SUBSURFACE SOIL EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION CPSL WATER CONTROL STRUCTURES A-16, A-17 & A-18 PORT ST. LUCIE, ST. LUCIE COUNTY, FLORIDA

AACE FILE NO. 23-220

ANDERSEN ANDRE CONSULTING ENGINEERS, INC.

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AACE FILE NO. 23-220

ANDERSEN ANDRE CONSULTING ENGINEERS, INC.
Geotechnical Engineering
Construction Materials Testing
Environmental Consulting

AACE File No. 23-220
September 20, 2023

CAPTEC Engineering, Inc.
301 NW Flagler Avenue
Stuart, FL 34994

Attention: Mr. Steven P. Marquart, P.E.

**SUBSURFACE SOIL EXPLORATION AND
GEOTECHNICAL ENGINEERING EVALUATION
CPSL WATER CONTROL STRUCTURES A-16, A-17 & A-18
PORT ST. LUCIE, ST. LUCIE COUNTY, FLORIDA**

1.0 INTRODUCTION

In accordance with your request and authorization, Andersen Andre Consulting Engineers, Inc. (AACE) has completed a subsurface exploration and geotechnical engineering analyses for the above referenced project. The purpose of performing this exploration was to explore shallow soil types and groundwater levels as they relate to the proposed water control structures, and restrictions which these soil and groundwater conditions may place on the project. Our work included Standard Penetration Test (SPT) borings, laboratory testing, and engineering analysis. This report documents our explorations and tests, presents our findings, and summarizes our conclusions and recommendations.

2.0 SITE AND PROJECT INFORMATION

2.1 Site Location and Project Understanding

The CPSL Water Control Structures A-16, A-17 and A-18 (i.e. the sites) are located on the west side of the Florida Turnpike within the Sawgrass and Paar Estates neighborhoods in Port St. Lucie, St. Lucie County, Florida (within Sections 20, 21 & 28, Township 37 South and Range 40 East). A Site Vicinity Map (2022 aerial photograph) which depicts the location of the sites is included on the attached Figure No. 1. The sites are further shown superimposed on the 2003 "Palm City, Florida" USGS topographic quadrangle map also included on Figure No. 1.

Based on our conversations, we understand that the subject water control structures are scheduled for replacement, and that the new structures will be similar to the existing structures (i.e. steel sheet pile weirs with concrete caps and with similar dimensions, grades and elevations). As such, based on our review of the provided original plans for the existing structures (CAS Engineering, 1981), we expect that the new structures will have maximum unsupported heights of about 6 feet (A-16 & A-17 sites) and 10 feet (A-18 site).

2.2 Review of USDA Soil Survey

According to the USDA NRCS Web Soil Survey, the predominant surficial soil types within the subject site are as follows:

- Map Unit 8: Basinger sand, 0 to 2 percent slopes
  [Structure A-16]
- Map Unit 39: Salerno and Punta sands
  [Structure A-18]
- Map Unit 50: Waveland and Immokalee sands
  [Structure A-17]

In brief, these soil types are all noted by the USDA NRCS to consist of poorly drained sandy marine deposits originating from within flats, flatwoods and drainageways on historic marine terraces, with sands/fine sands and loamy sands present to depths in excess of 80 inches below grade.

The approximate location of the subject site is shown superimposed on an aerial photograph obtained from the USDA Web Soil Survey on Figure No. 1. Further, excerpts from the USDA Web Soil Survey summary report are included in Appendix I.

3.0 FIELD EXPLORATION PROGRAM

To explore subsurface conditions at the three sites, six (6) Standard Penetration Test (SPT) borings were performed at the approximate locations shown on Figure No. 2. The SPT borings were completed at depths of about 50 feet below the existing grades.

Our site visits, layout of boring locations and completion of the borings were completed in the period August 28 - September 19, 2023. The boring locations shown on Figure No. 2 were determined in the field by our field crew using aerial photographs and existing site features as references. The locations should be considered accurate only to the degree implied by the method of measurement used. We preliminarily anticipate that the actual locations are within 10 feet of those shown on Figure No. 2.

Summaries of AACE's field procedures are included in Appendix II, and the individual soil boring profiles are presented on the attached Sheets Nos. 1-3. Samples obtained during performance of the borings were visually classified in the field, and representative portions of the samples were transported to our laboratory in sealed sample jars for further classification. The soil samples recovered from our explorations will be kept in our laboratory for 60 days, then discarded unless you specifically request otherwise.

4.0 OBSERVED SUBSURFACE CONDITIONS

4.1 General Soil Conditions

Detailed subsurface conditions are illustrated on the soil boring profiles presented on the attached Sheets Nos. 1-3. The stratification of the boring profiles represents our interpretation of the field boring logs and the results of laboratory examinations of the recovered samples. The stratification lines represent the approximate boundary between soil types. The actual transitions may be more gradual than implied.

In general, at the locations and depths explored, our soil borings encountered a thin mantle of topsoil (sands with roots/organics) followed by loose to medium dense/dense fine sands (SP) and occasionally slightly clayey/clayey fine sands (SP-SC/SC) reaching the termination depths of our borings. Further, the encountered sands included shell fragments starting at depths of about 20-25 feet.

Exceptions to these findings were noted as follows:

- Borings TB-3 and TB-4 (A-17 site) encountered a stratum of very loose slightly silty fine sands (SP-SM) at depths of about 33 to 38-39 feet below grade.

- Borings TB-5 and T-6 (A-18 site) encountered lenses of very dense/hard limestone at depths of about 31 to 32 feet and 47 to 50 feet (TB-5) and 28 to 29 feet (TB-6) below grade.

The above soil profile is outlined in general terms only; please refer to the attached Sheets Nos. 1-3 for individual soil profile details.

4.2 Measured Groundwater Levels

The groundwater table depth as encountered in the borings during the field investigations is shown adjacent to the soil profiles on the attached Sheets Nos. 1-3. As can be seen, the groundwater table was generally encountered at depths of about 5.5-6 feet (A-16 & A-17 sites) and 8-9.5 feet (A-18 site). In general, fluctuations in groundwater levels should be anticipated throughout the year primarily due to seasonal variations in rainfall, the level of water in the adjacent waterways, and other factors that may vary from the time the borings were conducted.

5.0 LABORATORY TESTING PROGRAM

Our drillers observed the soil recovered from the SPT sampler, placed the recovered soil samples in moisture proof containers, and maintained a log for each boring. The recovered soil samples, along with the field boring logs, were transported to our Port St. Lucie soils laboratory where they were visually examined by AACE's project engineer to determine their engineering classification. The visual classification of the samples was performed in general accordance with the Unified Soil Classification System, USCS.

Further, representative samples were selected for limited index laboratory testing, consisting of moisture content tests (ASTM D2216) and percent fines tests (ASTM D1140). These tests were performed to aid in classifying the soils and to help evaluate the general engineering characteristics of the site soils. The soil classifications and other pertinent data obtained from our explorations and laboratory examinations and tests are reported on the soil profiles presented on Sheets Nos. 1-3.

6.0 GEOTECHNICAL ENGINEERING EVALUATION

Based on the findings of our site exploration, our evaluation of subsurface conditions, and judgment based on our experience with similar projects, it is our opinion that the encountered soils are generally satisfactory to support the water control structure replacements. However, for the A-18 site, should the selected steel sheet piles reach depths greater than say 28-30 feet, lenses or strata of very dense limestone may be reached, as encountered in our boring TB-5 at about 31-32 feet below grade and again at a depth of about 47 feet, and in our boring TB-6 at about 28-29 feet below grade. It is possible that additional lenses of limestone (at different depths) may be encountered between the two borings.

The soil parameters summarized in Tables 1-3 are provided for others to use in a steel sheet pile weir design. We remain available to provide additional engineering consulting with respect to the design of the sheet pile weir (additional soil parameters, type of sheet pile, lengths, section modulus, etc.), if needed.

Table 1 - Soil Parameters for Steel Sheet Pile Design

A-16 Site						
Depth below existing grade (feet)	Average SPT 'N' Value and Soil Type	Unit Weight, $\gamma^{(1)}$ (pcf)		Angle of Internal Friction, ϕ	Cohesion (psf)	Wall Friction Angle, $\delta^{(2)}$
		Moist	Sat.			
0-30	14-16 (sands)	105	112	31	--	14
30-43	5 (sands w. shell)	102	109	29	--	11
43-50	40-41 (sands w. shell)	110	117	34	--	17

Notes: (1) $\gamma_{effective} = \gamma_{sat} - \gamma_{water}$
(2) Assumes vertical backface of steel wall, and steel wall directly against granular backfill.

