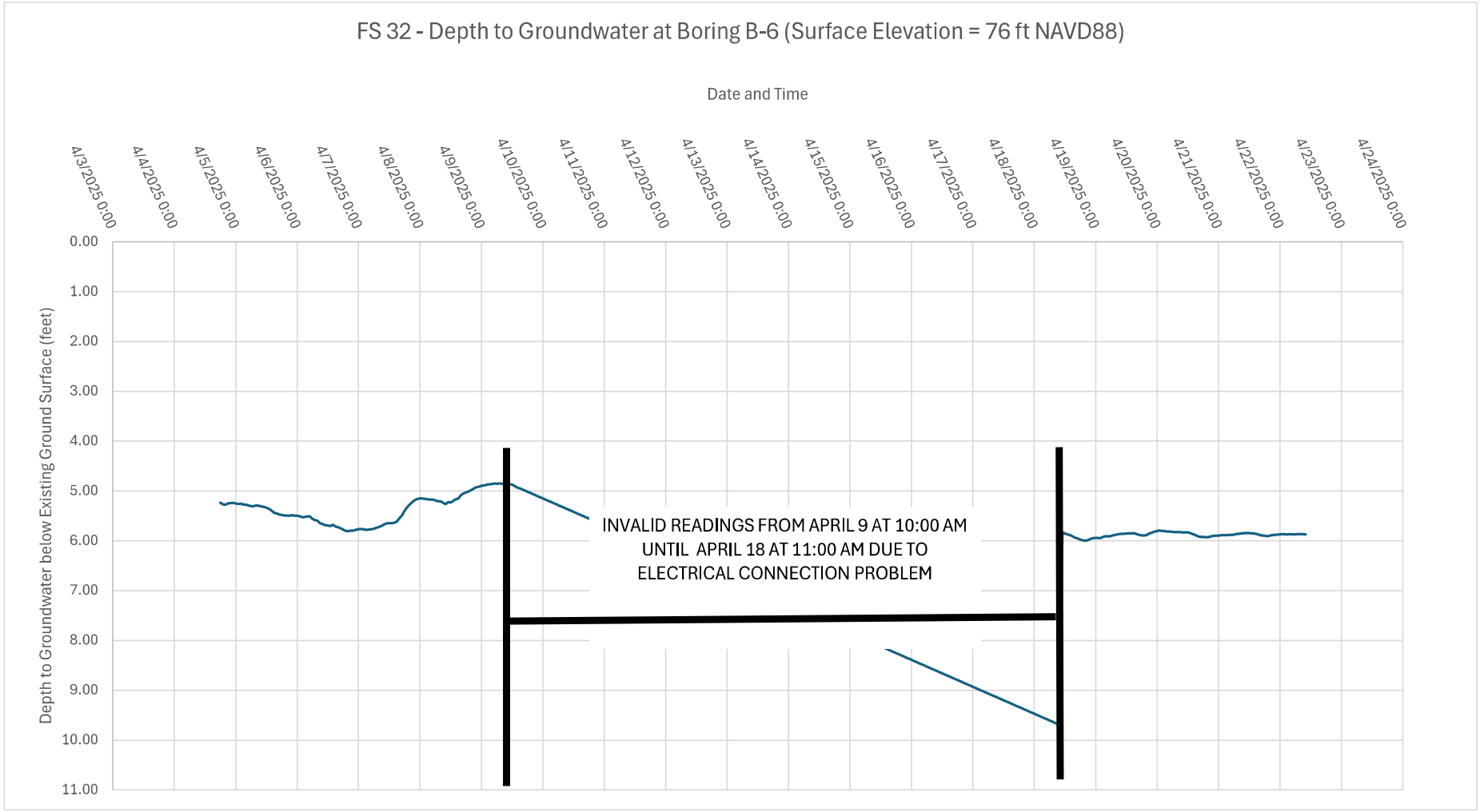
FS 32 - Depth to Groundwater at Boring B-6 (Surface Elevation = 76 ft NAVD88)
Date and Time
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4/4/2025 0:00
4/5/2025 0:00
4/6/2025 0:00
4/7/2025 0:00
4/8/2025 0:00
4/9/2025 0:00
4/10/2025 0:00
4/11/2025 0:00
4/12/2025 0:00
4/13/2025 0:00
4/14/2025 0:00
4/15/2025 0:00
4/16/2025 0:00
4/17/2025 0:00
4/18/2025 0:00
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4/21/2025 0:00
4/22/2025 0:00
4/23/2025 0:00
4/24/2025 0:00
Depth to Groundwater below Existing Ground Surface (feet)
0.00
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3.00
4.00
5.00
6.00
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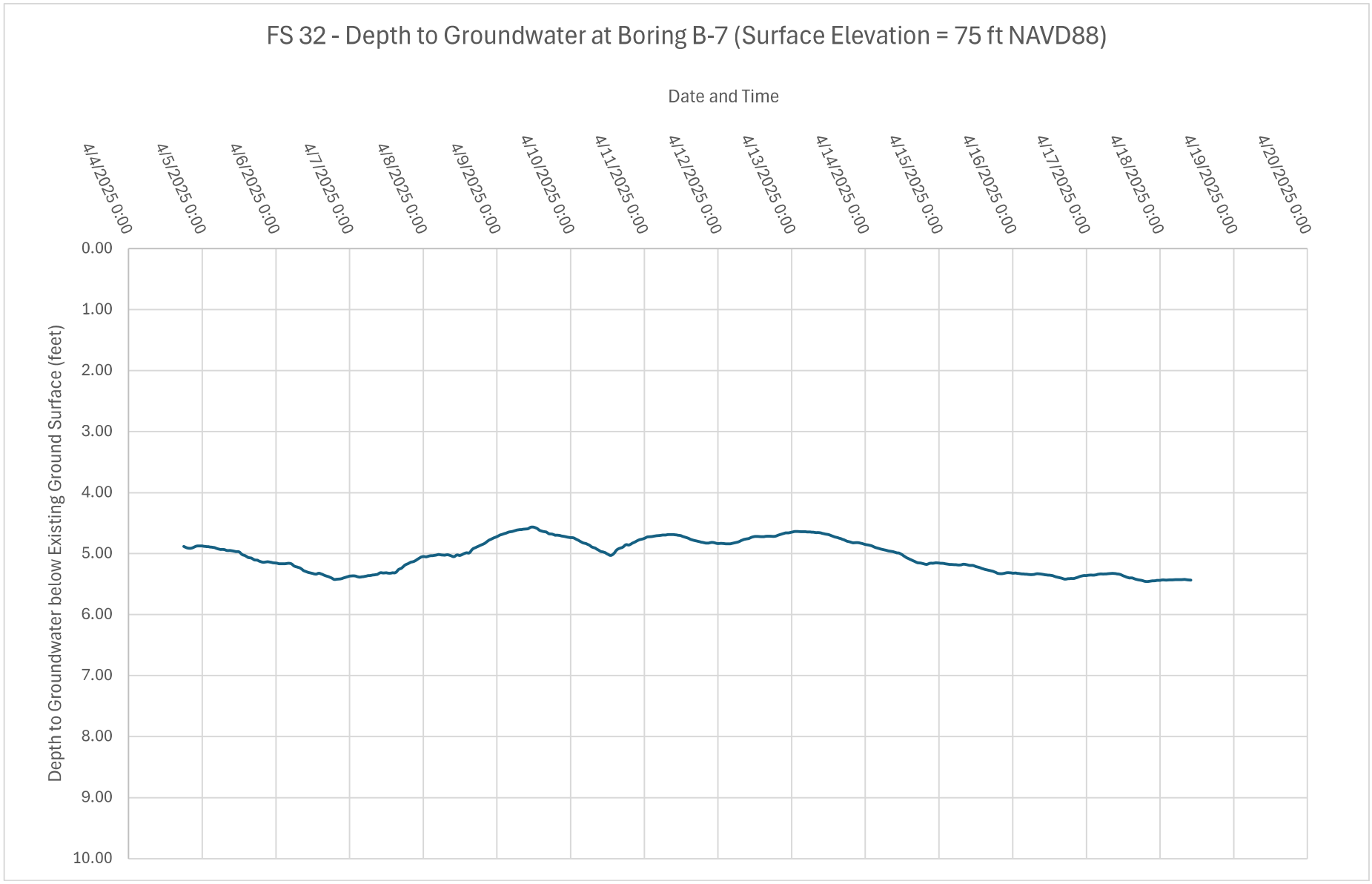
10.00
11.00
INVALID READINGS FROM APRIL 9 AT 10:00 AM
UNTIL APRIL 18 AT 11:00 AM DUE TO
ELECTRICAL CONNECTION PROBLEM


FS 32 - Depth to Groundwater at Boring B-7 (Surface Elevation = 75 ft NAVD88)
Date and Time
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4/5/2025 0:00
4/6/2025 0:00
4/7/2025 0:00
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4/16/2025 0:00
4/17/2025 0:00
4/18/2025 0:00
4/19/2025 0:00
4/20/2025 0:00
Depth to Groundwater below Existing Ground Surface (feet)
0.00
1.00
2.00
3.00
4.00
5.00
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7.00
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APPENDIX D
CRITICAL AREAS REPORT

HALEY ALDRICH

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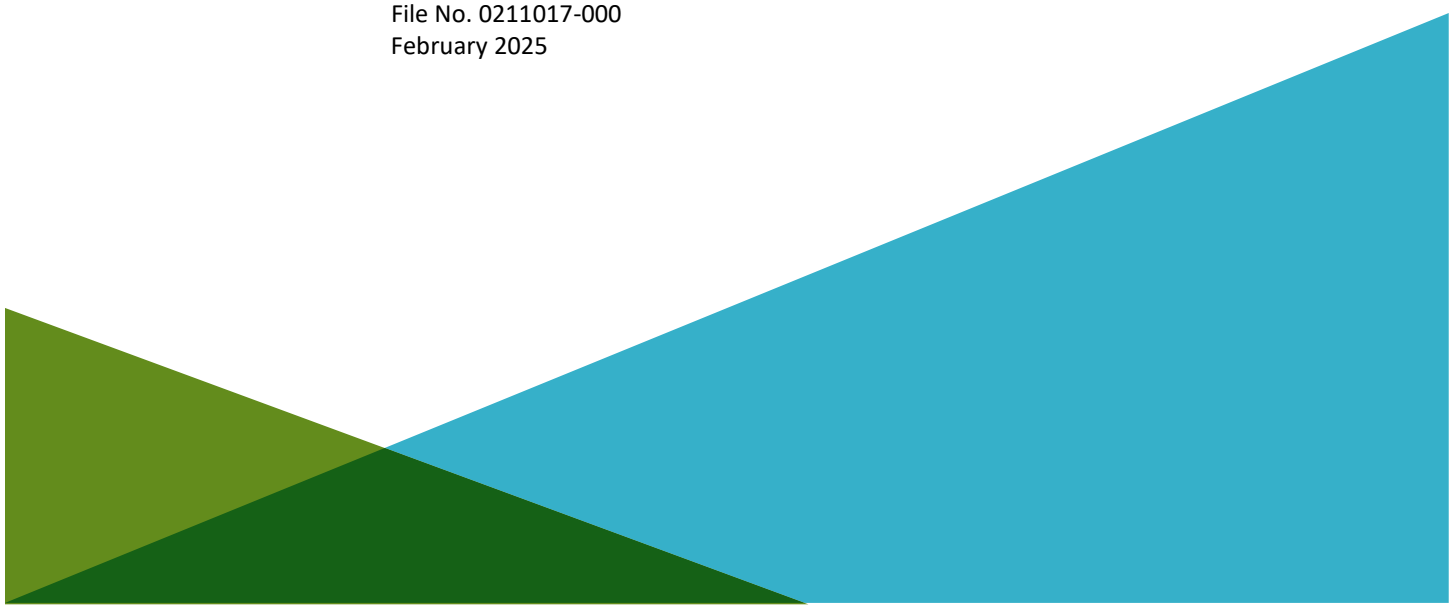
AQUATIC RESOURCES REPORT
SNOHOMISH REGIONAL FIRE & RESCUE
VACANT PARCEL NO. 27070600200300
MONROE, WASHINGTON

by
Haley & Aldrich, Inc.
Spokane, Washington

for
OAC Services, Inc.
Everett, Washington

File No. 0211017-000
February 2025



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SIGNATURE PAGE FOR

REPORT ON

SNOHOMISH REGIONAL FIRE & RESCUE
VACANT PARCEL NO. 27070600200300
MONROE, WASHINGTON

PREPARED FOR

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EVERETT, WASHINGTON

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REVIEWED AND APPROVED BY:

Ryan Tobias PWS
Associate Natural Resource Scientist
Haley & Aldrich, Inc.

