GEOTECHNICAL INVESTIGATION

TURBEVILLE FIRE STATION
TAX MAP #316-16-04-010-00
TURBEVILLE, SOUTH CAROLINA

PREPARED FOR, OR ON BEHALF OF:

CLARENDON COUNTY
MANNING, SOUTH CAROLINA

GEO-SYSTEMS DESIGN & TESTING, INC.
Geotechnical, Environmental, and Construction Services
1836 Augusta Highway
Post Office Box 2656
West Columbia, South Carolina 29171(2656)
(T) 803/791-7528 (F) 803/791-4686
office@geo1.net

GEO-SYSTEMS DESIGN & TESTING, INC.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

May 7, 2021

Clarendon County
411 Sunset Drive
Manning, SC 29102

Attn: Mr. Billy Timmons
Via e-mail: btimmons@clarendoncountygov.org
cmcinnis@clarendoncountygov.org

RE: Geotechnical Investigation
Turbeville Fire Station
US 378
Clarendon County, Turbeville, SC

Dear Mr. Timmons:

As authorized, Geo-Systems Design & Testing, Inc. has completed the requested subsurface exploration of the above referenced project. The report contains a description of the project information provided to us, general site and subsurface descriptions together with our recommendations for foundation / pavement design and construction considerations.

We are available to discuss our recommendations with you and to conduct any additional testing or inspections necessary during construction. We appreciate having the opportunity to serve you on this project and look forward to serving as your geotechnical consultant.

Respectively submitted,
GEO-SYSTEMS DESIGN & TESTING, INC.

Joe A. Smith, P.E.
President

I. PURPOSE AND SCOPE

The geotechnical study and report is concerned with definition of the existing site materials and analysis of the anticipated material performance during site construction and final long-term loading. Primary concerns to be addressed during the design phase of the project will be:

1) Availability and workability of site materials;
2) Foundation loading requirements;
3) Building subgrade elevations;

and, 4) Pavement Design

Within the scope of this report, each of the above will be addressed in detail and recommendations provided. Other considerations pertinent to design and construction throughout the site will also be addressed.

II. DESCRIPTION OF PROJECT

The proposed building will be located on US 378 (W. Turbeville Highway) in Clarendon County, Turbeville, SC. It is approximately one (1) acre portion of Tax Map # 316-16-04-010-00.

We understand the proposed building will be a 6,000 sq. ft. wood or steel frame structure with concrete floor slab construction. Maximum wall loads are anticipated to be 2 to 4 kips per lineal foot with anticipated column loads of 20 to 60 kips.

III. SUBSURFACE CONDITIONS

Soil Stratigraphy:

Four (4) soil test borings were performed to depths of fifteen (15) feet and one (1) soil test boring was performed to depth of forty (40) feet in the general location indicated on the Test Location Plan provided in the Appendix of this report.

The purpose of the test borings performed was to determine the consistency and possible load carrying capacities of the various soil strata, and to obtain information which might have an effect on foundation design and behavior as well as impact site development and construction procedures.

The county soil survey mapping classifies the surface soils as Fuquay Fine Sand and Lynchburg Loamy Sand (FuB, Ly) Soil Series.

(FuB)—Fuquay Fine Sand, 0 to 6 percent slopes
Typical profile

- *0 to 27 inches:* Fine Sand
- *27 to 72 inches:* Sandy Clay Loam

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Typical profile

- *0 to 27 inches:* Fine Sand
- *27 to 72 inches:* Sandy Clay Loam

(Ly)—Lynchburg Loamy Sand, 0 to 2 percent slopes
Typical profile

- *0 to 7 inches:* Loamy Sand
- *7 to 13 inches:* Sandy Loam
- *13 to 54 inches:* Sandy Clay Loam
- *54 to 80 inches:* Sandy Clay

Two (2) predominant soil strata were typically profiled within the site area below an average of six (6) inches of topsoil as follows:

Strata I	- Tan Slightly Silty Fine to Medium Sandy **CLAY** / Clayey **SAND** (CL, SC) - Depths of Six (6) to Eight (8) Feet - Firm
Strata II	- Red and Tan Clayey Fine to Medium **SAND** (SC) - Depths below Eight (8) Feet - Stiff

Based on the IBC 2018 code, the design earthquake is an earthquake from a fifty (50) year exposure with a 2% Probability of Exceedance (PE) (i.e. a 2475-year design earthquake). The IBC 2006 seismic design code is based on the 1997 National Earthquake Hazards Reduction Program (NEHRP) *Recommended Provisions for Seismic Regulations for New Building and Other Structures* (FEMA 302 and 303) and USGS National Seismic Hazard Mapping Project. A worst case maximum earthquake at the most likely causative fault is at Middleton Place, Dorchester County near Charleston.

Soil liquefaction is the sudden reduction in shear strength of sufficiently saturated cohesionless soils caused by external loading, which induces high excess pore water pressures in soils. Liquefaction effects can be in the form of ground surface disruption and/or volumetric compression. Soils most susceptible to liquefaction are saturated, loose, "clean" (i.e., percentage passing the No. 200 Sieve is less than 5%) fine sands. When the excess water pressures caused by the earthquake shaking dissipate, volumetric compression occurs resulting in settlement and subsequent densification of the liquefied soils.

Using ASCE 7-16 for IBC – 18 for the site soil profile is a "D" Site Class with a "C" design classification with the following seismic design parameters:

F_A	=	**1.465**
F_V	=	**2.319**
SD_S	=	**0.409**
SD_1	=	**0.217**
PGA	=	**0.1676**

The site soils are not susceptible to liquefaction, ground rupture or subsidence for the design earthquake event.

Groundwater:

Groundwater was indicated in the soil borings below the upper three (3) feet of existing surface grades. The permeable sand soils at shallow depth are prone to "perch" surface rainfall waters, however, and should be considered during construction to monitor positive surface drainage at all times.

IV. CONSTRUCTION RECOMMENDATIONS

Site Preparation:

All surface soils containing organic laden material, roots, sidewalks and vegetation should be stripped from the site outwards a minimal five (5) feet from within the building area(s). These materials should be wasted from the site or used in areas to be landscaped. A minimum eight (8) inch stripping depth should be required throughout each building area to remove any topsoils / pavements prior to additional excavation or 'fill' operations.

The base of stripping levels should be aerated, compacted and proofrolled with a loaded dump truck (20 + tons) after aeration and compaction. **Base of stripping levels and all structural fill soils should be compacted to ninety-five percent (95%) of the soils' Standard Proctor density value. Site soils are suitable for structural backfill with proper moisture conditioning.**

Exposed building subgrade soils should be well drained to minimize the accumulation of precipitation. If the exposed subgrade soils are not as anticipated or become excessively wet, the geotechnical engineer should be consulted for guidance.

Utility Excavation:

Utility excavations should be backfilled in uniform 4- to 6-inch lifts compacted to ninety-five percent (95%) of the soils' Standard Proctor density value. Excavation sidewalls should be no steeper than 1:1 (Horizontal:Vertical) for excavations within the upper four (4) feet. All excavation trenches should be protected from rainfall if to be opened for longer than a one (1) day period.

Earthen Fill:

No deleterious debris, organics or highly plastic soils should be placed in fill embankments. The following site area soil classifications can be utilized as suitable fill (SM, SC, SP, CL) according to the Unified Soil Classification System (ASTM D-2487).

Foundation Design and Construction:

The natural 'on-site' soils and any compacted site or acceptable borrow fill soils should be suitable for supporting shallow spread footings for the proposed building if constructed and inspected according to the above requirements. **An allowable design soil bearing pressure of 3,000 psf may be used for foundations bearing in compacted natural or fill soils within the upper two (2) to three (3) feet depth.**

Settlements within the virgin and/or compacted fill soils are expected to be within the tolerable limits of 0.7 inches for properly proofrolled upper surface soils. Differential settlements throughout the building structure will be principally controlled by the spacing and loading variances of individual columns but should not exceed 0.2 inch for the bearing pressures recommended throughout the structural area. Fill soils could experience greater settlements depending upon uniformity and control of fill placement during construction and stabilization of footing excavations prior to concrete placement.

The foundations should bear at a minimum depth of 12 inches below external grades to adequately extend below frost penetration depths and provide sufficient cover to safeguard against erosion.

The foundation bearing area should be free of loose or soft soil, ponded water and debris. Foundation concrete should not be placed on soils that have been softened by precipitation or from frost heave.

Grade Slab:

The grade slab may be "floated", supported by compacted subgrade soils in accordance with the site preparation recommendations contained in this report. A vapor barrier consisting of six (6) mil polyethylene moisture sheeting between the concrete slab and site sandy soils is recommended. This drainage layer will serve to minimize any build-up of capillary moisture and breakup any long-term hydrostatic pressure due to the capillary attraction of moisture beneath the slab.

Floor or other 'flat' concrete slabs should be designed based upon a recommended subgrade soil modulus of 170 psi/in for compacted grade level site soils.

V. PAVEMENT DESIGN

We recommend that SCDOT Type C Bituminous Asphalt be used for flexible pavement structures. The required thickness of Base Course material should be placed over a compacted subgrade of fill or virgin soils with the following recommended pavement section.

