Sailfish Cove

37 West Seminole Street, Stuart, Florida
Project No. 1941

STORMWATER MANAGEMENT REPORT

PREPARED FOR:

City of Stuart



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Exhibit 6 – Proposed Stormwater System Layout

Appendices:

1. Drainage Calculations
2. BMP Train Calculations
3. USDA / NRCS Custom Soil Resource Report
4. Geotechnical Engineering Evaluation (GFA International – July 2017)

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1.0 INTRODUCTION

The purpose of this report is to present the surface water management system design intended to serve the proposed Sailfish Cove Condominium Building. The proposed building will consist of Single-Family Condominiums and will be located in the City of Stuart, within Martin County, Florida. The report also describes related information discovered during site reconnaissance and project research.

2.0 BACKGROUND

2.1 Project Location

The project site is located at longitude 80°15'13" West and latitude 27°11'60" North, within Section 5, Township 38 South, Range 41 East in Martin County. It is located in the City of Stuart along SW Seminole Street. It is bordered to the northwest by Harbor House Hotel, to the north by St. Lucie River, to the southeast by a Private Residence, and to the south by SW Seminole Street. Refer to the attached Location Map on **Exhibit 1**.

2.2 Project Description

The existing Total Site Area is **0.925** acres. The site improvements consist of a proposed Condominium Building, on-site paved surfaces (under building parking area, sidewalks), a pool / common area, and the development of an on-site surface water management system consisting of exfiltration trench, storm inlets, and a pipe conveyance system to a control structure that will ultimately outfall to the St. Lucie River.

3.0 EXISTING CONDITIONS

3.1 Existing Land Use

The existing site previously contained two single family homes. The site has been cleared and the two single family residences have been removed. The site is currently vacant and cleared. The Site naturally grades away from Seminole Street toward the seawall. Drainage occurs predominantly by overland sheet flow towards the existing sea wall / St. Lucie River. Please refer to the attached Site Aerial Image on **Exhibit 2**.

3.2 Flood Zone

The site area contains a very minimal portion of the FEMA Flood Zone "VE" on the northeast side along the existing seawall as shown on the attached FEMA Firmette Flood Map (**Exhibit 3**) obtained from FEMA Map Number 12085C0134H, updated February 19, 2020. This portion of the Flood Zone shown on the FEMA Flood Zone Map is most likely present because the old sea wall had a breech allowing water past the property line. The old sea wall has since been removed and replaced with a functioning sea wall designed to remove any threat of flooding to the site; therefore, no Floodplain Compensation is required. Refer to the attached FEMA Firmette Flood Map on **Exhibit 3**.

3.3 Soils

The Soil Survey of the Martin County Area, Florida (USDA, SCS 1981) indicates that the surficial soil is Urban Land 0 to 2 percent slopes (23). Refer to **Exhibit 4** for the USDA Soil Survey Map. The USDA / NRCS Custom Soil Resource report for the subject area is also included in **Appendix 3**.

A geotechnical report was conducted by GFA International, Inc. dated July 17, 2017 (**Refer to Appendix 4**). This limited subsurface soil exploration and preliminary geotechnical engineering evaluation report consisted of standard penetration tests, auger borings, soil hydraulic conductivity testing, and engineering analysis.

3.4 Seasonal High Groundwater Elevation

The groundwater elevations were encountered 6.5 to 12.1 feet blow the existing ground surface (ground elevation 6.00 NAVD & 12.00 NAVD respectively). The groundwater table will fluctuate seasonally depending on local rainfall and other site-specific influences including the water levels in the nearby St. Lucie River with tidal influences. The Geotechnical report puts the groundwater at elevation 3.50+/- NGVD or 2.00+/- NAVD. Refer to **Appendix 4** for the soil boring data. A control elevation (MHW) of 2.00 NAVD was used.

3.5 Topography

The project parcel was surveyed by Stephen J. Brown, Inc. The survey prepared is entitled, "Topographic Boundary Survey" prepared for SBS Properties, LLC dated May 26, 2017.

According to the topographic information provided on this survey, natural ground elevations range from approximately EL 3.20 to EL 12.80, North American Vertical Datum of 1988 (NAVD88). This survey was conducted prior to the installation of the new sea wall. The overall site drains predominantly by overland sheet flow from Seminole Street to the St. Lucie River.

4.0 SURFACE WATER MANAGEMENT SYSTEM

4.1 Drainage Basin and Rainfall

Currently, a standard General Permit No. 43-00946 known as Confusion Corner Drainage Improvements is in effect for the surface water management system serving 24.6 acres of residential and commercial developments including the project site.

Storm event rainfall was determined using the South Florida Water Management District (SFWMD) Rainfall Records **(Exhibit 5A-5C)**.

4.2 Water Quality Treatment Volume

The Sailfish Cove development will provide water quality treatment for the proposed site via a storage volume in exfiltration that will be placed within the Parking area and ultimately discharge through a control structure into the St. Lucie River.

The Water Quality Volume of **0.73 ac-ft** provided on the plans and calculations meets the pollutant reduction volume of **0.08 ac-ft** required per the BMPTrains calculations. Refer to **Appendix 1.3** for Water Quality Treatment calculations. Refer to **Appendix 2** for BMPTrains Calculations.

4.3 TMDL Treatment

Nitrogen and Phosphorous removal will take place in the proposed Bio-swale. See **Appendix 2** for BMP Train Calculations. Required Nitrogen reduction was established at 57% and the Bio-swale was found to provide a 93% reduction. Required Phosphorous reduction was established at 69% and the Bio-swale was found to provide a 93% reduction.

4.4 Parking Elevations

The exfiltration system will provide storage volume to prevent any flooding that would occur at the ground level under building parking due to rainfall on-site. Any flow occurring over green areas will be picked up by yard drains that will connect to the outfall structure. The proposed FFE / Parking elevation will be set above the adjacent road crown elevation that was witnessed to range from 12.00 to 12.30.

5.0 CONCLUSION

The proposed Sailfish Cove is located in the City of Stuart along SW Seminole Street. It is bordered to the northwest by Harbor House Hotel, to the north by St. Lucie River, to the southeast by a Private Residence, and to the south by SW Seminole Street. The site is currently cleared and vacant with a recently constructed and improved sea wall. The site improvements consist of a proposed Condominium Building, on-site paved surfaces (under building parking area, sidewalks), a pool / common area, and the development of an on-site surface water management system consisting of exfiltration trench, storm inlets, and a pipe conveyance system to a control structure that will ultimately outfall to the Indian River. Please see the attached drainage calculations and construction plans. As described above, the proposed design meets and exceeds the site requirements to successfully treat, store, and safely discharge stormwater amounts established by historical rainfall benchmarks witnessed in the area.

6.0 REFERENCE MATERIAL

1. SFWMD ERP Applicant's Handbook Volume II, October 2013
2. Soil Survey of Martin County, Florida (USDA, NRCS)
3. Martin County Land Development Regulations
4. FEMA Flood Map

Sailfish Cove

City of Stuart, Martin County, Florida

Project No. 1941

EXHIBITS

Exhibit 1	Location Map
Exhibit 2	Site Aerial Image
Exhibit 3	FEMA Firmette Flood Map
Exhibit 4	USDA / NRCS Soil Survey Map
Exhibit 5A	SFWMD Rainfall Record (10-year / 1-day)
Exhibit 5B	SFWMD Rainfall Record (25-year / 3-day)
Exhibit 5C	SFWMD Rainfall Record (100-year / 3-day)
Exhibit 6	Proposed Stormwater System Layout

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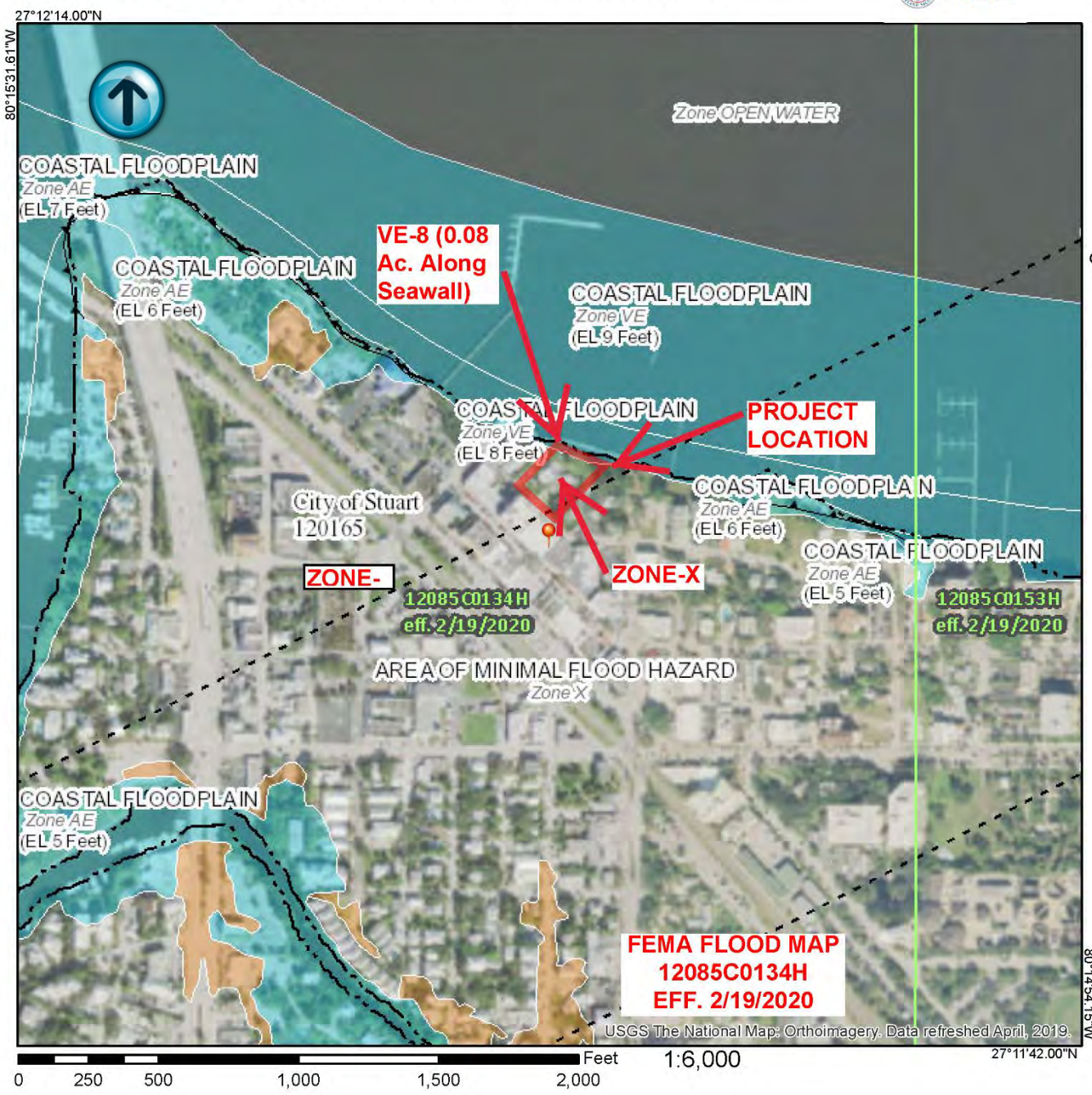
EXHIBIT 1 – LOCATION MAP
1941 – Sailfish Cove Drainage Report