Executive Summary

The purpose of this Aquatic Resources Report (ARR) is to identify and delineate wetlands occurring within the boundaries of Vacant Parcel No. 27070600200300, located at 19959 Oaks Street in Monroe, Washington (Site). This information may be used for compliance with the City of Monroe's Critical Area Ordinance (CAO; Chapter 22.80 Critical Areas), in conformance with Section 404 of the Clean Water Act, State of Washington Water Pollution Control Act, and Shoreline Management Act.

The subject property was evaluated for its content of potential jurisdictional wetlands and waterbodies, based on criteria set forth in the *2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains Valleys and Coast (Version 2.0)* (Engineer Research and Development Center, 2010) and the City of Monroe CAO Chapter 22.88.070 requirements for Critical Areas Studies. Prior to the Site visit, Haley & Aldrich, Inc. (Haley& Aldrich) reviewed existing project area literature including historical aerial photography, topographic maps, critical areas maps, and hydrology data. A subsequent field evaluation was performed to identify hydric soils, hydrology, and hydrophytic vegetation. Vegetation communities were evaluated and documented to delineate wetland and upland boundaries. The Site visit was performed on 15 May 2024.

Based on the information presented in this ARR and the data collected, Haley & Aldrich concurs that a 0.084-acre wetland (wetland W1) is present within the 2.16-acre study area. In addition, a 402 foot (ft) long stormwater ditch runs along the northeastern edge of the property boundary. The wetland within the investigation area is classified as palustrine emergent (PEM) and is located within the Eastern Puget Riverine Lowlands (2b) level IV ecoregion.

The U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (EPA) are the final authority over the jurisdictional status of both wetlands and waters of the U.S., per Section 404 of the Clean Water Act. The State of Washington Department of Ecology (Ecology) has final jurisdiction over wetlands and water of the state. The findings discussed in this report are solely the opinion of Haley & Aldrich and have not been verified by the aforementioned regulatory government agencies.

Table of Contents

		Page
Executive Summary		**i**
List of Tables		**iii**
List of Figures		**iii**
List of Appendices		**iii**
1.	**Introduction**	**1**
2.	**Project Location/General Setting**	**2**
3.	**Scope of Services**	**3**
4.	**Methods**	**4**
4.1	LITERATURE REVIEW	4
4.2	WETLAND DELINEATION	4
4.2.1	Field Methods	4
4.2.2	Vegetation	5
4.2.3	Hydrology	6
4.2.4	Soils	2
4.3	WETLAND CHARACTERISTICS	3
4.4	ORDINARY HIGH-WATER MARK DELINEATION	3
5.	**Results**	**2**
5.1	LITERATURE REVIEW	2
5.1.1	Soils	2
5.1.2	NWI Map	2
5.1.3	Topographic Maps/Historical Aerial Photographs	2
5.1.4	Critical Areas Maps	2
5.1.5	Climate	2
5.1.6	Flood Plains	3
5.2	FIELD INVESTIGATIONS	3
5.2.1	Wetland Delineation/ Assessment	3
5.2.2	Soils and Hydrology	4
5.2.3	General Vegetation	4
5.3	REGULATORY REVIEW	5
5.3.1	Wetland W1—approximately 3659 square feet (sf) (0.0.084 acres) in size	5
5.3.2	Stormwater Ditch S1	6
5.3.3	Regulatory Correspondence	6
6.	**Conclusions**	**7**
7.	**Limitations**	**8**
References		**9**

List of Tables

Table No.	Title
I	Plant Indicator Status Categories
II	Soil/Hydrology Data Summary
III	Dominant Vegetation
IV	Overview of Aquatic Resources

List of Figures

Figure No.	Title
1	Vicinity
2	Study Area
3	Desktop Review
4	Delineated Aquatic Resources
5	Delineated Aquatic Resources with Buffers

List of Appendices

Appendix	Title
A	USACE Wetland Determination Data Sheet
B	Site Photographs
C	NRCS Custom Soil Resource Report
D	Antecedent Precipitation vs. Normal Range
E	National Flood Hazard Layer FIRMette
F	Wetland Rating Summary

1. Introduction

Snohomish Regional Fire & Rescue (SRFR) is proposing to build a fire station and parking area on Vacant Parcel No. 27070600200300 located at 19959 Oaks Street in Monroe, Washington (Site). The existing Site is used as a temporary storage site for equipment and trucks. The proposed station will include an approximately 10,000 square foot building with parking in the upland portion of the property. This fire station is intended to improve response times and better serve the greater Monroe community. The purpose of this Aquatic Resources Report (ARR) is to identify and delineate any aquatic resources that are present on the Site.

2. Project Location/General Setting

The Site is located within the northwest one-fourth of Section 6, Township 27 north, Range 7, east of the Willamette Meridian, in Monroe, Washington. The Site encompasses 2.16 acres and is located in the valley floor, approximately 0.55 miles northwest of the mainstem of the Skykomish River. The Site is currently undeveloped and overgrown with Himalayan blackberry (*Rubus armeniacus*) and reed canary grass (*Phalaris arundinacea*). It is currently used as a parking area for vehicles and trailers. See Figure 1 for the Vicinity Map and Figure 2 for the Study Area Map.

3. Scope of Services

Haley & Aldrich, Inc. (Haley & Aldrich) was retained by OAC Services, Inc. (OAC) to conduct wetland delineation and rating assessment services within the 2.16-acre Site boundary. The scope of services associated with Aquatic Assessment report included:

- **Literature Review/Field Preparation:** Haley & Aldrich reviewed appropriate reference materials pertinent to the Site, including the United States Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps; United States Geological Survey (USGS) topographic maps; United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Web Soil Survey for Snohomish County, Washington; critical areas maps, recent aerial photographs; and other readily available background information to assist in preparation of the wetland delineation/rating assessment.
- **Field Delineation:** Haley & Aldrich mobilized to the Site to conduct wetland delineation/rating assessment services on 15 May 2024. Wetland boundaries were determined after considering three wetland parameters: (1) vegetation; (2) soils; and (3) hydrology, in accordance with the U.S. Army Corps of Engineers (USACE) Wetland Delineation Manual (1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (WMVC; USACE, 2010). Soil pits were hand excavated throughout the Site, as needed and appropriate, to record soil conditions relative to hydric indicators. Haley & Aldrich assessed the vegetative cover near each soil pit and estimated the relative abundance of hydrophytic species.
- **Wetland Boundaries**: Haley & Aldrich delineated and flagged wetland boundaries in the field for surveying and subsequent mapping by others. Each wetland boundary determination point and data plots were flagged in the field and located by global positioning system (GPS) equipment with sub meter accuracy.
- **Report Preparation:** Haley & Aldrich prepared this ARR to describe the wetland delineation and rating classification results of the wetland identified, in accordance with regulatory requirements and guidance. The report includes documentation of the wetland areas, supporting illustrations, photographs, wetland ratings forms, and reference citations. Map excerpts and appropriate appendices are also presented to support Haley & Aldrich's findings and conclusions.

4. Methods

4.1 LITERATURE REVIEW

Haley & Aldrich researched existing information on wetlands, streams, ditches, and other man-made aquatic features documented within the project boundary prior to conducting the Site visit. The readily available literature reviewed includes:

- USFWS NWI maps (USFWS, 2023);
- USGS Topographic Map;
- USDA/NRCS Websoil Survey for Snohomish County, WA (USDA NRCS, 2020);
- Critical Areas Maps (City of Monroe, 2024a);
- Readily available online, current, and historical aerial photographs - Aerial Imagery-National Aerial Imagery Program (NAIP; USDA, 2021);
- Washington Department of Natural Resources (WDNR) Hydrography Dataset (DNR, 2023); and
- Precipitation Data, Daily and Monthly and Thirty-Year Averages Precipitation (USDA NRCS, 2023).

4.2 WETLAND DELINEATION

The wetland delineation was conducted in accordance with the guidance set forth in the 1987 USACE Wetland Delineation Manual (Environmental Laboratory, 1987) and the 2010 Regional Supplement to the USACE Wetland Delineation Manual: WMVC (USACE, 2010). These manuals follow the three-parameter approach for conducting wetland determinations. This approach documents: (1) the presence of hydrophytic vegetation; (2) hydric soils; and (3) wetland hydrology, all of which are described in further detail below. Except for wetlands with special characteristics, the presence of all three criteria is required for a given area to be classified as a wetland. The USACE and Ecology recognize the use of these methodologies for delineating wetlands in specific vegetation zones.

The Ordinary High-Water Mark (OHWM) of all open-water, non-wetland aquatic resources were also delineated using the appropriate OHWM characteristics, as defined in 33 CFR § 328.3(e) and 33 CFR § 329.11(a)(1) and Ecology guidance (Ecology, 2016). The USACE and Ecology recognize the use of these methodologies for delineating OHWM of open waters such as streams or rivers.

4.2.1 Field Methods

Prior to visiting the Site, a health and safety briefing was completed; field gear and travel plans were prepared; and a communications protocol for the field crew was established. Haley & Alrich's wetland scientists conducted the field assessment and delineation services on site 15 May 2024.

Based on Site observations, relative to topography, hydrology, and vegetation, wetland boundaries were estimated for subsequent testing to compare upland and wetland characteristics within the depressional and adjacent areas. Soil pits were hand dug to approximately 16 inches below ground surface (bgs) or until refusal or saturation was encountered. Soil pits were advanced within and outside a given wetland boundary to assess soil conditions in wetland and upland areas. Soils in each pit were

evaluated for texture, matrix color, presence, or absence of redoximorphic features or gleying (soil color) and depth of saturation. This information was used to determine the presence/absence of hydric soils and to assist developing wetland boundaries. Details regarding soils evaluation methodology are described in Section 4.2.4.

Wetland hydrology indicators included drainage patterns, presence of surface water and depth of groundwater within soil pits. The vegetation community was assessed within an approximate 30-ft radius of the soil pits. Vegetation, soil, and hydrology information collected during the field study are presented on the standard wetland delineation data forms, which are included in the USACE Wetland Determination Data Sheet, Appendix A.

Wetland boundaries were delineated and flagged in the field for subsequent mapping. A photographic record of Site conditions during our field study is provided in the Site Photographs, Appendix B.

4.2.2 Vegetation

The USACE manual defines hydrophytic vegetation as the community within areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to exert a controlling influence on the plant species present (USACE, 2010). Hydrophytic plant species have the ability to grow, compete, and establish in areas where anaerobic conditions exist due to the presence of surface water and/or groundwater. The USACE and USFWS (Reed, 1988) developed plant indicator categories that describe the probability of vegetation species to occur in wetlands. This list was updated and is now the USACE National Wetlands Plant Inventory (NWPI; USACE, 2020). Each plant species observed, within a given on-Site sample plot, was categorized according to the Arid West indicator status under the NWPI. Table I provides summarized definitions of the indicator status categories.