Heavy Use Drive Areas: Flexible

1.5 inches Asphaltic Surface Course Type C (SCDOT, Sec. 403)
2.0 inches Asphaltic Binder Course
6.0 inches Macadam compacted to 95% Modified Proctor Maximum density (ASTM D-1557)
12.0 Inches Compacted Subgrade to 98% soils standard Proctor (ASTM D-698)

Heavy Use Drive Areas: Rigid

7.0 inches Concrete 4,000 psi
6.0 inches Macadam compacted to 95% Modified Proctor Maximum density (ASTM D-1557)
12.0 Inches Compacted Subgrade to 98% soils standard Proctor (ASTM D-698)

Light Duty Parking: Flexible

2.0 inches Asphaltic Surface Course Type C (SCDOT, Sec. 403)
6.0 inches Crushed Aggregate Base Course compacted to 95% Modified Proctor Maximum density (ASTM D-1557)
12.0 Inches Compacted Subgrade to 98% soils standard Proctor (ASTM D-698)

Compaction of subgrade soils should meet 98 percent of the standard Proctor (ASTM D-698) maximum dry density. Base course materials should meet 95 percent of their modified Proctor (ASTM D-1557) maximum dry density. All materials should be within the latest version of the South Carolina State Highway Department of Transportation specifications. Any paved areas adjacent to sprinkler systems should be designed with an underdrain system to prevent wetting or saturation of the subgrade soils. Positive drainage and pavement sealers should be provided throughout pavement areas subjected to wetting cycles. Construction operations should not be performed without proper quality control inspection and testing by experienced engineering technicians working under the supervision of a geotechnical engineer. These services should include field density testing of subgrade and base course materials as well as field inspection of asphalt paving operations to check conformance with project plans and specifications.

A major factor contributing to the life and success of any pavement structure is to provide good surface and subgrade drainage. In a dry, well-compacted condition, the on-site soils will exhibit high shear strength and provide good subgrade support properties. If saturated or subjected to wetting and drying cycles; however, the soils will exhibit a considerable loss in shear strength and poor subgrade support properties.

Periodic inspections should be required throughout the life of the pavement to seal minor surface cracks as to be expected in any pavement structure with time. Unattended surface deterioration cracks will decrease the life of a pavement structure significantly.

VI. CONSTRUCTION CONSIDERATIONS

Foundations:

Exposure of the bearing soil to the environment may weaken the soils at the footing bearing level if the foundation excavation remains open for long periods of time during construction. Therefore, we recommend that each building site be concreted soon after footing excavations are completed to minimize potential damage to the baring soils. The foundation area should be free of loose or soft soil, ponded water, and debris. Foundation concrete should not be placed on soils that have been softened by precipitation or from frost heave.

If bearing soils are softened by surface water intrusion or from frost heave, the softened soils must be removed from the foundation excavation bottom prior to the placement of concrete. If the excavation must remain open and rainfall becomes imminent while the bearing soils are exposed, either a plastic membrane can be placed across the excavation or a 2 to 4 inch thick "mud mat" of 'lean' (2,000 psi) concrete can be placed on the bearing soils for protection.

We recommend that a qualified geotechnical engineer using hand auger/cone penetrometer testing equipment examine the base of footing excavations. This is necessary to document that the actual disturbed soils due to excavation have been re-compacted and acceptable for the recommended design allowable soil bearing pressure. Any unsuitable soil detected during the examination should be 'under-cut' or treated as directed by the geotechnical engineer. The resulting excavation can be backfilled with suitable structural fill or may be concreted.

VIII. BASIS FOR RECOMMENDATIONS

The recommendations provided are based on our understanding of the project information as presented in this report and our interpretation of the data collected during this subsurface exploration. We have made recommendations based on our experience with similar subsurface conditions under similar loading conditions. The soil penetration tests and laboratory test data have been used to estimate allowable soil strengths and evaluate the anticipated behavioral performance of the soils during construction and long-term loading for this particular project. Any deviation of grades and/or loads other than those presented in this report should be provided to us so that we may review our conclusion and recommendations.

Regardless of the thoroughness of geotechnical exploration, there is always a possibility that subsurface conditions between borings may be different from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered soil conditions. Therefore, experienced geotechnical personnel should evaluate the earthwork and foundation construction to document that the conditions anticipated in design actually exist. The owner should retain Geo-Systems Design & Testing, Inc. for this evaluation, as we are already familiar with the project, subsurface conditions and the intent of the recommendations.

APPENDIX A

SITE/TEST PLAN LOCATION

Turbeville Fire Station
US 378
Turbeville, South Carolina

Site Location Plan

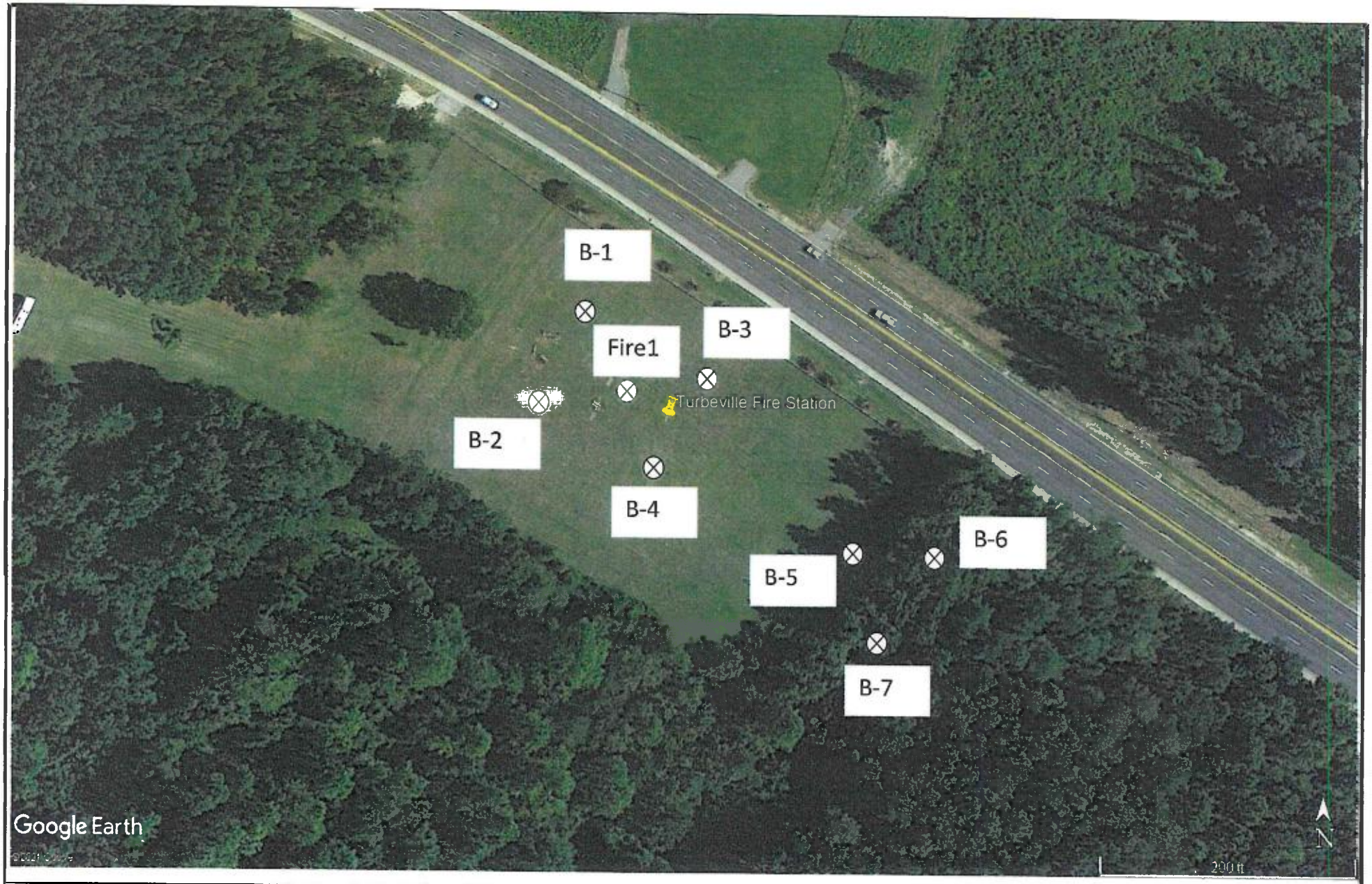
GEO-SYSTEMS DESIGN & TESTING, INC.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING

Post Office Box 2656
West Columbia, S.C. 29171
(803) 791-7528

JOB NAME:	Date	APPROVED BY:	SCALE:	Drawing No.:	DRAWN BY:
Turbeville Fire Station	4/30/21	JAS	NTS		REVISED:

ARCHITECTS STANDARD FORM

MADE IN U.S.A.



