

REVIEW COPY

REPORT OF **GEOTECHNICAL INVESTIGATION**

BRIDGE REPLACEMENT
ALAFIA RIVER STATE PARK
HILLSBOROUGH COUNTY, FLORIDA

Prepared For:

HYDRA ENGINEERING & CONSTRUCTION, LLC
36 JASPER THOMAS ROAD
CRAWFORDVILLE, FLORIDA 32327

Prepared By:

ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.
3676 HARTSFIELD ROAD
TALLAHASSEE, FLORIDA 32303
(850) 386-1253

July 2023
81-28-23-01

ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC.

July 14, 2023

EGS File: 81-28-23-01

Hydra Engineering & Construction, LLC
36 Jasper Thomas Road
Crawfordville, Florida 32327

ATTN: Leslie Weiss, P.E., CGC, F.ASCE
President

SUBJECT: **Review Copy** - Report of Geotechnical Investigation
Bridge Replacement
Alafia River State Park
Hillsborough County, Florida

Dear Leslie:

Environmental and Geotechnical Specialists, Inc. (**EGS**) has completed the Geotechnical Investigation, as authorized by Hydra Engineering & Construction, LLC (**Hydra**), for the proposed bridge replacement in the Alafia River State Park in Hillsborough County, Florida. This Report includes a summary of the subsurface investigation, an evaluation of field and laboratory test data, geotechnical design parameters and recommendations, and construction considerations.

SCOPE OF SERVICES

The Scope of Services for this investigation included the following:

- Installation of 2 Standard Penetration Test (**SPT**) to assess subsoil conditions within the study area;
- Measuring groundwater levels;
- Performance of routine laboratory testing on representative soil samples for uniformity and classification;
- Developing geotechnical design parameters and recommendations; and,
- Preparation of this Report.

SITE LOCATION AND EXISTING CONDITIONS

The project site is located in Lithia, Florida, approximately 4¼ miles north of State Road (SR) 674 and ¼-mile east of South County Road 39 in southwest Hillsborough County. A Project Location Map has been provided as **Figure 1**.

The United States Geological Survey (**USGS**) topographic contours have been overlain on aerial photography in the Aerial View Map, provided as **Figures 2A** and **2B**. As can be seen in these **Figures**, the existing topography surrounding the project area gradually slopes downward from the northwest and the east, with ground surface elevations (EL) ranging between about EL 100 to EL 60 feet as referenced to the North American Vertical Datum of 1988 (NAVD 88). At the subject bridge crossing, which is along a powerline easement, the topography is relatively flat with ground surface elevations ranging between approximately EL 70 and EL 60 feet.

As part of this investigation, **EGS** reviewed Florida Geological Survey (**FGS**) maps for potential karst features (i.e., closed basin depressional features) within the project area. As can be seen on **Figure 2A**, a potential karst feature is mapped by the **FGS** within approximately 1,500 feet east of the proposed construction.

PROPOSED CONSTRUCTION

EGS understands that the proposed replacement bridge will be a single span structure approximately 35 feet long, 9 feet wide and will consist of steel beams supporting timber decking. The proposed foundation will consist of a cast-in-place concrete footing underlain by No. 57 Stone at each end abutment, which will be “wrapped” with vinyl sheet pile walls.

PROPOSED SUBSURFACE INVESTIGATION

The subsurface investigation was conducted by **EGS** in June of 2023. Kevin Sweeney, P.E. served as the Geotechnical Engineer of Record. Additional project oversight and QA/QC was provided by **EGS** Senior Geotechnical Engineer, Craig Dunkelberger, P.E.

EGS installed 2 Standard Penetration Test (**SPT**) soil borings using a mechanized rotary drill and an automatic hammer. These soil borings were drilled to a depth of about 28 feet below the existing ground surface at each end of the proposed replacement bridge structure.

In order to reduce potential impacts to mismarked or unmarked utilities, the SPT soil borings were hand-augered within the top 5½ feet coupled with static hand Cone Penetration Index (**CPI**) tests conducted on 1-foot intervals. A summary of the soil boring labels, depths, and approximate locations are provided in **TABLE 1** with a plan view of the soil boring locations shown in **Figure 2B** and on the *Report of Soil Borings* plan sheet provided in **APPENDIX A**.

The **SPT** soil borings were installed in accordance with **ASTM D1586**. Sampling was performed continuously in the top 12 feet, and then on 2½-foot intervals to the boring termination depth. **CPI** values were converted to equivalent **SPT “N”** values using the correlation **N=CPI/4**.

Soil samples collected from the **SPT** soil borings were classified in the field by **EGS** personnel, placed in sealed, water-proof bags, then delivered to the **EGS** geotechnical laboratory for classification testing. The laboratory tests included water content and grain-size distribution testing.

The soils were classified using the Unified Soil Classification System (**USCS**). A summary of the testing performed has been provided on the *Report of Soil Borings* plan sheet included in **APPENDIX A**. Additionally, Soil Boring Logs and Soil Classification Data Sheets have been provided as **APPENDICES B** and **C**, respectively.

SUBSURFACE CONDITIONS

Soils - As can be seen in the “Generalized” Design Soil Profile illustrated in **Figure 3**, the encountered soils consisted of Loose to Medium Dense Medium to Fine Sand (**SP** to **SP-SM**) and Moderately Soft Weathered Limestone to a depth of about 15 feet below the existing ground surface. Below a depth of 15 feet, the subsurface materials consisted primarily of Hard Weathered Limestone to the boring termination depths.

Groundwater - As can be seen on the *Report of Soil Borings* plan sheet, the depth to the measured groundwater ranged from about 5½ to 6 feet below the ground surface. **TABLE 1** provides a summary of the measured groundwater depths. For the purpose of this Report, **EGS** assumed the water level to be at the ground surface for applicable computations.

Karst Conditions - Based on the subsurface materials encountered during the Geotechnical Investigation outlined in this Report, **EGS** believes the likelihood for development of sinkholes resulting from the proposed construction is low.

GEOTECHNICAL DESIGN RECOMMENDATIONS

Foundation Preparation - In order to construct a firm bearing and working surface, **EGS** recommends the following preparation for the proposed structural footings:

- Excavate the subsoils to a depth of approximately 2 feet below the bottom of the proposed footings;
- Backfill the excavation with No. 57 Stone in combination with a filter fabric and geotextile reinforcement as detailed in the Coarse Aggregate Reinforcement Detail provided as **Figure 4**. The No. 57 stone is to be placed in maximum 6-inch thick lifts and compacted to a firm and stable condition as determined by visual inspection by a qualified on-site materials testing representative.

As detailed in **Figure 4**, the filter fabric shall consist of a Mirafi 140N nonwoven geotextile, or equivalent, and shall be fully wrapped around the No. 57 Stone. The geotextile reinforcement shall consist of a Tensar BX1200 or equivalent. All edges, sides, and seams of the filter fabric and geotextile shall be overlapped a minimum of 24-inches.

Geotechnical Design Parameters - Based on the soil borings conducted for this Geotechnical Investigation and understanding that the bearing surface will be prepared as outlined above, the Geotechnical Design Parameters provided in **TABLE 2** may be considered for a shallow foundation analysis. Sample calculations used to develop the geotechnical design parameters are provided in **APPENDIX D**.

Miscellaneous Backfill - **EGS** recommends that the backfill soils placed above the structural footing consist of clean sands (**SP**, **SP-SM**, **SM**) with less than 15% passing the No. 200 sieve and less than 3% organic content. Fill soil shall be placed in lifts not to exceed 6 inches of compacted soil and compacted to at least 100% of the soil's maximum Standard Proctor (ASTM D698) dry density.

Sheet Pile Retaining Walls - The geotechnical design parameters presented in **TABLES 3A** and **3B** may be used for design of the proposed vinyl sheet pile walls.