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EXHIBIT 2 – SITE AERIAL IMAGE
1941 – Sailfish Cove Drainage Report

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- **SPECIAL FLOOD HAZARD AREAS**
  - Without Base Flood Elevation (BFE) *Zone A, V, A99*
  - With BFE or Depth *Zone AE, AO, AH, VE, AR*
  - Regulatory Floodway
- **OTHER AREAS OF FLOOD HAZARD**
  - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
  - Future Conditions 1% Annual Chance Flood Hazard *Zone X*
  - Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
  - Area with Flood Risk due to Levee *Zone D*
- **OTHER AREAS**
  - NO SCREEN Area of Minimal Flood Hazard *Zone X*
  - Effective LOMRs
  - Area of Undetermined Flood Hazard *Zone D*
- **GENERAL STRUCTURES**
  - Channel, Culvert, or Storm Sewer
  - Levee, Dike, or Floodwall
- **OTHER FEATURES**
  - 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
  - Coastal Transect
  - 513 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 4/17/2020 at 9:05:02 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

EXHIBIT 3 – FEMA FIRMETTE FLOOD MAP
1941 – Sailfish Cove Drainage Report

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Custom Soil Resource Report
Soil Map



Martin County, Florida

23—Urban land, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 2x9fc
Elevation: 0 to 200 feet
Mean annual precipitation: 40 to 68 inches
Mean annual air temperature: 68 to 79 degrees F
Frost-free period: 345 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition
Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting
Landform: Flatwoods on marine terraces, ridges on marine terraces, rises on marine terraces, hills on marine terraces, knolls on marine terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope, riser, talf, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Parent material: No parent material

Minor Components

Matlacha
Percent of map unit: 3 percent
Landform: Flats on marine terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Convex, linear
Across-slope shape: Linear
Hydric soil rating: No

St. augustine
Percent of map unit: 3 percent
Landform: Marine terraces
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Eaugallie
Percent of map unit: 1 percent
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: No

Immokalee
Percent of map unit: 1 percent
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Riser, talf
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: No

Pomello
Percent of map unit: 1 percent
Landform: Knolls on marine terraces, ridges on marine terraces
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, interfluve, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear
Other vegetative classification: Sand Pine Scrub (R156XY001FL)
Hydric soil rating: No

Boca
Percent of map unit: 1 percent
Landform: Drainageways on marine terraces, flats on marine terraces
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Linear, convex
Across-slope shape: Linear, concave
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: Yes

Myakka
Percent of map unit: 1 percent
Landform: Drainageways on flatwoods on marine terraces
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear
Across-slope shape: Linear, concave
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: No

Paola
Percent of map unit: 1 percent
Landform: Knolls on marine terraces, ridges on marine terraces
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, interfluve, riser
Down-slope shape: Convex, linear
Across-slope shape: Linear
Other vegetative classification: Sand Pine Scrub (R156XY001FL)
Hydric soil rating: No

Hallandale
Percent of map unit: 1 percent
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: Yes

Adamsville
Percent of map unit: 1 percent
Landform: Knolls on marine terraces, rises on marine terraces
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Upland Hardwood Hammock (R155XY008FL)
Hydric soil rating: No

Apopka
Percent of map unit: 1 percent
Landform: Hills on marine terraces, ridges on marine terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope, riser
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Longleaf Pine-Turkey Oak Hills (R155XY002FL)
Hydric soil rating: No

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EXHIBIT 4 – USDA / NRCS SOIL SURVEY
1941 –Sailfish Cove Drainage Report

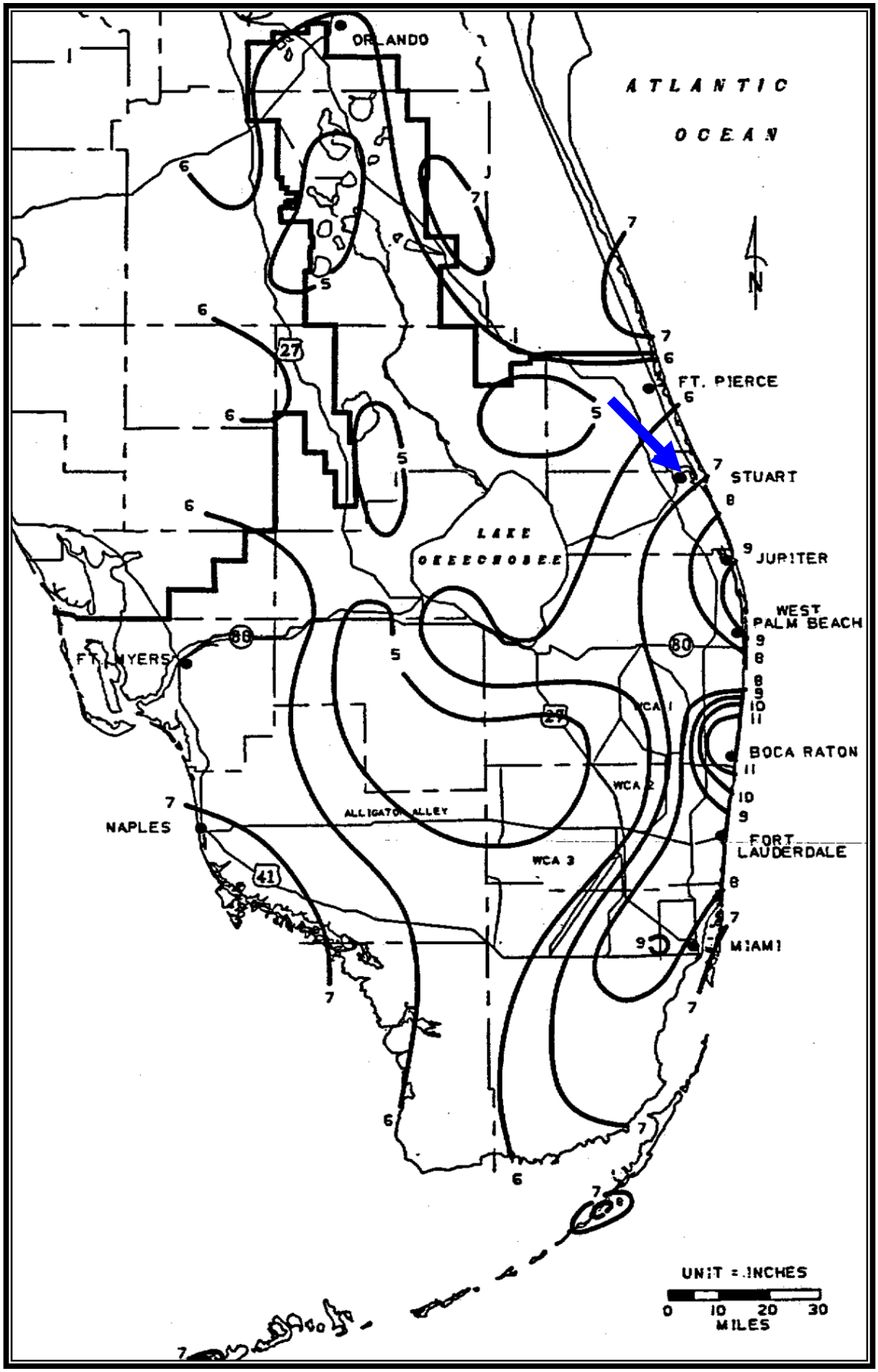


EXHIBIT 5A – SFWMD RAINFALL RECORD (10-YEAR / 1-DAY)
1941 – Sailfish Cove Drainage Report