TEST LOCATION PLAN

GEO-SYSTEMS DESIGN & TESTING, INC.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING

Post Office Box 2656
West Columbia, S.C. 29171
(803) 791-7528

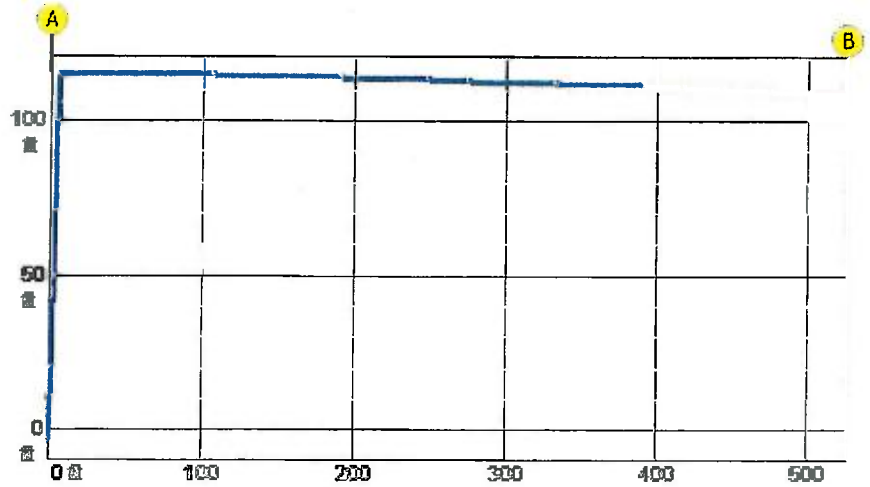
JOB NAME:	Date	APPROVED BY:	SCALE:	Drawing No.	DRAWN BY:
Turbeville Fire Station	5/7/21	JAS	NTS		REVISED:

ARCHITECTS STANDARD FORM

MADE IN U.S.A.

Type notes here	Printed 04/29/2021	The purpose of this map is to display the geographic location of a variety of data sources frequently updated from local government and other agencies. Neither WTH Technology nor the agencies providing this data make any warranty concerning its accuracy or merchantability. And no part of it should be used as a legal description or document.

Elevation Profile



Elevation Data: USGS

Start New Profile

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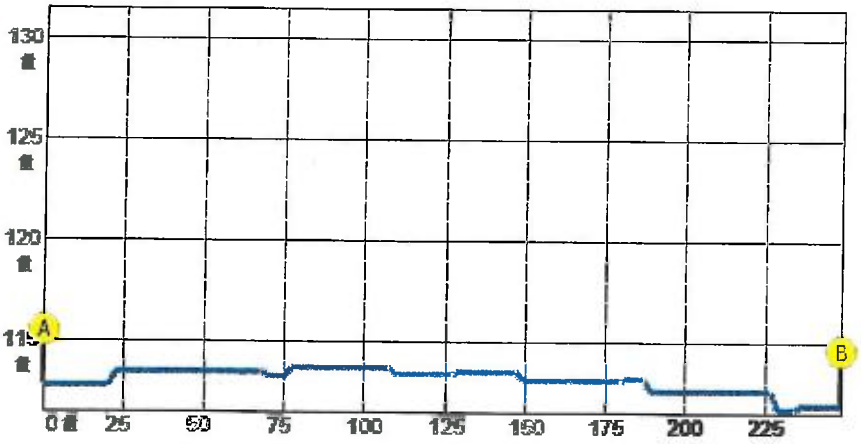

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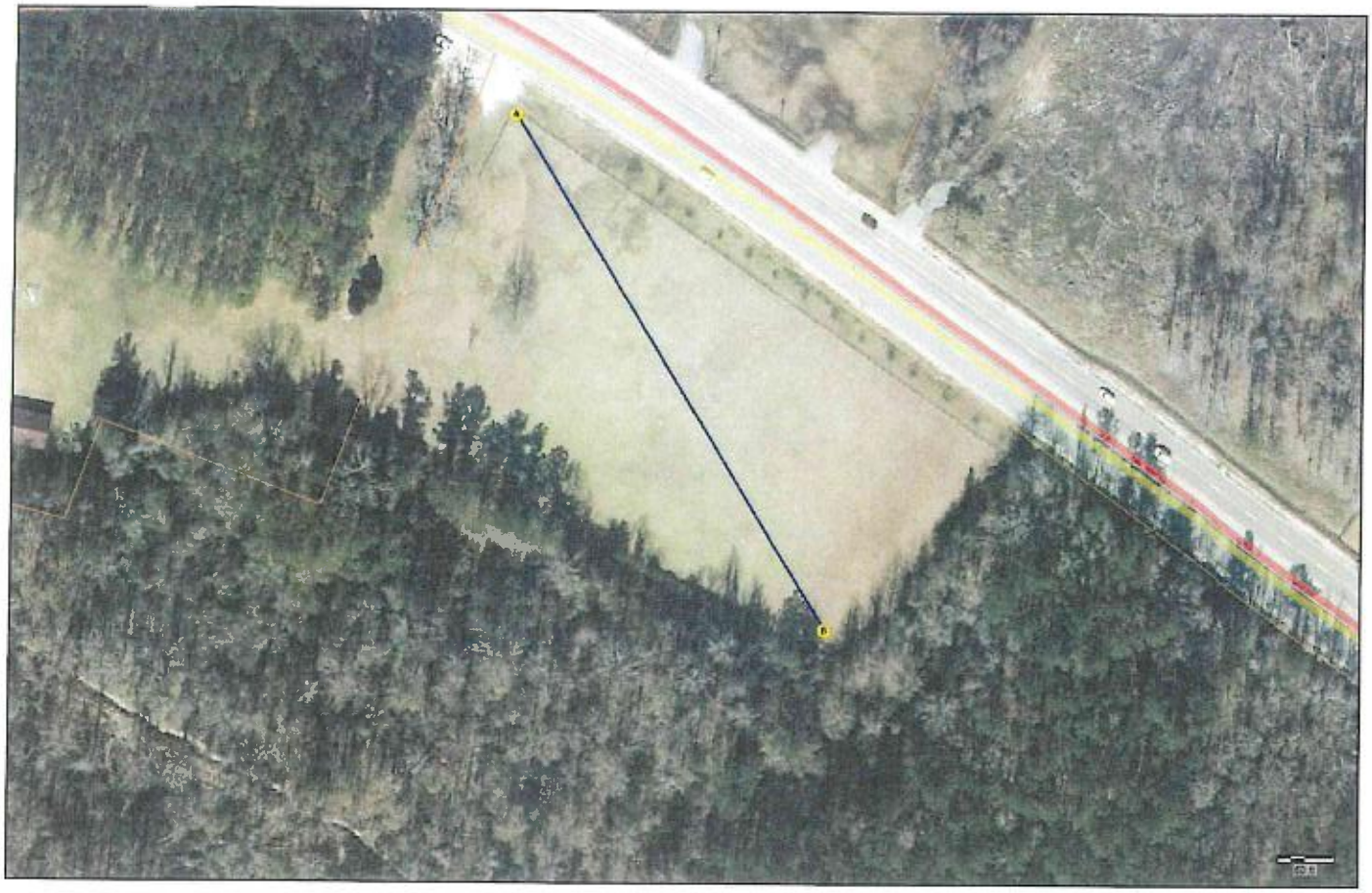

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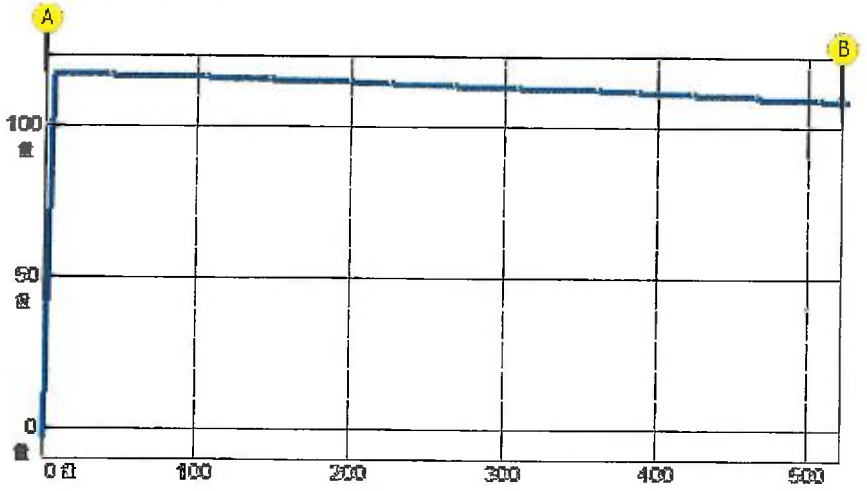