CONSTRUCTION CONSIDERATIONS

Groundwater Impacts and Dewatering - All construction is to be performed in the dry, therefore the Contractor should expect that control of surface water and groundwater may be necessary. Dewatering should be performed in accordance with the latest edition of the **FDOT Standard Specifications**. Selection of an appropriate dewatering system is dependent on the Contractor's means and methods and is therefore the Contractor's responsibility.

Plans Preparation - **EGS** recommends the following be included in the Construction Plans:

- *Report of Soil Borings* plan sheet included in **APPENDIX A**.

CLOSURE

The data and results presented in this Report of Geotechnical Investigation are intended for use by Hydra Engineering & Construction, LLC for the proposed Alafia River State Park Bridge Replacement project, identified herein. This data may not be used without the expressed written consent of Hydra Engineering & Construction, LLC. This Report is not intended for any other use and will likely not be applicable. This Report shall not be reproduced, except in full, without the written approval of Environmental and Geotechnical Specialists, Inc. The data and recommendations presented in this Report are based on the soil borings made at the specific locations and depths noted. Subsurface conditions at other locations may vary significantly from those presented herein. Should data become available which is different from the data presented herein, Environmental and Geotechnical Specialists, Inc. requests the opportunity to review the data and make any modifications to the design recommendations that may be appropriate.

If you have any questions concerning the information contained in this Report, please do not hesitate to call me at (850) 536-8365.

Sincerely,

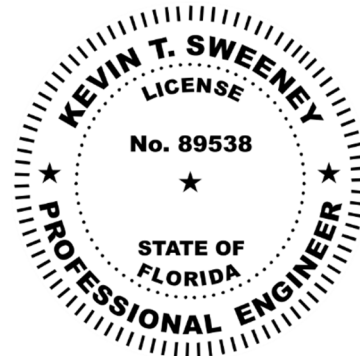
Environmental & Geotechnical Specialists, Inc.
Certificate of Authorization: 6222

For Review

Kevin T. Sweeney, P.E.
Geotechnical Project Manager
FL P.E. No.: 89538

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY KEVIN SWEENEY 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.



TABLES

TABLE 1
SOIL BORING LOCATION AND GROUNDWATER DATA
BRIDGE REPLACEMENT
ALAFIA RIVER STATE PARK
HILLSBOROUGH COUNTY, FLORIDA

BORING LABEL	BORING DEPTH ¹	GROUND SURFACE ELEVATION ²	GLOBAL POSITIONING SYSTEM (GPS) COORDINATES ³				MEASURED GROUNDWATER DEPTH ¹	APPROXIMATE SURFACE WATER ELEVATION ⁴
	(FEET)		LATITUDE		LONGITUDE			
			DEG (°)	MIN (')	DEG (°)	MIN (')		
AR-B-1	28.2	--	27	45.986	82	8.483	6.0	60.0 ⁴
AR-B-2	28.8	--	27	45.993	82	8.482	5.5	60.0 ⁴

NOTES: 1. DEPTHS MEASURED BELOW EXISTING GROUND SURFACE.
2. GROUND SURFACE ELEVATIONS AT SOIL BORING LOCATIONS NOT AVAILABLE AT TIME OF SUBMITTAL.
3. BORING LOCATIONS ARE APPROXIMATE & BASED ON MEASUREMENTS RECORDED USING A TRIMBLE GEOEXPLORER XH HANDHELD UNIT.
4. APPROXIMATE SURFACE WATER ELEVATION FROM PRELIMINARY PLANS PROVIDED BY G.S. PREBLE ENGINEERING, INC.

TABLE 2
GEOTECHNICAL DESIGN PARAMETERS - SHALLOW FOUNDATIONS
BRIDGE REPLACEMENT
ALAFIA RIVER STATE PARK
HILLSBOROUGH COUNTY, FLORIDA

DESIGN SPT N-VALUE ¹ N_{60}	FRICTION ANGLE ϕ (DEGREES)	EFFECTIVE UNIT WEIGHT γ' (LB/FT ²)	NOMINAL BEARING RESISTANCE q_{nom} (LB/FT ²)	FACTORED BEARING RESISTANCE q_{all} (LB/FT ²)	MODULUS SUBGRADE REACTION K_s (LB/FT ²)	TOTAL SETTLEMENT S (IN)	LONG-TERM DIFFERENTIAL SETTLEMENT ΔS (IN)
10	30	53	5,300	2,100	43,200	≤ 1.0	≤ 1.0

NOTES: 1. DESIGN SPT N-VALUE (N_{60}) CORRECTED FOR HAMMER EFFICIENCY.
2. GEOTECHNICAL DESIGN PARAMETERS APPLY IF FOUNDATION IS CONSTRUCTED AS OUTLINED IN THE COARSE AGGREGATE REINFORCMENT DETAIL SHEET PROVIDED IN FIGURE 4.

TABLE 3A
GEOTECHNICAL DESIGN PARAMETERS - VINYL SHEET PILE WALLS
BRIDGE REPLACEMENT
ALAFIA RIVER STATE PARK
HILLSBOROUGH COUNTY, FLORIDA

TOP OF LAYER DEPTH	BOTTOM OF LAYER DEPTH	LAYER SPT 'N ₆₀ ' VALUE ¹	TOTAL SOIL UNIT WEIGHT, γ	EFFECTIVE SOIL UNIT WEIGHT, γ'	COHESION, c	ADHESION, c _a	ANGLE OF INTERNAL FRICTION, ϕ	WALL-SOIL FRICTION ANGLE, δ	RANKINE ACTIVE EARTH PRESSURE COEFFICIENT k _a	RANKINE PASSIVE EARTH PRESSURE COEFFICIENT k _p	SOIL DESCRIPTION
(FEET)	(FEET)		(LB/FT ³)	(LB/FT ³)	(LB/FT ²)	(LB/FT ²)	(DEGREES)	(DEGREES)			
SOUTHERN BRIDGE ABUTMENT (SOIL BORING AR-B-1)											
0	15	10	115	53	0	0	30	15	0.33	3.00	LOOSE TO MEDIUM DENSE MEDIUM TO FINE SAND (SP TO SP-SM)
15 ²	20 ²	60	120	58	2,000	600	0	0	1.00	1.00	HARD TO VERY HARD WEATHERED LIMESTONE
20	25	15	115	53	0	0	33	17	0.29	3.39	MODERATELY SOFT WEATHERED LIMESTONE
25	28	100	120	58	2,000	600	0	0	1.00	1.00	HARD TO VERY HARD WEATHERED LIMESTONE

NOTES: 1. SPT 'N₆₀' VALUE HAS BEEN CORRECTED FOR HAMMER EFFICIENCY.