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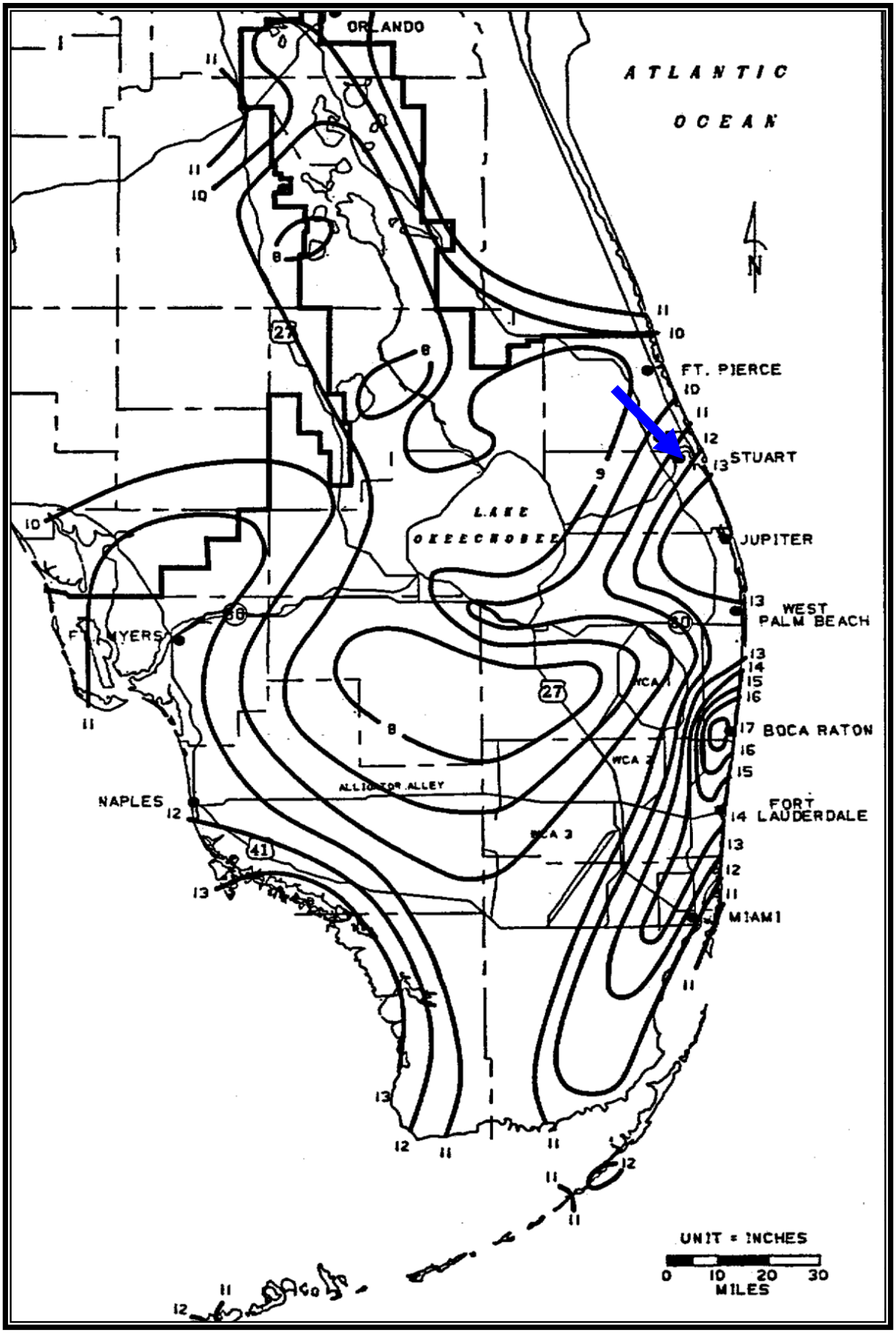


EXHIBIT 5B – SFWMD RAINFALL RECORD (25-YEAR / 3-DAY)
1941 – Sailfish Cove Drainage Report

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Civil Engineering Professionals

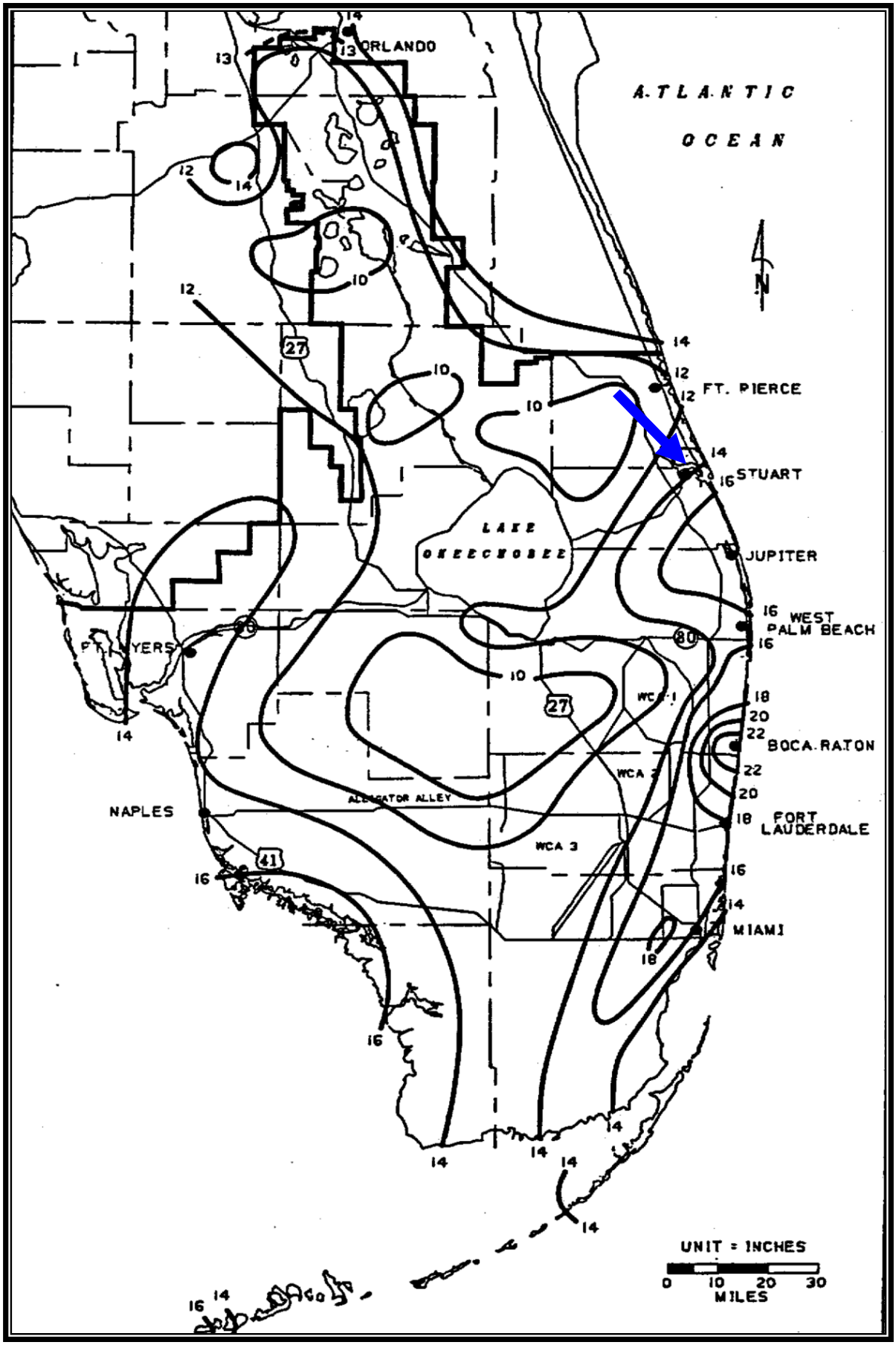


EXHIBIT 5C – SFWMD RAINFALL RECORD (100-YEAR / 3-DAY)
1941 – Sailfish Cove Drainage Report

CAPTEC Engineering, Inc.
Civil Engineering Professionals

Sailfish Cove

City of Stuart, Martin County, Florida

Project No. 1941

APPENDIX 1

Drainage Calculations

1.1 Site Data

1.2 Design Storm

1.3 Water Quality

1.4 Exfiltration

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Project No. 1941

Drainage Calculations

Site Data

Calculate Basin Area

Total Site Area	=	0.92 Ac.
Wetland Area	=	0.00 Ac.
Non Contributing Site Area	=	0.00 Ac.
Total Proposed Developed Basin Area	=	0.92 Ac.

Calculate Impervious Area

Building	=	0.16 Ac.
Other Misc. Impervious Areas	=	0.53 Ac.
Total Impervious Area	=	0.69 Ac.
Total Pervious Area	=	0.23 Ac.

Fema Areas

VE-8	=	0.08 Ac.
Zone-X (Note the proposed building and parking is in Zone X) *	=	0.84 Ac.

* Finished Floor Elevation set at Elevation 12.90 NAVD.

Calculate CN

Land Type	Hydrologic Soil Group	Area	CN
Green Area	D	0.23 Ac.	80
Building		0.16 Ac.	98
Other Misc. Impervious Areas		0.53 Ac.	95
Total Composite CN			91

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Project No. 1941

Drainage Calculations

Soil Storage[1]

Depth to Water Table		>	4.00 Ft.
Soil Storage (4.0 depth to Water Table) for	Coastal	=	10.90 In.
Compaction Reduction (25%) For Developed Area		=	8.18 In.
Pervious Area (Developed)		=	0.23 Ac.
S = 8.18 * (Dev. Perv. / 0.92)		=	2.04 In.

1.) South Florida Water Management District Environmental Resource Permit Applicants Handbook Volume II Effectie October, 2013 Appendix C pages A-12 to A-19

Design Storm (Zero Discharge)

3 Yr. - 1 Day P = 4.20
V=(((4.2-.2*2.04)^2)/(4.2+.8*2.04))*1'/12"*0.92 = 0.19 Ac.-Ft.

5 Yr. - 1 Day P = 5.50
V=(((5.5-.2*2.04)^2)/(5.5+.8*2.04))*1'/12"*0.92 = 0.28 Ac.-Ft.

10 Yr. - 1 Day P = 6.50
V=(((6.5-.2*2.04)^2)/(6.5+.8*2.04))*1'/12"*0.92 = 0.35 Ac.-Ft.

10 Yr. - 3 Day P = 9.10
V=(((9.1-.2*2.04)^2)/(9.1+.8*2.04))*1'/12"*0.92 = 0.54 Ac.-Ft.

25 Yr. - 1 Day P = 7.80
V=(((7.8-.2*2.04)^2)/(7.8+.8*2.04))*1'/12"*0.92 = 0.44 Ac.-Ft.

25 Yr. - 3 Day P = 10.80
V=(((10.8-.2*2.04)^2)/(10.8+.8*2.04))*1'/12"*0.92 = 0.67 Ac.-Ft.

100 Yr. - 1 Day P = 10.00
V=(((10.0-.2*2.04)^2)/(10.0+.8*2.04))*1'/12"*0.92 = 0.61 Ac.-Ft.

100 Yr. - 3 Day P = 13.00
V=(((13.0-.2*2.04)^2)/(13.0+.8*2.04))*1'/12"*0.92 = 0.83 Ac.-Ft.

CAPTEC Engineering, Inc.