Table 1. Plant Indicator Status Categories

Indicator Status	Indicator Symbol	Description
Obligate Wetland Plants	OBL	Plants that occur in wetlands, under natural conditions, greater than 99 percent of the time
Facultative Wetland Plants	FACW	Plants that occur in wetlands, under natural conditions, between 67 to 99 percent of the time
Facultative Plants	FAC	Plants that occur in wetlands, under natural conditions, between 34 to 66 percent of the time
Facultative Upland Plants	FACU	Plants that occur in wetlands, under natural conditions, between 1 to 33 percent of the time
Obligate Upland Plants	UPL	Plants that occur in wetlands, under natural conditions, less than 1 percent of the time
No Indicator	NI	Indicator status has not been identified for the species
No Occurrence	NO	No known occurrence of the plant in the region

The prevalence of wetland vegetation is characterized by the dominant species comprising the plant community within a wetland. A dominant species is considered any plant species that represents 20 percent or greater total aerial coverage for each vegetative stratum (tree, shrub, herbaceous, or aquatic bed). If more than 50 percent of the dominant plant species in an area were categorized as OBL, FACW

or FAC, the plant community is classified as hydrophytic and, therefore, meets that wetland indicator parameter. Additional observations of hydrophytic plant characteristics include: morphological adaptations (water roots or shallow root systems); physiological adaptations (inflated stems or polymorphic leaves); and reproductive adaptations (delayed flowering or floating seeds).

On-Site wetland vegetation communities, identified by field scientists, were classified according to the Cowardin Classification System (Cowardin, et al., 1979). Vegetation nomenclature described in this report follows the format outlined in the book, *Flora of the Pacific Northwest* (Hitchcock, et al., 1973).

4.2.3 Hydrology

Hydrologic patterns that may create wetlands can be influenced by precipitation, stratigraphy, topography, soil permeability, plant cover, and human disturbance. Wetland hydrology encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season.

Primary and secondary hydrologic indicators used by field biologists to assist in the identification of potential wetlands include the following (USACE, 2008):

- Surface water or inundation
- High water table or saturated soil within 12 inches of the ground surface for 14 or more consecutive days at a minimum frequency of five years out of 10
- Water marks
- Sediment and drift deposits
- Algal mat or crust
- Iron deposits
- Surface soil cracks
- Salt crust
- Inundation visible on aerial photography
- Sparsely vegetated concave surface
- Aquatic invertebrates
- Water-stained leaves
- Hydrogen sulfide odor
- Oxidized rhizospheres along living roots
- Presence of reduced iron
- Stunted or stressed plants

Secondary indicators include (USACE, 2008):

- Drainage patterns
- Dry-season water table
- Saturation visible on aerial photography
- Geomorphic position
- Shallow aquitard
- FAC-neutral test
- Raised ant mounds
- Frost-heave hummocks

The growing season for a region is dependent on climate, precipitation, and topography. Hydrology must be present for at least 14 consecutive days and within 12 inches of the ground surface during the growing season to be considered a wetland. Indicators of the onset of the growing season include: (1) a soil temperature at 41 degrees Fahrenheit (°F) measured at 12 inches bgs; and/or (2) aboveground growth and development of vascular plants (USACE, 2008).

The growing season initiates on a given Site when two or more different non-evergreen vascular plants exhibit one or more of the following indicators of biological activity:

- Emergence of herbaceous plants;
- New growth on vegetative crowns;
- Coleoptiles/cotyledon emergence from seed;
- Bud burst on woody plants;
- Emergence or elongation of woody plant leaves; and
- Emergence or opening of flowers.

The growing season terminates on a given Site when woody deciduous species lose their leaves, and/or the last herbaceous plants cease flowering and their leaves become dry or brown. Additional information may be obtained from the Climate Analysis for Wetlands Tables (WETS) available from the USDA NRCS National Water and Climate Center. The objective of the WETS tables is to define the normal range for monthly precipitation and growing season to assess climatic characteristics for a geographic area over a representative interval. The growing season dates in the WETS tables provide an estimate of air temperature averages above 28°F.

4.2.4 Soils

Hydric soils are formed under conditions of saturation, flooding, or ponding for a period long enough during the growing season that anaerobic conditions develop in the upper soil strata (zero to 20 inches commonly; USACE, 2008). These anaerobic conditions exhibit certain soil characteristics that can be identified in the field to investigate (confirm or deny) the hydric soil wetland parameter. Prolonged anaerobic soil conditions eventually lead to a chemically reduced state, where soil components (iron, manganese, sulfur, and carbon compounds) develop soil colors and other physical characteristics indicative of hydric status. These chemically-reduced soil components persist when the soil is either wet or dry. Specific hydric soil characteristics Haley & Aldrich's wetland scientist used to identify hydric soils include:

- Reduced iron resulting in a soil color that is known as gley (bluish-gray or greenish-gray);
- Loss of iron resulting in a soil color that is known as redox depletion (gray or reddish-gray);
- Loss of iron resulting in concentrated soil patches known as redoximorphic concretions (orange or red);
- Sulfidic odor; and
- High organic matter content (peat or muck) in the upper 32 inches of the soil profile.

Haley & Aldrich's study methods for hydric soil analysis included digging soil pits wherever drainage patterns, ponded areas, or indicators of water presence were observed. Soil pits were hand dug to depths between 10 and 24 inches bgs, as described previously in Section 4.2.1, along a transect perpendicular to the predicted wetland boundary in a gradient from dry to wet. Soils obtained from each soil pit were observed for color profile, odor, and redoximorphic condition. Hydric soil conditions must be met within 12 inches of the ground surface to consider the soil types hydric.

Soil colors were determined using Munsell® Soil Color Charts (Munsell Color, 2009) and their appropriate hue: spectral colors (e.g., 10YR); value: degree of lightness (e.g., 2/); and chroma: strength or purity of the color (e.g., /1). Soil profiles must have a dominant chroma of 2 or less or the layer with dominant chroma of more than 2 must be less than 6 inches thick to meet any hydric soil indicators. Hydric soil indicators commonly found in wetlands are identified in the technical document, *Field Indicators of Hydric Soils in the United States, a Field Guide for Identifying and Delineating Hydric Soils* (USDA NRCS, 2018). These indicators help identify soils formed under saturated, flooded, or ponded conditions long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile.

4.3 WETLAND CHARACTERISTICS

The wetlands delineated in this study were characterized according to the Cowardin classification, which categorizes wetlands and deep-water habitats according to five separate systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (Cowardin, et al., 1979). These systems are then stratified into subsystems based on plant community types and are further stratified into classes and subclasses from substrate material. Each class and subclass are then annotated with specific modifiers for water regimes, water chemistry, soil, and other special modifiers. The USFWS uses this classification system in their NWI maps.

Site wetlands were also identified according to their hydrogeomorphic (HGM) classification to determine their location and function within the watershed. HGM classifications include the following:

- Depressional;
- Riverine;
- Lake-fringe;
- Slope;
- Flats; and
- Freshwater tidal.

4.4 ORDINARY HIGH-WATER MARK DELINEATION

To estimate the presence of stream (lotic) features within the study area, Haley & Aldrich applied the methods utilized by the USACE in their *Regulatory Guidance Letter, Ordinary High Water Mark Identification* (USACE, 2005) and various indicators outlined with the USACE's *A Guide to the Identification of the OHWM in the Arid West Region of the Western United States* documentation (USACE, 2008). Haley & Aldrich's scientists used the Arid West OHWM definition for this study, as described below:

> *"The term "OHWM" means that line on the shore established by the fluctuations of weather and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas."*

During the field investigation, we walked the Site to identify physical characteristics present on the shoreline of a given watercourse. Conditions may vary depending on the type of water body and conditions of the area. There are no required physical indicators that must be present to make an OHWM determination. However, the following physical characteristics were considered when making the OHWM determination:

- Natural line impressed on the bank
- Shelving or topographic breaks
- Changes in the character of soil
- Destruction of terrestrial vegetation
- Presence of litter or debris (drift lines)
- Wracking
- Vegetation matted down, bent, or absent
- Sediment sorting
- Leaf litter disturbed or washed away
- Scour
- Deposition
- Multiple observed flow events
- Bed and banks
- Water staining
- Change in plant community

Other methods for determining the OHWM that do not include physical observation:

- Lake and stream gauge data
- Elevation data
- Spillway height
- Flood predictions
- Historic records of water flow
- Statistical evidence

5. Results

5.1 LITERATURE REVIEW

5.1.1 Soils

The Snohomish County, Washington NRCS Web Soils Soil Survey (USDA NRCS, 2020) identified two soil types within the Site boundary, as shown in the Desktop Review, Figure 3. A general description of the soil types, as defined by the NRCS Web Soil Survey, are provided below. Both soils identified on the property are listed on the National Hydric Soils List as being "hydric" soils.

- **7-Bellingham Silty Clay Loam:** 0 to 3 percent slopes; Landform: Drainageways, depressions; Parent material: Alluvium over lacustrine deposits; Drainage Class: poorly drained; Profile: silty clay loam over silty clay; Hydric.
- **55-Puget Silty Clay Loam:** 0 to 2 percent slopes; Landform: Flood plains; Parent Material: Alluvium; Drainage Class: Poorly drained; Profile: Silty clay loam; Hydric

Haley & Aldrich's field observations during the Site survey generally confirmed that these soil conditions occurred in the area of the subject Site. See the NRCS Custom Soil Resource Report in Appendix C.

5.1.2 NWI Map

The USFWS NWI online mapping database (USFWS NWI Wetland Mapper) identified a Palustrine Freshwater Emergent (PEM) wetland along the eastern edge of the property boundary, and a Type F (Fish-bearing) stream running north-south through the property, as shown in the Desktop Review, Figure 3.

5.1.3 Topographic Maps/Historical Aerial Photographs

Haley & Aldrich reviewed various Monroe, Washington Quadrangle USGS topographical maps, dating to 1921 and historical aerial photographs, dating to 1985. The scales at which these maps were drawn or photos taken did not provide sufficient quality to determine changes over time. However, from what was observed from both resources, the Site vicinity appears to have remained undeveloped until the mid-1980s when development began on adjacent properties. The Site does not appear to have significantly changed since the mid-1980's.

5.1.4 Critical Areas Maps

Review of the City of Monroe Streams and Wetlands Maps indicated an unclassified stream (ditch) adjoins the eastern Site boundary. A critical area buffer associated with the unclassified stream is depicted within the project Site. Unclassified wetlands are mapped adjacent to the northeast of the project Site. The Shoreline Environment Designations map did not identify any shoreline designations at the Site (City of Monroe, 2024a).

5.1.5 Climate

The closest weather station that records temperature data to the study area is the Monroe Station, which shows the normal temperature range reaching the low 60s (Fahrenheit) in the summer months

and high 30s in the winter. For the year 2024, January-March has had average temperatures, with a colder-than-average spring from the end of March through early May (USDA NRCS, 2023). See Appendix D for normal and 2024 observed temperatures.

The 30-year normal for precipitation at the Monroe Station is approximately 50 inches annually (USDA NRCS, 2023). The USACE Antecedent Precipitation Tool (APT) provides precipitation information for a specific point using nearby weather station data, weighted depending on horizontal and vertical distance from the specified point. The tool compares recent precipitation conditions to the 30-year normal range (30th-70th percentile) to determine whether field data or observations were made during normal climatic conditions. The tool can assess the presence or absence of drought conditions, or the approximate dates of wet or dry seasons for a given location.

An output from the APT tool was generated for the study area location. In March, April, and May of 2024, the study area was under normal climatic (precipitation) conditions. See Appendix D for precipitation data and deviations from normal.

5.1.6 Flood Plains

The study area lies within the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 535534. The entire project is within an area of minimal flood hazard and outside of the regulated floodplain. See Appendix E for FEMA FIRM.

5.2 FIELD INVESTIGATIONS

5.2.1 Wetland Delineation/ Assessment

The study area encompasses approximately 2.16 acres adjacent to the northeast of the intersection of Oaks Street and Woods Creek Road in Monroe, Washington. The study area for the project includes any areas where soil disturbance could occur as a result of this Project. All quantities and areas in this report are referencing the aquatic resources within the study area boundary. See Figure 2 for a map of the Study Area.