2. PRACTICAL REFUSAL CONDITIONS AND/OR SHEET PILE DAMAGE MAY OCCUR IF SHEET PILES ARE INSTALLED INTO THIS LAYER.

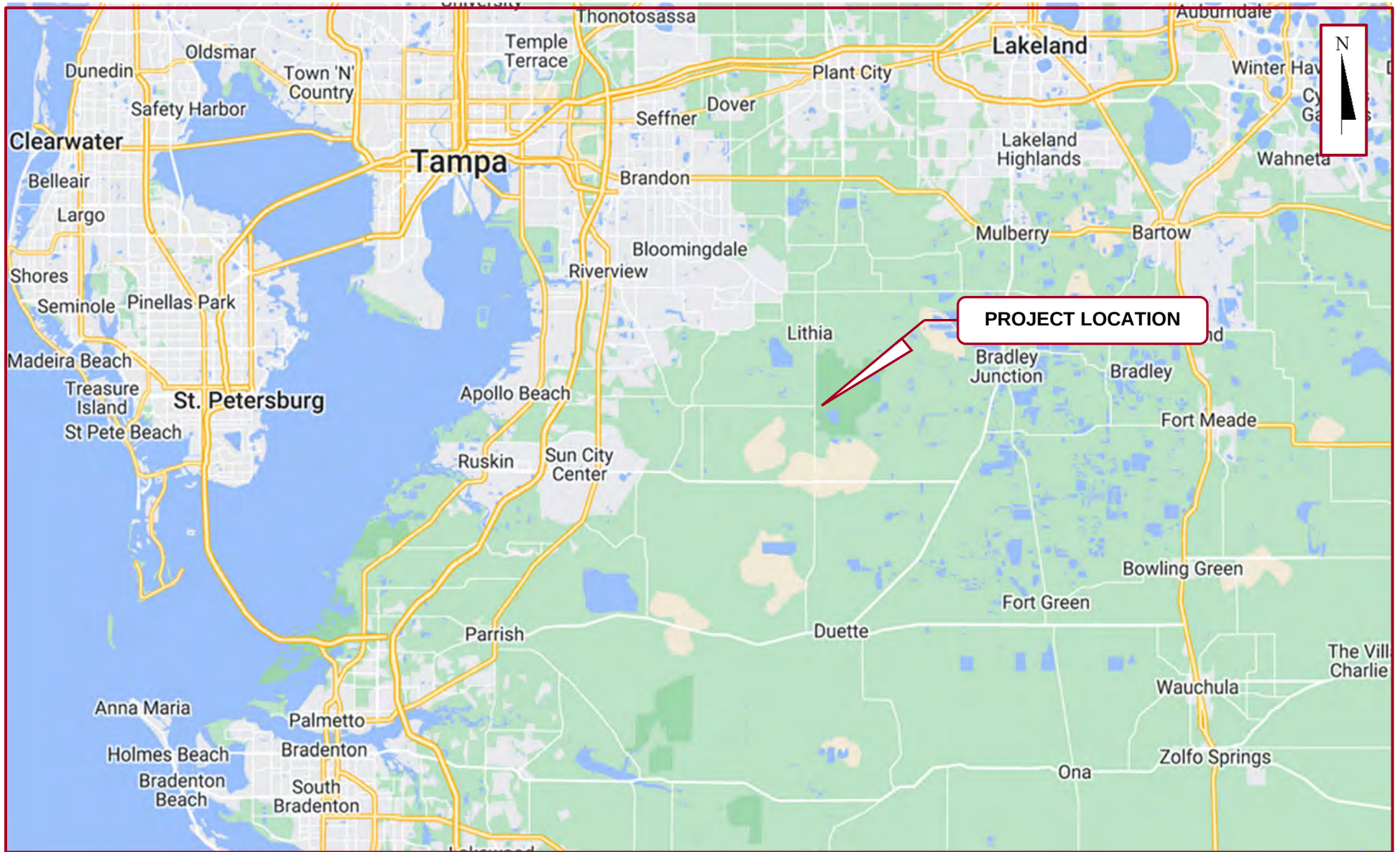
TABLE 3B
GEOTECHNICAL DESIGN PARAMETERS - VINYL SHEET PILE WALLS
BRIDGE REPLACEMENT
ALAFIA RIVER STATE PARK
HILLSBOROUGH COUNTY, FLORIDA

TOP OF LAYER DEPTH (FEET)	BOTTOM OF LAYER DEPTH (FEET)	LAYER SPT 'N ₆₀ ' VALUE ¹	TOTAL SOIL UNIT WEIGHT, γ (LB/FT ³)	EFFECTIVE SOIL UNIT WEIGHT, γ' (LB/FT ³)	COHESION, c (LB/FT ²)	ADHESION, c_a (LB/FT ²)	ANGLE OF INTERNAL FRICTION, ϕ (DEGREES)	WALL-SOIL FRICTION ANGLE, δ (DEGREES)	RANKINE ACTIVE EARTH PRESSURE COEFFICIENT k_a	RANKINE PASSIVE EARTH PRESSURE COEFFICIENT k_p	SOIL DESCRIPTION
NORTHERN BRIDGE ABUTMENT (SOIL BORING AR-B-2)											
0	9	10	115	53	0	0	30	15	0.33	3.00	LOOSE TO MEDIUM DENSE MEDIUM TO FINE SAND (SP TO SP-SM)
9 ²	15 ²	20	115	53	0	0	33	17	0.29	3.39	MODERATELY SOFT WEATHERED LIMESTONE
15 ²	20 ²	60	120	58	2,000	600	0	0	1.00	1.00	HARD TO VERY HARD WEATHERED LIMESTONE
20	25	15	115	53	0	0	33	17	0.29	3.39	MODERATELY SOFT WEATHERED LIMESTONE
25	28	100	120	58	2,000	600	0	0	1.00	1.00	HARD TO VERY HARD WEATHERED LIMESTONE

NOTES: 1. SPT 'N₆₀' VALUE HAS BEEN CORRECTED FOR HAMMER EFFICIENCY.