Sailfish Cove

Project No. 1941 **Drainage Calculations**

Water Quality Storage

South Florida Water Management District

1.) Water Quality Treatment Volume Required

a) First inch of runoff

Va = 0.92 * 1 In. * (1 Ft./12 In.) = ***0.04 Ac.-Ft.***

b) Runoff from 2.5" * % net impervious

Site Area for Water Quality (S_{WQ}) = Basin - Building - Wtr Mgmt =

= 0.92 Ac. - 0.16 Ac. - 0.00 Ac. = ***0.76 Ac.***

Impervious Area for Water Quality (I_{WQ})= S_{WQ} - Pervious Area =

= 0.76 Ac. - 0.23 Ac. = ***0.53 Ac.***

% Impervious Area for Water Quality = I_{WQ} / S_{WQ}

= 0.53 Ac. / 0.76 Ac. = ***69.74%***

Vb (SFWMD) = % Impervious Area for WQ * (Total Basin Area - Wtr Mgmt) =

= 2.5" * 0.70 * (0.92 - 0.00) * (1 Ft./12 In.) = ***0.08 Ac.-Ft.***

e) Since Vb > Va the water quality volume required

Vc (sfwmd) = Total Water Quality Volume Required = ***0.08 Ac.-Ft.***

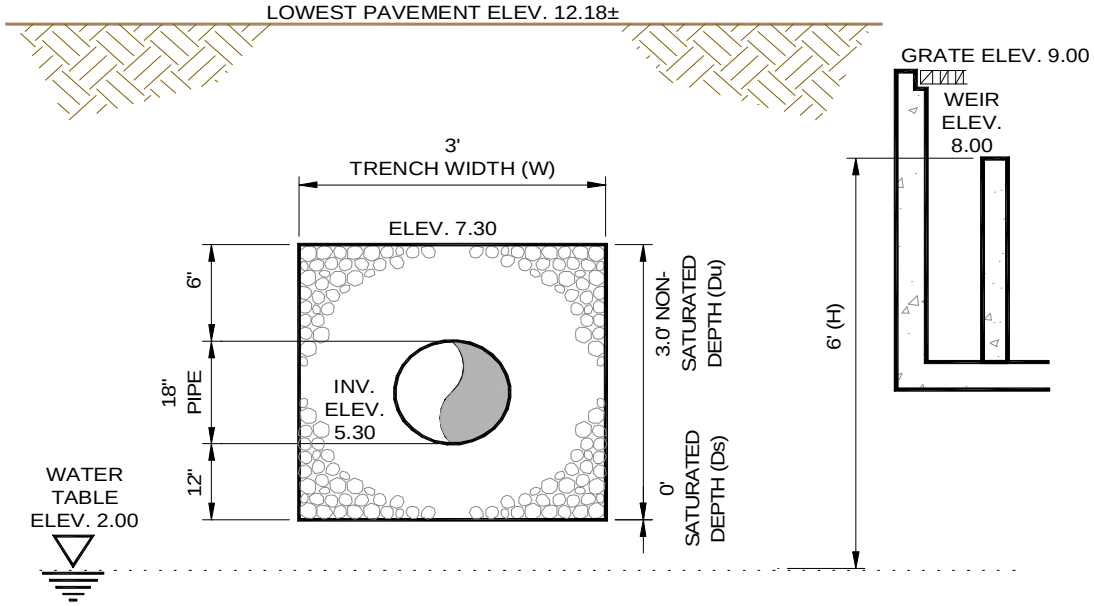
d) TMDL Treatment Volume provided in bio-swale (see **Appendix 2** - BMPTrains)

2.) Water Quality Treatment Volume Provided

Wet Retention (Exfiltration)*	=	***0.61 Ac.-Ft.***	100% Credit	=	***0.61 Ac.-Ft.***
Dry Detention (Bio-Swale)	=	***0.09 Ac.-Ft.***	75% Credit	=	***0.12 Ac.-Ft.***
			Total		***0.73 Ac.-Ft.***
Nutrient Loading Elevation	=	***8.00 Ft.-NAVD***			
WQ Elevation	=	***8.00 Ft.-NAVD***			

Exfiltration Design

a) ** $V = L * (k * (H*W + 2*H*D_U - D_U*D_U + 2*H*D_S) + (0.000139*W*D_U)) / FS$



Where:

V = Volume (Ac.-In.)		
FS = Factor of Safety	=	***2.00***
L = Length of Exfiltration (FT.)	=	***304.00 Ft.***
k = Hydraulic Conductivity (cfs/Ft^2-Ft-Hd) *	=	***1.04E-03***
H = Water Table Depth	=	***6.00 Ft.***
W = Width of Trench	=	***3.00 Ft.***
D_U = Unsaturated Depth	=	***3.00 Ft.***
D_S = Saturated Depth	=	***0.00 Ft.***

V = 304 * (0.001040 * (6*3 + 2*6*3
- 3^2 + 2*6*0) + (0.000139*3*3)) / 2 = ***7.30 Ac.-In.***

Exfiltration Trench Volume Provided: = ***7.30 Ac.-In.***
= ***0.61 Ac.-Ft.***

** Note: See Exfiltration Test in Appendix A - Geotechnical Report.

Sailfish Cove

City of Stuart, Martin County, Florida

Project No. 1941

APPENDIX 2

BMP Train Calculations

CAPTEC Engineering, Inc.

Sailfish Cove BMPTrains (TMDL)
Complete Report (not including cost) Ver 2.0.2

Project: Sailfish Cove
Date: 4/27/2020 9:51:37 AM

Site and Catchment Information

Analysis: Net Improvement

Catchment Name	Sailfish Cove
Rainfall Zone	Florida Zone 5
Annual Mean Rainfall	59.00

Pre-Condition Landuse Information

Landuse	Single-Family: TN=2.070 TP=0.327
Area (acres)	0.92
Rational Coefficient (0-1)	0.16
Non DCIA Curve Number	80.00
DCIA Percent (0-100)	0.00
Nitrogen EMC (mg/l)	2.070
Phosphorus EMC (mg/l)	0.327
Runoff Volume (ac-ft/yr)	0.710
Nitrogen Loading (kg/yr)	1.813
Phosphorus Loading (kg/yr)	0.286

Post-Condition Landuse Information

Landuse	Multi-Family: TN=2.320 TP=0.520
Area (acres)	0.92
Rational Coefficient (0-1)	0.32
Non DCIA Curve Number	91.00
DCIA Percent (0-100)	0.00
Wet Pond Area (ac)	0.00
Nitrogen EMC (mg/l)	2.320
Phosphorus EMC (mg/l)	0.520
Runoff Volume (ac-ft/yr)	1.459
Nitrogen Loading (kg/yr)	4.174
Phosphorus Loading (kg/yr)	0.936

Catchment Number: 1 Name: Sailfish Cove

Project: Sailfish Cove
Date: 4/27/2020

Swale Design	
Swale Top Width for Flood Conditions - **W** (ft)	24.000
Swale Bottom Width - **B** (ft)	4.000
Swale Length - **L** (ft)	35.000
Average Impervious Length (ft)	0.000
Average Impervious Width (ft)	0.000
Average Pervious Width (ft)	24.000
Swale Slope (foot drop/foot length) - **S**	4.000
Mannings N	0.035
Soil Infiltration Rate (in/hr)	45.000
Side Slope of Swale horizontal/vertical - **Z**	4.000

Watershed Characteristics

Catchment Area (acres)	0.92
Contributing Area (acres)	0.920
Non-DCIA Curve Number	91.00
DCIA Percent	0.00
Rainfall Zone	Florida Zone 5
Rainfall (in)	59.00

Surface Water Discharge

Required TN Treatment Efficiency (%)	57
Provided TN Treatment Efficiency (%)	93
Required TP Treatment Efficiency (%)	69
Provided TP Treatment Efficiency (%)	93

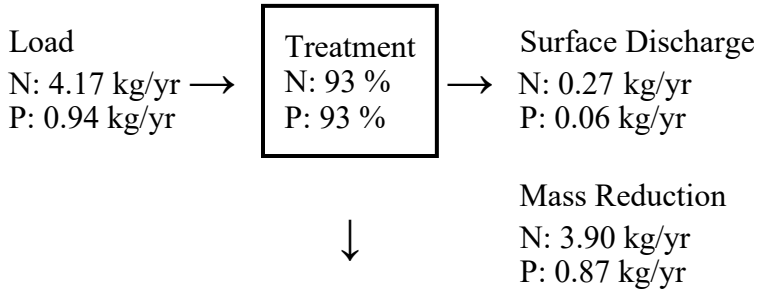
Media Mix Information

Type of Media Mix	Not Specified
Media N Reduction (%)	
Media P Reduction (%)	

Groundwater Discharge (Stand-Alone)

Treatment Rate (MG/yr)	0.444
TN Mass Load (kg/yr)	3.901
TN Concentration (mg/L)	0.000
TP Mass Load (kg/yr)	0.874
TP Concentration (mg/L)	0.000

Load Diagram for Swale (stand-alone)



Sailfish Cove

City of Stuart, Martin County, Florida

Project No. 1941

APPENDIX 3

USDA / NRCS Custom Soil Resource Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for City of Stuart

Sailfish Cove



April 8, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:603 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Martin County, Florida
Survey Area Data: Version 18, Sep 17, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 8, 2019—Mar 28, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
23	Urban land, 0 to 2 percent slopes	0.9	100.0%
Totals for Area of Interest		**0.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Martin County, Florida

23—Urban land, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2x9fc
Elevation: 0 to 200 feet
Mean annual precipitation: 40 to 68 inches
Mean annual air temperature: 68 to 79 degrees F
Frost-free period: 345 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Flatwoods on marine terraces, ridges on marine terraces, rises on marine terraces, hills on marine terraces, knolls on marine terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope, riser, talf, rise
Down-slope shape: Linear, convex
Across-slope shape: Linear
Parent material: No parent material