Table 2 - Soil Parameters for Steel Sheet Pile Design

A-17 Site						
Depth below existing grade (feet)	Average SPT 'N' Value (Soil Type)	Unit Weight, $\gamma^{(1)}$ (pcf)		Angle of Internal Friction, ϕ	Cohesion (psf)	Wall Friction Angle, $\delta^{(2)}$
		Moist	Sat.			
0-33	9-11 (sands)	105	111	30	--	14
33-39	2-3 (sl. silty sands)	102	109	29	--	11
39-50	24 (sands w. shell)	106	113	32	--	17

Notes: (1) $\gamma_{effective} = \gamma_{sat} - \gamma_{water}$
(2) Assumes vertical backface of steel wall, and steel wall directly against granular backfill.

Table 3 - Soil Parameters for Steel Sheet Pile Design

A-18 Site							
Depth below existing grade (feet)	Average SPT 'N' Value and Soil Type	Unit Weight, $\gamma^{(1)}$ (pcf)		Angle of Internal Friction, ϕ	Cohesion (psf)	Wall Friction Angle, $\delta^{(2)}$
		Moist	Sat.			
0-18	12-15 (sands and sl. clayey/clayey sands)	105	112	31	--	14
18-23	2 (sands and clayey sands)	102	109	29	--	11
23-33	11-12 (sands w. shell)$^{(3)}$	105	111	30	--	14
33-50	27-30 (sands w. shell)$^{(4)}$	107	114	33	--	17

Notes: (1) $\gamma_{effective} = \gamma_{sat} - \gamma_{water}$
(2) Assumes vertical backface of steel wall, and steel wall directly against granular backfill.
(3) Lenses of very dense limestone (TB-5 31'-32' and TB-6 28'-29') excluded.
(4) Stratum of very dense limestone (TB-5 47'-50') excluded.

We recommend that appropriate safety factors be used in the sheet pile design. The safety factors selected should be based on design and construction considerations which are beyond the scope of this report.

It is assumed that the proposed sheet piles will be installed using a vibratory hammer. Based on the findings of our borings, it is preliminarily anticipated that steel sheet piles can be utilized for the weirs without the need for a heavy-duty vibratory hammer, unless the aforementioned lenses of very dense limestone are reached/encountered (A-18 site). Should the steel sheet piles be designed to reach this stratum, specialized equipment may be needed. We recommend that the bidding Contractors carefully review this report.

Should fill need to be placed upstream or downstream following the installation of the sheet piles, we recommend using clean sands, free of organics and other deleterious materials. The fill should have less than 12 percent by dry weight passing the U.S. No. 200 sieve, and no particle larger than 3 inches in diameter. All fill materials should be placed in uniform layers not exceeding 12 inches in loose thickness, with each layer compacted to a dry density not less than 95 percent of its modified Proctor (ASTM D1557) maximum value.

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7.0 CLOSURE

The geotechnical evaluation submitted herein is based on the data obtained from the soil borings and test results presented on Sheets Nos. 1-3, and our previously described understanding of the proposed construction. Limitations and conditions to this report are presented in Appendix III.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices for the exclusive use of the CAPTEC Engineering, Inc. and the City of Port St. Lucie for the subject project. No other warranty, expressed or implied, is made.

We are pleased to be of assistance to you on this phase of your project. When we may be of further service to you or should you have any questions, please contact us.

Sincerely,
ANDERSEN ANDRE CONSULTING ENGINEERS, INC.

Peter G. Andersen, P.E.
Principal Engineer
Fla. Reg. No. 57956

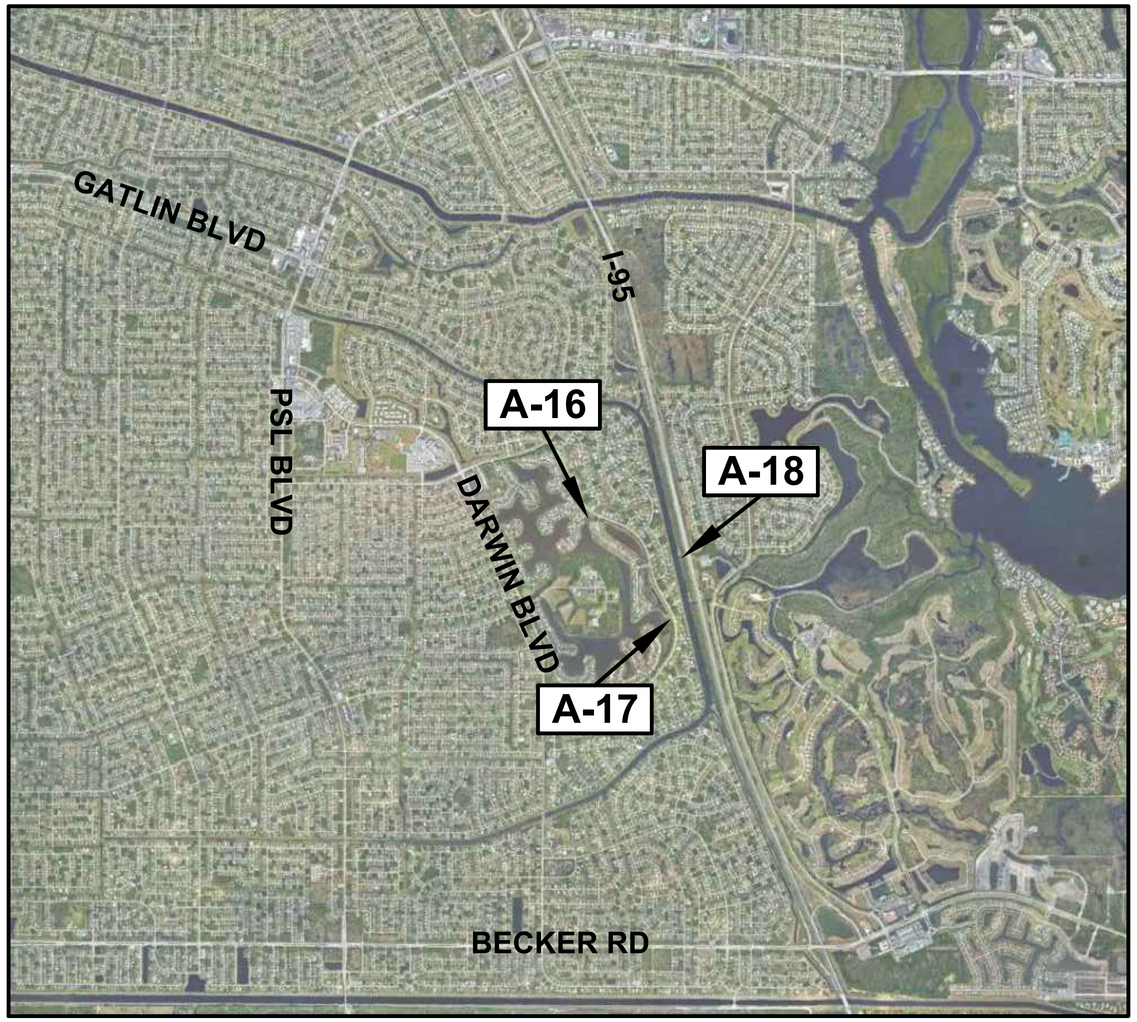
PETER GREGERS ANDERSEN
LICENSE
No 57956
STATE OF FLORIDA
PROFESSIONAL ENGINEER

Digitally signed by Peter G. Andersen, P.E.
DN: cn=Peter G. Andersen, P.E., email=pandersen@aaceinc.com, c=US
Date: 2023.09.20 11:37:51 -04'00'