2. PRACTICAL REFUSAL CONDITIONS AND/OR SHEET PILE DAMAGE MAY OCCUR IF SHEET PILES ARE INSTALLED INTO THIS LAYER.

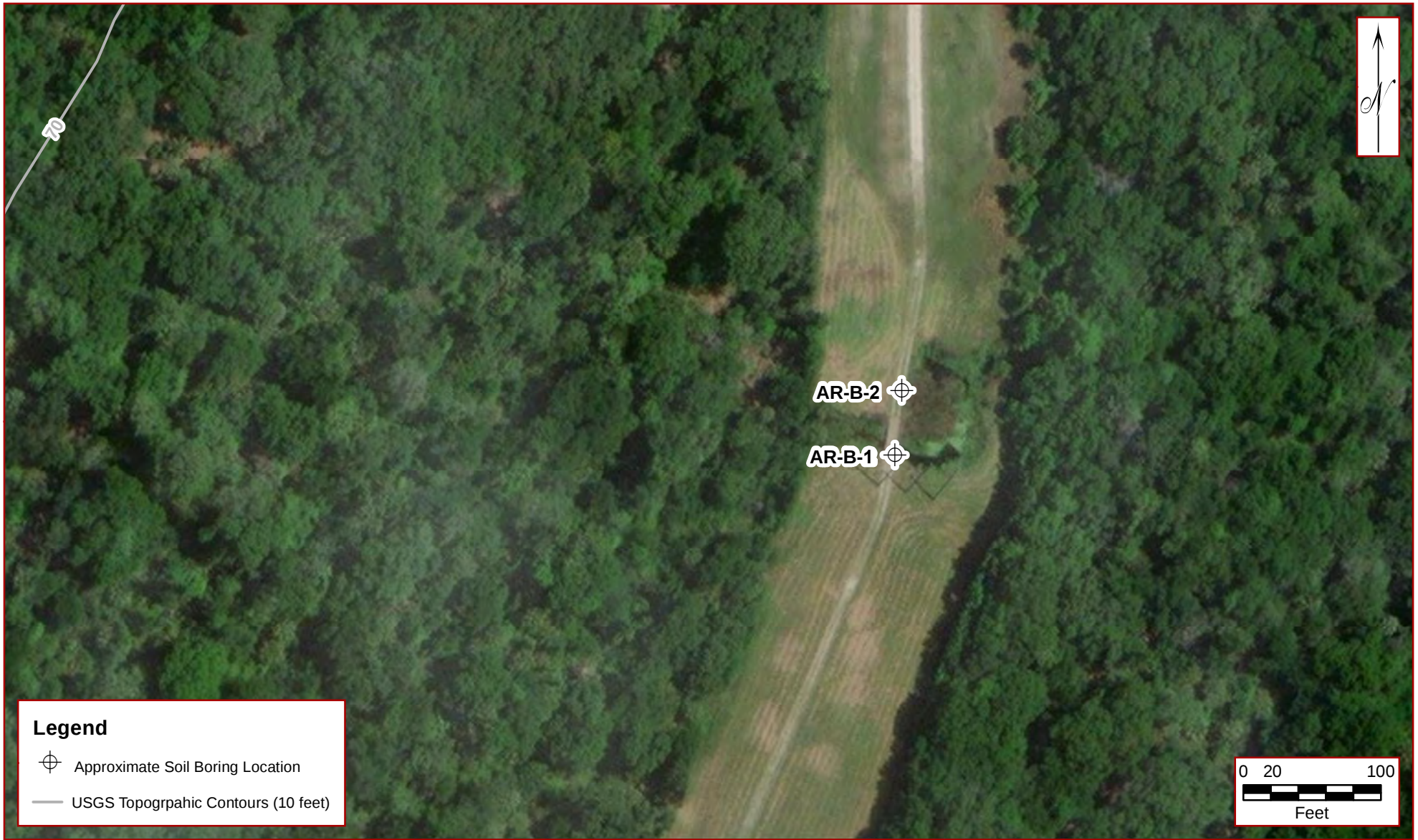
FIGURES



DRAWN: D. TALBOTT	CHECKED: C. DUNKELBERGER, P.E.	ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC. 3676 HARTSFIELD ROAD TALLAHASSEE, FLORIDA 32303 OFFICE #: (850) 386-1253	TITLE: PROJECT LOCATION MAP BRIDGE REPLACEMENT ALAFIA RIVER STATE PARK HILLSBOROUGH COUNTY, FLORIDA	
ENGINEER: K. SWEENEY, P.E.			DATE: JULY 2023	
CLIENT: HYDRA ENGINEERING & CONSTRUCTION, LLC			FIGURE NO.: 1	
PROJ. NO.: 81-28-23-01				



DRAWN: D. TALBOTT	CHECKED: C. DUNKELBERGER, P.E.	ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC. 3676 HARTSFIELD ROAD TALLAHASSEE, FLORIDA 32303 OFFICE #: (850) 386-1253	TITLE: AERIAL VIEW MAP BRIDGE REPLACEMENT ALAFIA RIVER STATE PARK HILLSBOROUGH COUNTY, FLORIDA	
ENGINEER: K. SWEENEY, P.E.				
CLIENT: HYDRA ENGINEERING & CONSTRUCTION, LLC				
PROJ. NO.: 81-28-23-01	SCALE: AS SHOWN		DATE: JULY 2023	FIGURE NO.: 2A



DRAWN: D. TALBOTT	CHECKED: C. DUNKELBERGER, P.E.	ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC. 3676 HARTSFIELD ROAD TALLAHASSEE, FLORIDA 32303 OFFICE #: (850) 386-1253	TITLE: AERIAL VIEW MAP BRIDGE REPLACEMENT ALAFIA RIVER STATE PARK HILLSBOROUGH COUNTY, FLORIDA	
ENGINEER: K. SWEENEY, P.E.				
CLIENT: HYDRA ENGINEERING & CONSTRUCTION, LLC				
PROJ. NO.: 81-28-23-01	SCALE: AS SHOWN		DATE: JULY 2023	FIGURE NO.: 2B

ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT



1. NUMBERS LEFT OF BORING INDICATE SPT N-VALUES OR EQUIVALENT VALUES (*) FOR 12-INCH PENETRATION.
2. SEE TABLES 3A AND 3B FOR ADDITIONAL GEOTECHNICAL DESIGN PARAMETERS.
3. SEE FIGURE 4 FOR COARSE AGGREGATE REINFORCEMENT DETAIL.

LEGEND

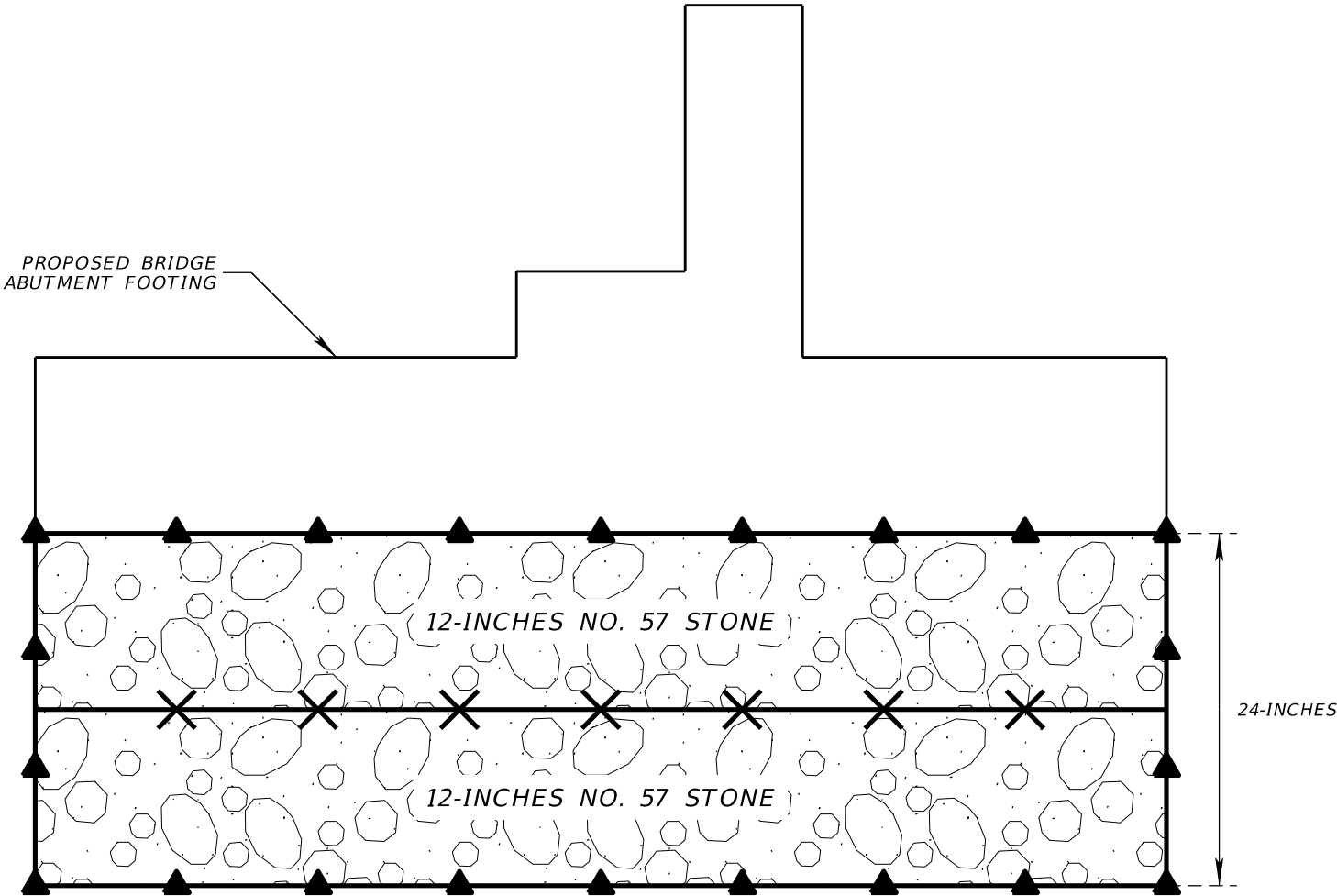
	DESIGN GROUNDWATER LEVEL	c	ESTIMATED UNDRAINED SHEAR STRENGTH (LB/FT ²) [PSF]
	DESIGN GROUNDWATER LEVEL	ϕ	INTERNAL FRICTION ANGLE (DEGREES)
N	UNCORRECTED FIELD N-VALUE	γ	EFFECTIVE UNIT WEIGHT (LB/FT ³) [PCF]
N_{60}	CORRECTED DESIGN N-VALUE		

PREPARED:	K. SWEENEY, P.E.	ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC. 3676 HARTSFIELD ROAD TALLAHASSEE, FLORIDA 32303 OFFICE #: (850) 386-1253	"GENERALIZED" DESIGN SOIL PROFILE BRIDGE REPLACEMENT ALAFIA RIVER STATE PARK HILLSBOROUGH COUNTY, FLORIDA			
CHECKED:	C. DUNKELBERGER, P.E.		SCALE:	AS SHOWN	DATE:	JULY 2023
REVISED:	K. SWEENEY, P.E.		PROJ. NO.:	81-28-23-01	FIGURE NO.:	3
ENGINEER:	K. SWEENEY, P.E.					