The aquatic resources were delineated by Lindsay Chutas and Samantha Fisher from Haley & Aldrich on 15 May 2024. Aside from wetland W1 and the stormwater ditch, no additional aquatic resources were identified during the field investigation. Wetland data points were selected based on topography, hydrophytic vegetation, saturated soils, and drainage patterns. Each data point was assigned a unique number, and a data form from the WMVC Supplement was completed in both upland and wetland representative areas to delineate the wetland boundaries. Additional soil pits were dug periodically around wetland boundaries to confirm that the recorded data points are representative of the soil types and hydrologic conditions of each wetland.

The OHWM was delineated using physical characteristics as described in *A Guide to OHWM Delineation for Non-Perennial Streams in the Western Mountains, Valleys, and Coast Region (WMVC) of the United States* (USACE, 2014) and Ecology (Ecology, 2016) guidance.

Wetland boundaries and data points were mapped in the field and further refined by Haley & Aldrich staff using GIS software, imagery, LiDAR, and field observations. The wetland boundary was flagged with pink pin-flags and labeled with the date of observation.

5.2.2 Soils and Hydrology

The Haley & Aldrich scientists established 2 soil pits (WSP-1 and USP-1) within the project Site. Soil pits were located based on site observations such as topography gradient or low points within the terrain, general vegetative cover, or color change. Table II provides a summary of soil and hydrology data conditions encountered during the delineation/assessment.

Table II. Soil/Hydrology Data Summary

Soil Pit ID	Approximate Depth (inches bgs)	Hue, Value, Chroma	Redox Features	Soil Description	Sulfide Odor	Depth to Water/ Saturation (inches bgs)	Hydric Soils Present? (Yes/No)
WSP-1	**0 – 4** **4 – 7** **7-16**	**10YR 3/3** **10YR 4/1** **N4/**	**No** **Yes** **No**	**Loamy/Clayey**	**No**	**15**	**Yes**
USP-1	0 – 7 7-17	10YR 3/2 10YR 3/3	-No Yes	Loamy/Clayey	No	--	No

Notes:

** = hydric soil indicators present; however, the soil characteristics did not meet the specific requirements needed to trigger a "hydric soil" condition.*

***Bold** text indicates tests plots that occurred within a wetland.*

Soils observed from the sample plot within Wetland W1 (WSP-1) consist of clay ranging from 10YR 3/3 with high organic content in the upper part of the soil, to a gley color in the lower part of the soil profile. Mucky loam was observed from zero to 4 inches depth. 4 to 7 inches depth contained redox concentrations within a 10YR 4/1 matrix, and below 7 inches was 100 percent N4/ gley. Hydric soil indicators observed include Loamy Mucky Mineral (F1), Loamy Gleyed Matrix (F2), Depleted Matrix (F3), and Redox Depressions (F8). USP-1 did not have soil indicative of hydric conditions and, therefore, were not considered wetland/hydric soils.

The wetland determination sample plot data forms are provided in Appendix A, and a photographic record of the soil pit conditions is provided in Appendix B.

5.2.3 General Vegetation

The study area consists of upland and riparian corridors and is currently utilized as a parking area for vehicles. The upland areas consist of invasive upland species and grasslands consistent with the eastern Puget Lowlands of Snohomish County, including common tansy (*tanacetum vulgar)*, Himalayan blackberry (*Rubus armeniacus)*, crabgrass (*poa spp*.), and small flowered cranesbill (*geranium californicum).* The riparian corridor was dominated by reed canary grass, soft rush (*juncus effusus)*, western lady fern (*athrium cyclosorum)*, and Geyer's willow (*salix geyeriana)*.

Hydrophytic vegetation was characterized based on general dominant species observed within the approximately 5 to 30-foot-diameter sample plot surrounding each soil pit. Hydrophytic vegetation was observed across the cultivated areas of the Site, but was prevalent in depressional areas, as described in Table III below.

Table III. Dominant Vegetation			
Wetland	**Herbaceous Layer** *(Common & Scientific Name with Hydric Plant Classification)*	**Scrub/Shrub Layer** *(Common & Scientific Name with Hydric Plant Classification)*	**Forested Layer** *(Common & Scientific Name with Hydric Plant Classification)*
Wetland A	• Reed Canarygrass *(Phalaris arundinacea)* – FACW • Soft Rush *(juncus effusus)* – FAC • Western Lady Fern *(athrium cyclosorum)*	• Geyer's Willow *(Salix lutea)* – FACW	• None

5.3 REGULATORY REVIEW

According to the USACE, EPA, and Ecology, a wetland is defined as:

> *"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."*

Based on this regulatory definition, field observations, data collection, historical site data, and previous report documentation, Haley & Aldrich identified one wetland (Wetland 1) that likely meets Ecology and the City of Monroe's jurisdictional criteria. In addition, a non-wetland water (stormwater ditch) is located along the eastern boundary of the Site. A summary and quantities of aquatic resources delineated within the study area are described in Table IV below.

Table IV. Overview of Aquatic Resources							
ID	**Type**	**Cowardin* Classification**	**Latitude**	**Longitude**	**Acres**	**Linear Feet**	**Average Width (inches)**
W1	Wetland	PEM	47.86114	-121.964324	0.0084	N/A	NA
S1	Stormwater Ditch	Riverine	47.86114	-121.964324	NA	401.61	18-27"
				Totals:	**0.0084**	**401.61**	
Notes: ** = Class as defined in Cowardin, et al., 1979.*							

5.3.1 Wetland W1—approximately 3659 square feet (sf) (0.0.084 acres) in size

One wetland feature, with a Cowardin classification of PEM and HGM classification of Riverine, was confirmed within the study area. Wetland hydrology comes from surface water runoff from the uplands and overflow of the stormwater ditch into the PEM wetland during wet periods of the year.

The Wetland W1 (0.084 acres) is dominated by reed canary grass and soft rush, with lesser amounts of western lady fern . See Appendix A for wetland determination forms and Figure 4 for a map of delineated aquatic resources. The photographic record of wetland characteristics are provided in Appendix B.

Site observations indicated that the NWI classification/mapping effort incorrectly mapped the Site and/or changes occurred on Site that that may have altered the wetland parameters of hydric soils, hydric vegetation, and hydrology, since the development of the NWI and DNR mapping.

5.3.1.1 Wetland W1 Rating

Wetland W1 was rated using the Washington State Wetland Rating System for Western Washington (Hruby, et al., 2014). The HGM class used for the rating was Riverine, and found to be an overall Category IV wetland based on functions, with a total score of 14: water quality function rating of 7, hydrologic function rating of 4, and habitat function rating of 3. Buffer widths are recommended as identified in the City of Monroe Development Standards (Table 22.80.090(D)(3)). Utilizing the matrix provided, a 50 ft buffer for the Category IV wetland is recommended. A figure showing the location of buffers relative to the proposed project boundary can be found in Figure 5. Full wetland rating can be found in Appendix F.

5.3.2 Stormwater Ditch S1

One stormwater ditch (S1) was confirmed on Site. This ditch was identified in the City of Monroe utilities database, but was not depicted as a stream on the NWI database. The DNR Water Courses map indicated a type F (Fish-bearing) stream was located running from the northern most part of the property through the southern boundary of the property. No stream was found in this location. However, the City of Monroe Streams and Wetlands Map identified the stormwater ditch as an unclassified stream with a 50-foot buffer along the eastern boundary of the site (City of Monroe, 2024a), which is consistent with field observations. The confirmed stormwater ditch flows along the northeast property boundary, from northwest to southeast, and exits the property through a stormwater inlet to a 30-inch reinforced concrete pipe. See Appendix B for photographic record of the stormwater ditch.

5.3.3 Regulatory Correspondence

An agency Site visit to review the findings from the delineation of aquatic resources was conducted on 13 November 2024, with representatives from Ecology and the Washington Department of Fish and Wildlife (WDFW), as well as representatives from the City of Monroe and Haley & Aldrich, in attendance. On 18 November 2024, Ryan Shaw of WDFW communicated via email that WDFW confirmed the stormwater ditch is a non-fish bearing stormwater drainage, with no current or historical connection to a surface water body (R. Shaw personal communication November 18, 2024). An email correspondence dated 12 December 2024 (post-Site visit) from USACE local field representative Ryan Cochoit indicated that the USACE had no concerns about the stormwater ditch as a jurisdictional water body (R. Cochoit personal communication, December 12, 2024).

6. Conclusions

Haley & Aldrich conducted a wetland delineation on the 2.16 -acre parcel located at 19959 Oaks Street in Monroe, Washington. The Site is currently used as a parking or storage space for vehicles and trailers, and is largely undeveloped and overgrown with blackberry, reed canary grass, and upland grasses.

Haley & Aldrich identified and delineated one wetland (Wetland 1) within the project Site boundary. This wetland was classified as a PEM wetland, and is approximately 3659 square feet (sf; 0.084 acres) in size.

In addition, one approximately 402-foot-long stormwater ditch (S1) was identified connecting Wetland 1 to a downstream culvert at the site boundary. This stormwater ditch was confirmed as having no surface water connection to any downstream water bodies.

Haley & Aldrich believes Wetland 1 likely meet the requisite criteria to be considered jurisdictional by Ecology under current wetland definitions as defined in the GMA, and Stormwater ditch S1 will not be considered jurisdictional after correspondence with both the USACE, WDFW, and Ecology.

Please note, this report contains opinions from Haley & Aldrich based on specific site data and previous professional experience, however, final determinations will be made by the USACE and Washington Department of Ecology.

7. Limitations

The above services consist of professional opinions and conclusions by consulting professional wetland scientists. The only warranty or guarantee made by the consultant, in connection with the services performed for this project, is that such services are performed with the care and skill ordinarily exercised by members of the profession practicing under similar conditions, at the same time, and in the same or a similar locality. No other warranty, expressed or implied, is made or intended by rendering such consulting services, or by furnishing written reports of the findings.

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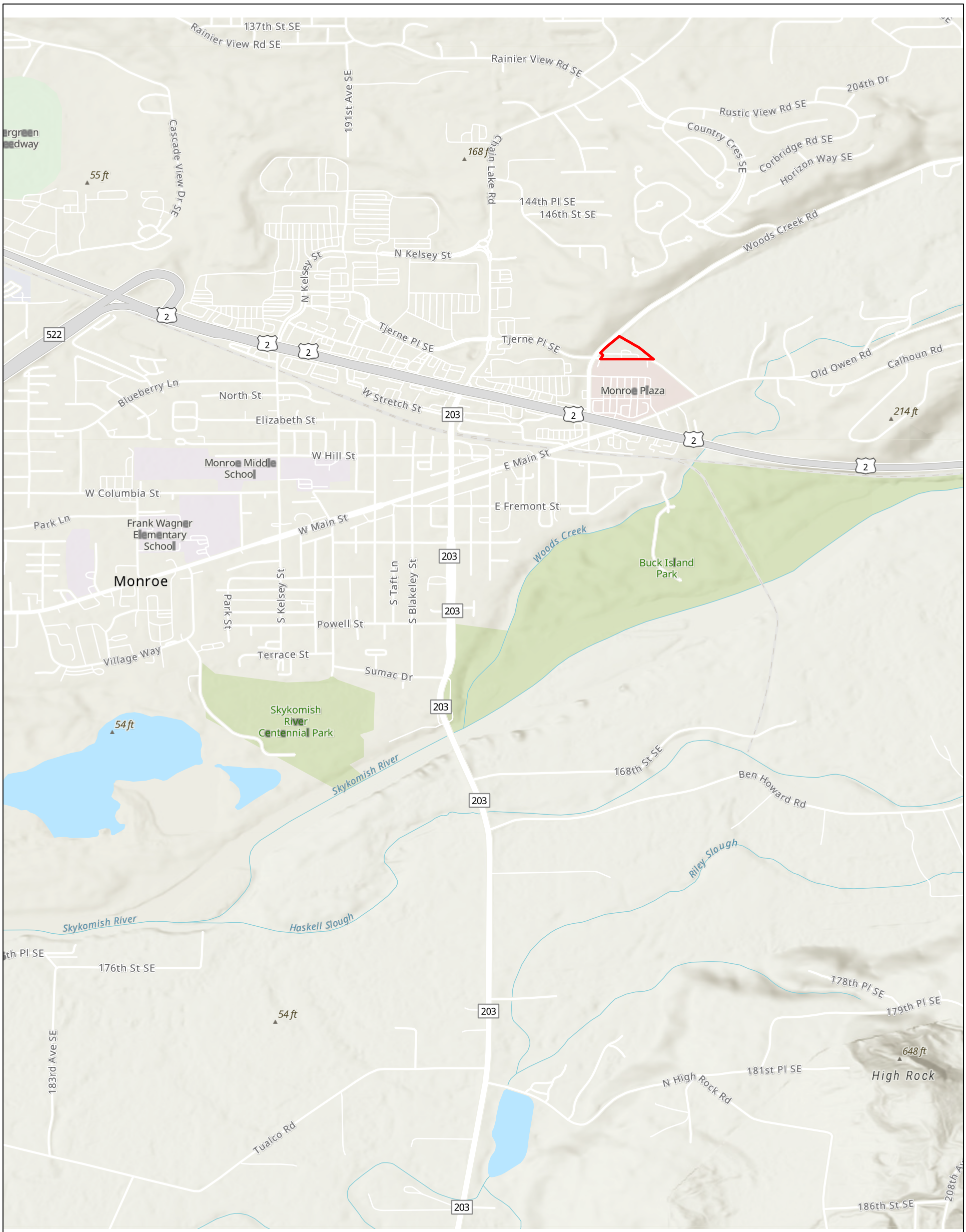
FIGURES