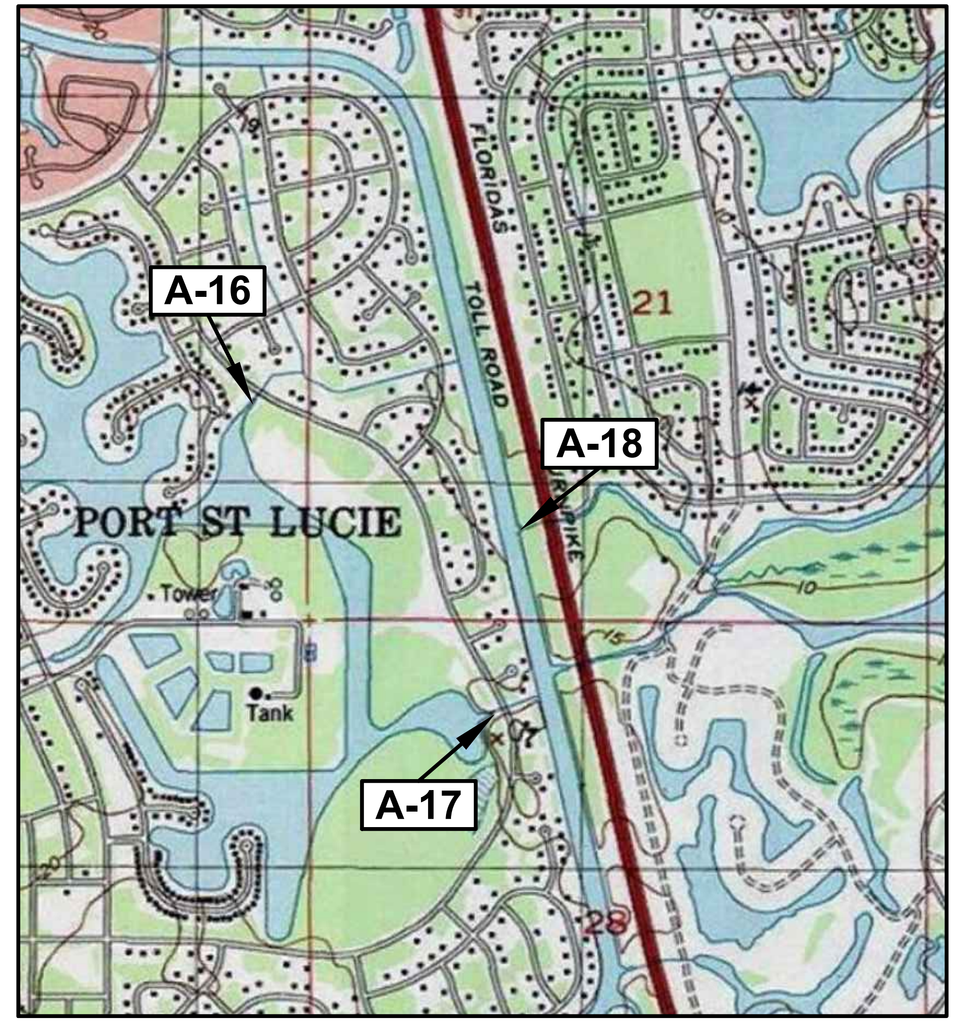
David P. Andre, P.E.
Principal Engineer
Fla. Reg. No. 53969

This report has been digitally signed by Peter G. Andersen, P.E. on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

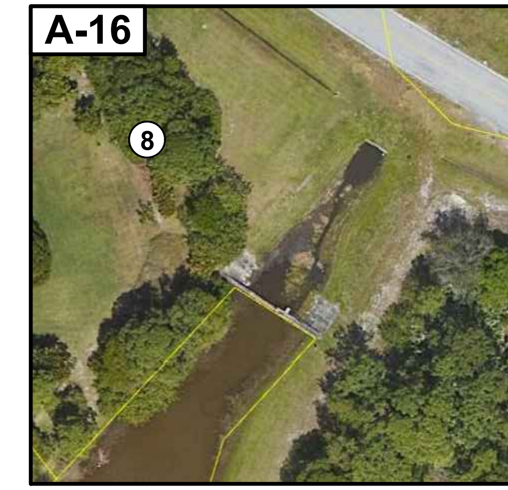
2022 AERIAL PHOTOGRAPH

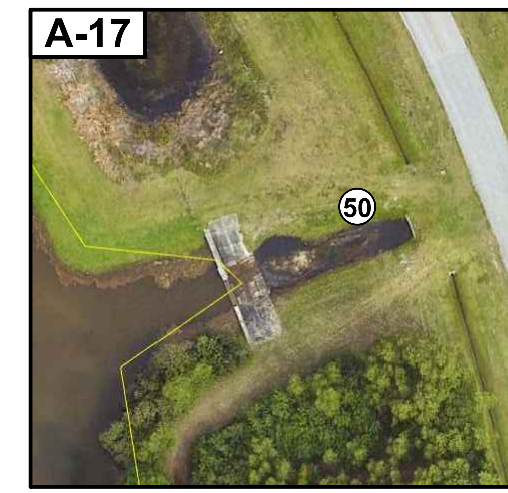


USGS TOPOGRAPHIC QUADRANGLE MAP OF "PALM CITY, FL"



USDA SOIL SURVEY MAPS





NORTH

NOT TO SCALE

Sources:
- Google Earth Pro
- QUADS/Earth Survey
- USDA NRCS Web Soil Survey

PUBLIC LAND SURVEY SYSTEM

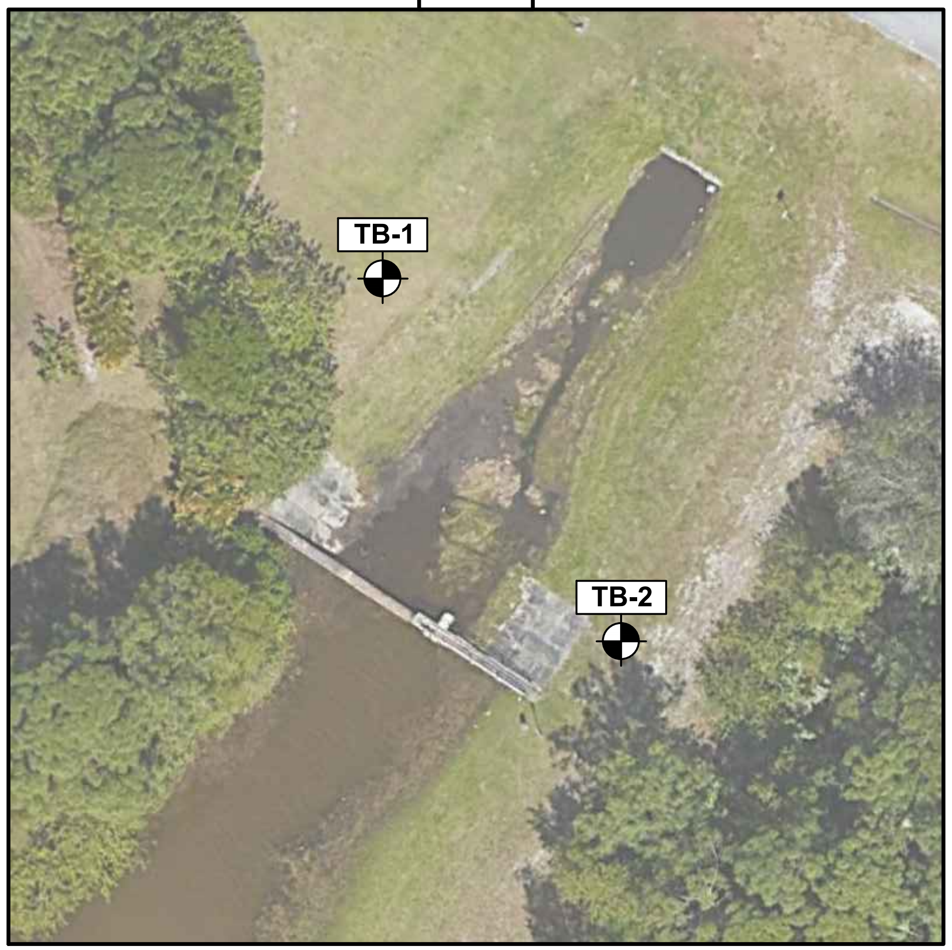
Sections 20, 21 & 28, Township 37 South, Range 40 East

USDA NRCS SOIL TYPES WITHIN SITES

(8) Basinger sand, 0 to 2 percent slopes
(39) Salerno and Punta sands
(50) Waveland and Immokalee sands

AACE **ANDERSEN ANDRE CONSULTING ENGINEERS, INC.** 834 SW Swan Avenue, Port St. Lucie, FL 34983 772-807-9191 www.AACEinc.com	**SITE VICINITY MAPS**	SUBSURFACE SOIL EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION CPSL WATER CONTROL STRUCTURES A-16, A-17 & A-18 PORT ST. LUCIE, ST. LUCIE COUNTY, FLORIDA	Drawn by: PGA	Date: September 2023
			Checked by: DPA	Date: September 2023
			AACE File No: 23-220	**Figure No. 1**