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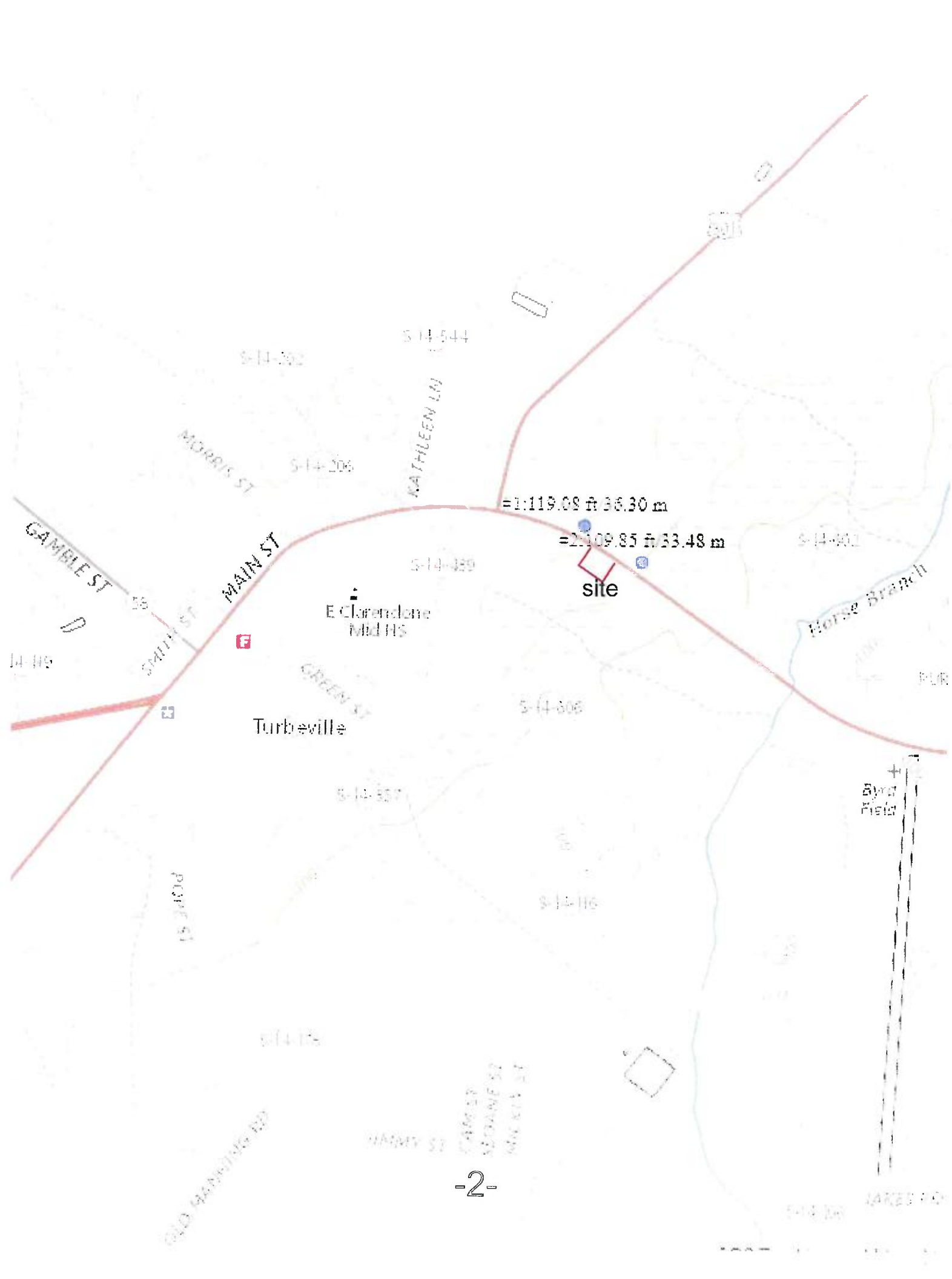
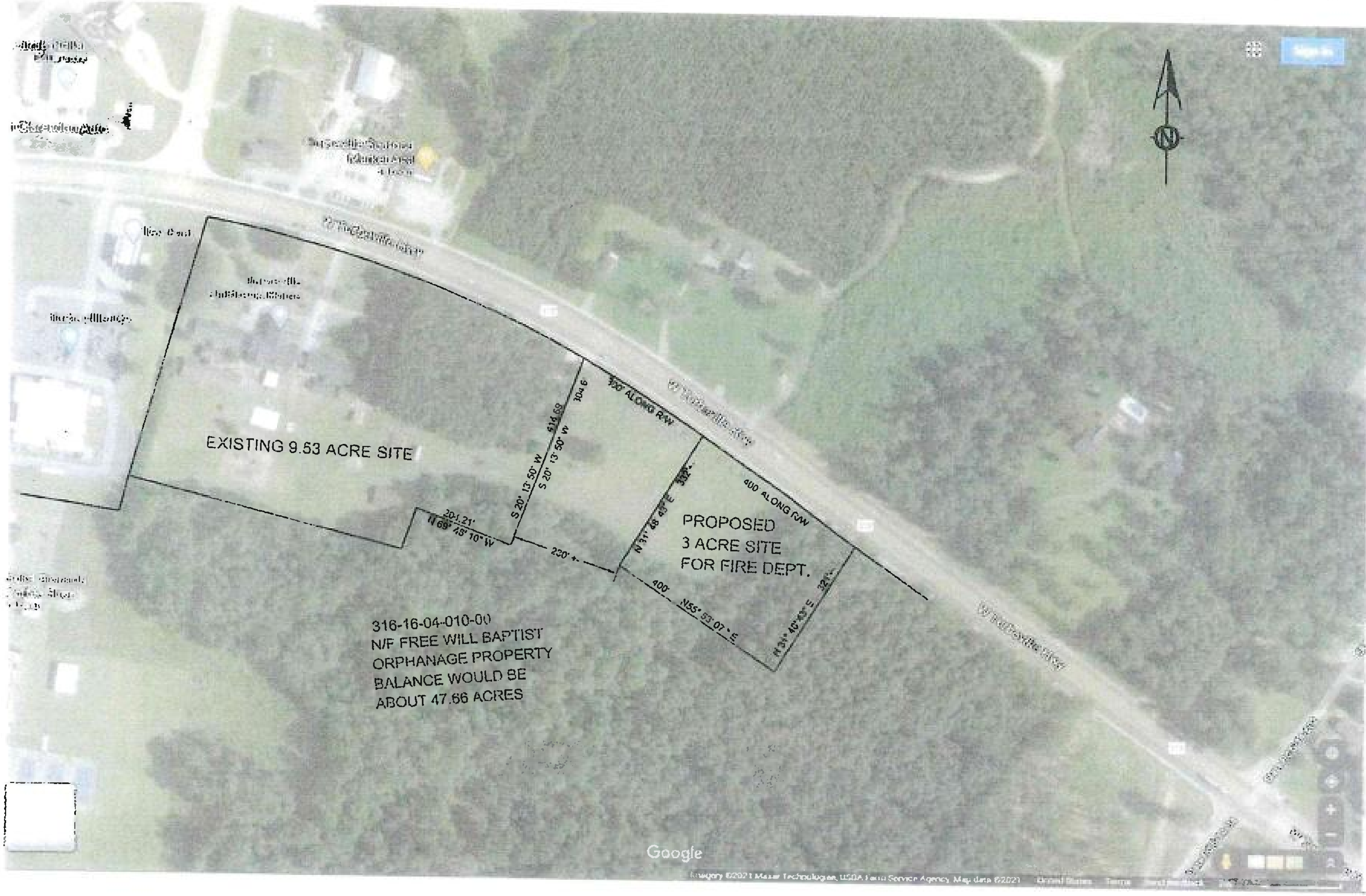

=1:119.09 ft 36.30 m
=1:409.85 ft 33.48 m
site
KATHLEEN LN
MORRIS ST
MAIN ST
GAMBLE ST
E Clarendale Mid HS
Turbeville
Horse Branch
Byrd Field
GREEN ST
S-14-544
S-14-206
S-14-339
S-14-308
S-14-116



PROPOSED PROPERTY

DATE: 3/23/21

SCALE: AS SHOWN

SHEET: C1

Clarendon County Engineering

411 SUNSET DR. - MANNING, S.C. 29102

(803) 433-3256 FAX: (803) 435-2208

Clarendon County Fire Dept.