LEGEND

STUDY AREA

N

0 1,000 2,000

SCALE IN FEET

HALEY ALDRICH

SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

VICINITY

FEBRUARY 2025

FIGURE 1

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM

LEGEND

- STUDY AREA
- PARCELS
- PUBLIC LAND SURVEY SECTIONS

N

0 1000 2000

SCALE IN FEET

HALEY ALDRICH

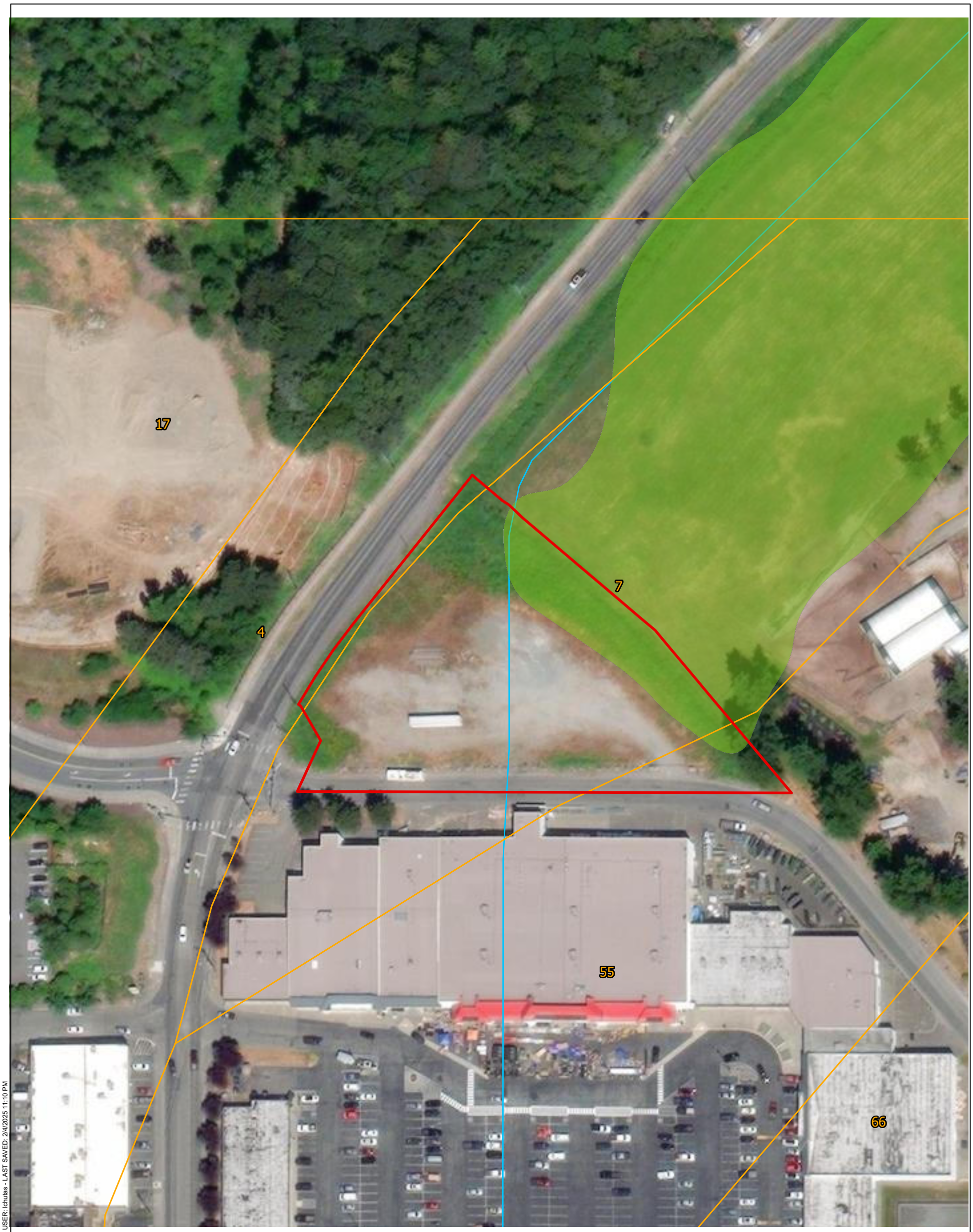
SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

STUDY AREA

FEBRUARY 2025

FIGURE 2

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM



LEGEND

STUDY AREA

NRCS SOIL MAP UNITS

WETLANDS
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

Wetlands

DNR WATER TYPE

F

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

N

0 100 200

SCALE IN FEET

HALEY ALDRICH

SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

DESKTOP REVIEW

FEBRUARY 2025

FIGURE 3

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM

LEGEND

- STUDY AREA
- STORMWATER DITCH

SOIL PLOT TYPE

- UPLAND
- WETLAND
- DELINEATED WETLAND

0 100 200

SCALE IN FEET

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

HALEY ALDRICH

SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

DELINEATED AQUATIC RESOURCES

FEBRUARY 2025

FIGURE 4

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM

LEGEND

SOIL PLOTS

- **UPLAND**
- **WETLAND**
- **DELINEATED STREAM/STORMWATER DITCH**
- **STUDY AREA**
- **DELINEATED WETLAND**
- **50 FT WETLAND BUFFER**

N

0 100 200

SCALE IN FEET

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

HALEY ALDRICH

SRFR SITE
OAC SERVICES
MONROE, WASHINGTON

DELINEATED AQUATIC RESOURCES WITH BUFFERS

FEBRUARY 2025

FIGURE 5

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM

APPENDIX A
USACE Wetland Determination Data Sheet

U.S. Army Corps of Engineers

WETLAND DETERMINATION DATA SHEET – Western Mountains, Valleys, and Coast Region

See ERDC/EL TR-10-3; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: OAC-SRFR | City/County: Monroe/Snohomis | Sampling Date: 2024-05-15

Applicant/Owner: OAC-SRFR | State: WA | Sampling Point: WSP1

Investigator(s): Chutas, Fisher, Bangasser | Section, Township, Range: S06 T27N R7E

Landform (hillside, terrace, etc.): floodplain | Local relief (concave, convex, none): none | Slope (%): 2-5

Subregion (LRR): LRR A, MLRA 2 | Lat: 47.861195 | Long: -121.964381 | Datum: WGS 84

Soil Map Unit Name: 7- Bellingham silty clay loam | NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix geyeriana*	5	Yes	FACW
2.			
3.			
4.			
	5	=Total Cover	
Sapling/Shrub Stratum (Plot size: 5)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Phalaris arundinacea*	75	Yes	FACW
2. *Juncus effusus*	15	No	FAC
3. *Athyrium cyclosorum*	10	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
		=Total Cover	

% Bare Ground in Herb Stratum ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	80	x 2 =	160
FAC species	25	x 3 =	75
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105 (A)		235 (B)

Prevalence Index = B/A = 2.24

Hydrophytic Vegetation Indicators:

____ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

X 3 - Prevalence Index is ≤3.0[1]

____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ 5 - Wetland Non-Vascular Plants[1]

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: WSP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/3	100					Mucky Loam/Clay	with roots
4-7	10YR 4/1	60	7.5YR 4/6	40	C	M	Loamy/Clayey	Prominent redox concentrations
7-16	N 4/	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ 1 cm Muck (A9) **(LRR D, G)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- X Loamy Mucky Mineral (F1) **(except MLRA 1)**
- X Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR A, E)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- X Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes X	No ___	Depth (inches): 15
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers

WETLAND DETERMINATION DATA SHEET – Western Mountains, Valleys, and Coast Region

See ERDC/EL TR-10-3; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: OAC-SRFR City/County: Monroe/Snohomis Sampling Date: 2024-05-15

Applicant/Owner: OAC-SRFR State: WA Sampling Point: USP1

Investigator(s): Chutas, Fisher, Bangasser Section, Township, Range: S06 T27N R7E

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): none Slope (%): 0-2%

Subregion (LRR): LRR A, MLRA 2 Lat: 47.86108134 Long: -121.96449587 Datum: WGS 84

Soil Map Unit Name: 7- Bellingham silty clay loam NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X

Hydric Soil Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5)			
1. *Rubus armeniacus*	40	Yes	
2. *Salix pseudomonticola*	5	No	FACW
3.			
4.			
5.			
	45	=Total Cover	
Herb Stratum (Plot size: 5)			
1. *Tanacetum vulgare*	30	Yes	FACU
2. *Digitaria*	20	Yes	FAC
3. *Geranium californicum*	10	No	FAC
4. *Myosotis discolor*	5	No	FAC
5. *Taraxacum officinale*	5	No	FACU
6.			
7.			
8.			
9.			
10.			
11.			
	70	=Total Cover	
Woody Vine Stratum (Plot size: 30)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	35	x 3 =	105
FACU species	35	x 4 =	140
UPL species	0	x 5 =	0
Column Totals:	75 (A)		255 (B)

Prevalence Index = B/A = 3.40

Hydrophytic Vegetation Indicators:

____ 1 - Rapid Test for Hydrophytic Vegetation

____ 2 - Dominance Test is >50%

____ 3 - Prevalence Index is ≤3.0[1]

____ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ 5 - Wetland Non-Vascular Plants[1]

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: USP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 3/2	100					Loamy/Clayey	with roots
7-17	10YR 3/3	99	10YR 5/8	1	C	M	Loamy/Clayey	with gravel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ 1 cm Muck (A9) **(LRR D, G)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR A, E)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

APPENDIX B
Site Photographs

Photo 1: Soil profile of WSP-1

Photo 2: Wetland vegetation looking northeast from WSP-1

Photo 3: Upland Vegetation looking north from USP-1

Photo 4: Stormwater ditch S1

Photo 5: Stormwater ditch S1; view is upstream looking North

Photo 6: Stormwater ditch S1 entering the stormwater inlet to concrete pipe at southeast corner of property

Photo 7: View north across property from south property boundary. Note lack of type F stream as indicated on DNR water type map

Photo 8: Current property use for trailer storage

APPENDIX C
NRCS Custom Soil Resource Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Snohomish County Area, Washington

May 19, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
Snohomish County Area, Washington.....13
4—Alderwood-Everett gravelly sandy loams, 25 to 70 percent slopes.....13
7—Bellingham silty clay loam.....14
17—Everett very gravelly sandy loam, 0 to 8 percent slopes.....16
55—Puget silty clay loam.....17
66—Sultan silt loam.....18
References.....20