A-16



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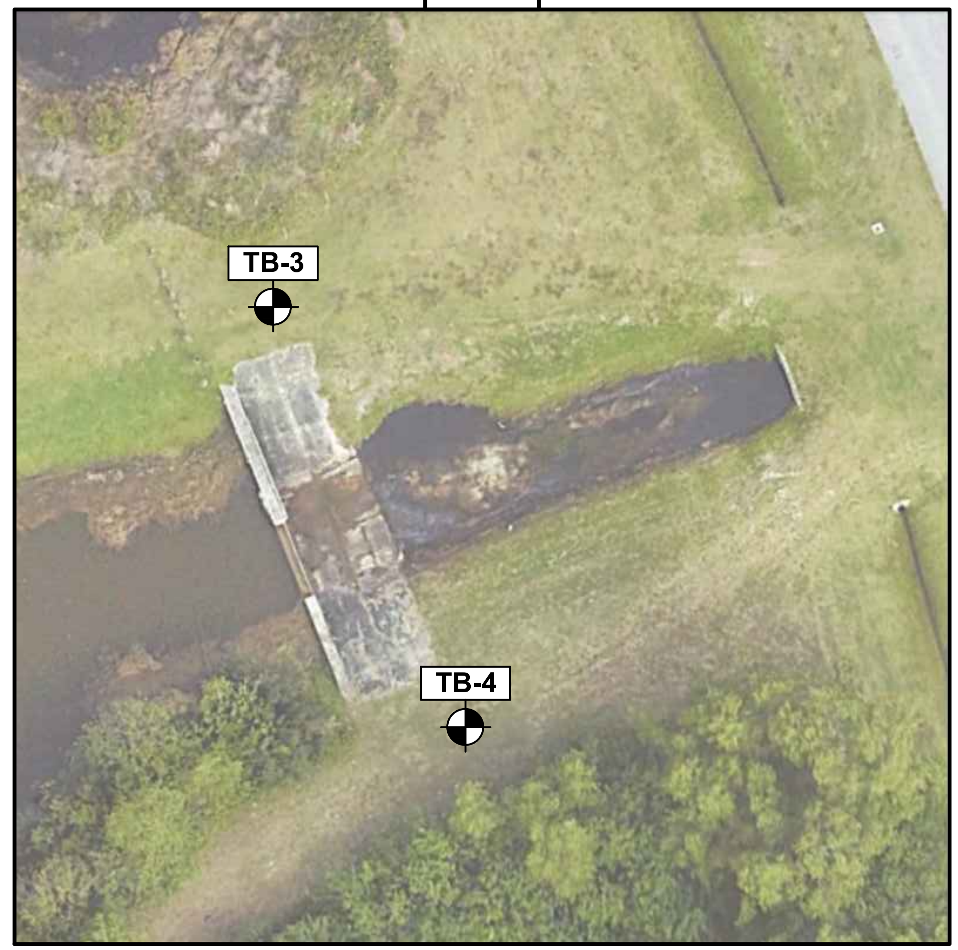


A-18

NORTH

NOT TO SCALE

Source:
- Google Earth Pro

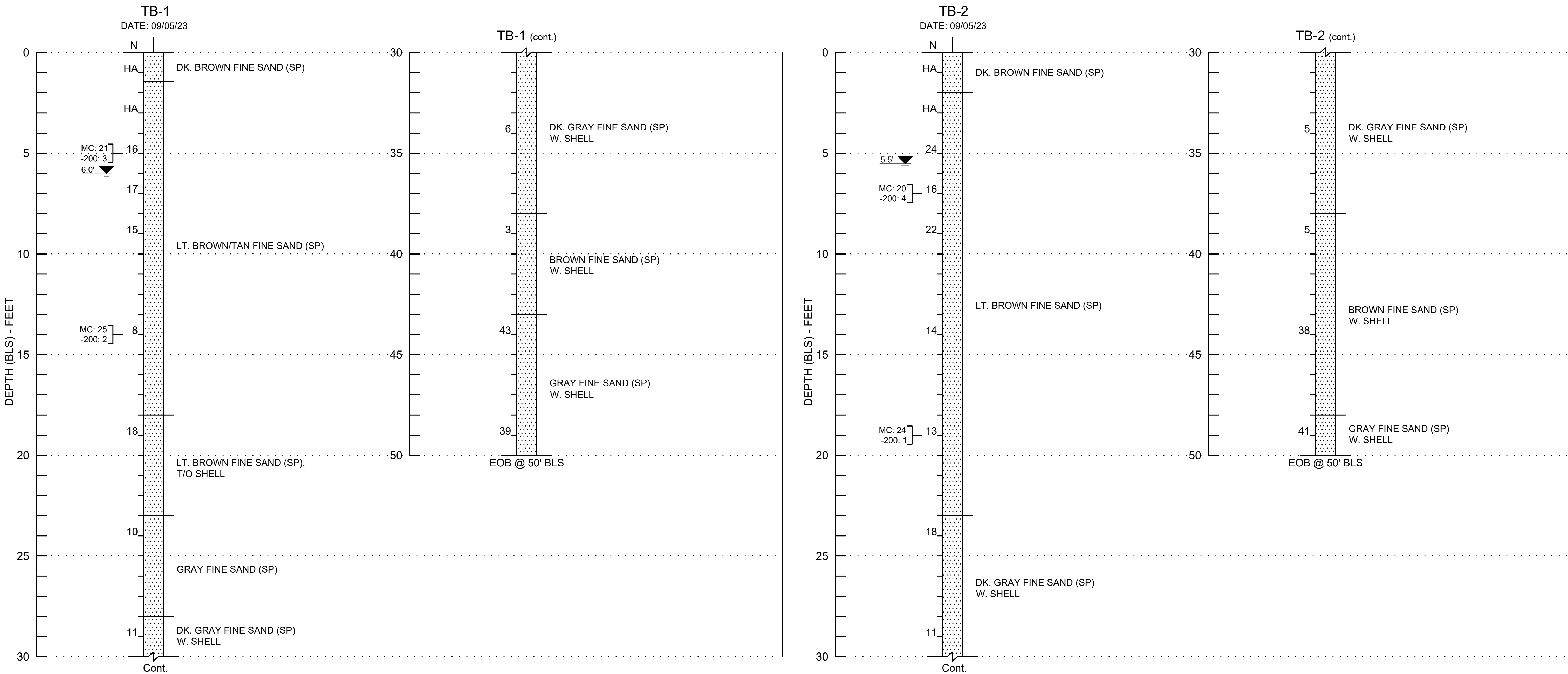
LEGEND

TB-# Standard Penetration Test Boring

NOTES

Shown and noted soil boring locations are approximate, and were located using aerial photographs and existing site features as references.

ANDERSEN ANDRE CONSULTING ENGINEERS, INC. 834 SW Swan Avenue, Port St. Lucie, FL 34983 772-807-9191 www.AACEinc.com	**FIELD WORK LOCATION PLAN**	SUBSURFACE SOIL EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION CPSL WATER CONTROL STRUCTURES A-16, A-17 & A-18 PORT ST. LUCIE, ST. LUCIE COUNTY, FLORIDA	Drawn by: PGA	Date: September 2023
			Checked by: DPA	Date: September 2023
			AACE File No: 23-220	**Figure No. 2**



SOIL GRAPHICAL LEGEND:

- FINE SAND (SP)
- SLIGHLY SILTY FINE SAND (SP-SM)
- SLIGHTLY CLAYEY FINE SAND (SP-SC)
- CLAYEY FINE SAND (SC)
- LIMESTONE (L)

NOTE: 3"-6" of topsoil (sands with roots/organics) encountered in borings (not shown on boring profiles)