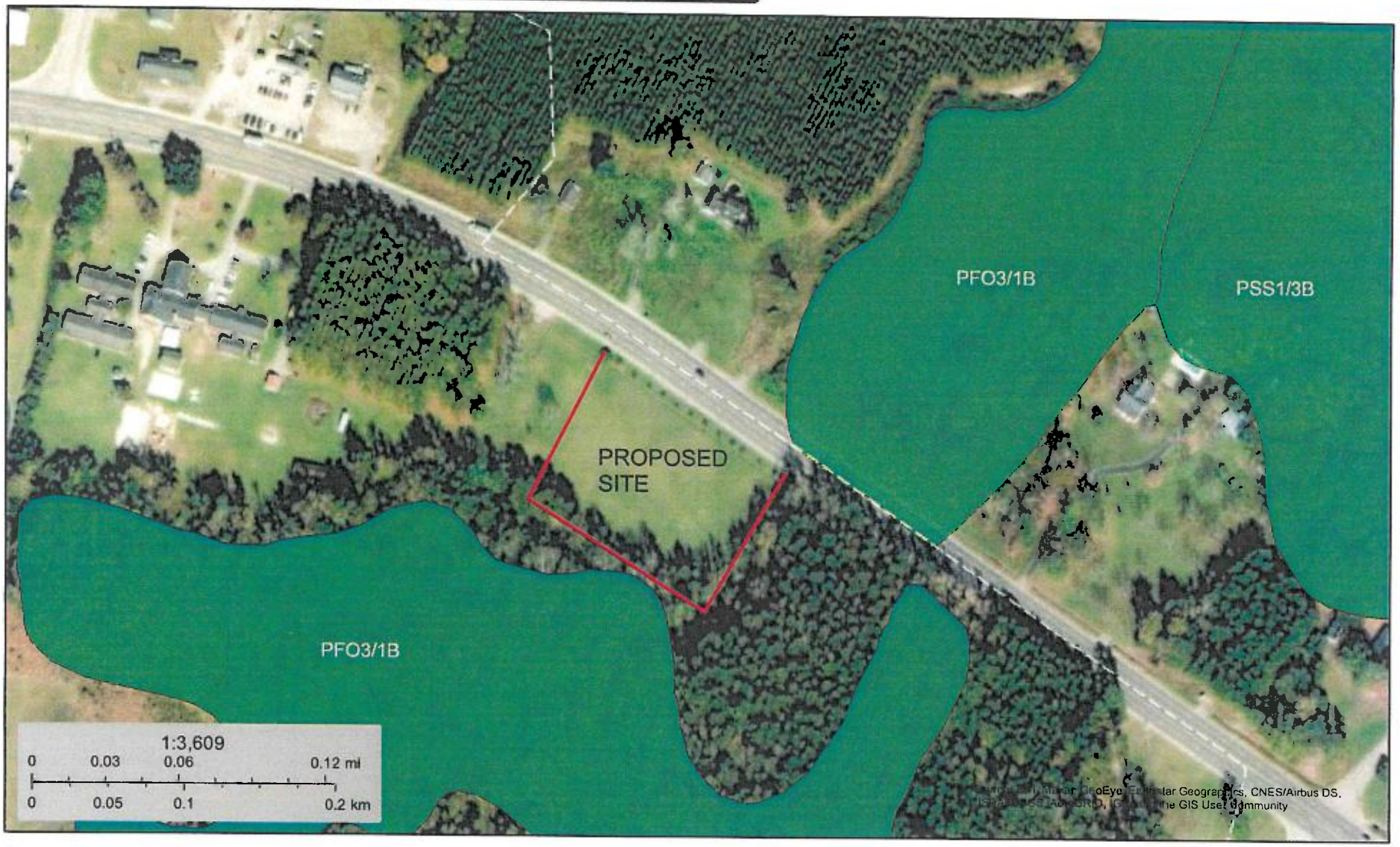
NEW STATION 2 SITE


US 378
EAST CLAR.
SCHOOL
PROPOSED
SITE
LOCATION MAP
TURBEVILL, SC
Google

U.S. Fish and Wildlife Service

National Wetlands Inventory

Turbeville Fire Station Site



March 22, 2021

Wetlands

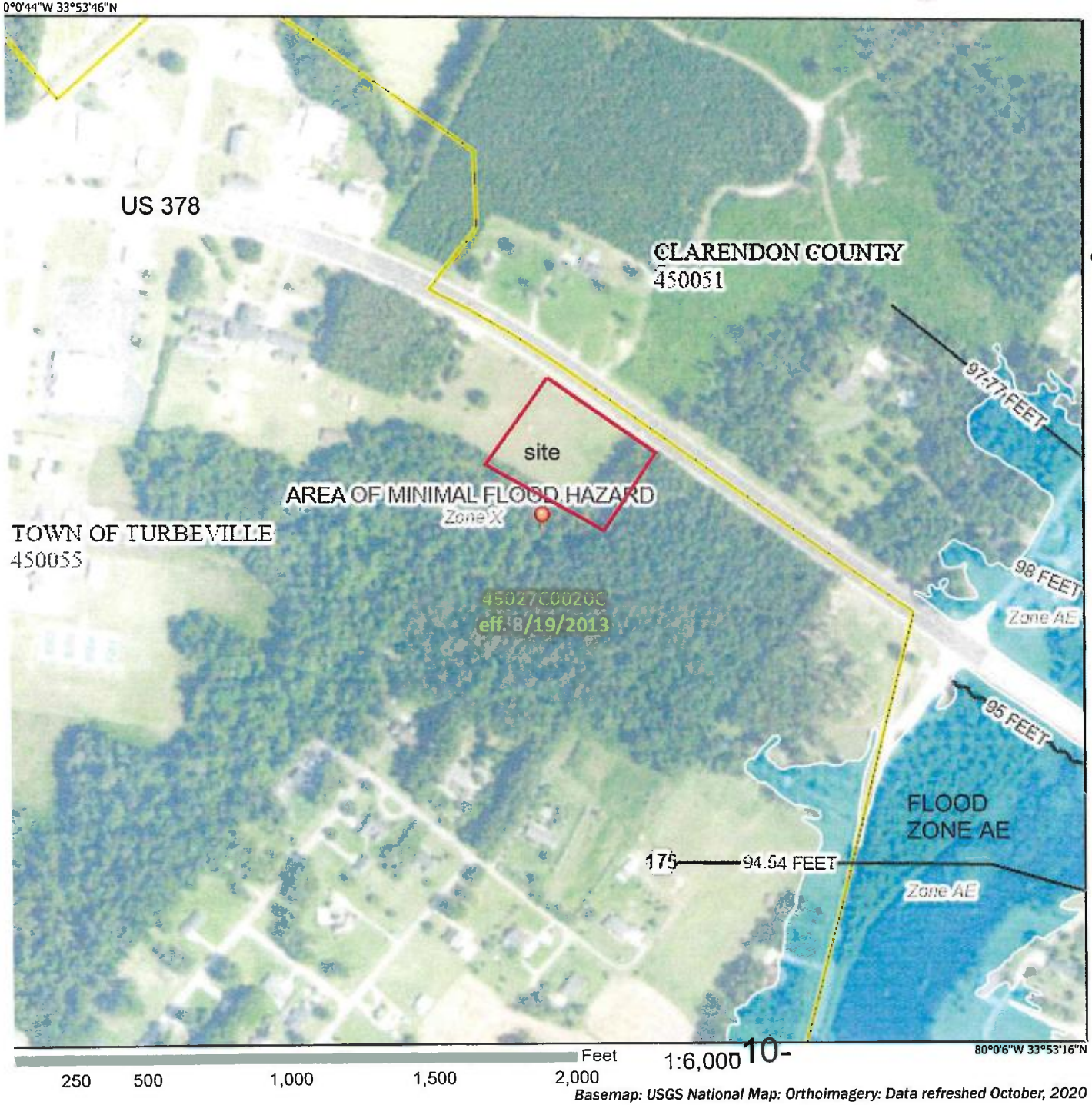
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

National Flood Hazard Layer FIRMette

FEMA



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

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 Cross Sections with 1% Annual Chance
- 17.5 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 3/22/2021 at 3:57 PM 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.