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 25, Aug 29, 2023

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

Date(s) aerial images were photographed: Aug 6, 2022—Sep 8, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
4	Alderwood-Everett gravelly sandy loams, 25 to 70 percent slopes	5.8	17.3%
7	Bellingham silty clay loam	7.2	21.6%
17	Everett very gravelly sandy loam, 0 to 8 percent slopes	4.4	13.1%
55	Puget silty clay loam	10.5	31.5%
66	Sultan silt loam	5.5	16.5%
Totals for Area of Interest		**33.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Snohomish County Area, Washington

4—Alderwood-Everett gravelly sandy loams, 25 to 70 percent slopes

Map Unit Setting

National map unit symbol: 2hyy
Elevation: 50 to 800 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Alderwood and similar soils: 60 percent
Everett and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Till plains
Parent material: Basal till

Typical profile

H1 - 0 to 7 inches: gravelly ashy sandy loam
H2 - 7 to 35 inches: very gravelly ashy sandy loam
H3 - 35 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 25 to 70 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F002XA004WA - Puget Lowlands Forest
Hydric soil rating: No

Description of Everett

Setting

Landform: Plains, terraces
Parent material: Glacial outwash

Typical profile

H1 - 0 to 6 inches: gravelly ashy sandy loam
H2 - 6 to 18 inches: very gravelly ashy sandy loam

H3 - 18 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 25 to 70 percent
Depth to restrictive feature: 14 to 20 inches to strongly contrasting textural stratification
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Hydric soil rating: No

Minor Components

Mckenna

Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Norma, undrained

Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Terric medisaprists, undrained

Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

7—Bellingham silty clay loam

Map Unit Setting

National map unit symbol: 2j00
Elevation: 0 to 820 feet
Mean annual precipitation: 35 to 60 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 150 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Bellingham, undrained, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bellingham, Undrained

Setting

Landform: Drainageways, depressions
Parent material: Alluvium over lacustrine deposits

Typical profile

H1 - 0 to 9 inches: silty clay loam
H2 - 9 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 12.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: F002XA007WA - Puget Lowlands Wet Forest
Forage suitability group: Wet Soils (G002XN102WA)
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Minor Components

Kitsap

Percent of map unit: 5 percent
Hydric soil rating: No

Bellingham, drained

Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Soils with Few Limitations (G002XN502WA)
Hydric soil rating: Yes

Terric medisaprists, undrained

Percent of map unit: 5 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

17—Everett very gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t629
Elevation: 30 to 900 feet
Mean annual precipitation: 35 to 91 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Kames, moraines, eskers
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
Bw - 3 to 24 inches: very gravelly sandy loam
C1 - 24 to 35 inches: very gravelly loamy sand
C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA)

Other vegetative classification: Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XS401WA)
Hydric soil rating: No

Minor Components

Alderwood
Percent of map unit: 10 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Indianola
Percent of map unit: 10 percent
Landform: Terraces, kames, eskers
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

55—Puget silty clay loam

Map Unit Setting
National map unit symbol: 2hzh
Elevation: 10 to 650 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 160 to 180 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition
Puget, drained, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Puget, Drained

Setting
Landform: Flood plains
Parent material: Alluvium

Typical profile
H1 - 0 to 9 inches: silty clay loam
H2 - 9 to 38 inches: silty clay loam
H3 - 38 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 47 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F002XA007WA - Puget Lowlands Wet Forest
Forage suitability group: Soils with Few Limitations (G002XN502WA)
Other vegetative classification: Soils with Few Limitations (G002XN502WA)
Hydric soil rating: Yes

Minor Components

Puget, undrained

Percent of map unit: 5 percent
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Sultan

Percent of map unit: 4 percent
Hydric soil rating: No

Snohomish, undrained

Percent of map unit: 3 percent
Landform: Flood plains
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Sumas, undrained

Percent of map unit: 3 percent
Landform: Flood plains
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

66—Sultan silt loam

Map Unit Setting

National map unit symbol: 2hzw
Elevation: 0 to 820 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 150 to 200 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Sultan and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sultan

Setting

Landform: Flood plains
Parent material: Alluvium

Typical profile

H1 - 0 to 12 inches: ashy silt loam
H2 - 12 to 42 inches: silty clay loam
H3 - 42 to 60 inches: stratified sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Seasonally Wet Soils (G002XN202WA)
Other vegetative classification: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: No

Minor Components

Puget, undrained

Percent of map unit: 5 percent
Landform: Flood plains
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

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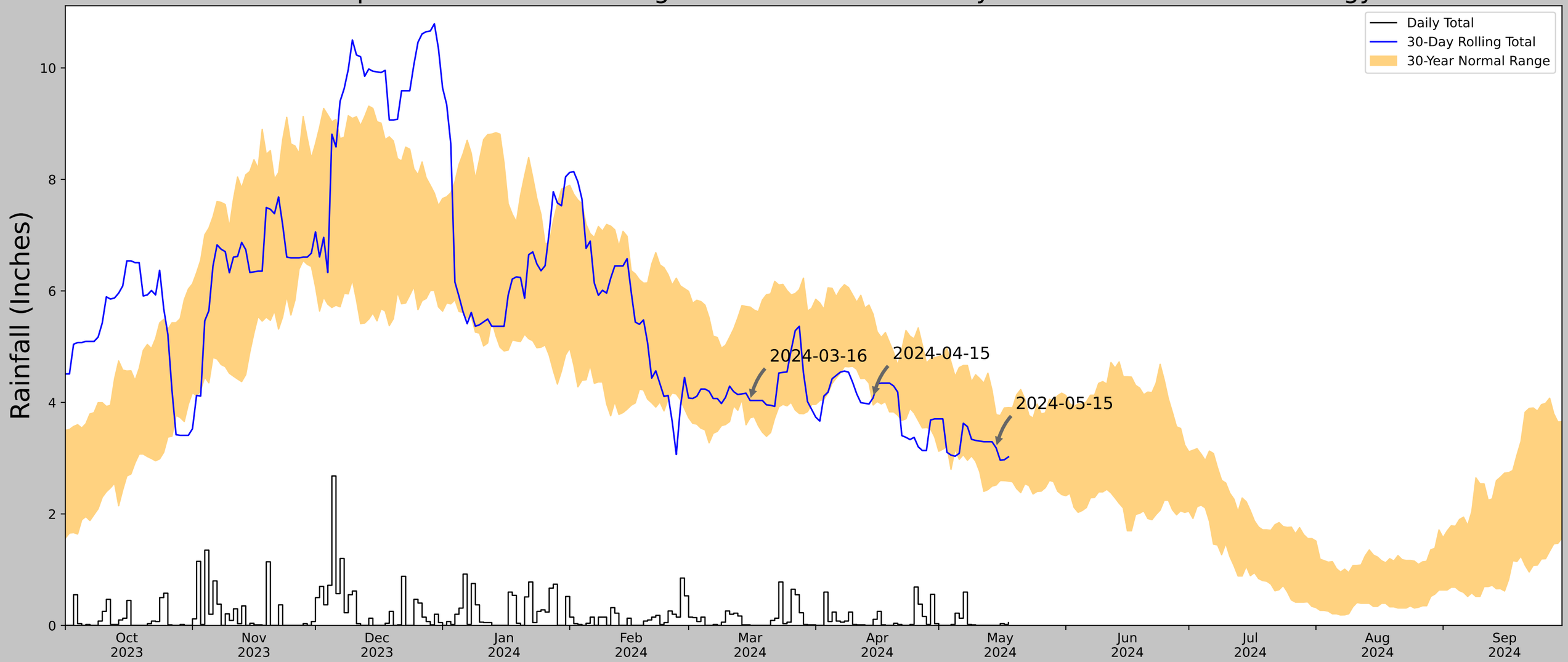
APPENDIX D
Antecedent Precipitation vs. Normal Range

Antecedent Precipitation vs Normal Range based on NOAA's Daily Global Historical Climatology Network



Coordinates	47.861299, -121.964381
Observation Date	2024-05-15
Elevation (ft)	73.518
Drought Index (PDSI)	Moderate drought (2024-04)
WebWIMP H_2O Balance	Wet Season

30 Days Ending	30^{th} %ile (in)	70^{th} %ile (in)	Observed (in)	Wetness Condition	Condition Value	Month Weight	Product
2024-05-15	2.518504	3.780709	3.185039	Normal	2	3	6
2024-04-15	3.953937	5.583071	4.082677	Normal	2	2	4
2024-03-16	3.72441	5.711811	4.035433	Normal	2	1	2
Result							Normal Conditions - 12

US Army Corps of Engineers

ERDC

Figures and tables made by the Antecedent Precipitation Tool Version 2.0

Developed by: U.S. Army Corps of Engineers and U.S. Army Engineer Research and Development Center

Weather Station Name	Coordinates	Elevation (ft)	Distance (mi)	Elevation Δ	Weighted Δ	Days Normal	Days Antecedent
MONROE	47.8453, -121.9944	120.079	1.777	46.561	0.883	10966	88
MONROE 0.6 SE	47.8526, -121.9712	73.163	1.188	46.916	0.59	6	0
MONROE 1.8 NW	47.8785, -122.0066	128.937	2.363	8.858	1.084	4	2
DUVALL 0.8 WNW	47.7391, -121.9841	129.921	7.353	9.842	3.381	14	0
WOODINVILLE 0.9 ENE	47.7531, -122.0943	288.058	7.879	167.979	4.869	117	0
WOODINVILLE 1.7 SE	47.7295, -122.0836	217.848	9.009	97.769	4.935	7	0
SNOHOMISH 3.5 NNE	47.9641, -122.0572	255.906	8.708	135.827	5.101	1	0
STARTUP 1 E	47.8672, -121.7175	170.932	12.926	50.853	6.474	235	0
EVERETT	47.9753, -122.195	60.039	12.922	60.04	6.591	2	0

APPENDIX E
National Flood Hazard Layer FIRMette

National Flood Hazard Layer FIRMette

FEMA

121°58'10"W 47°51'51"N

121°57'33"W 47°51'27"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/20/2024 at 11:03 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX F
Wetland Rating Summary

Wetland name or number: SRFR Option 1

RATING SUMMARY - Western Washington

Name of wetland (or ID#): SRFR Option 1 **Date of site visit:** 05/15/2024

Rated By: Lindsay Chutas **Trained by Ecology? Yes** [X] **No** [ ] **Date of Training:** 11/10/2022

HGM Class used for rating: Riverine

Wetland has multiple HGM classes? Yes [ ] **No** [X]

NOTE: Form is not complete without the figures requested *(figures can be combined).*

Source of base aerial photo/map: Bing

OVERALL WETLAND CATEGORY: [**Category IV**] (based on functions [X] or special characteristics [ ])

1. Category of wetland based on FUNCTIONS

[ ] **Category I** - Total score = 23 - 27

[ ] **Category II** - Total score = 20 - 22

[ ] **Category III** - Total score = 16 - 19

[X] **Category IV** - Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
Site Potential	**L**	**L**	**L**	
Landscape Potential	**H**	**M**	**L**	
Value	**H**	**L**	**L**	**Total**
Score Based on Ratings	**7**	**4**	**3**	**14**

Score for each function based on three ratings (order of ratings is not important)

9 = H,H,H

8 = H,H,M

7 = H,H,L

7 = H,M,M

6 = H,M,L

6 = M,M,M

5 = H,L,L

5 = M,M,L

4 = M,L,L

3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	
Wetland of High Conservation Value	
Bog	
Forested	
Coastal Lagoon	
Interdunal	
None of the above	**Not Applicable**

Wetland name or number: SRFR Option 1

Maps and figures required to answer questions correctly for Western Washington

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1km Polygon: Area that extends 1km form entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Wetland name or number: SRFR Option 1

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

R 1.0 Does the site have the potential to improve water quality?

R 1.1 What is the total area of surface depressions within the Riverine wetland that can trap sediments during a flooding event?