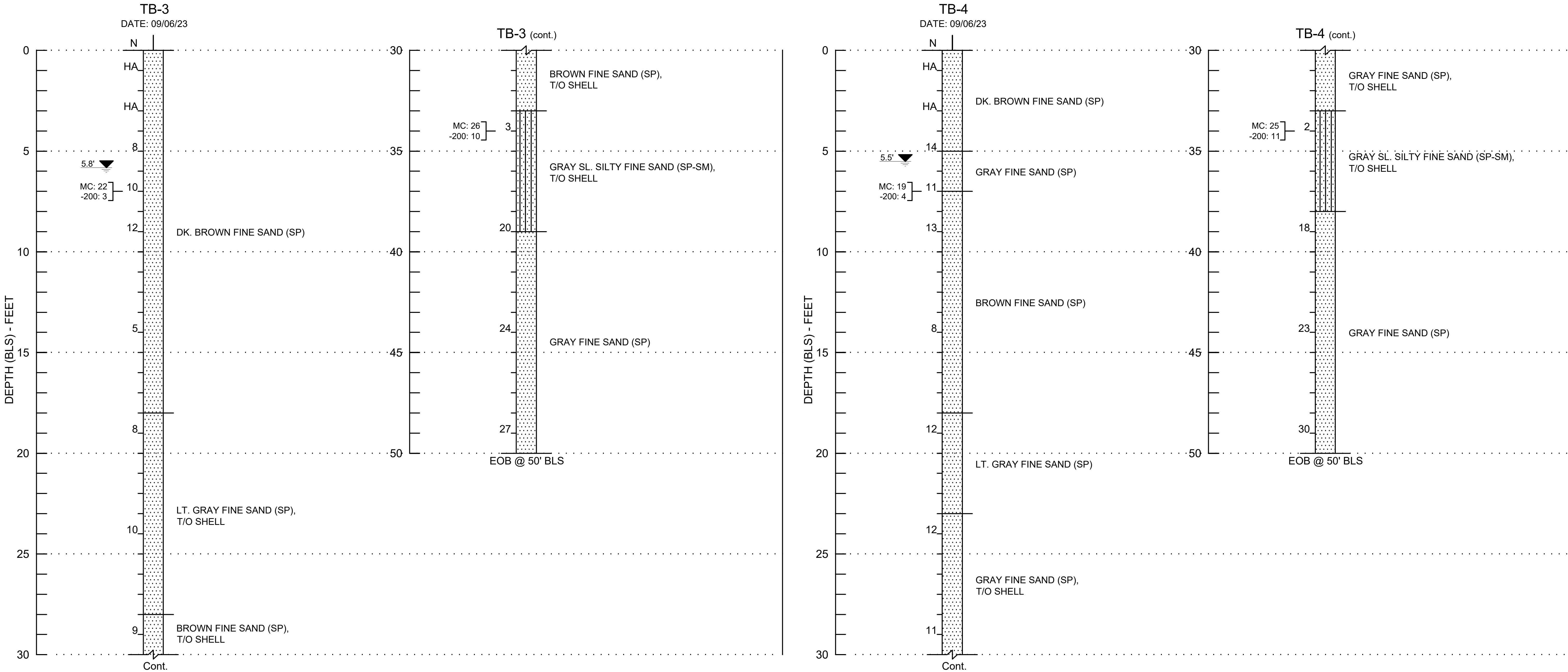
DRILLING NOTES:

TB-#	STANDARD PENETRATION TEST [SPT] BORING (ASTM D1586)
N	SPT RESISTANCE IN BLOWS PER FOOT
X.X' ▼	GROUNDWATER TABLE (FT-BLS) AT TIME OF DRILLING
EOB	END OF BORING
BLS	BELOW LAND SURFACE
HA	HAND AUGER FOR UTILITY CLEARANCE
SP, SP-SM, SP-SC, SC	UNIFIED SOIL CLASSIFICATION SYSTEM [USCS] USCS GROUPS DETERMINED BY VISUAL CLASSIFICATION EXCEPT FOR NOTED LABORATORY TESTS
MC	NATURAL MOISTURE CONTENT IN PERCENT (ASTM D2216)
-200	PERCENT FINES PASSING THE NO. 200 SIEVE (ASTM D1140)

DRILL CREW CHIEF: DT
DRILL RIG: CME-45
DRILLING METHOD: ROTARY-WASH/BENTONITE SLURRY
SPLIT-SPOON SAMPLER:
- INSIDE DIAMETER: 1.375"
- OUTSIDE DIAMETER: 2.0"
- LENGTH: 24"

SPT HAMMER:
- AVERAGE DROP: 30"
- WEIGHT: 140 LBS
- TYPE: SAFETY/MANUAL

AACE — ANDERSEN ANDRE CONSULTING ENGINEERS, INC. 834 SW Swan Avenue, Port St. Lucie, FL 34983 772-807-9191 www.AACEinc.com	SOIL BORING PROFILES	SUBSURFACE SOIL EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION CPSL WATER CONTROL STRUCTURES A-16, A-17 & A-18 PORT ST. LUCIE, ST. LUCIE COUNTY, FLORIDA	Drawn by: PGA / Checked by: DPA / AACE File No: 23-220	Date: September 2023 / Date: September 2023 / Sheet No. 1



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SOIL BORING PROFILES

SUBSURFACE SOIL EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION CPSL WATER CONTROL STRUCTURES A-16, A-17 & A-18 PORT ST. LUCIE, ST. LUCIE COUNTY, FLORIDA

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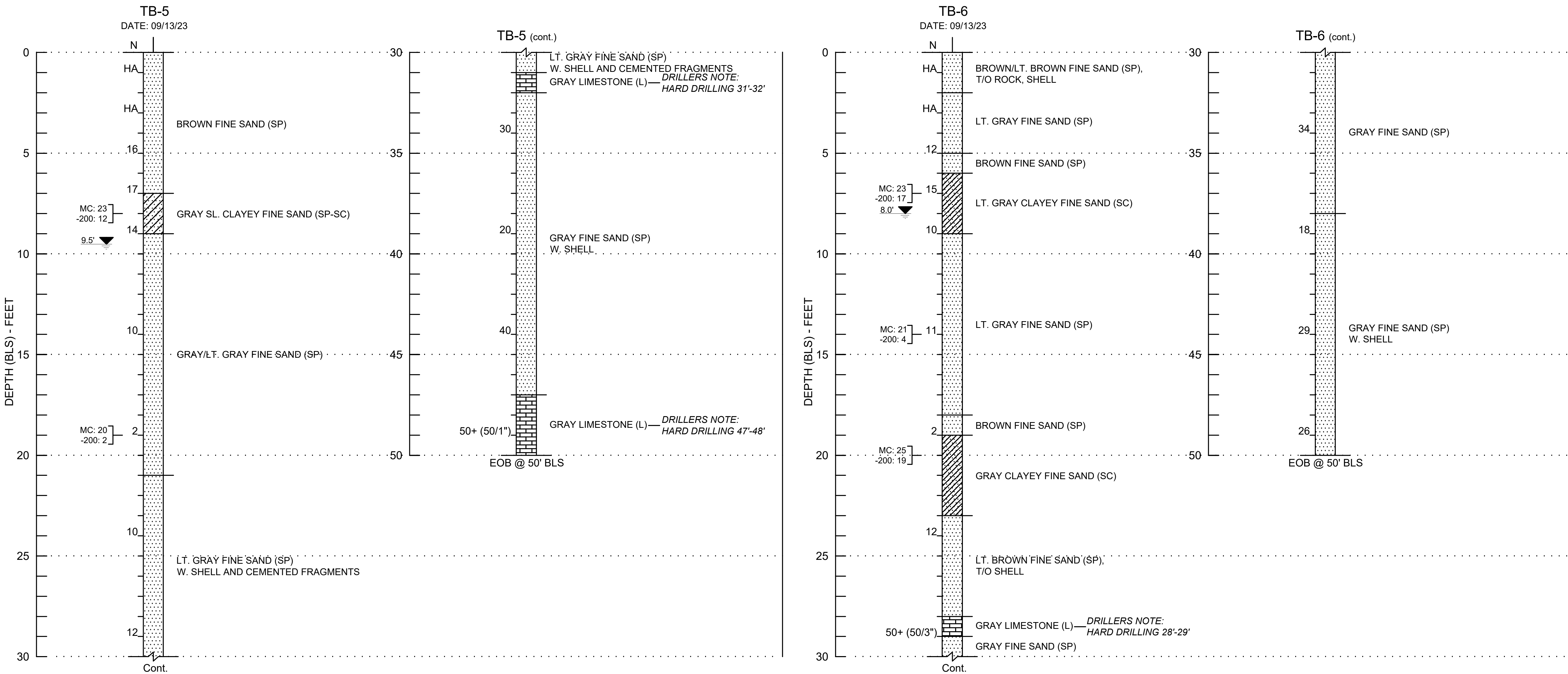