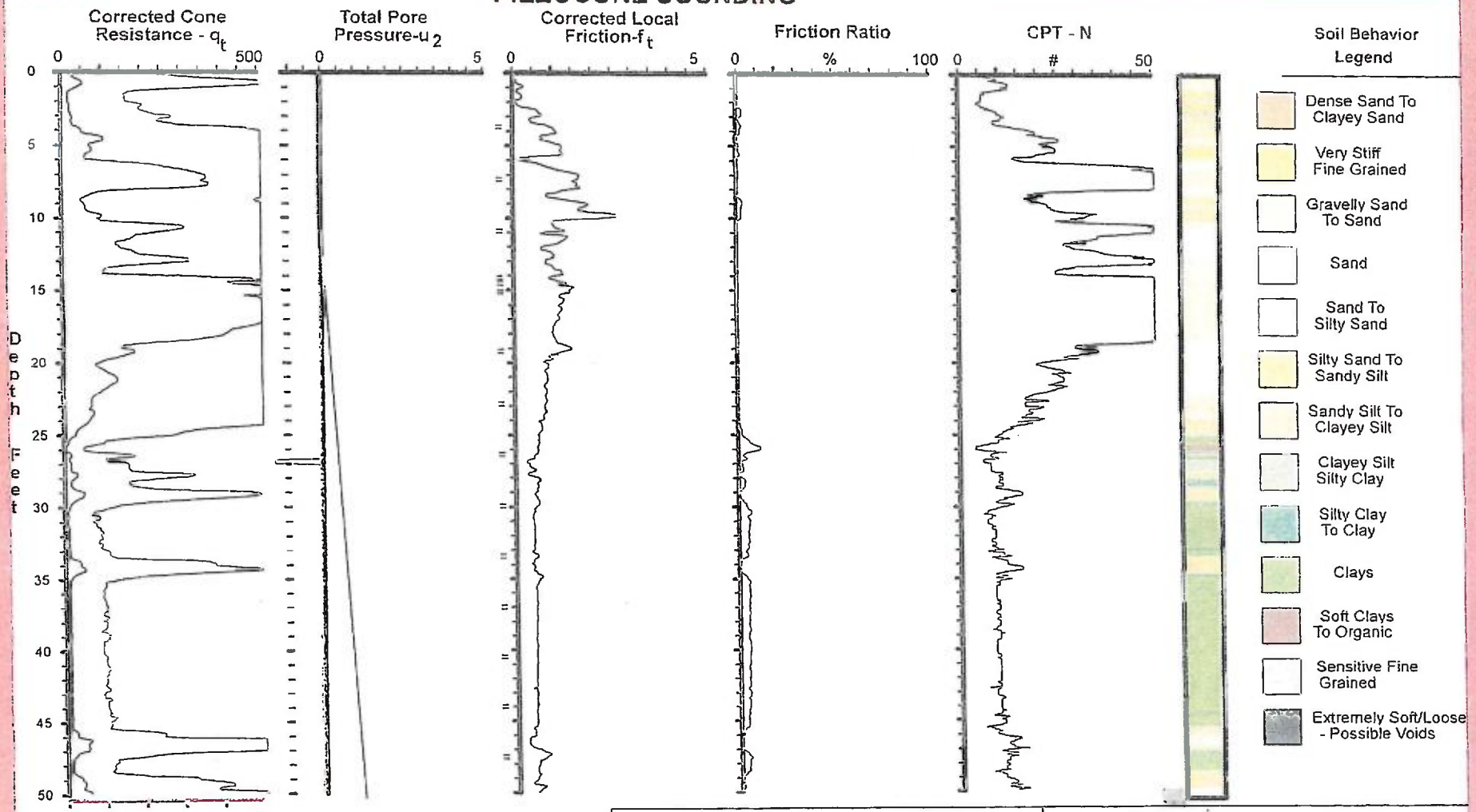
APPENDIX B

FIELD TEST DATA

Turbeville Fire Station
US 378
Turbeville, South Carolina

REV: 04-42.33 - 0

PIEZOCONE SOUNDING



Fire Station
Location: Turbeville, SC
Sounding: FS-1
Date: 5-4-2021

REV 04 42 33 - 0

STANDARD SOIL BEHAVIOR TABLE

Depth (Feet)	Soil Behavior Type	Qt	Corrected Local Friction Lf	CPT N (#)	Vertical Effective Stress	Relative Density (%)	Friction Angle (Degrees)	Constrained Modulus	Undrained Shear Strength	Sens.	Comp.	OCR
1	SILTY SAND TO SANDY SILT	37.11	0.174	12	0.048	50%-58%	>43	81.64	--	--	--	--
2	SANDY SILT TO CLAYEY SILT	17.98	0.212	7	0.101	42%-50%	37-39	39.57	--	--	--	--
3	SANDY SILT TO CLAYEY SILT	24.57	0.597	9	0.153	42%-50%	37-39	54.06	--	--	--	--
4	SILTY SAND TO SANDY SILT	61.43	0.953	20	0.202	58%-65%	39-41	135.15	--	--	--	--
5	SILTY SAND TO SANDY SILT	77.82	1.176	25	0.251	58%-65%	39-41	171.22	--	--	--	--
6	SAND	138.99	0.63	27	0.297	>85%	41-43	305.78	--	--	--	--
7	GRAVELLY SAND TO SAND	353.34	1.574	58	0.341	>85%	>43	777.36	--	--	--	--
8	SAND	176.92	1.269	35	0.386	>85%	41-43	389.22	--	--	--	--
9	SANDY SILT TO CLAYEY SILT	58.54	1.734	23	0.439	50%-58%	37-39	128.79	--	--	--	--
10	SAND TO SILTY SAND	153.72	1.709	38	0.487	>85%	39-41	338.19	--	--	--	--
11	SAND	216.55	1.178	43	0.533	>85%	41-43	476.42	--	--	--	--
12	SAND	171.87	0.917	34	0.557	65%-85%	39-41	378.11	--	--	--	--
13	SAND	222.41	0.956	44	0.582	>85%	41-43	489.31	--	--	--	--
14	GRAVELLY SAND TO SAND	356.2	1.163	59	0.606	>85%	>43	783.64	--	--	--	--
15	GRAVELLY SAND TO SAND	544.52	1.34	90	0.631	>85%	>43	1197.94	--	--	--	--
16	GRAVELLY SAND TO SAND	636.33	1.202	106	0.655	>85%	>43	1399.92	--	--	--	--
17	GRAVELLY SAND TO SAND	497.49	1.08	82	0.68	>85%	>43	1094.49	--	--	--	--
18	GRAVELLY SAND TO SAND	344.66	1.061	57	0.705	>85%	41-43	758.27	--	--	--	--
19	SAND	155.45	1.182	31	0.729	65%-85%	39-41	341.99	--	--	--	--
20	SAND TO SILTY SAND	98.01	0.826	24	0.756	50%-58%	37-39	215.62	--	--	--	--
21	SAND	126.94	0.824	25	0.781	58%-65%	37-39	279.27	--	--	--	--
22	SAND TO SILTY SAND	79.57	0.816	19	0.808	50%-58%	35-37	175.07	--	--	--	--
23	SAND TO SILTY SAND	71.16	0.777	17	0.835	50%-58%	35-37	156.55	--	--	--	--
24	SILTY SAND TO SANDY SILT	46.04	0.686	15	0.862	35-42%	31-33	101.3	--	--	--	--
25	CLAYS	13.55	0.601	13	0.894	--	--	--	.81	2.2	.01	3
26	CLAYS	11.56	0.507	11	0.926	--	--	--	.67	2.2	.02	3
27	SANDY SILT TO CLAYEY SILT	21.22	0.397	8	0.956	35-42%	27-29	46.7	--	--	--	--
28	CLAYEY SILT TO SILTY CLAY	20.35	0.587	10	0.988	--	--	--	1.25	3.4	.01	6
29	SILTY SAND TO SANDY SILT	35.18	0.557	11	1.015	35-42%	29-31	77.41	--	--	--	--
30	CLAYS	8.94	0.475	8	1.047	--	--	--	.48	1.8	.02	1-1.5
31	CLAYS	8.62	0.475	8	1.079	--	--	--	.46	1.8	.02	1-1.5
32	CLAYS	9.16	0.476	9	1.111	--	--	--	.49	1.9	.02	1-1.5
33	SANDY SILT TO CLAYEY SILT	21.11	0.474	8	1.141	35-42%	25-27	46.45	--	--	--	--
34	SILTY SAND TO SANDY SILT	36.12	0.523	12	1.168	35-42%	29-31	79.46	--	--	--	--
35	CLAYS	10.25	0.536	10	1.2	--	--	--	.55	1.9	.02	1-1.5
36	CLAYS	9.81	0.522	9	1.232	--	--	--	.52	1.8	.02	1-1.5
37	CLAYS	10.03	0.519	10	1.264	--	--	--	.53	1.9	.02	1-1.5
38	CLAYS	10.17	0.51	10	1.296	--	--	--	.53	1.9	.02	1-1.5
39	CLAYS	9.69	0.508	9	1.328	--	--	--	.5	1.9	.02	1-1.5
40	CLAYS	9.98	0.513	9	1.36	--	--	--	.51	1.9	.02	1-1.5

Fire Station
Location: Turbeville, SC
Sounding: FS-1
Date: 5-4-2021

Geo-Systems Design & Testing, Inc.
Geotechnical& Environmental Engineering
Construction Testing

Date Drilled: 4/30/2021

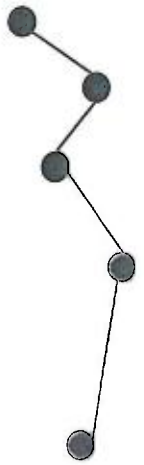
Project Name: Turbeville Fire Station

Boring Log Number: B-1

Elevation	Depth (ft.)	Soil Classification	Sample Depth	Blow Counts
	0.0	Ground Surface		
	0.6	Brown Loamy **SAND** (Topsoil)		
		Very Stiff to Stiff	2.0	16
	-3	Brown **SAND** (SM)		
		Stiff to Very Stiff	4.0	22
-5.0		Brown Sandy **CLAY (CL)**		
		(Water @ 6 FEET)	6.0	19
			9.0	23
-10.0				
		Very Firm	14.0	21
-15.0	-15	Grey Silty **SAND** (SM)		
		Boring Terminated @ 15 FEET		
-20.0				
-25.0				
-30.0				

Penetration Resistance (Blows Per Foot)

1 5 10 20 30 50



Groundwater at Time of Boring: 6'

Groundwater at 24 Hrs: 6'

Sampler Type		Drilling Method	
SS-Split Spoon	NQ- Rock Core 1-7/8"	HAS- Hollow Stem Auger	RW-Rotary Wash
ST- Shelby Tube	CU-Cuttings	CFA-Continuous Flight Augers	DP - Direct Push
AWG-Rock Core 1 1/8"	CT-Continuous Tube	DC-Driving Casing	HA- Hand Auger