COARSE AGGREGATE REINFORCEMENT DETAIL
ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT

ABUTMENT FOOTING - TYPICAL SECTION
COARSE AGGREGATE REINFORCEMENT

(Not To Scale)



NOTES

1. FILTER FABRIC SHALL CONSIST OF A MIRAFI 140N NONWOVEN GEOTEXTILE, OR EQUIVALENT, AND SHALL BE WRAPPED AROUND THE NO. 57 STONE. ALL EDGES, SIDES, AND SEAMS OF THE FILTER FABRIC SHALL BE OVERLAPPED A MINIMUM OF 24-INCHES.
2. EXTRUDED BIAXIAL GEOGRID SHALL CONSIST OF A TENSAR BX1200 OR EQUIVALENT. ALL EDGES, SIDES, AND SEAMS OF THE GEOGRID SHALL BE OVERLAPPED A MINIMUM OF 24-INCHES.

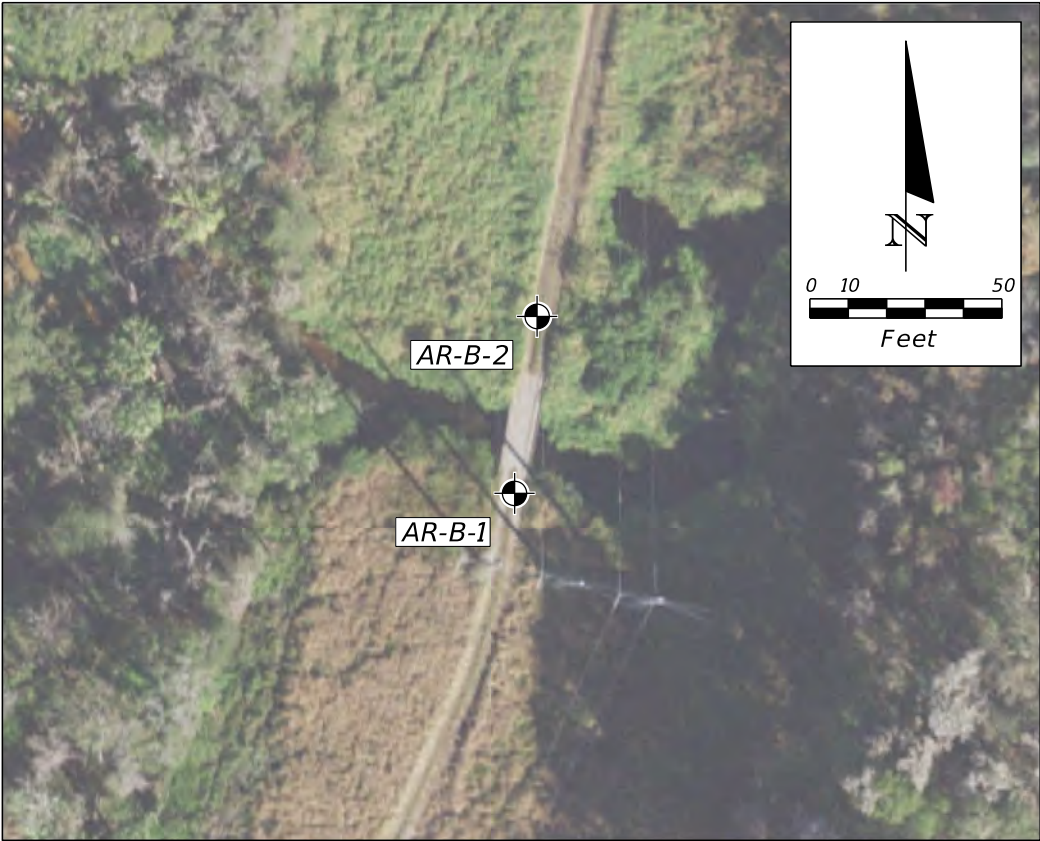
LEGEND

-  GEOTEXTILE FILTER FABRIC (NOTE 1)
-  EXTRUDED BIAXIAL GEOGRID (NOTE 2)

PREPARED: K. SWEENEY, P.E.	ENVIRONMENTAL AND GEOTECHNICAL SPECIALISTS, INC. 3676 HARTSFIELD ROAD TALLAHASSEE, FLORIDA 32303 OFFICE #: (850) 386-1253	COARSE AGGREGATE REINFORCEMENT DETAIL BRIDGE REPLACEMENT ALAFIA RIVER STATE PARK HILLSBOROUGH COUNTY, FLORIDA	
CHECKED: C. DUNKELBERGER, P.E.			
REVISED: K. SWEENEY, P.E.		SCALE: AS SHOWN	DATE: JULY 2023
ENGINEER: K. SWEENEY, P.E.		PROJ. NO.: 81-28-23-01	FIGURE NO.: 4