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NOTE: 3"-6" of topsoil (sands with roots/organics) encountered in borings (not shown on boring profiles)

DRILLING NOTES:

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N	SPT RESISTANCE IN BLOWS PER FOOT
X.X'	GROUNDWATER TABLE (FT-BLS) AT TIME OF DRILLING
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SOIL BORING PROFILES

SUBSURFACE SOIL EXPLORATION AND GEOTECHNICAL ENGINEERING EVALUATION
CPSL WATER CONTROL STRUCTURES A-16, A-17 & A-18
PORT ST. LUCIE, ST. LUCIE COUNTY, FLORIDA

Drawn by: PGA	Date: September 2023
Checked by: DPA	Date: September 2023
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APPENDIX I

USDA NRCS Web Soil Survey
Summary Report

Custom Soil Resource Report
Soil Map (CPSL WCS A-16)

St. Lucie County, Florida

8—Basinger sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2vbpc
Elevation: 0 to 50 feet
Mean annual precipitation: 42 to 62 inches
Mean annual air temperature: 68 to 77 degrees F
Frost-free period: 350 to 365 days
Farmland classification: Farmland of unique importance

Map Unit Composition

Basinger and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Basinger

Setting

Landform: Drainageways on marine terraces, flats on marine terraces
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave, convex
Across-slope shape: Concave, linear
Parent material: Sandy marine deposits

Typical profile

A - 0 to 6 inches: sand
E - 6 to 25 inches: sand
Bh - 25 to 50 inches: sand
C - 50 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 3 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 4.0
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Forage suitability group: Sandy soils on flats of mesic or hydric lowlands (G155XB141FL)
Other vegetative classification: Slough (R155XY011FL), Sandy soils on flats of mesic or hydric lowlands (G155XB141FL)
Hydric soil rating: Yes

Minor Components

Holopaw

Percent of map unit: 6 percent
Landform: Flats on marine terraces, drainageways on marine terraces
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear, concave, convex
Across-slope shape: Concave, linear
Other vegetative classification: Slough (R155XY011FL), Sandy soils on stream terraces, flood plains, or in depressions (G155XB145FL)
Hydric soil rating: Yes

Malabar

Percent of map unit: 5 percent
Landform: Depressions on marine terraces
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Other vegetative classification: South Florida Flatwoods (R155XY003FL), Sandy soils on flats of mesic or hydric lowlands (G155XB141FL)
Hydric soil rating: Yes

Pompano

Percent of map unit: 3 percent
Landform: Drainageways on flats on marine terraces
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear
Across-slope shape: Linear, concave
Other vegetative classification: Slough (R155XY011FL), Sandy soils on flats of mesic or hydric lowlands (G155XB141FL)
Hydric soil rating: Yes

Anclote

Percent of map unit: 1 percent
Landform: Depressions on marine terraces
Landform position (three-dimensional): Tread, dip
Down-slope shape: Convex, concave
Across-slope shape: Linear, concave
Other vegetative classification: Freshwater Marshes and Ponds (R155XY010FL), Sandy soils on stream terraces, flood plains, or in depressions (G155XB145FL)
Hydric soil rating: Yes

99—Water

Map Unit Composition

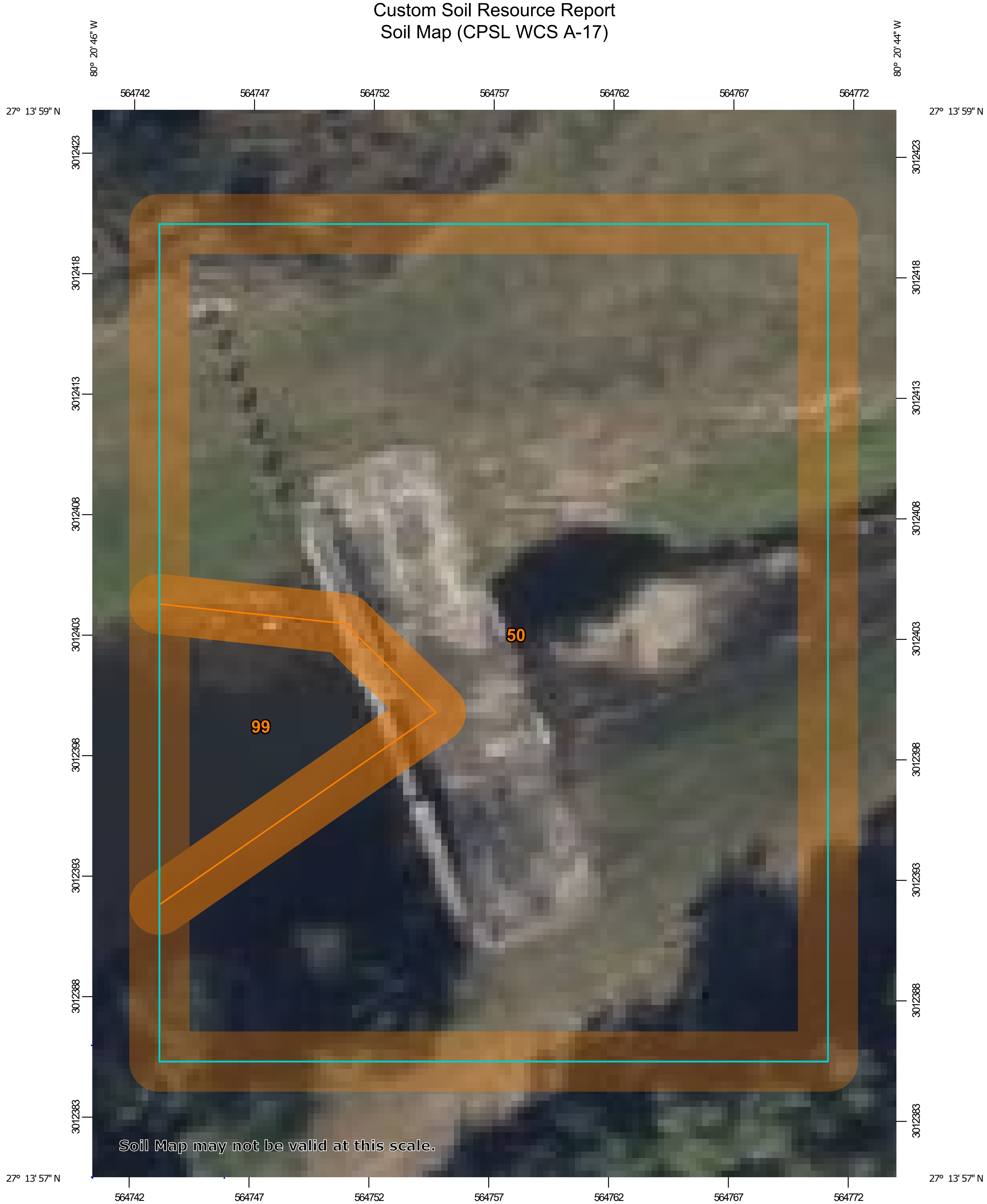
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Ecological site: R156BY100FL - Subaqueous Freshwater Riverine Habitats
Forage suitability group: Forage suitability group not assigned (G156BC999FL)
Other vegetative classification: Forage suitability group not assigned (G156BC999FL)
Hydric soil rating: Unranked

Soil Map (CPSL WCS A-17)



Map Scale: 1:216 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 3, 6, 12, 18

Feet: 0, 10, 20, 40, 60

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

St. Lucie County, Florida

50—Waveland and Immokalee fine sands

Map Unit Setting

National map unit symbol: 1jpwd
Elevation: 0 to 200 feet
Mean annual precipitation: 49 to 58 inches
Mean annual air temperature: 70 to 77 degrees F
Frost-free period: 350 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Waveland and similar soils: 45 percent
Immokalee and similar soils: 43 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Waveland

Setting

Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy marine deposits

Typical profile

A - 0 to 4 inches: fine sand
Eg - 4 to 32 inches: sand
Bh1 - 32 to 40 inches: loamy sand
Bh2 - 40 to 53 inches: sand
Cg1 - 53 to 66 inches: sand
Cg2 - 66 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 31 to 50 inches to ortstein
Drainage class: Poorly drained
Runoff class: High
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 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 4.0
Available water supply, 0 to 60 inches: Very low (about 0.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Forage suitability group: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)