Depressions cover >75% area of wetland	points = 8	
Depressions cover >50% area of wetland	points = 4	
Depressions present but cover <50% area of wetland	points = 2	
No depressions present	points = 0	**Score: 0**

R 1.2 What is the structure of plants in the wetland?

Trees or shrubs cover >66% area of the wetland	points = 8	
Trees or shrubs cover 33% - 66% of the area of the wetland	points = 6	
Ungrazed, herbaceous plants cover (>6in high) >66% area of the wetland	points = 6	
Ungrazed, herbaceous plants cover (>6in high) 33%-66% of the area of the wetland	points = 3	
Trees, shrubs, and ungrazed herbaceous plants cover <33% area of the wetland	points = 0	**Score: 3**

Total for R 1: 3

Rating of Site Potential [ ] **12-16 = H** [ ] **6-11 = M** [X] **0-5 = L** *Record the rating on the first page*

R 2.0 Does the landscape have the potential to support the water quality function of the site?

R 2.1 Is the wetland within an incorporated city or within its UGA?

Yes	points = 2	
No	points = 0	**Score: 2**

R 2.2 Does the contributing basin to the wetland include a UGA or incorporated area?

Yes	points = 1	
No	points = 0	**Score: 1**

R 2.3 Does at least 10% of the contributing basin contain tilled fields, pastures, or forests that have been clearcut within the last 5 years?

Yes	points = 1	
No	points = 0	**Score: 1**

R 2.4 Is >10% of the area within 150ft of the wetland in land uses that generate pollutants?

Yes	points = 1	
No	points = 0	**Score: 1**

R 2.5 Are there other sources of pollutants coming into the wetland that are not listed in question R 2.1-R 2.4?

Yes	points = 1	
No	points = 0	**Score: 0**

R 2.6 What are the other sources of pollutants coming into the wetland?

Total for R 2: 5

Rating of Landscape Potential [X] **3-4 = H** [ ] **1-2 = M** [ ] **0 = L** *Record the rating on the first page*

Wetland name or number: SRFR Option 1

R 3.0 Is the water quality improvement provided by the site valuable to society?		
R 3.1 Is the wetland along a stream or river that is on the 303(d) list or on a tributary that drains to one within 1 mi?		
Yes	points = 1	
No	points = 0	**Score: 0**
R 3.2 Is the wetland along a stream or river that has TMDL limits for nutrients, toxics, or pathogens?		
Yes	points = 1	
No	points = 0	**Score: 1**
R 3.3 Has the site been identified in a watershed or local plan as important for maintaining water quality?		
Yes	points = 2	
No	points = 0	**Score: 2**
	Total for R 3:	**3**

Rating of Value [X] **2-4 = H** [ ] **1 = M** [ ] **0 = L** *Record the rating on the first page*

RIVERINE AND FRESHWATER TIDAL FRINGE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradtion

R 4.0 Does the site have the potential to reduce flooding and erosion?		
R 4.1 What are the characteristics of the overbank storage the wetland provides?		
If the ratio is more than 20	points = 9	
If the ratio is 10-20	points = 6	
If the ratio is 5-<10	points = 4	
If the ratio is 1-<5	points = 2	
If the ratio is < 1	points = 1	**Score: 1**
R 4.2 What are the characteristics of plants that slow down water velocities during floods?		
Forest or shrubs cover >33% of the wetland area OR emergent plants cover >66% of the wetland area	points = 7	
Forest or shrubs cover >10% of the wetland area OR emergent plants cover >33% of the wetland area	points = 4	
Plants do not meet the above criteria	points = 0	**Score: 4**
	Total for R 4:	**5**

Rating of Site Potential [ ] **12-16 = H** [ ] **6-11 = M** [X] **0-5 = L** *Record the rating on the first page*

Wetland name or number: SRFR Option 1

R 5.0 Does the landscape have the potential to support the hydrologic functions of the site?		
R 5.1 Is the stream or river adjacent to the wetland downcut?		
Yes	points = 0	
No	points = 1	**Score: 0**
R 5.2 Does the up-gradient watershed include a UGA or incorporated area?		
Yes	points = 1	
No	points = 0	**Score: 1**
R 5.3 Is the up-gradient stream or river controlled by dams?		
Yes	points = 0	
No	points = 1	**Score: 1**
	Total for R 5:	**2**

Rating of Landscape Potential [ ] **3 = H** [X] **1-2 = M** [ ] **0 = L** *Record the rating on the first page*

R 6.0 Are the hydrologic functions provided by the site valuable to society?		
R 6.1 What is the distance to the nearest areas downstream that have flooding problems?		
The sub-basin immediately down-gradient of the wetland has flooding problems	points = 2	
Surface flooding problems are in a sub-basin farther down-gradient	points = 1	
No flooding problems anywhere downstream	points = 0	**Score: 0**
R 6.2 Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan?		
Yes	points = 2	
No	points = 0	**Score: 0**
	Total for R 6:	**0**

Rating of Value [ ] **2-4 = H** [ ] **1 = M** [X] **0 = L** *Record the rating on the first page*

Wetland name or number: SRFR Option 1

HABITAT FUNCTIONS

These questions apply to wetlands of all HGM classes - Indicators that the site functions to provide important habitat

H 1.0 Does the wetland have the potential to provide habitat for many species?

H 1.1 What is the structure of the plant community?

- [ ] Aquatic Bed
- [x] Emergent
- [ ] Scrub-shrub
- [ ] Forested
- [ ] Multiple strata within the Forested class (canopy, sub-canopy, shrubs, herbaceous, moss/ground cover)

4 structures or more	points = 4	
3 structures	points = 2	
2 structures	points = 1	
1 structure	points = 0	
No structures present	points = 0	**Score: 0**

H 1.2 What are the hydroperiods that meet the size thresholds in the wetland?

- [ ] Permanently flooded or inundated
- [ ] Seasonally flooded or inundated
- [ ] Occasionally flooded or inundated
- [x] Saturated only
- [x] Permanently flowing stream or river in, or adjacent to, the wetland
- [ ] Seasonally flowing stream in, or adjacent to, the wetland
- [ ] Lake Fringe wetland
- [ ] Freshwater Tidal wetland

4 or more types present	points = 3	
3 types present or Lake Fringe / Freshwater Tidal Fringe	points = 2	
2 types present	points = 1	
1 type present	points = 0	
None present	points = 0	**Score: 1**

H 1.3 What is the richness of the plant species in the wetland?

>19 species	points = 2	
5-19 species	points = 1	
<5 species	points = 0	**Score: 0**

Wetland name or number: SRFR Option 1

H 1.4 What is the interspersion of habitats?

High	points = 3	
Moderate	points = 2	
Low	points = 1	
None	points = 0	**Score: 0**

H 1.5 What are the special habitat features in the wetland?

- [ ] Large, downed, woody debris within the wetland (>4in diameter and 6ft long).
- [ ] Standing snags (dbh >4in) within the wetland
- [ ] Undercut banks are present for at least 6.6ft (2m) and/or overhanging plants extend at least 3.3ft (1m) over open water or a stream (or ditch) in, or contiguous with the wetland, for at least 33ft (10m)
- [ ] Stable steep banks of fine material that might be used by beaver or muskrat for denning (>30 degree slope) OR signs of recent beaver activity are present (cut shrubs or trees that have not yet weathered where wood is exposed)
- [ ] At least 0.25ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated (structures for egg-laying by amphibians)
- [ ] Invasive plants cover less than 25% of the wetland area in every stratum of plants (see H 1.1 for list of strata)

6 habitats selected	points = 6	
5 habitats selected	points = 5	
4 habitats selected	points = 4	
3 habitats selected	points = 3	
2 habitats selected	points = 2	
1 habitat selected	points = 1	
No habitats selected	points = 0	**Score:**

Total for H 1: **1**

Rating of Site Potential [ ] **15-18 = H** [ ] **7-14 = M** [X] **0-6 = L** *Record the rating on the first page*

H 2.0 Does the landscape have the potential to support habitat functions of the site?

H 2.1 What is the percentage of accessible habitat within 1km of the wetland?

>33% of 1km Polygon	points = 3	
20-33% of 1km Polygon	points = 2	
10-19% of 1km Polygon	points = 1	
<10% of 1km Polygon	points = 0	**Score: 0**

H 2.2 What is the percentage of total habitat in a 1km polygon around the wetland?

Total habitat is >50% of the Polygon	points = 3	
Total habitat is 10-50% of the Polygon and in 1-3 patches	points = 2	
Total habitat is 10-50% of the Polygon and in >3 patches	points = 1	
Total habitat is <10% of the Polygon	points = 0	**Score: 1**

Wetland name or number: SRFR Option 1

H 2.3 What is the land use intensity in the 1km polygon?

50% of the Polygon is high intensity land use	points = -2	
<50% of the Polygon is high intensity land use	points = 0	**Score: -2**
	Total for H 2:	**-1**

Rating of Landscape Potential [ ] **4-6 = H** [ ] **1-3 = M** [X] **0 = L** *Record the rating on the first page*

H 3.0 Is the habitat provided by the site valuable to society?

H 3.1 Does the site provide habitat for species valued in laws, regulations, or policies?

- [ ] Aspen Stands
- [ ] Biodiversity Areas and Corridors
- [ ] Herbaceous Balds
- [ ] Old-growth/Mature Forests
- [ ] Oregon White Oak
- [ ] Riparian
- [ ] Westside Prarie
- [ ] Fresh Deepwater
- [ ] Instream
- [ ] Nearshore (Coastal, Open Coast, Puget Sound)
- [ ] Caves
- [ ] Cliffs
- [ ] Snags and Logs
- [ ] Talus

The following criteria automatically score 2 points:

- [ ] The wetland provides habitat for Threatened or Endangered species
- [ ] The wetland is mapped as a location for an individual WDFW priority species
- [ ] The wetland is a Wetland of High Conservation Value
- [ ] The wetland has been categorized as an important habitat site in a local plan

The wetland has 3 or more WDFW priority habitats within 100m, or meets the criteria for societal value	points = 2	
The site has 1 or 2 WDFW priority habitats within 100m	points = 1	
The site does not meet any of the criteria for societal value	points = 0	**Score: 0**
	Total for H 3:	**0**

Rating of Value [ ] **2 = H** [ ] **1 = M** [X] **0 = L** *Record the rating on the first page*

Wetland name or number: SRFR Option 1

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

SC 1.0 Estuarine Wetlands

SC 1.1 Does the wetland meet all of the following criteria for Estuarine wetlands?

☐ The dominant water regime is tidal

☐ The wetland is vegetated

☐ The water salinity is greater than 0.5 ppt

Yes - Go to SC 1.2

No - Not an Estuarine Wetland **Result:**

SC 1.2 Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151?

Yes - Category I Estuarine Wetland

No - Go to SC 1.3 **Result:**

SC 1.3 Is the wetland unit at least 1ac in size and meets at least two of the following three conditions?

☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 10% cover of non-native plant species.

☐ At least 75% of the landward edge of the wetland has a 100ft buffer of shrub, forest, or un-grazed or un-mowed grassland

☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands.

Yes - Category I Estuarine Wetland

No - Category II Estuarine Wetland **Result:**

SC 2.0 Wetlands of High Conservation Value

SC 2.1 Does the wetland overlap with any known or historical rare plant or rare & high-quality ecosystem polygons on the WNHP Data Explorer?

Yes - Category I Wetland of High Conservation Value

No - Go to SC 2.2 **Result:**

SC 2.2 Does the wetland have a rare plant species, rare plant community, or high-quality common plant community that may qualify the site as a WHCV?

Yes - Category I Wetland of High Conservation Value

No - Not a Wetland of High Conservation Value **Result:**

Wetland name or number: SRFR Option 1

SC 3.0 Bogs

SC 3.1 Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16in or more of the first 32in of the soil profile?

Yes - Go to SC 3.3
No - Go to SC 3.2 **Result:**

SC 3.2 Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond?

Yes - Go to SC 3.3
No - Not a Bog Wetland **Result:**

SC 3.3 Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least 30% cover of plant species listed in the table provided in the instructions?