Minor Components

Matlacha

Percent of map unit: 3 percent
Landform: Flats on marine terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Convex, linear
Across-slope shape: Linear
Hydric soil rating: No

St. augustine

Percent of map unit: 3 percent
Landform: Marine terraces
Landform position (three-dimensional): Tread, rise
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Eaugallie

Percent of map unit: 1 percent
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: No

Immokalee

Percent of map unit: 1 percent
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Riser, talf
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: No

Pomello

Percent of map unit: 1 percent
Landform: Knolls on marine terraces, ridges on marine terraces
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, interfluve, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear
Other vegetative classification: Sand Pine Scrub (R155XY001FL)
Hydric soil rating: No

Boca

Percent of map unit: 1 percent
Landform: Drainageways on marine terraces, flats on marine terraces
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Linear, convex
Across-slope shape: Linear, concave
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: Yes

Myakka

Percent of map unit: 1 percent
Landform: Drainageways on flatwoods on marine terraces
Landform position (three-dimensional): Tread, talf, dip
Down-slope shape: Linear
Across-slope shape: Linear, concave
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: No

Paola

Percent of map unit: 1 percent
Landform: Knolls on marine terraces, ridges on marine terraces
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Side slope, interfluve, riser
Down-slope shape: Convex, linear
Across-slope shape: Linear
Other vegetative classification: Sand Pine Scrub (R155XY001FL)
Hydric soil rating: No

Hallandale

Percent of map unit: 1 percent
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: South Florida Flatwoods (R155XY003FL)
Hydric soil rating: Yes

Adamsville

Percent of map unit: 1 percent
Landform: Knolls on marine terraces, rises on marine terraces
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Upland Hardwood Hammock (R155XY008FL)
Hydric soil rating: No

Apopka

Percent of map unit: 1 percent
Landform: Hills on marine terraces, ridges on marine terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, side slope, riser
Down-slope shape: Convex
Across-slope shape: Linear
Other vegetative classification: Longleaf Pine-Turkey Oak Hills (R155XY002FL)
Hydric soil rating: No

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Sailfish Cove

City of Stuart, Martin County, Florida

Project No. 1941

APPENDIX 4

Geotechnical Engineering Evaluation

(GFA International. – *July 2017*)

July 17, 2017

SBS Properties, LLC.
Attention: Jamie Mix
7991 SE Asaro Street
Hobe Sound, Florida 33455

Subject: Geotechnical Services for Stormwater Management Planning
Seminole Bluff
34 and 41 W Seminole Street
Stuart, Martin County, Florida
GFA Project No. 17-4486.00

Dear Ms. Mix:

We are pleased to submit this geotechnical report for the referenced project. This letter describes the project, field explorations, results of testing, findings, and information from outside references. The scope of services was completed in accordance with our Geotechnical Engineering Proposal (17-4486.00) dated June 12, 2017, planned in conjunction with and authorized by you.

PROJECT DESCRIPTION

Based on a site plan prepared by Gerald Belgrave Designs, LLC latest revision dated 5/3/2017 (reproduced as the Test Location Plan) and conversations with the client, the project consists of constructing a 4-story residential building with underground parking and stormwater treatment below the parking. GFA assumes the top of the parking level floor elevation will be on the order of +4 feet NGVD or more. Details of stormwater treatment methods considered for the project are not available.

Based on elevations from nearby projects, GFA estimates the current grade at about +10 to +12 feet NGVD for the majority of the site except for the north area which slopes sharply down to a seawall and the St. Lucie River with elevation on the order of 0 to +2 feet NGVD.

FIELD EXPLORATIONS

The subsurface conditions at the site were explored on May 24 & 25, 2017, with four (4) Standard Penetration Test (SPT) borings and one (1) auger boring. Subsequently an Exfiltration (EX) test was conducted in the auger borehole. The upper 4 feet of the SPT borings were drilled with a hand auger in order to avoid damaging utilities. Hand Cone

Penetrometer (HCP) readings were taken at one-foot intervals in the auger borings. The HCP test, in conjunction with information about the soil type, is empirically correlated to the relative density of subsurface soils. The SPT borings were performed in general compliance with ASTM D 1586, "Penetration Test and Split-Barrel Sampling of Soils", the auger boring in general compliance with ASTM D 1452, "Practice for Soil Investigation and Sampling by Auger Borings", and the exfiltration test with the SFWMD Usual Open Hole Test procedure. The samples obtained from the borings were classified in general accordance with ASTM D 2488, "Description and Identification of Soils" (Visual-Manual Procedure).

The borings were completed at the approximate locations noted on the Test Location Plan. The boring logs are attached. The depths on the boring logs are below the existing ground surface at the time the borings were performed. The borings were located based on the provided plans and estimated distances to distinguishable landmarks. GPS coordinates obtained at boring locations are noted on logs.

In addition to the present exploration, our firm performed a geotechnical exploration for the proposed building. The results are presented in the GFA Engineering Report No. 17-4486.00 dated on June 12, 2017.

FINDINGS

The project site was generally uneven and grassy with miscellaneous landscaping. The property consists of two lots with existing one and two-story residences. The grade at the site was generally even with, to 2 feet below, the adjacent road at the time of drilling except for the for the north area which slopes sharply down to a seawall and the St. Lucie River. Residential structures were adjacent to the property. The St. Lucie River bordered the north side of the property. Structures were adjacent to the property. There were drainage improvements along the adjacent roadway and properties.

The ground surface elevations at the boring locations were estimated to be about +10 to +12 feet NGVD. The subsurface soil conditions encountered at the boring locations generally consist of:

- +12 to +4 feet NGVD: Very loose to loose sand (SP)
- +4 to -8 feet NGVD: Loose to medium dense sand (SP) with occasional clayey sand (SC) layers
- -8 to depths of -24 to -30 feet NGVD: very loose to medium dense sand (SP)
- -24 to -30 to boring termination depths of -33 to -43 feet NGVD: Medium dense to very dense/hard cemented sand (GP)

The hydraulic conductivity (K-values) at exfiltration test location EX-1 (elevation at test location was 0 to 2 feet below adjacent roadway estimated to be about +10 to +12 feet NGVD) was 1.04×10^{-03} (cfs/ft^2-ft).

Ground water was encountered at depths ranging from 6.5 to 12.1 feet below top of boring elevations at the boring locations.

LABORATORY TESTS

Laboratory permeability tests were run on two (2) selected samples from the borings. The samples were compacted in the permeameter mold to densities that approximated the existing field conditions. After saturating the samples, falling head permeability tests with an initial head of 1½ feet were performed. We consider the test results present a good order of magnitude approximation of the in situ permeabilities. The results are as follows:

Boring	Sample Depth (feet)	Sample Description Summary	Dry Density (pcf)	Coefficient of Permeability, k	
				(cm/sec)	(ft/day)
SPT-1	8 - 11	Brown fine sand, some silt and clay (SC)	91.6	3.9×10^{-4}	1.1
SPT-2	6 - 13	Light brown fine sand (SP)	91.9	5.3×10^{-3}	15.0

*The vertical permeabilites provided should be multiplied by 2 to obtain horizontal permeability values.

Most naturally occurring soils and many man-placed soils are anisotropic soils, which means they have greater horizontal permeabilities than vertical permeabilities, as well as greater horizontal hydraulic conductivities than vertical hydraulic conductivities. Based on the literature and our experience with these types of soil, we recommend using a horizontal permeability value that is twice the vertical permeabilities reported above.

Laboratory tests were performed on selected clayey samples for soil classification purposes. The samples were tested for moisture content (ASTM D 2216) and gradation sieve analysis for clay/silt content determination (ASTM D 422). The moisture contents ranged from 12.4 to 20.1 percent and the silt/clay content passing the No. 200 sieve ranged from 17.1 to 18.4 percent. The test results are shown on the boring logs.

USGS TOPOGRAPHICAL AND USDA SOIL SURVEY INFORMATION

We reviewed the USGS 7.5-minute series quadrangle topographic map of the area, entitled Palm City, FLA. Revisions to this map were based on aerial photographs taken in 1983. The USGS map showed the project site is located on a broad area with an elevation between 0 and 15 feet NGVD. The site property is surrounded by commercial and/or residential development with corresponding drainage improvements. The St. Lucie River borders the east side of the property.

The site is shown on sheet number 9 of the Soil Survey of the Martin County Area, Florida, issued by the U.S. Dept. of Agriculture in April 1981. According to the Soil Survey, Waveland sand (4) occur at the site.

The Soil Survey describes Waveland sand (4) as nearly level, poorly drained soil in broad areas of flatwoods. The soil profile consists of fine sand to fine sand with little silt (SP,SP-SM)(A-3) to a depth of 3½ feet, weakly cemented fine sand with little to some silt (SP-SM,SM)(A-2-4) from 3½ to 7½ feet, then and fine sand with little silt (SP-SM,SM)(A-3,A-2-4) from 7½ to 8¼ feet. With unimproved drainage, under natural conditions the water table is at a depth of less than 10 inches for 2 to 4 months and within a depth of 40 inches for 6 months or more during most years. Permeability is rapid in the surface and subsurface layers and very slow to moderately slow in the subsoil. The high water table is perched and at the ground surface to 1 foot below the ground surface.

It should be noted that the Soil Survey generally extends to a maximum depth of 80 inches (approximately 6¾ feet) below ground surface and is not indicative of deeper soil conditions.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT RAINFALL INFORMATION

According to the SFWMD web site the rainfall in Martin and St. Lucie Counties from May 1 to 24, 2017 was 2.15 inches (80% of normal for that time of month, normal monthly total for all of May is 3.62 inches), for the month of April 2017 was 2.01 inches (74% of monthly normal), for the month of March 2017 was 1.03 inches (29% of monthly normal), for the month of February 2017 was 1.52 inches (66% of monthly normal), for the month of January 2017 was 1.25 inches (55% of monthly normal), for the month of December 2016 was 1.15 inches (50% of monthly normal), for the month of November 2016 was 0.32 inches (11% of monthly normal), for the month of October 2016 was 4.78 inches (92% of monthly normal), for the month of September 2016 was 6.72 inches (95% of monthly normal), for the month of August 2016 was 8.37 inches (105% of monthly normal), for the month of July 2016 was 3.16 inches (48% of monthly normal), for the month of June 2016 was 7.17 inches (104% of monthly normal), and for the month of May 2016 was 8.19 inches (226% of monthly normal).