Other vegetative classification: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Hydric soil rating: No

Description of Immokalee

Setting

Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy marine deposits

Typical profile

A - 0 to 6 inches: fine sand
E - 6 to 35 inches: fine sand
Bh - 35 to 54 inches: fine sand
Cg - 54 to 72 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 4.0
Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Forage suitability group: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Other vegetative classification: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Hydric soil rating: No

Minor Components

Jonathan

Percent of map unit: 3 percent
Landform: Knolls on marine terraces, ridges on marine terraces
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Sandy soils on rises, knolls, and ridges of mesic uplands (G156BC121FL)
Hydric soil rating: No

Salerno

Percent of map unit: 3 percent

Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Hydric soil rating: No

Lawnwood

Percent of map unit: 3 percent
Landform: Marine terraces on flatwoods
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Hydric soil rating: No

Electra

Percent of map unit: 3 percent
Landform: Knolls on marine terraces, rises on marine terraces
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Sandy soils on rises and knolls of mesic uplands (G156BC131FL)
Hydric soil rating: No

99—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Ecological site: R156BY100FL - Subaqueous Freshwater Riverine Habitats
Forage suitability group: Forage suitability group not assigned (G156BC999FL)
Other vegetative classification: Forage suitability group not assigned (G156BC999FL)
Hydric soil rating: Unranked

Soil Map (CPSL WCS A-18)

St. Lucie County, Florida

39—Salerno and Punta sands

Map Unit Setting

National map unit symbol: 1jpw1
Elevation: 0 to 50 feet
Mean annual precipitation: 49 to 58 inches
Mean annual air temperature: 70 to 77 degrees F
Frost-free period: 350 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Salerno and similar soils: 46 percent
Punta and similar soils: 44 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salerno

Setting

Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy marine deposits

Typical profile

A - 0 to 5 inches: sand
E - 5 to 55 inches: sand
Bh - 55 to 68 inches: sand
Cg - 68 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 51 to 72 inches to ortstein
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 4.0
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Forage suitability group: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Other vegetative classification: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)

Hydric soil rating: No

Description of Punta

Setting

Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy marine deposits

Typical profile

A - 0 to 4 inches: sand
E - 4 to 57 inches: sand
Bh - 57 to 80 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 4.0
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Forage suitability group: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Other vegetative classification: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Hydric soil rating: No

Minor Components

Pendarvis

Percent of map unit: 5 percent
Landform: Knolls on marine terraces, rises on marine terraces
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Sandy soils on rises and knolls of mesic uplands (G156BC131FL)
Hydric soil rating: No

Waveland

Percent of map unit: 5 percent
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Convex

Across-slope shape: Linear
Other vegetative classification: Sandy soils on flats of mesic or hydric lowlands (G156BC141FL)
Hydric soil rating: No

99—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Ecological site: R156BY100FL - Subaqueous Freshwater Riverine Habitats
Forage suitability group: Forage suitability group not assigned (G156BC999FL)
Other vegetative classification: Forage suitability group not assigned (G156BC999FL)
Hydric soil rating: Unranked

APPENDIX II

General Notes
(Soil Boring, Sampling and Testing Methods)

ANDERSEN ANDRE CONSULTING ENGINEERS, INC.

SOIL BORING, SAMPLING AND TESTING METHODS

GENERAL

Andersen Andre Consulting Engineers, Inc. (AACE) borings describe subsurface conditions only at the locations drilled and at the time drilled. They provide no information about subsurface conditions below the bottom of the boreholes. At locations not explored, surface conditions that differ from those observed in the borings may exist and should be anticipated.

The information reported on our boring logs is based on our drillers' logs and on visual examination in our laboratory of disturbed soil samples recovered from the borings. The distinction shown on the logs between soil types is approximate only. The actual transition from one soil to another may be gradual and indistinct.

The groundwater depth shown on our boring logs is the water level the driller observed in the borehole when it was drilled. These water levels may have been influenced by the drilling procedures, especially in borings made by rotary drilling with bentonitic drilling mud. An accurate determination of groundwater level requires long-term observation of suitable monitoring wells. Fluctuations in groundwater levels throughout the year should be anticipated.

The absence of a groundwater level on certain logs indicates that no groundwater data is available. It does not mean that groundwater will not be encountered at that boring location at some other point in time.

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in situ testing of foundation soils (ASTM D-1586). A 2-foot (0.6m) long, 2-inch (50mm) O.D. split-barrell sampler attached to the end of a string of drilling rods is driven 24 inches (0.60m) into the ground by successive blows of a 140-pound (63.5 Kg) hammer freely dropping 30 inches (0.76m). The number of blows needed for each 6 inches (0.15m) increments penetration is recorded. The sum of the blows required for penetration of the middle two 6-inch (0.15m) increments of penetration constitutes the test result of N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Qu):

Cohesionless Soils:	N-Value	Description
	0 to 4	Very loose
	4 to 10	Loose
	10 to 30	Medium dense
	30 to 50	Dense
	Above 50	Very dense

Cohesive Soils:	N-Value	Description	Qu
	0 to 2	Very soft	Below 0.25 tsf (25 kPa)
	2 to 4	Soft	0.25 to 0.50 tsf (25 to 50 kPa)
	4 to 8	Medium stiff	0.50 to 1.0 tsf (50 to 100 kPa)
	8 to 15	Stiff	1.0 to 2.0 tsf (100 to 200 kPa)
	15 to 30	Very stiff	2.0 to 4.0 tsf (200 to 400 kPa)
	Above 30	Hard	Above 4.0 tsf (400 kPa)

The tests are usually performed at 5 foot (1.5m) intervals. However, more frequent or continuous testing is done by AACE through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test borings, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling, either with accumulated cuttings or lean cement.

Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangement have been made.

POWER AUGER BORINGS

Auger borings (ASTM D-1452) are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4-inch (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5-foot (1.5m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger our of the ground without rotating it. The soil sample so obtained, is classified in the field and representative samples placed in bags or jars and returned to the AACE soils laboratory for classification and testing, if necessary.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5-foot [1.5m]) depth or when access is not available to power drilling equipment. A 3-inch (75mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6-inch (0.15m) interval and its contents emptied for inspection. On occasion post-hole diggers are used, especially in the upper 3 feet (1m) or so. Penetrometer probings can be used in the upper 5 feet (1.5m) to determine the relative density of the soils. The soil sample obtained is described and representative samples put in bags or jars and transported to the AACE soils laboratory for classification and testing, if necessary.

UNDISTURBED SAMPLING

Undisturbed sampling (ASTM D-1587) implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of in situ conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized for most geotechnical engineering purposes. Testing of undisturbed samples gives a more accurate estimate of in situ behavior than is possible with disturbed samples.

Normally, we obtain undisturbed samples by pushing a 2.875-inch (73 mm) I.D., thin wall seamless steel tube 24 inches (0.6 m) into the soil with a single stoke of a hydraulic ram. The sampler, which is a Shelby tube, is 30 (0.8 m) inches long. After the sampler is retrieved, the ends are sealed in the field and it is transported to our laboratory for visual description and testing, as needed.

ROCK CORING

In case rock strata is encountered and rock strength/continuity/composition information is needed for foundation or mining purposes, the rock can be cored (ASTM D-2113) and 2-inch to 4-inch diameter rock core samples be obtained for further laboratory analyses. The rock coring is performed through flush-joint steel casing temporarily installed through the overburden soils above the rock formation and also installed into the rock. The double- or triple-tube core barrels are advanced into the rock typically in 5-foot intervals and then retrieved to the surface. The barrel is then opened so that the core sample can be extruded. Preliminary field measurements of the recovered rock cores include percent recovery and Rock Quality Designation (RQD) values. The rock cores are placed in secure core boxes and then transported to our laboratory for further inspection and testing, as needed.

SFWMD EXFILTRATION TESTS

In order to estimate the hydraulic conductivity of the upper soils, constant head or falling head exfiltration tests can be performed. These tests are performed in accordance with methods described in the South Florida Water Management District (SFWMD) Permit Information Manual, Volume IV. In brief, a 6 to 9 inch diameter hole is augered to depths of about 5 to 7 feet; the bottom one foot is filled with 57-stone; and a 6-foot long slotted PVC pipe is lowered into the hole. The distance from the groundwater table and to the ground surface is recordedand the hole is then saturated for 10 minutes with the water level maintained at the ground surface.