Geo-Systems Design & Testing, Inc.
Geotechnical& Environmental Engineering
Construction Testing

Date Drilled:	4/30/2021	Project Name: Turbeville Fire Station
		Boring Log Number: B-2

Elevation	Depth (ft.)	Soil Classification	Sample Depth	Blow Counts	Penetration Resistance (Blows Per Foot)
	0.0	Ground Surface			1 5 10 20 30 50
	0.6	Brown Loamy **SAND** (Topsoil)			
		Very Stiff to Stiff Brown **CLAY** (CL) (Water @ 4 Feet)	2.0	11	
			4.0	18	
-5.0			6.0	24	
	-8				
			9.0	22	
-10.0		Very Firm Grey Silty **SAND** (SC)			
			14.0	23	
-15.0	-15				
		Boring Terminated @ 15 FEET			
-20.0					
-25.0					
-30.0					

Groundwater at Time of Boring: 4'	Groundwater at 24 Hrs: 4'

Sampler Type		Drilling Method	
SS-Split Spoon	NQ- Rock Core 1-7/8"	HAS- Hollow Stem Auger	RW-Rotary Wash
ST- Shelby Tube	CU-Cuttings	CFA-Continuous Flight Augers	DP - Direct Push
AWG-Rock Core 1 1/8"	CT-Continuous Tube	DC-Driving Casing	HA- Hand Auger

Geo-Systems Design & Testing, Inc.
Geotechnical& Environmental Engineering
Construction Testing

Date Drilled:	4/30/2021	Project Name: Turbeville Fire Station
		Boring Log Number: B-3

Elevation	Depth (ft.)	Soil Classification	Sample Depth	Blow Counts	Penetration Resistance (Blows Per Foot)
	0.0	Ground Surface			1 5 10 20 30 50
	0.6	Brown Loamy **SAND** (Topsoil)			
	-3	Very Stiff to Stiff Tan **SAND** (SM)	2.0	16	
		Very Stiff Brown Silty **CLAY**	4.0	20	
-5.0		(CL) (Water @ 6 FEET)	6.0	18	
			9.0	23	
-10.0	-10				
		Very Firm Grey Silty F/M **SAND** (SM)	14.0	19	
-15.0	-15				
		Boring Terminated @ 15 FEET			
-20.0					
-25.0					
-30.0					

Groundwater at Time of Boring: 6'	Groundwater at 24 Hrs: 6'
Sampler Type	Drilling Method
SS-Split Spoon NQ- Rock Core 1-7/8"	HAS- Hollow Stem Auger RW-Rotary Wash
ST- Shelby Tube CU-Cuttings	CFA-Continuous Flight Augers DP - Direct Push
AWG-Rock Core 1 1/8" CT-Continuous Tube	DC-Driving Casing HA- Hand Auger

Geo-Systems Design & Testing, Inc.
Geotechnical& Environmental Engineering
Construction Testing

Date Drilled:	4/30/2021	Project Name: Turbeville Fire Station
		Boring Log Number: B-4

Elevation	Depth (ft.)	Soil Classification	Sample Depth	Blow Counts	Penetration Resistance (Blows Per Foot)
	0.0	Ground Surface			1 5 10 20 30 50
	0.6	Brown Loamy **SAND** (Topsoil)			
		Firm to Loose Tan **SAND (SM)**	2.0	10	
		(Water @ 3 Feet)	4.0	4	
-5.0		Stiff to Very Stiff Brown Silty **CLAY** (CL)	6.0	21	
	-8				
			9.0	27	
-10.0		Very Firm Grey Silty **SAND** (SM)			
			14.0	22	
-15.0	-15				
		Boring Terminated @ 15 FEET			
-20.0					
-25.0					
-30.0					

Groundwater at Time of Boring: 3'	Groundwater at 24 Hrs: 3'
Sampler Type	**Drilling Method**
SS-Split Spoon	NQ- Rock Core 1-7/8"	HAS- Hollow Stem Auger	RW-Rotary Wash
ST- Shelby Tube	CU-Cuttings	CFA-Continuous Flight Augers	DP - Direct Push
AWG-Rock Core 1 1/8"	CT-Continuous Tube	DC-Driving Casing	HA- Hand Auger

Geo-Systems Design & Testing, Inc.
Geotechnical& Environmental Engineering
Construction Testing

Date Drilled: 5/6/2021

Project Name: Turbeville Fire Station

Boring Log Number: B-5

Elevation	Depth (ft.)	Soil Classification	Sample Depth	Blow Counts	Penetration Resistance (Blows Per Foot)
	0.0	Ground Surface			1 5 10 20 30 50
	0.6	Brown Loamy **SAND** (Topsoil)			
	-3	Very Stiff to Stiff Brown **SAND** (SM)	2.0	8	
		(Water @ 4 Feet)	4.0	12	
-5.0		Stiff to Very Stiff Tan/Grey Silty **CLAY**	6.0	26	
			9.0	13	
-10.0					
			14.0	9	
-15.0	-15				
		Boring Terminated @ 15 FEET			
-20.0					
-25.0					
-30.0					

Groundwater at Time of Boring: 4'

Groundwater at 24 Hrs: 4'

Sampler Type		Drilling Method	
SS-Split Spoon	NQ- Rock Core 1-7/8"	HAS- Hollow Stem Auger	RW-Rotary Wash
ST- Shelby Tube	CU-Cuttings	CFA-Continuous Flight Augers	DP - Direct Push
AWG-Rock Core 1 1/8"	CT-Continuous Tube	DC-Driving Casing	HA- Hand Auger

Geo-Systems Design & Testing, Inc.
Geotechnical& Environmental Engineering
Construction Testing

Date Drilled:	5/6/2021	Project Name: Turbeville Fire Station
		Boring Log Number: B-6

Elevation	Depth (ft.)	Soil Classification	Sample Depth	Blow Counts	Penetration Resistance (Blows Per Foot)
	0.0	Ground Surface			1 5 10 20 30 50
	0.6	Brown Loamy **SAND** (Topsoil)			
		Very Stiff to Stiff	2.0	24	
		Brown **CLAY** (CL)			
	-4	(Water @ 4 Feet)	4.0	31	
-5.0		Tan/Grey Silty **CLAY**	6.0	34	
			9.0	22	
-10.0					
			14.0	12	
-15.0	-15				
		Boring Terminated @ 15 FEET			
-20.0					
-25.0					
-30.0					

Groundwater at Time of Boring: 4'	Groundwater at 24 Hrs: 4'

Sampler Type		Drilling Method	
SS-Split Spoon	NQ- Rock Core 1-7/8"	HAS- Hollow Stem Auger	RW-Rotary Wash
ST- Shelby Tube	CU-Cuttings	CFA-Continuous Flight Augers	DP - Direct Push
AWG-Rock Core 1 1/8"	CT-Continuous Tube	DC-Driving Casing	HA- Hand Auger

Geo-Systems Design & Testing, Inc.
Geotechnical& Environmental Engineering
Construction Testing

Date Drilled: 5/6/2021	Project Name: Turbeville Fire Station
	Boring Log Number: B-7

Elevation	Depth (ft.)	Soil Classification	Sample Depth	Blow Counts	Penetration Resistance (Blows Per Foot)
	0.0	Ground Surface			1 5 10 20 30 50
	0.6	Brown Loamy **SAND** (Topsoil)			
	-3	Very Stiff to Stiff Tan Silty **SAND**	2.0	18	
		(Water @ 4 Feet)	4.0	32	
-5.0		Tan/Grey Silty **CLAY**	6.0	36	
			9.0	18	
-10.0					
			14.0	7	
-15.0	-15				
		Boring Terminated @ 15 FEET			
-20.0					
-25.0					
-30.0					

Groundwater at Time of Boring: 4'	Groundwater at 24 Hrs: 4'
Sampler Type	Drilling Method
SS-Split Spoon	NQ- Rock Core 1-7/8"	HAS- Hollow Stem Auger	RW-Rotary Wash
ST- Shelby Tube	CU-Cuttings	CFA-Continuous Flight Augers	DP - Direct Push
AWG-Rock Core 1 1/8"	CT-Continuous Tube	DC-Driving Casing	HA- Hand Auger

CPT Soil Classification Legend

Zone	Q_t/N	Description
1	2	Sensitive, Fine Grained
2	1	Organic Soils-Peats
3	1.5	Clays-Clay to Silty Clay
4	2	Silt Mixtures-Clayey Silt to Silty Clay
5	3	Sand Mixtures-Silty Sand to Sandy Silt
6	4.5	Sands-Clean Sand to Silty Sand
7	6	Gravelly Sand to Sand
8	1	Very Stiff Clay to Clayey Sand*
9	2	Very Stiff, Fine Grained*

(*) Heavily Overconsolidated or Cemented

Robertson's Soil Behavior Type (SBT), 1990			
Group #	Description	Ic	
		Min	Max
1	Sensitive, fine grained	N/A	
2	Organic soils - peats	3.60	N/A
3	Clays - silty clay to clay	2.95	3.60
4	Silt mixtures - clayey silt to silty clay	2.60	2.95
5	Sand mixtures - silty sand to sandy silt	2.05	2.60
6	Sands - clean sand to silty sand	1.31	2.05
7	Gravelly sand to dense sand	N/A	1.31
8	Very stiff sand to clayey sand (High OCR or cemented)	N/A	
9	Very stiff, fine grained (High OCR or cemented)	N/A	

Soil behavior type is based on empirical data and may not be representative of soil classification based on plasticity and grain size distribution.