DISCUSSION AND CONCLUSIONS

The subsurface soils encountered in the borings corresponded somewhat well with the information presented in the Soil Survey. The recent rainfall history indicates that the observed water table level should be about normal for this time of year. Drainage improvements in the vicinity indicate the average wet season high water table should be below that stated in the Soil Survey. The presence of the existing stormwater improvements in the vicinity lowers the surrounding water tables. The presence of the St. Lucie River that borders the east side of the property lowers the surrounding water tables.

The groundwater table will fluctuate seasonally depending upon local rainfall and other site specific and/or local influences including the water level in the nearby St. Lucie River with tidal influences. Brief ponding of stormwater may occur across the site after heavy rains. Due to the proximity of the St. Lucie River on the east side of the property, we anticipate fluctuation of the water table will be due to rain events and the water level in the nearby St.

Lucie River with tidal influences and rain events. The wet season high water table can be taken as at +3.5 feet NGVD for the property.

The soil survey and the soil samples obtained from the borings indicate there are silty and clayey layers with very low permeability. It should be noted for drainage system design that the soils described by the soil survey and boring logs as sand with little/some silt/clay has a low permeability. The Soil Survey generally gives the coefficient of permeability for this material as less than 0.4 feet per day (1.4×10^{-4} cm/sec). Based on our experience the coefficient of permeability ranges from 0.01 to 0.1 feet per day (10^{-4} to 10^{-5} cm/sec) for these low permeability soils. "Perching" of the ground water on top of these layers after rainfall should be expected.

CLOSURE

This consulting report has been prepared for the exclusive use of the current project owners and other members of the design team for the project. This report has been prepared in accordance with generally accepted local geotechnical engineering practices; no other warranty is expressed or implied. The evaluation submitted in this report, is based in part upon the data collected during a field exploration, however, the nature and extent of variations throughout the subsurface profile may not become evident until the time of construction. If variations then appear evident, it may be necessary to reevaluate information and professional opinions as provided in this report. In the event changes are made in the nature, design, or locations of the proposed structure, the evaluation and opinions contained in this report shall not be considered valid, unless the changes are reviewed and conclusions modified or verified in writing by GFA International.

The analysis and recommendations submitted in this report are based on the data obtained from the tests performed. This report does not reflect any variations, which may occur between borings. While the borings are representative of the subsurface conditions at their respective locations and for their vertical reaches, local variations characteristic of the subsurface soils of the region are anticipated and may be encountered. The delineation between soil types shown on the soil logs is approximate and the description represents our interpretation of the subsurface conditions at the designated boring locations on the particular date drilled.

Any third party reliance of our geotechnical report or parts thereof is strictly prohibited without the expressed written consent of GFA International. Any third party reliance of our geotechnical report or parts thereof is strictly prohibited without the expressed written consent of GFA International. The applicable SPT methodology (ASTM D-1586), CPT methodology (ASTM D-3441), and Auger Boring methodology (ASMT D-1452) used in performing our borings/soundings and for determining penetration resistance is specific to the sampling tools utilized and does not reflect the ease or difficulty to advance other tools, equipment or materials.

We appreciate the opportunity to be of service to you on this project and look forward to a continued association. Please contact the undersigned if you have any questions or comments, or if we may further assist you as your plans proceed.

Respectfully Submitted,
GFA INTERNATIONAL, INC.
FBPE Certificate No. 4930



Donald W. Moler, P.E.
Senior Geotechnical Engineer
Florida Registration No. 60675

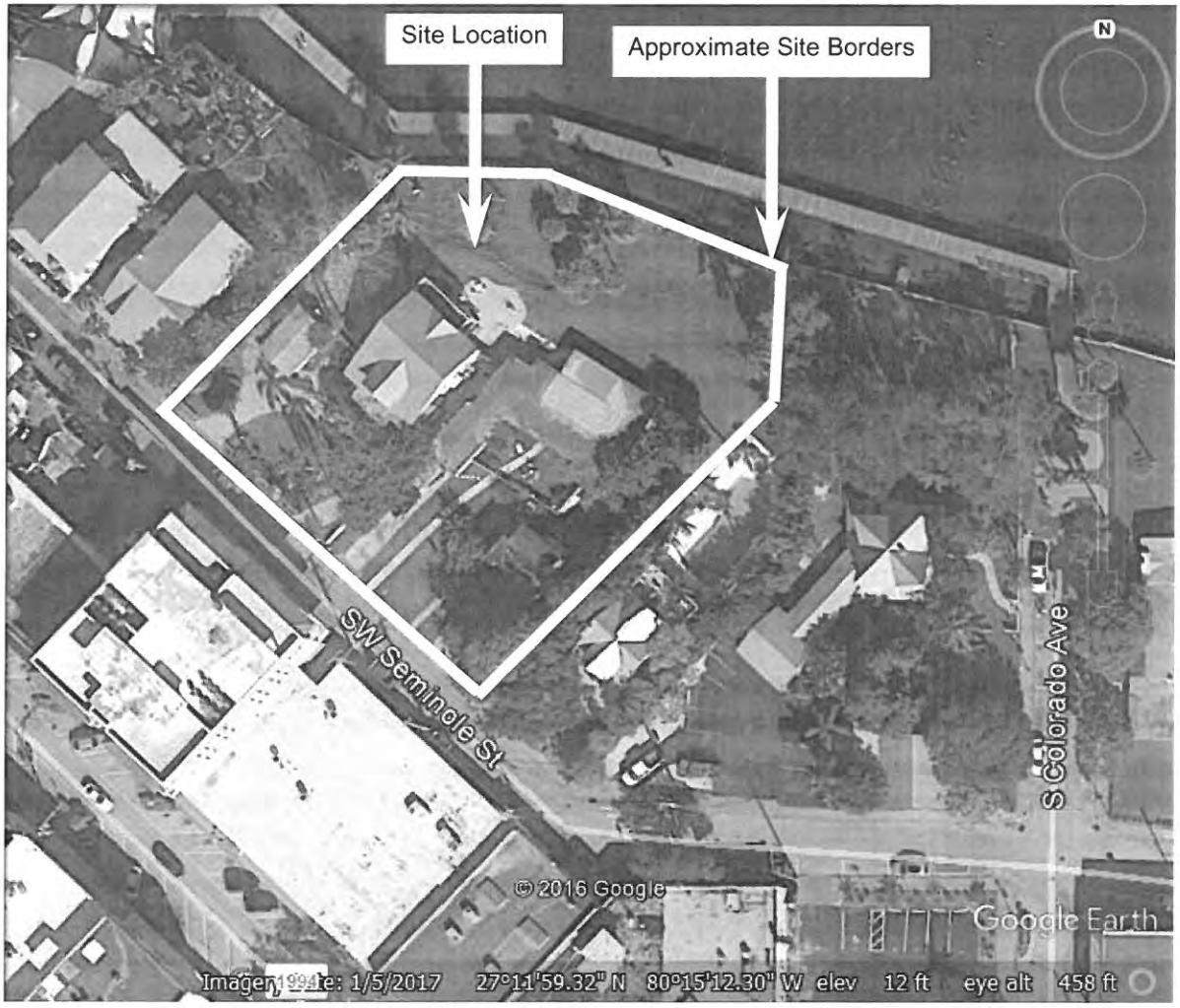
Craig Van Collie, E.I.
Project Manager

Attachments: Vicinity Map
Test Location Plan
SPT Boring Logs (4)
Exfiltration Test Report (1)
Notes Related to Test Borings

Copies: Client (2)