APPENDIX A
REPORT OF SOIL BORINGS

SOIL BORING LOCATION MAP

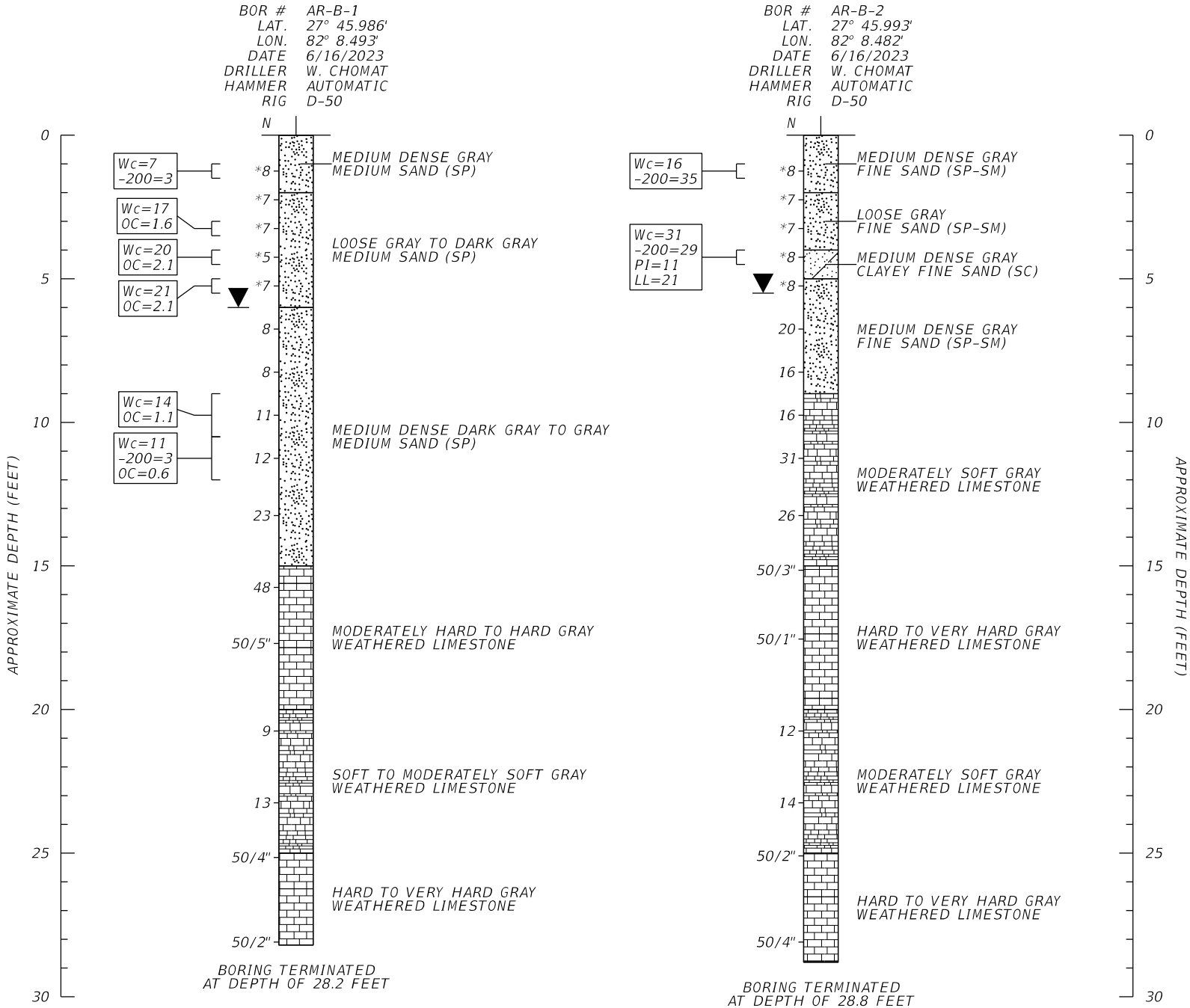


NOTES

1. NUMBERS LEFT OF BORINGS INDICATE EQUIVALENT STANDARD PENETRATION TEST (SPT) N-VALUES, OR EQUIVALENT.
2. SOIL BORINGS WERE AUGERED BY HAND TO A DEPTH OF 5.5 FEET. N-VALUES REPORTED IN THIS RANGE, DENOTED WITH AN ASTERISK (*), WERE DERIVED FROM HAND OPERATED STATIC CONE PENETROMETER TESTS.
3. MEASURED GROUNDWATER LEVEL SHOWN IS THE GROUNDWATER LEVEL ENCOUNTERED DURING THE SUBSURFACE INVESTIGATION. GROUNDWATER LEVEL FLUCUATIONS SHOULD BE ANTICIPATED.
4. SOIL DESCRIPTIONS, TEST DATA, AND EQUIVALENT STANDARD PENETRATION VALUES SHOWN ARE FOR THE SOIL BORING ONLY AND MAY NOT APPLY TO ANY OTHER LOCATIONS EXCEPT AT THE LOCATION OF THE SOIL BORING. EXTRAPOLATION OF THE SOIL BORING DATA TO OTHER LOCATIONS IS THE SOLE RESPONSIBILITY OF THE PERSON PERFORMING THE EXTRAPOLATION.
5. DEPTHS MEASURED BELOW EXISTING GROUND SURFACE. ELEVATIONS NOT AVAILABLE AT TIME OF SUBMITTAL.

AUTOMATIC HAMMER			
GRANULAR MATERIALS RELATIVE DENSITY	SPT (BLOWS/12 IN.)	SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/12 IN.)
VERY LOOSE	LESS THAN 3	VERY SOFT	LESS THAN 1
LOOSE	3 - 8	SOFT	1 - 3
MEDIUM DENSE	8 - 24	FIRM	3 - 6
DENSE	24 - 40	STIFF	6 - 12
VERY DENSE	GREATER THAN 40	VERY STIFF HARD	12 - 24 GREATER THAN 24

SPLIT-SPOON:
INSIDE DIAMETER: 1.375 in.
OUTSIDE DIAMETER: 2.0 in.
AVG. HAMMER DROP: 30.0 in.
HAMMER WEIGHT: 140 lbs.



LEGEND

SOIL BORING LOCATION		MEDIUM TO FINE SAND (SP TO SP-SM)	
MEASURED GROUNDWATER LEVEL		CLAYEY FINE SAND (SC)	
LABORATORY TESTING RESULTS		WEATHERED LIMESTONE	
WATER CONTENT (%)	Wc=	HARD WEATHERED LIMESTONE	
-200 SIEVE	-200=	UNIFIED SOIL CLASSIFICATION GROUP SYMBOL	(SP-SM)
LIQUID LIMIT	LL=		
PLASTIC INDEX	PI=		
ORGANIC CONTENT (%)	OC=		
N-VALUE EQUIVALENT (NOTE 2)	*N		

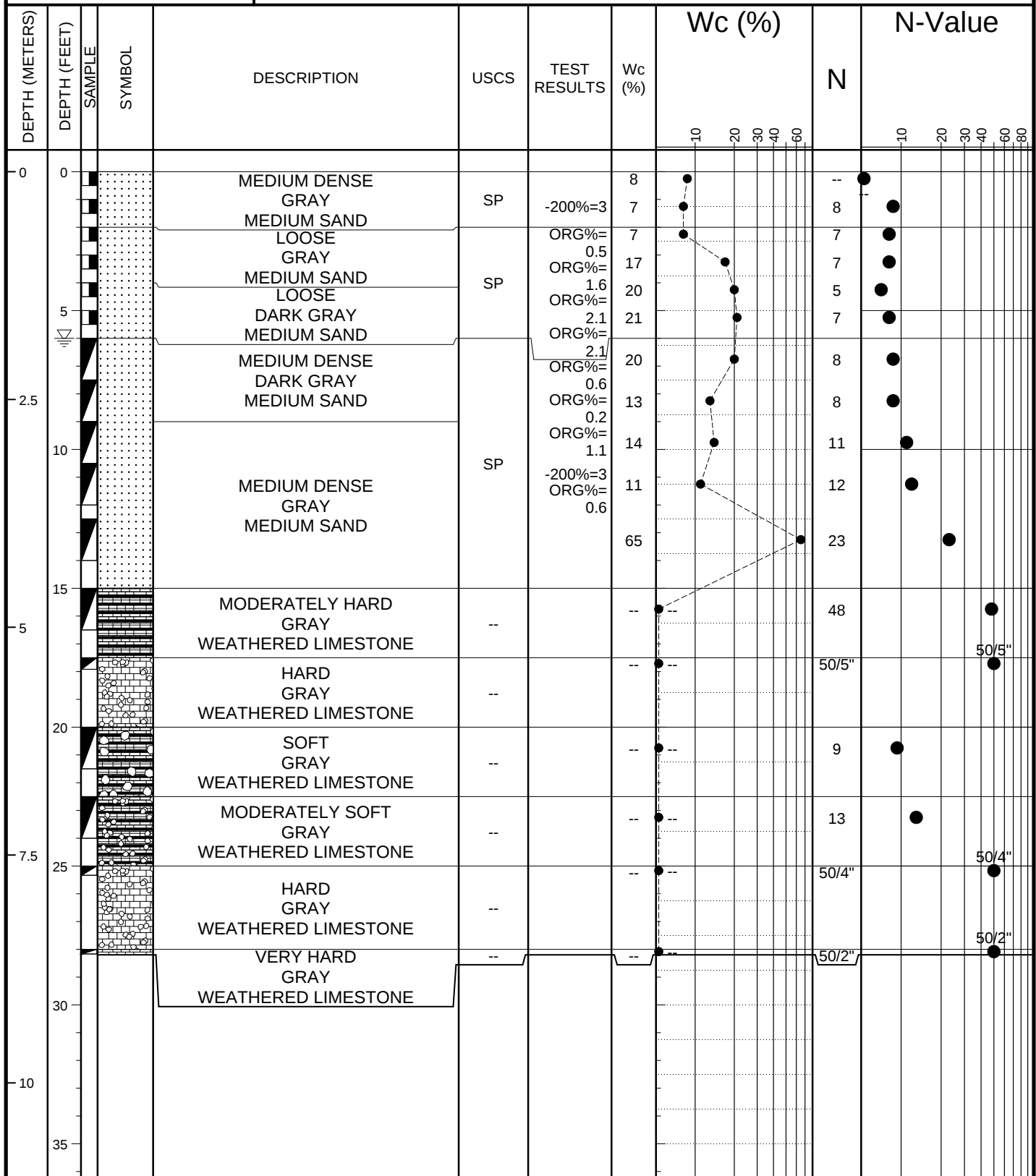
REVISIONS						SEAL:	Environmental & Geotechnical Specialists, Inc.	HYDRA ENGINEERING & CONSTRUCTION, LLC	REPORT OF SOIL BORINGS	SHEET NO.
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION					
						KEVIN T. SWEENEY, P.E.	3676 Hartsfield Road Tallahassee, Florida 32303 Phone: (850) 386-1253	PROJECT TITLE		
						P.E. NO.: 89538	Cert. of Auth.: 6222	ALFIA RIVER STATE PARK BRIDGE REPLACEMENT		