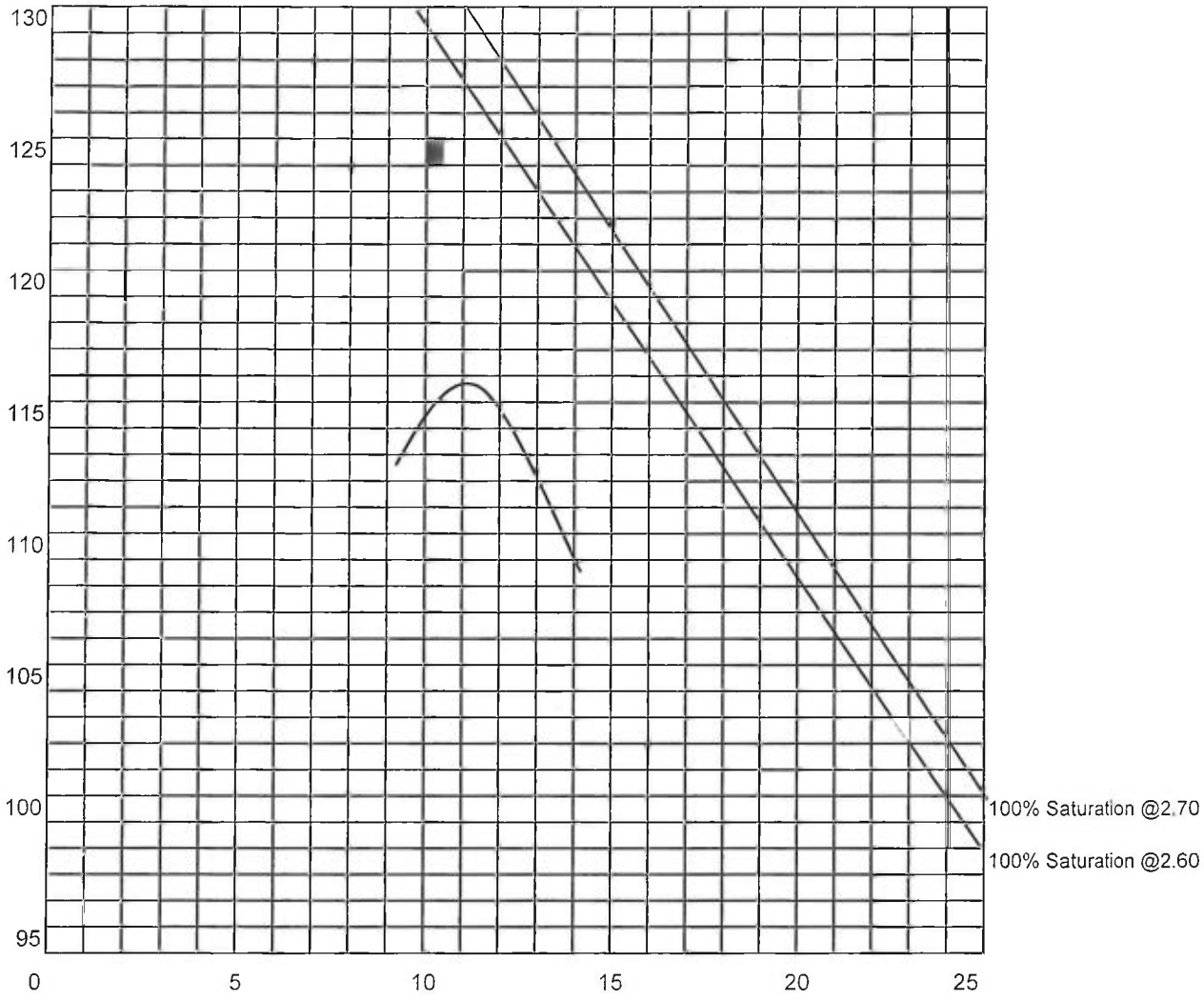
Relative Density and Consistency Table			
SANDS		SILTS and CLAYS	
Cone Tip Stress, qt (tsf)	Relative Density	Cone Tip Stress, qt (tsf)	Consistency
Less than 20	Very Loose	Less than 5	Very Soft
20 - 40	Loose	5 - 15	Soft to Firm
40 - 120	Medium Dense	15 - 30	Stiff
120 - 200	Dense	30 - 60	Very Stiff
Greater than 200	Very Dense	Greater than 60	Hard

APPENDIX C

LABORATORY DATA

Turbeville Fire Station
US 378
Turbeville, South Carolina

STANDARD PROCTOR (ASTM D-698)



TEST RESULTS	SOIL DESCRIPTION
Optimum Moisture: 11.2 Maximum Dry Density 116.7	Tan **SAND** (SM)
Project: Turbeville Fire Station Location: Turbeville, SC Date: 4/30/2021	Sample No.: Bulk # 1 Client: Clarendon County

GEO-SYSTEMS DESIGN & TESTING, INC.
Geotechnical Services and Material Testing

GEO-SYSTEMS DESIGN & TESTING, INC.
P.O. Box 2656
West Columbia, South Carolina 29171

CALIFORNIA BEARING RATIO (CBR)

Date: 4-30-2021

Project Name: Turbeville Fire Station

Sample No.: Bulk # 1

Soil Description Tan Silty F/M SAND (SM)

Molded Dry Density (pcf)	113.9
Molded Moisture Content	13.1
Maximum Proctor Density (pcf)	116.7
Optimum Moisture Content	11.2
C B R @ 0.1"	6.4
Surcharge Weight (lbs.)	20.0
% Swell	.01

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]	GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]	SW	Well-graded sand[I]
			Cu < 6 and/or 1 > Cc > 3[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines Classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI lots below "A" line	MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

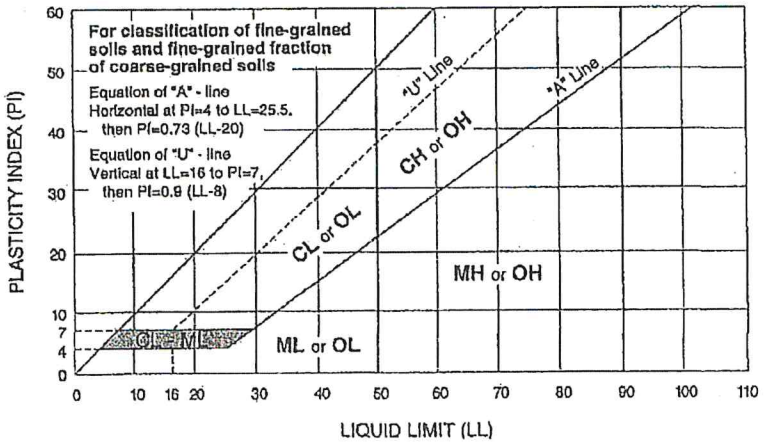
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



APPENDIX D

STEPS FOR CLASSIFYING A SITE

Turbeville Fire Station
US 378
Turbeville, South Carolina

GEO-SYSTEMS DESIGN & TESTING, INC.
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING

Post Office Box 2656
West Columbia, S.C. 29171
(803) 791-7528

STEPS FOR CLASSIFYING A SITE

Step 1: Check for the four categories of Site Class 'F' requiring site-specific evaluation. If the site corresponds to any of these categories, classify the site as Site Class 'F' and conduct a site-specific evaluation.

1. Quick and highly sensitive clays or collapsible weakly cemented soils.
2. Peats and highly organic clays in excess of ten (10) feet thickness.
3. Very high plasticity clays in excess of ten (10) feet thickness.
4. Very thick soft medium stiff clays in excess of ten (10) feet thickness.

Step 2: Check for the existence of a total thickness of soft clay > 10 feet where a soft clay layer is defined by:

1. s_u <500 psf (undrained shear strength).
2. $w \geq 40$ percent (moisture).
3. $PI > 20$ (Plastic Index).

If these criteria are satisfied, classify the site as Site Class 'E' These are soft soils vulnerable to large strains under seismic motion. .

Step 3: Categorize the site using one of the following three methods with v_s , N, s_u, computed:

1. v_s for the top 100 feet (v_s method).
2. N for the top 100 feet (N method).
3. N_{ch} for cohesionless soil layers ($PI < 20$) in the top 100 feet and average s_u for cohesive soil layers ($PI > 20$) in the top 100 feet. (s_u method).

Site Class	v_s	N or N_{ch}	s_u
E	< 600 fps	< 15	< 1,000 psf
D	600 to 1,200 fps	15 to 20	1,000 to 2,000 psf
C	>1,200 to 2,500 fps	> 50	> 2,000

If the s_u method is used and the N_{ch} and s_u criteria differ, select the category with the softer soils.