If a constant head test is performed, the rate of pumping will be recorded at fixed intervals of 1 minute for a total of 10 minutes, following the saturation period.

LABORATORY TEST METHODS

Soil samples returned to the AACE soils laboratory are visually observed by a geotechnical engineer or a trained technician to obtain more accurate description of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report.

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHEAST FLORIDA

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is performed in general accordance with the United Soil Classification System and is also based on visual-manual procedures.

BOULDERS (>12" [300 MM]) and COBBLES (3" [75 MM] TO 12" [300 MM]):

GRAVEL:

Coarse Gravel:	3/4" (19 mm) to 3" (75 mm)
Fine Gravel:	No. 4 (4.75 mm) Sieve to 3/4" (19 mm)

Descriptive adjectives:

0 - 5%	– no mention of gravel in description
5 - 15%	– trace
15 - 29%	– some
30 - 49%	– gravelly (shell, limerock, cemented sands)

SANDS:

COARSE SAND: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
MEDIUM SAND: No. 40 (425 µm) Sieve to No. 10 (2 mm) Sieve
FINE SAND: No. 200 (75 µm) Sieve to No. 40 (425 µm) Sieve

Descriptive adjectives:

0 - 5%	– no mention of sand in description
5 - 15%	– trace
15 - 29%	– some
30 - 49%	– sandy

SILT/CLAY: < #200 (75µM) Sieve

SILTY OR SILT: PI < 4
SILTY CLAYEY OR SILTY CLAY: 4 ≤ PI ≤ 7
CLAYEY OR CLAY: PI > 7

Descriptive adjectives:

< - 5%	– clean (no mention of silt or clay in description)
5 - 15%	– slightly
16 - 35%	– clayey, silty, or silty clayey
36 - 49%	– very

ORGANIC SOILS:

Organic Content	**Descriptive Adjectives**	**Classification**
0 - 2.5%	Usually no mention of organics in description	See Above
2.6 - 5%	slightly organic	add "with organic fines" to group name
5 - 30%	organic	SM with organic fines
		Organic Silt (OL)
		Organic Clay (OL)
		Organic Silt (OH)

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHEAST FLORIDA

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

Organic Clay (OH)

HIGHLY ORGANIC SOILS AND MATTER:

Organic Content	**Descriptive Adjectives**	**Classification**
30 - 75%	sandy peat	Peat (PT)
	silty peat	Peat (PT)
> 75%	amorphous peat	Peat (PT)
	fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE:

Descriptive Term		**Thickness**
with interbedded		
seam	--	less than ½ inch (13 mm) thick
layer	--	½ to 12-inches (300 mm) thick
stratum	--	more than 12-inches (300 mm) thick
pocket	--	small, erratic deposit, usually less than 1-foot
lens	--	lenticular deposits
occasional	--	one or less per foot of thickness
frequent	--	more than one per foot of thickness
calcareous	--	containing calcium carbonate (reaction to diluted HCL)
hardpan	--	spodic horizon usually medium dense
marl	--	mixture of carbonate clays, silts, shells and sands

ROCK CLASSIFICATION (FLORIDA) CHART:

Symbol	Typical Description
LS	Hard Bedded Limestone or Caprock
WLS	Fractured or Weathered Limestone
LR	Limerock (gravel, sand, silt and clay mixture)
SLS	Stratified Limestone and Soils

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHEAST FLORIDA

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

LEGEND FOR BORING LOGS

N:	Number of blows to drive a 2-inch OD split spoon sampler 12 inches using a 140-pound hammer dropped 30 inches
R:	Refusal (less than six inches advance of the split spoon after 50 hammer blows)
MC:	Moisture content (percent of dry weight)
OC:	Organic content (percent of dry weight)
PL:	Moisture content at the plastic limit
LL:	Moisture content at the liquid limit
PI:	Plasticity index (LL-PL)
qu:	Unconfined compressive strength (tons per square foot, unless otherwise noted)
-200:	Percent passing a No. 200 sieve (200 wash)
+40:	Percent retained above a No. 40 sieve
US:	Undisturbed sample obtained with a thin-wall Shelby tube
k:	Permeability (feet per minute, unless otherwise noted)
DD:	Dry density (pounds per cubic foot)
TW:	Total unit weight (pounds per cubic foot)

APPENDIX III

AACE Project Limitations and Conditions

Project Limitations and Conditions

Andersen Andre Consulting Engineers, Inc. has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made herein. Further, the report, in all cases, is subject to the following limitations and conditions:

VARIABLE/UNANTICIPATED SUBSURFACE CONDITIONS

The engineering analysis, evaluation and subsequent recommendations presented herein are based on the data obtained from our field explorations, at the specific locations explored on the dates indicated in the report. This report does not reflect any subsurface variations (e.g. soil types, groundwater levels, etc.) which may occur adjacent or between borings.

The nature and extent of any such variations may not become evident until construction/excavation commences. In the event such variations are encountered, Andersen Andre Consulting Engineers, Inc. may find it necessary to (1) perform additional subsurface explorations, (2) conduct in-the-field observations of encountered variations, and/or re-evaluate the conclusions and recommendations presented herein.

We at Andersen Andre Consulting Engineers, Inc. recommend that the project specifications necessitate the contractor immediately notifying Andersen Andre Consulting Engineers, Inc., the owner and the design engineer (if applicable) if subsurface conditions are encountered that are different from those presented in this report.

No claim by the contractor for any conditions differing from those expected in the plans and specifications, or presented in this report, should be allowed unless the contractor notifies the owner and Andersen Andre Consulting Engineers, Inc. of such differing site conditions. Additionally, we recommend that all foundation work and site improvements be observed by an Andersen Andre Consulting Engineers, Inc. representative.

SOIL STRATA CHANGES

Soil strata changes are indicated by a horizontal line on the soil boring profiles (boring logs) presented within this report. However, the actual strata's changes may be more gradual and indistinct. Where changes occur between soil samples, the locations of the changes must be estimated using the available information and may not be at the exact depth indicated.

SINKHOLE POTENTIAL

Unless specifically requested in writing, a subsurface exploration performed by Andersen Andre Consulting Engineers, Inc. is not intended to be an evaluation for sinkhole potential.

MISINTERPRETATION OF SUBSURFACE SOIL EXPLORATION REPORT

Andersen Andre Consulting Engineers, Inc. is responsible for the conclusions and recommendations presented herein, based upon the subsurface data obtained during this project. If others render conclusions or opinions, or make recommendations based upon the data presented in this report, those conclusions, opinions and/or recommendations are not the responsibility of Andersen Andre Consulting Engineers, Inc.

CHANGED STRUCTURE OR LOCATION

This report was prepared to assist the owner, architect and/or civil engineer in the design of the subject project. If any changes in the construction, design and/or location of the structures as discussed in this report are planned, or if any structures are included or added that are not discussed in this report, the conclusions and recommendations contained in this report may not be valid. All such changes in the project plans should be made known to Andersen Andre Consulting Engineers, Inc. for our subsequent re-evaluation.

USE OF REPORT BY BIDDERS

Bidders who are reviewing this report prior to submission of a bid are cautioned that this report was prepared to assist the owners and project designers. Bidders should coordinate their own subsurface explorations (e.g.; soil borings, test pits, etc.) for the purpose of determining any conditions that may affect construction operations. Andersen Andre Consulting Engineers, Inc. cannot be held responsible for any interpretations made using this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which may affect construction operations.

IN-THE-FIELD OBSERVATIONS

Andersen Andre Consulting Engineers, Inc. attempts to identify subsurface conditions, including soil stratigraphy, water levels, zones of lost circulation, “hard” or “soft” drilling, subsurface obstructions, etc. However, lack of mention in the report does not preclude the presence of such conditions.

LOCATION OF BURIED OBJECTS

Users of this report are cautioned that there was no requirement for Andersen Andre Consulting Engineers, Inc. to attempt to locate any man-made, underground objects during the course of this exploration, and that no attempts to locate any such objects were performed. Andersen Andre Consulting Engineers, Inc. cannot be responsible for any buried man-made objects which are subsequently encountered during construction.

PASSAGE OF TIME

This report reflects subsurface conditions that were encountered at the time/date indicated in the report. Significant changes can occur at the site during the passage of time. The user of the report recognizes the inherent risk in using the information presented herein after a reasonable amount of time has passed. We recommend the user of the report contact Andersen Andre Consulting Engineers, Inc. with any questions or concerns regarding this issue.

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

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