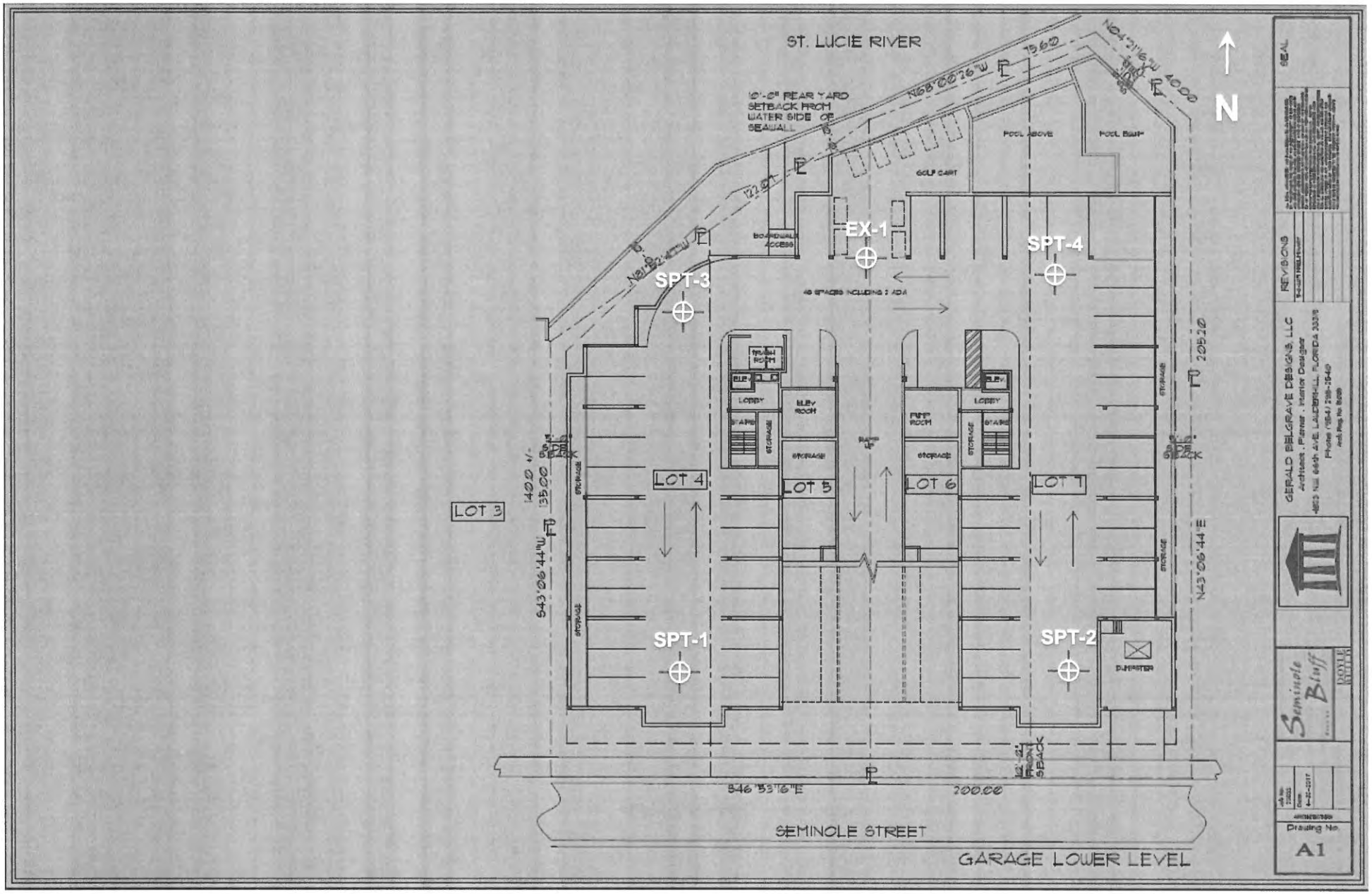
Vicinity Map

37 and 41 W Seminole Street
Stuart, FL
GFA Project No. 17-4486.00



Note: Aerial Photograph from GoogleEarth Website

Test Location Plan: 37 and 41 W Seminole Street, Stuart, FL



Approximate Standard Penetration Test (SPT) Boring & Exfiltration Test (EX) Locations

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PHONE: (772) 924-3575 - FAX: (772) 924-3580

STANDARD PENETRATION TEST BORING (ASTM D-1586)

Client: **SBS Properties, LLC.**

Project: **37 and 41 W Seminole Street**
Stuart, Florida

Elevation: **0 to 2 feet below adjancent roadway (estimated +10 to + 12 feet NGVD)**

Water Level: **12.1 feet after 0 hours** Drilling Fluid commenced at depth of 16 feet

Hand Auger with Hand Cone Pentrometer Test (HCP in ksf) performed in top 4 feet

Project No.: **17-4486.00**
Lab No.:
Page: **1 of 2**
Date: **5/25/2017**
Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: **SPT - 1** N27.19991° W80.25381°

Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Laboratory Tests: Passing No. 200	Moisture Content	Organic Content
0									
1	HCP=	80+	1	0 - 2	SP	Gray fine sand			
2	HCP=	50							
3	HCP=	80+	2	2 - 8	SP	Light gray fine sand			
4	HCP=	80+							
5	4 4								
6	5 6	9	3						
7	4 4								
8	6 7	10	4						
9	4 5			8 - 11	SC	Brown fine sand, some silt and clay			
10	6 7	11	5				17.4%	12.4%	
11	8 6								
12	5 5	11	6	11 - 15	SP	Light brown fine sand			
13	4 4								
14	3 3	7	7						
15	3 3								
16	5 6	8	8	15 - 18½	SP	Gray fine sand			
17	3 3								
18	4 4	7	9						
19	4 5			18½ - 20	SC	Gray fine sand, some silt and clay			
	4 5	9	10				18.4%	19.7%	

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Lab No.:
Page: **2 of 3**
Date: **5/25/2017**
Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: SPT - 1 N27.19991° W80.25381°

Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Laboratory Tests: Passing No. 200	Moisture Content	Organic Content
20									
21									
22									
23									
24	3			23½ - 25	SP	Light brown fine sand			
25	1 1	2	11						
26									
27									
28									
29	2			28½ - 30	SP	Light brown fine sand			
30	1 3	4	12						
31									
32									
33									
34	12			33½ - 35	SP	Light brown fine sand, some cemented sand and shell fragments			
35	8 8	16	13						
36						Drilled hard from 37 to 38½ feet			
37									
38									
39	25			38½ - 40	(GP)	Light gray cemented sand and shell			
	20 20	40	14						

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Project No.: **17-4486.00**
Lab No.:
Page: **3 of 3**
Date: **5/25/2017**
Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: **SPT - 1** N27.19991° W80.25381°

Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Laboratory Tests: Passing No. 200	Moisture Content	Organic Content
40						Drilled hard from 40 to 43½ feet			
41									
42									
43									
44	32			43½ - 45	(GP)	Light gray cemented sand and shell			
	25								
45	10	35	15						
46						Drilled hard from 45 to 48½ feet			
47									
48									
49	26			48½ - 50	(GP)	Light gray cemented sand and shell			
	23								
50	23	46	16			Terminated boring at 50 feet			
51									
52									
53									
54									
55									
56									
57									
58									
59									

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Project No.: **17-4486.00**
Lab No.:

Project: **37 and 41 W Seminole Street**
Stuart, Florida

Page: **1 of 2**
Date: **5/25/2017**

Elevation: **0 to 2 feet below adjancent roadway (estimated +10 to + 12 feet NGVD)**

Drill Rig: **CME45**

Water Level: **12.1 feet after 0 hours** Drilling Fluid commenced at depth of 16 feet

Field Party: **PM/MM**

Hand Auger with Hand Cone Pentrometer Test (HCP in ksf) performed in top 4 feet

TEST LOCATION: SPT - 2 N27.19961° W80.25363°							Laboratory Tests		
Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Passing No. 200	Moisture Content	Organic Content
0				0 - 2	SP	Gray fine sand			
1	HCP=	30	1						
2	HCP=	30							
3	HCP=	30	2	2 - 6	SP	Light gray fine sand			
4	HCP=	30							
5	2 2								
6	2 1	4	3						
7	3 2			6 - 13	SP	Light brown fine sand			
8	2 1	4	4						
9	3 3								
10	5 6	8	5						
11	4 4								
12	5 6	9	6						
13	3 4								
14	4 5	8	7	13 - 20	SP	Gray fine sand			
15	1 2								
16	3 5	5	8						
17	3 2								
18	2 3	4	9						
19	3 3								
	4 4	7	10						

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STANDARD PENETRATION TEST BORING (ASTM D-1586)

Client: **SBS Properties, LLC.**

Project: **37 and 41 W Seminole Street**
Stuart, Florida

Elevation: **0 to 2 feet below adjancent roadway (estimated +10 to + 12 feet NGVD)**

Water Level: **12.1 feet after 0 hours** Drilling Fluid commenced at depth of 16 feet

Project No.: **17-4486.00**
Lab No.:
Page: **2 of 3**
Date: **5/25/2017**
Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: SPT - 2 N27.19961° W80.25363°

Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Laboratory Tests: Passing No. 200	Moisture Content	Organic Content
20									
21									
22									
23									
24	7			23½ - 25	SP	Light brown fine sand			
25	8 9	17	11						
26									
27									
28									
29	5			28½ - 30	SP	Light brown fine sand			
30	7 5	12	12						
31									
32									
33									
34	7			33½ - 35	SP	Light brown fine sand			
35	7 9	16	13						
36									
37									
38									
39	9			38½ - 40	SP	Light brown fine sand			
	7 4	11	14						

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Client: **SBS Properties, LLC.**

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Lab No.:

Project: **37 and 41 W Seminole Street**
Stuart, Florida

Page: **3 of 3**

Date: **5/25/2017**

Elevation: **0 to 2 feet below adjancent roadway (estimated +10 to + 12 feet NGVD)**

Drill Rig: **CME45**

Water Level: **12.1 feet after 0 hours** Drilling Fluid commenced at depth of 16 feet

Field Party: **PM/MM**

TEST LOCATION: SPT - 2 N27.19961° W80.25363°							Laboratory Tests		
Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Passing No. 200	Moisture Content	Organic Content
40									
41						Drilled hard from 42 to 43½ feet			
42									
43									
44	15			43½ - 45	(GP)	Light gray cemented sand and shell			
45	30 20	50	15						
46						Drilled hard from 45 to 47 feet Drilled moderately hard from 47 to 48½ feet			
47									
48									
49	17			48½ - 50	SP	Gray fine sand, little cemented sand and shell			
50	10 9	19	16						
51						Drilled moderately hard from 45 to 48½ feet			
52									
53									
54	30			53½ - 55	SP	Gray fine sand, little cemented sand and shell			
55	26 7	33	17						
56						Terminated boring at 55 feet			
57									
58									
59									

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Client: **SBS Properties, LLC.**

Project No.: **17-4486.00**
Lab No.:

Project: **37 and 41 W Seminole Street**
Stuart, Florida

Page: **1 of 2**
Date: **5/24/2017**

Elevation: **0 to 2 feet below adjancent roadway (estimated +10 to + 12 feet NGVD)**

Drill Rig: **CME45**

Water Level: **6.5 feet after 0 hours** Drilling Fluid commenced at depth of 10 feet

Field Party: **PM/MM**

Hand Auger with Hand Cone Pentrometer Test (HCP in ksf) performed in top 4 feet

TEST LOCATION: SPT - 3 N27.20021° W80.25360°							Laboratory Tests		
Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Passing No. 200	Moisture Content	Organic Content
0				0 - 4	SP	Gray fine sand			
1	HCP=	20	1						
2	HCP=	20							
3	HCP=	10	2						
4	HCP=	10							
5	2 1			4 - 6	SM	Dark brown organically stained fine sand, some silt			
6	2 4	3	3						
7	4 4			6 - 8½	SP	Light gray fine sand			
8	4 4	8	4						
9	3 4			8½ - 10	SP	Light gray fine sand, trace clay			
10	4 8	8	5						
11	6 6			10 - 12	SP	Light gray fine sand			
12	8 8	14	6						
13	9 9			12 - 14	SC	Light gray fine sand, some silt and clay			
14	10 9	19	7				17.1%	20.1%	
15	10 9			14 - 20	SP	Light brown fine sand			
16	14 14	23	8						
17	7 13								
18	15 18	28	9						
19	6 5								
	7 9	12	10						