APPENDIX B
SOIL BORING LOGS

3676 Hartsfield Road
Tallahassee, Florida, 32303
Office #: (850) 386-1253

24 HR:

CAVING: C NONE



NOTE: N/M - NOT MEASURED
N/A - NOT AVAILABLE

**ENVIRONMENTAL & GEOTECHNICAL
SPECIALISTS, INC.**

3676 Hartsfield Road
Tallahassee, Florida, 32303
Office #: (850) 386-1253

PROJECT: ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT

CLIENT: HYDRA ENGINEERING & CONSTRUCTION, LLC

PROJECT NO.: 81-28-23-01

PROJECT LOCATION: HILLSBOUROUGH COUNTY, FLORIDA

BORING NO.: AR-B-2

DRILLER: W. CHOMAT

DEPTH TO WATER: INITIAL: 5.5'

24 HR: 5.5'

HAMMER TYPE: AUTOMATIC

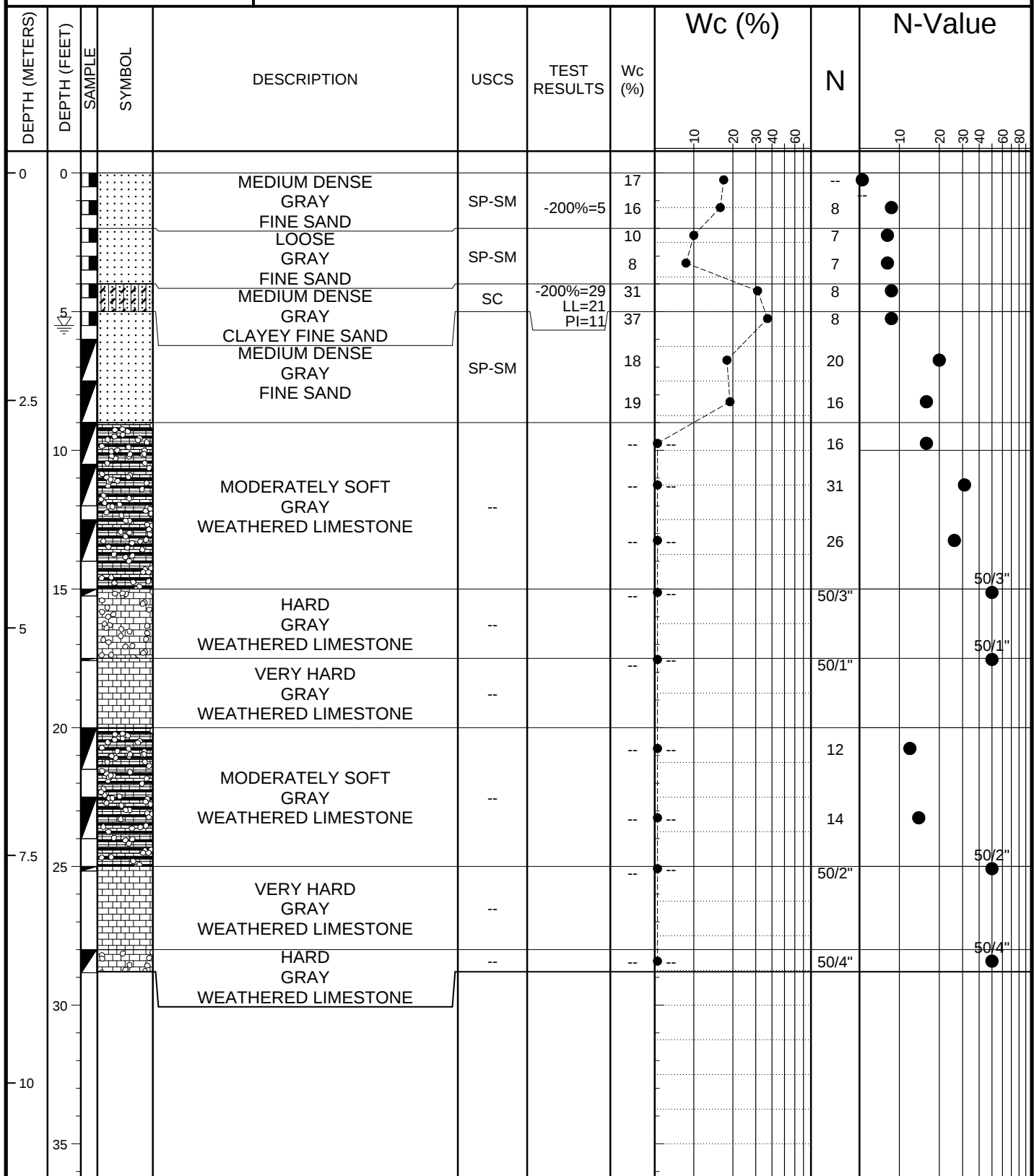
ELEVATION (FEET): N/A

DATE: 6/16/2023

FLUID LOSS: N/M

CAVING: C NONE

This information pertains only to this boring and should not be interpreted as being indicative of the site.



NOTE: N/M - NOT MEASURED
N/A - NOT AVAILABLE

APPENDIX C
SOIL CLASSIFICATION DATA

SOIL CLASSIFICATION DATA

Project: ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT

Client: HYDRA ENGINEERING & CONSTRUCTION, LLC

Project No.: 81-28-23-01

Boring: AR-B-1

Location: HILLSBOUROUGH COUNTY, FLORIDA

DEPTH (FEET)	Wc (%)	-4 (%)	-10 (%)	-20 (%)	-40 (%)	-60 (%)	-100 (%)	-200 (%)	LL	PI	Org. (%)	N Value	USCS	Description
0.0-0.5	8											--	SP	MEDIUM DENSE GRAY MEDIUM SAND
1.0-1.5	7	100	100	100	92	52	30	3				8	SP	MEDIUM DENSE GRAY MEDIUM SAND
2.0-2.5	7										0.5	7	SP	LOOSE GRAY MEDIUM SAND
3.0-3.5	17										1.6	7	SP	LOOSE GRAY MEDIUM SAND
4.0-4.5	20										2.1	5	SP	LOOSE DARK GRAY MEDIUM SAND
5.0-5.5	21										2.1	7	SP	LOOSE DARK GRAY MEDIUM SAND
6.0-7.5	20										0.6	8	SP	MEDIUM DENSE DARK GRAY MEDIUM SAND
7.5-9.0	13										0.2	8	SP	MEDIUM DENSE DARK GRAY MEDIUM SAND
9.0-10.5	14										1.1	11	SP	MEDIUM DENSE GRAY MEDIUM SAND
10.5-12.0	11	100	99	97	73	30	11	3			0.6	12	SP	MEDIUM DENSE GRAY MEDIUM SAND
12.5-14.0	65											23	SP	MEDIUM DENSE GRAY MEDIUM SAND
15.0-16.5	--											48	--	MODERATELY HARD GRAY WEATHERED LIMESTONE
17.5-17.9	--											50/5"	--	HARD GRAY WEATHERED LIMESTONE