Yes - Category I Bog Wetland
No - Go to SC 3.4 **Result:**

SC 3.4 Is an area with peats or mucks forested (>30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann Spruce, or western white pine AND any of the species (or combinations of species) listed in the table found in the instructions provide more than 30% of the cover under the canopy?

Yes - Category I Bog Wetland
No - Not a Bog Wetland **Result:**

SC 4.0 Forested Wetlands

SC 4.1 Does the wetland have at least 1 contiguous acre of forest that meets one of the following criteria?

- [ ] Old-growth forests
- [ ] Mature forests

Yes - Category I Forested Wetland
No - Not a Forested Wetland **Result:**

Wetland name or number: SRFR Option 1

SC 5.0 Wetlands in Coastal Lagoons

SC 5.1 Coastal Lagoons: Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

☐ The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or rocks

☐ The depression in which the wetland is located contains ponded water that is saline or brackish (>0.5 ppt) during most of the year in at least a portion of the open water area (measured near the bottom)

☐ The lagoon retains some of its surface water at low tide during spring tides

Yes - Go to SC 5.2

No - Not a Coastal Lagoon Wetland **Result:**

SC 5.2 Does the wetland meet all of the following three conditions?

☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species).

☐ At least 75% of the landward edge of the wetland has a 100ft buffer of shrub, forest, or un-grazed or un-mowed grassland.

☐ the wetland is larger than 0.10ac (4350 sqft)

Yes - Category I Coastal Lagoon

No - Category II Coastal Lagoon **Result:**

SC 6.0 Interdunal Wetlands

SC 6.1 Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership WBUO)?

Yes - Go to SC 6.2

No - Not an Interdunal Wetland **Result:**

SC 6.2 Is the wetland 1ac or larger in size, or a mosaic that is 1ac or larger in size?

Wetland is larger than 1ac in size - Go to SC 6.3

Wetland is a mosaic larger than 1ac is size - Category II Interdunal Wetland

No - Go to SC 6.4 **Result:**

SC 6.3 Does the wetland score 8 or 9 points for the habitat functions?

Yes - Category I Interdunal Wetland

No - Category II Interdunal Wetland **Result:**

SC 6.4 Is the wetland unit between 0.1ac and 1ac, or in a mosaic of wetlands that is between 0.1ac and 1ac in size?

Yes - Category III Interdunal Wetland

No - Category IV Interdunal Wetland **Result:**

Wetland name or number: SRFR Option 1

Category of wetland based on Special Characteristics	
If you answered No for all types, enter "Not Applicable" on Summary Form	**Final Category: Not Applicable**

LEGEND

COWARDIN CLASS NAME

EMERGENT

OPEN WATER

0 50 100

SCALE IN FEET

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

HALEY ALDRICH

SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

WETLAND RATING COWARDIN CLASSES

FEBRUARY 2025

FIGURE 6

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM

LEGEND

HYDROPERIOD CLASS NAME

- **PERMENANT STREAM**
- **SATURATED ONLY**

N

0 50 100

SCALE IN FEET

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

HALEY ALDRICH

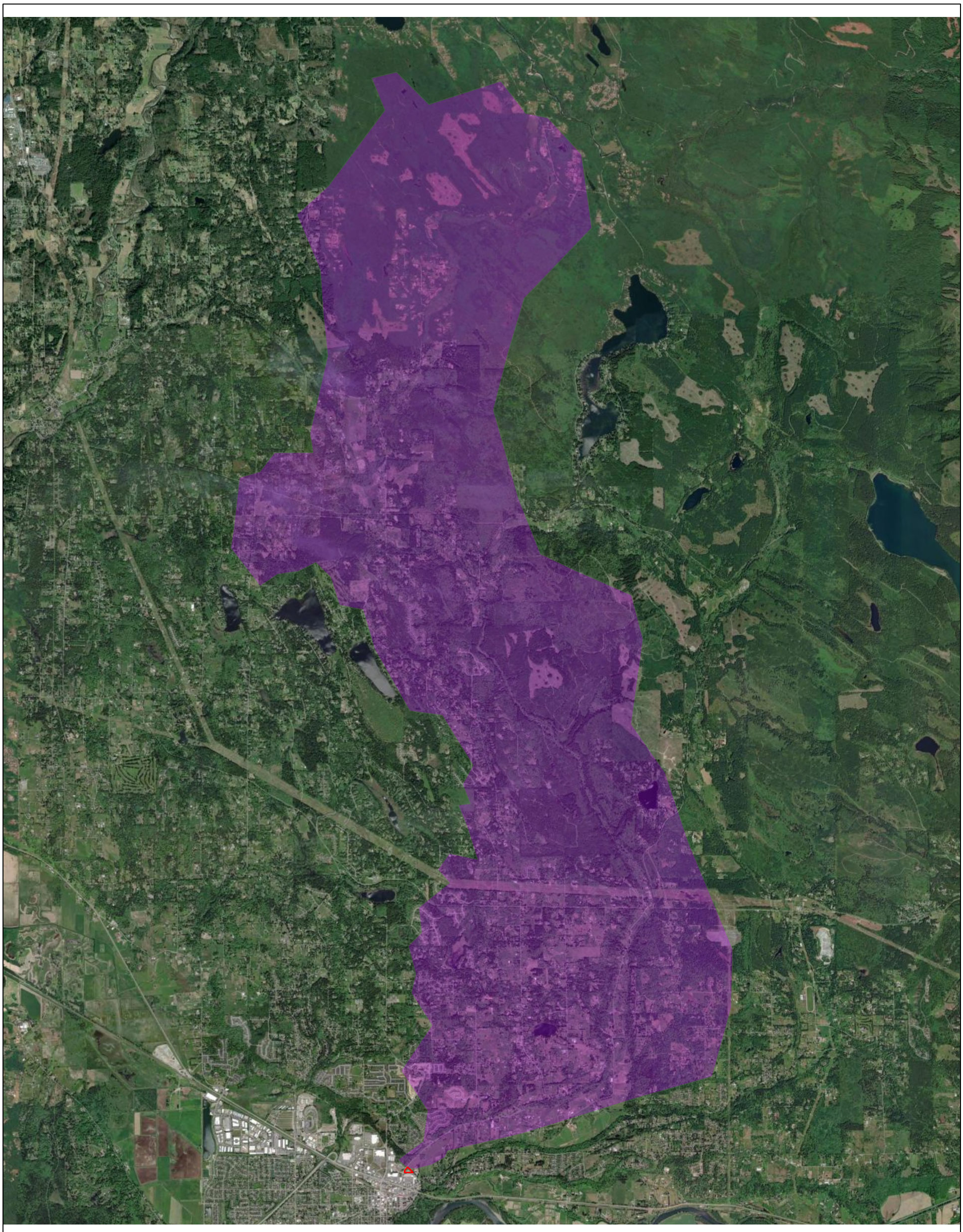
SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

WETLAND RATING HYDROPERIODS

FEBRUARY 2025

FIGURE 7

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM



LEGEND

- STUDY AREA
- CONTRIBUTING BASIN

N

1000

SCALE IN FEET

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

HALEY ALDRICH

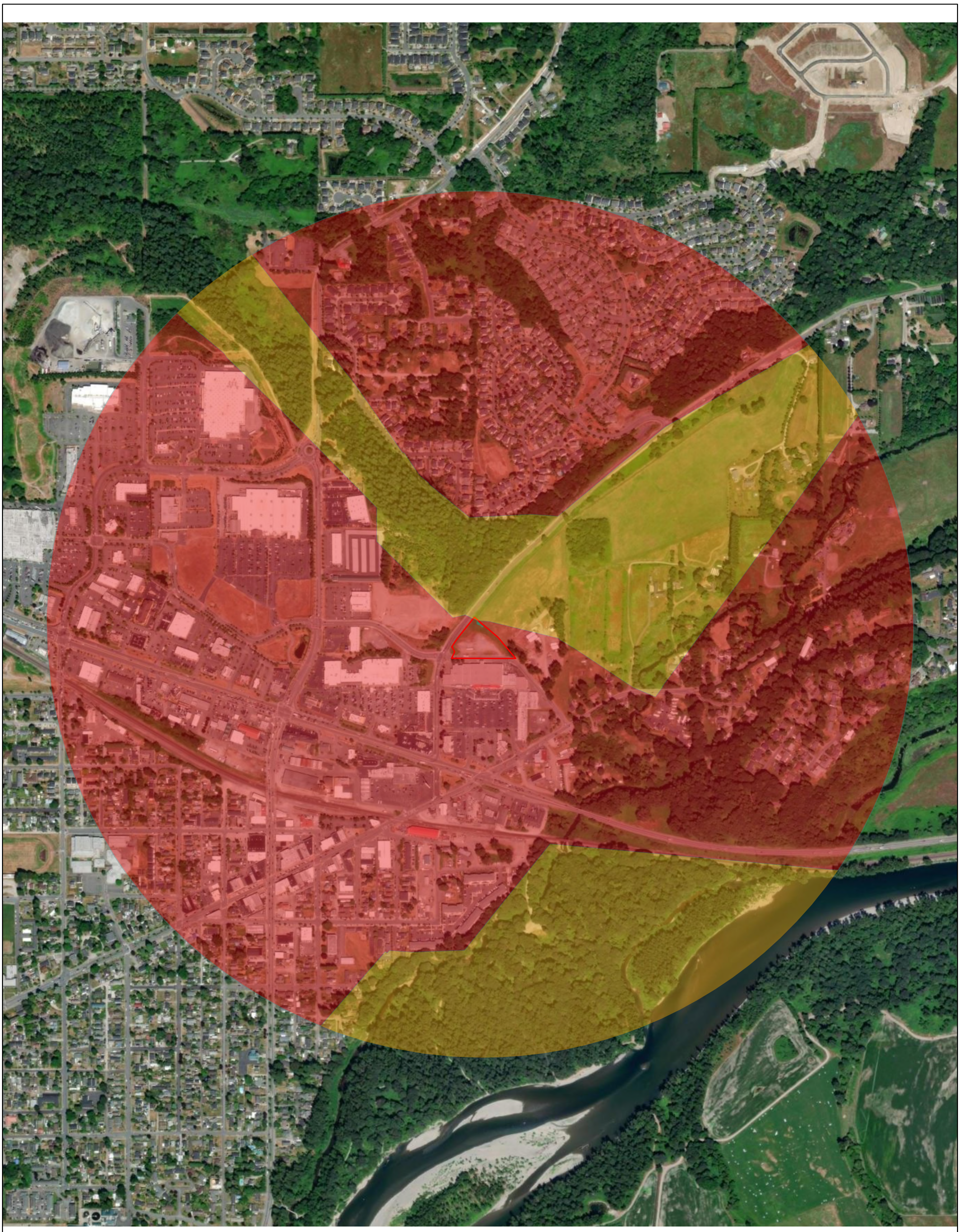
SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

WETLAND RATING CONTRIBUTING BASIN

FEBRUARY 2025

FIGURE 8

GIS FILE PATH: \\haleyaldrich\share\CF\Projects\0211007\GIS\SRFR MONROE\SRFR MONROE.aprx - USER: lchutas - LAST SAVED: 2/4/2025 11:10 PM



LEGEND

HABITAT CLASS INTENSITY

- **HIGH INTENSITY**
- **LOW/MODERATE INTENSITY-NOT ACCESSIBLE**
- **WETLAND**
- **STUDY AREA**

N

0 100 200
SCALE IN FEET

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

HALEY ALDRICH

SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

WETLAND RATING
HABITAT ACCESSIBILITY

FEBRUARY 2025

FIGURE 9

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LEGEND

DELINEATED WETLAND

BUFFER DISTANCE

100 FT

150 FT

1 KM

250 FT

N

0 100200

SCALE IN FEET

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.

HALEY ALDRICH

SRFR SITE 19959 OAKS STREET
OAC SERVICES
MONROE, WASHINGTON

WETLAND RATING BUFFER AREAS

FEBRUARY 2025

FIGURE 10

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