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STANDARD PENETRATION TEST BORING (ASTM D-1586)

Client: **SBS Properties, LLC.**

Project: **37 and 41 W Seminole Street**
Stuart, Florida

Elevation: **0 to 2 feet below adjancent roadway (estimated +10 to + 12 feet NGVD)**

Water Level: **6.5 feet after 0 hours** Drilling Fluid commenced at depth of 10 feet

Project No.: **17-4486.00**
Lab No.:
Page: **2 of 3**
Date: **5/24/2017**
Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: SPT - 3 N27.20021° W80.25360°

Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Laboratory Tests: Passing No. 200	Moisture Content	Organic Content
20									
21									
22									
23									
24	7			23½ - 25	SP	Light brown fine sand			
25	8 10	18	11						
26									
27									
28									
29	10			28½ - 30	SP	Light brown fine sand			
30	9 11	20	12						
31									
32									
33									
34	4			33½ - 35	SP	Brown fine sand			
35	2 2	4	13						
36						Drilled hard from 36 to 38½ feet			
37									
38									
39	50/3"			38½ - 40	(GP)	Light gray cemented sand and shell			
		50/3"	14						

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Water Level: **6.5 feet after 0 hours** Drilling Fluid commenced at depth of 10 feet

Project No.: **17-4486.00**
Lab No.:
Page: **3 of 3**
Date: **5/24/2017**
Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: **SPT - 3** N27.20021° W80.25360°

Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Laboratory Tests: Passing No. 200	Moisture Content	Organic Content
40									
41						Drilled hard from 40 to 43½ feet			
42									
43									
44	31			43½ - 45	(GP)	Light gray cemented sand and shell			
	12								
45	16	28	15			Terminated boring at 45 feet			
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									

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Project: **37 and 41 W Seminole Street**
Stuart, Florida

Page: **1 of 2**

Date: **5/24/2017**

Elevation: **0 to 2 feet below adjancent roadway (estimated +10 to + 12 feet NGVD)**

Drill Rig: **CME45**

Water Level: **10.0 feet after 0 hours** Drilling Fluid commenced at depth of 10 feet

Field Party: **PM/MM**

Hand Auger with Hand Cone Pentrometer Test (HCP in ksf) performed in top 4 feet

TEST LOCATION: SPT - 4 N27.19993° W80.25316°							Laboratory Tests		
Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Passing No. 200	Moisture Content	Organic Content
0				0 - 2	SP	Gray fine sand			
1	HCP=	30	1						
2	HCP=	40							
3	HCP=	50	2	2 - 10	SP	Light gray fine sand			
4	HCP=	50							
5	3 3								
6	3 3	6	3						
7	3 4								
8	4 5	8	4						
9	5 4								
10	5 6	9	5						
11	10 7			10 - 12	SP	Brown fine sand			
12	8 8	15	6						
13	4 5			12 - 18	SP	Light gray fine sand			
14	7 8	12	7						
15	7 5								
16	6 6	11	8						
17	5 5								
18	6 7	11	9						
19	6 4			18 - 20	SP	Gray fine sand			
	2 2	6	10						

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Lab No.:
Page: **2 of 3**
Date: **5/24/2017**
Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: SPT - 4 N27.19993° W80.25316°							Laboratory Tests		
Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Passing No. 200	Moisture Content	Organic Content
20									
21									
22									
23									
24	9			23½ - 25	SP	Light brown fine sand			
25	10 10	20	11						
26									
27									
28									
29	8			28½ - 30	SP	Light brown fine sand			
30	10 15	25	12						
31									
32									
33									
34	9			33½ - 35	SP	Light brown fine sand			
35	11 15	26	13						
36									
37									
38									
39	12			38½ - 40	SP	Light brown fine sand			
	15 16	31	14						

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Drill Rig: **CME45**
Field Party: **PM/MM**

TEST LOCATION: SPT - 4 N27.19993° W80.25316°

Depth (feet)	Blows/ 6 in.	N Value	Sample No.	Layer: From/to	USCS	Description	Laboratory Tests: Passing No. 200	Moisture Content	Organic Content
40									
41						Drilled hard from 42 to 43½ feet			
42									
43									
44	50/1"			43½ - 45	(GP)	Light gray cemented sand and shell			
45		50/1"	15						
46						Drilled hard from 45 to 48½ feet			
47									
48									
49	50/1"			48½ - 50	SP	Gray fine sand, little cemented sand and shell			
50		50/1"	16						
51						Terminated boring at 50 feet			
52									
53									
54									
55									
56									
57									
58									
59									

Since 1988

Florida's Leading Engineering Source

EXFILTRATION TEST
South Florida Water Management District - Usual Open Hole Test

Client: John J Doyle Builder
1314 East Las Olas Blvd.
Ft. Lauderdale, Florida 33301

Site: 37 and 41 W Seminole Street
Stuart, Florida

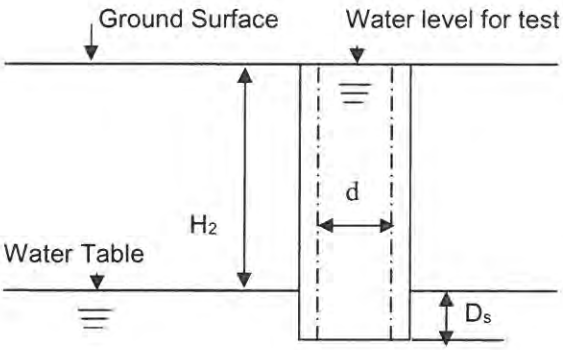
Project No: 17-4486.00
Report No: -----

Test Date: 5/24/2017
Technicians: CC/PM/MM

SOIL PROFILE

Test Location:	EX-1 (see Test Location Plan)	Depth (feet)	Soil Description
N27.20005° W80.25348°			Note: Elevation at test location was 0 to 2 feet below adjacent
			roadway (estimated to be +10 to +12 feet NGVD)
		0 - 1½	Gray fine sand (SP)
		1½ - 4½	Light gray fine sand (SP)
		4½ - 6	Brown fine sand (SP)
		Depth to Water Table from Ground Surface (feet)	>6

CALCULATION OF HYDRAULIC CONDUCTIVITY



$$K = \frac{4Q}{\pi d(2H_2^2 + 4H_2D_S + H_2d)}$$

K	Hydraulic Conductivity (cfs/ ft² – ft head)	**1.04 x 10^{-03}**
Q	Stabilized Flow Rate (cubic ft per second)	**2.01 x 10^{-02}**
d	Diameter of Test Hole (feet)	**0.33**
H_2	Depth to Water Table (feet)	**6.0***
D_S	Saturated Hole Depth (feet)	**0.0**
Notes: * Used for calculations – Actual Water Table >6 feet		

Distribution:
Client

Reviewed by:
GFA INTERNATIONAL

DONALD W. MOLER LICENSE No. 60675 STATE OF FLORIDA PROFESSIONAL ENGINEER

Donald W. Moler, P.E.
Florida Registration No. 60675

NOTES RELATED TO
RECORDS OF TEST BORING AND
GENERALIZED SUBSURFACE PROFILE

1. Groundwater level was encountered and recorded (if shown) following the completion of the soil test boring on the date indicated. Fluctuations in groundwater levels are common; consult report text for a discussion.

2. The boring location was identified in the field by offsetting from existing reference marks and using a cloth tape and survey wheel.

3. The borehole was backfilled to site grade following boring completion, and patched with asphalt cold patch mix when pavement was encountered.

4. The Record of Test Boring represents our interpretation of field conditions based on engineering examination of the soil samples.

5. The Record of Test Boring is subject to the limitations, conclusions and recommendations presented in the Report text.

6. "Field Test Data" shown on the Record of Test Boring indicated as 11/6 refers to the Standard Penetration Test (SPT) and means 11 hammer blows drove the sampler 6 inches. SPT uses a 140-pound hammer falling 30 inches.

7. The N-value from the SPT is the sum of the hammer blows required to drive the sampler the second and third 6-inch increments.

8. The soil/rock strata interfaces shown on the Records of Test Boring are approximate and may vary from those shown. The soil/rock conditions shown on the Records of Test Boring refer to conditions at the specific location tested; soil/rock conditions may vary between test locations.

9. Relative density for sands/gravels and consistency for silts/clays are described as follows:

SPT	CPT	SANDS/GRAVELS	SPT	CPT	SILTS/CLAYS
BLOWS/FOOT	KG/CM^2	RELATIVE DENSITY	BLOWS/FOOT	KG/CM^2	CONSISTENCY
0-4	0-16	Very loose	0-1	0-3	Very soft
5-10	17-40	Loose	2-4	4-6	Soft
11-30	41-120	Medium Dense	5-8	7-12	Firm
31-50	121-200	Dense	9-15	13-25	Stiff
50+	over 200	Very Dense	16-30	25-50	Very stiff
			>30	>50	Hard

10. Grain size descriptions are as follows:

NAME	SIZE LIMITS
Boulder	12 Inches or more
Cobbles	3 to 12 Inches
Coarse Gravel	¾ to 3 Inches
Fine Gravel	No. 4 sieve to ¾ inch
Coarse Sand	No. 10 to No. 4 sieve
Medium Sand	No. 40 to No. 10 sieve
Fine Sand	No. 200 to No. 40 sieve
Fines	Smaller than No. 200 sieve

11. Definitions related to adjectives used in soil/rock descriptions:

PROPORTION	ADJECTIVE	APPROXIMATE ROOT DIAMETER	ADJECTIVE
<5%	Trace	Less than 1/32"	Fine roots
5% to 12%	Little	1/32" to ¼"	Small roots
12% to 30%	Some	¼" to 1"	Medium roots
30% to 50%	And	Greater than 1"	Large roots
Organic Soils: Soils containing vegetable tissue in various stages of decomposition that has a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor. Organic Content <25%: Slightly to Highly Organic; 25% to 75%: Muck; >75%: Peat			

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