SOIL CLASSIFICATION DATA

Project: ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT

Client: HYDRA ENGINEERING & CONSTRUCTION, LLC

Project No.: 81-28-23-01

Boring: AR-B-1

Location: HILLSBOUROUGH COUNTY, FLORIDA

[illegible]

SOIL CLASSIFICATION DATA

Project: ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT

Client: HYDRA ENGINEERING & CONSTRUCTION, LLC

Project No.: 81-28-23-01

Boring: AR-B-2

Location: HILLSBOUROUGH COUNTY, FLORIDA

DEPTH (FEET)	Wc (%)	-4 (%)	-10 (%)	-20 (%)	-40 (%)	-60 (%)	-100 (%)	-200 (%)	LL	PI	Org. (%)	N Value	USCS	Description
0.0-0.5	17											--	SP-SM	MEDIUM DENSE GRAY FINE SAND
1.0-1.5	16	100	99	98	85	45	17	5				8	SP-SM	MEDIUM DENSE GRAY FINE SAND
2.0-2.5	10											7	SP-SM	LOOSE GRAY FINE SAND
3.0-3.5	8											7	SP-SM	LOOSE GRAY FINE SAND
4.0-4.5	31	100	100	99	95	75	49	29	21	11		8	SC	MEDIUM DENSE GRAY CLAYEY FINE SAND
5.0-5.5	37											8	SP-SM	MEDIUM DENSE GRAY FINE SAND
6.0-7.5	18											20	SP-SM	MEDIUM DENSE GRAY FINE SAND
7.5-9.0	19											16	SP-SM	MEDIUM DENSE GRAY FINE SAND
9.0-10.5	--											16	--	MODERATELY SOFT GRAY WEATHERED LIMESTONE
10.5-12.0	--											31	--	MODERATELY SOFT GRAY WEATHERED LIMESTONE
12.5-14.0	--											26	--	MODERATELY SOFT GRAY WEATHERED LIMESTONE
15.0-15.3	--											50/3"	--	HARD GRAY WEATHERED LIMESTONE
17.5-17.6	--											50/1"	--	VERY HARD GRAY WEATHERED LIMESTONE

SOIL CLASSIFICATION DATA

Project: ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT

Client: HYDRA ENGINEERING & CONSTRUCTION, LLC

Boring: AR-B-2

Project No.: 81-28-23-01

Location: HILLSBOUROUGH COUNTY, FLORIDA

DEPTH (FEET)	Wc (%)	-4 (%)	-10 (%)	-20 (%)	-40 (%)	-60 (%)	-100 (%)	-200 (%)	LL	PI	Org. (%)	N Value	USCS	Description
20.0-21.5	--											12	--	MODERATELY SOFT GRAY WEATHERED LIMESTONE
22.5-24.0	--											14	--	MODERATELY SOFT GRAY WEATHERED LIMESTONE
25.0-25.2	--											50/2"	--	VERY HARD GRAY WEATHERED LIMESTONE
28.0-28.8	--											50/4"	--	HARD GRAY WEATHERED LIMESTONE

APPENDIX D

SAMPLE COMPUTATIONS

BEARING CAPACITY ANALYSIS - ALAFIA RIVER STATE PARK BRIDGE REPLACEMENT

Design Soil Properties

$N_{1_{60}} := 10$	Depth Corrected SPT N-value	$c := 0 \cdot \frac{\text{lb}}{\text{ft}^2}$	Undrained Cohesion
$N_{60} := 10$	SPT N-value	$\phi := 30 \cdot \text{deg}$	Internal Friction Angle
$\gamma := 115 \cdot \frac{\text{lb}}{\text{ft}^3}$	Total Unit Weight	$\gamma_{\text{eff}} := 53 \cdot \frac{\text{lb}}{\text{ft}^3}$	Effective Unit Weight

Foundation Dimensions

$B := 5 \cdot \text{ft}$	Foundation Base Width
$L := 16 \cdot \text{ft}$	Foundation Length
$D_f := 2.0 \cdot \text{ft}$	Depth of Foundation

Groundwater Coefficients

$D_w := 0.0 \cdot \text{ft}$	Design Water Level
$C_{w\gamma} := 0.5$	Modifier for Water Table
$C_{wq} := 0.5$	Modifier for Water Table

Nominal Bearing Resistance (Munfakh)

Subject to Local Shear? ("YES" or "NO")	LS := "NO"	$\phi_{\text{eff}} := \text{if}(\text{LS} = \text{"YES"}, \text{atan}(\tan(0.67\phi)), \phi)$
$N_q := \tan\left(45\text{deg} + \frac{\phi_{\text{eff}}}{2}\right)^2 \cdot e^{\pi \cdot \tan(\phi_{\text{eff}})}$	$N_\gamma := 2 \cdot (N_q + 1) \tan(\phi_{\text{eff}})$	$N_c := (N_q - 1) \cot(\phi_{\text{eff}})$
$N_q = 18.40$	$N_\gamma = 22.40$	$N_c = 30.14$
$s_q := 1 + \left(\frac{B}{L}\right) \cdot \tan(\phi_{\text{eff}})$	$s_\gamma := 1 - 0.4 \cdot \left(\frac{B}{L}\right)$	$s_c := 1 + \left(\frac{B}{L}\right) \cdot \left(\frac{N_q}{N_c}\right)$
$s_q = 1.18$	$s_\gamma = 0.875$	$s_c = 1.191$
$q_n := c \cdot N_c \cdot s_c + \gamma \cdot D_f \cdot N_q \cdot s_q \cdot C_{wq} + 0.5 \cdot \gamma \cdot B \cdot N_\gamma \cdot s_\gamma \cdot C_{w\gamma}$		

$$q_n = 5.3 \frac{\text{kip}}{\text{ft}^2}$$

Nominal Bearing Resistance

FS := 2.5 Bearing Capacity Factor of Safety

$$q_{\text{all}} := \frac{q_n}{\text{FS}}$$

$$q_{\text{all}} = 2.1 \frac{\text{kip}}{\text{ft}^2}$$

Factored Bearing Resistance

Meyerhof's Factored Bearing Resistance

$$F_d := 1 + 0.33 \left(\frac{D_f}{B} \right) \quad F_d := \text{if}(F_d > 1.33, 1.33, F_d)$$

$$F_d = 1.132 \quad \text{Foundation Depth Factor}$$

$$S := 1.0 \quad \text{Maximum Tolerable Settlement (inches)}$$

$$S_k := 0.083 \cdot \text{ft} \quad \text{Estimated Settlement (feet)}$$

$$\Phi := 0.45 \quad \text{Resistance Factor}$$

$$q_r := \frac{N_{60}}{4} \cdot \left(\frac{B + 1\text{ft}}{B} \right)^2 F_d \cdot S \cdot \frac{\text{kip}}{\text{ft}^2} \quad q_r = 4075 \frac{\text{lb}}{\text{ft}^2} \quad \text{Factored Bearing Resistance}$$

$$k := \frac{q_r}{S_k} \quad k = 49099 \frac{\text{lb}}{\text{ft}^3} \quad \text{Coefficient of Subgrade Reaction}$$

Coefficient of Subgrade Reaction (Scott & Terzaghi) - For Sandy Soils

$$k_1 := 6 \cdot N_{1-60} \cdot \frac{\text{ton}}{\text{ft}^3} \quad k_1 = 120000 \frac{\text{lb}}{\text{ft}^3} \quad \text{Coefficient of Subgrade Reaction of 1ft x 1ft plate}$$

$$k_{B \times B} := k_1 \cdot \left(\frac{B + 1\text{ft}}{2B} \right)^2 \quad k_{B \times B} = 43200 \frac{\text{lb}}{\text{ft}^3} \quad \text{Coefficient of Subgrade Reaction of B x B plate}$$