Miami-Dade County

Department of Transportation
and Public Works

SET # 4 OF 5 SETS

VOLUME II OF III

CALCULATIONS AND REPORTS

Geotechnical Report

Improvements to SW 87 Avenue Bridge Over Canal C-100

Miami-Dade County

Small Business Enterprise-Construction Program (SBE-CONST.):
SBE–Con 22.01%

Small Business Enterprise-Services Program (SBE-S):
SBE–S 0.26%

Community Workforce Program:
N/A

DTPW Capital Improvements Engineer:
Katherine Fernandez

RPQ Issue Date:
May 26, 2022

October 29, 2021

Mr. Jose A. Pena Ramos, P.E.
Project Manager
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6861 SW 196th Avenue, Suite 302
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Subject: Report of a Geotechnical Exploration – Bridge over C-100 Canal
SW 87th Avenue, from South of SW 164th Street to SW 163rd Street
Miami-Dade County Department of Transportation and Public Works
Project No. N/A
Miami-Dade County, Florida
HRES Project No. HR21-1691R

Dear Jose:

HR Engineering Services, Inc. (HRES) is presenting this Report of a Geotechnical Exploration – Bridge – for the subject project. This report presents our understanding of the project, outlines our exploratory procedures, and documents the field and laboratory test data obtained for the proposed project.

We have enjoyed assisting you on this project and look forward to serving as your geotechnical consultant on the remainder of this project and on future projects. If you have any questions concerning this report, please call our office at (305) 888-8880.

Sincerely,

HR ENGINEERING SERVICES, INC.
(Certificate of Authorization No. 7991)

HERNANDO R. RAMOS LICENSE No 42045 STATE OF FLORIDA PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

ON THE DATE ADJACENT TO THE SEAL

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1.0 INTRODUCTION

The purpose of this geotechnical evaluation was to obtain information concerning the site and subsurface conditions in the area of the proposed bridge, and provide an evaluation of the suitability of the in-situ materials and recommendations for two selected foundation alternatives. This report discusses the subsurface conditions based on the available test borings, presents our findings and evaluation, and includes the following items:

Field Services

- Two (2) test borings were performed by HRES for the proposed bridge. Each boring was performed to a depth of 100 measured from the existing ground surface. The test boring subsurface information is presented in the Report of Core Borings in Appendix A.

Evaluation

- A general review of existing surface features and site conditions.
- Miami-Dade County Soil Survey Map.
- USGS Quadrangle Map.
- USGS Average Yearly High and October Water levels Maps.
- Report of core borings which illustrate the subsurface conditions in the area of the proposed bridge.
- An evaluation of the different foundation systems for support of the bridge structure.
- Augercast piles axial compression capacities.
- Soil/rock parameters for augercast piles lateral analyses.
- Driven pile axial compression capacities.
- Soil/rock parameters for driven pile lateral analyses.

Laboratory Testing

- The results of laboratory tests performed on selected soil samples obtained from the test borings.
- Environmental corrosion classification based on FDOT guidelines.
- A brief description of our laboratory testing procedures.

2.0 PROJECT INFORMATION

2.1 GENERAL

Project information for this subsurface exploration has been provided to us by Mr. Jose A. Pena Ramos, PE, Engineer of Record of R.J. Behar & Company, Inc.

During our geotechnical study, we have been furnished with the following project-related plans and information:

- 30% Plans: SW 87th Avenue, from South of SW 164th Street to SW 163rd Terrace
- Prepared by: R.J. Behar & Company, Inc.
- Dated: September 21, 2021

2.2 PROJECT DESCRIPTION

The project consists of the construction of a new section of SW 87th Avenue, from south of SW 164th Street to SW 163rd Terrace in Miami, Florida. The project includes the construction of a new section of SW 87th Avenue, and a new bridge over C-100 Canal with associated MSE Walls. Drainage improvements are also planned.

This report provides our foundation recommendations for the proposed bridge.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The field exploration was conducted by HRES. The locations of the test borings are provided in the Summary of Test Boring Locations in Appendix A and at the approximate locations shown on the Field Exploration Plans in Appendix A.

The Report of Core Borings in Appendix A summarize the approximate boundary between soil types. In some instances, the transition between material types may be gradual. A discussion of the subsurface conditions encountered along the project alignment is provided in Section 4.2 of this report.

The boring elevations shown on the Report of Core Borings were provided by R.J. Behar & Company, Inc.

3.2 LABORATORY TESTING

3.2.1 Soil Testing

In order to aid in classifying and estimate engineering characteristics of the subsurface materials encountered, laboratory classification tests were performed on representative soil samples obtained from the test borings performed for the project. The laboratory testing program included the following:

- 3 Fines Content Tests
- 1 Organic Content Test

In addition, a total of 3 moisture content tests were performed in conjunction with the classification tests. The laboratory test results are presented in Appendix B.

3.2.2 Corrosivity Classification Testing

Corrosivity classification testing was performed on a representative water sample obtained from Percolation Test P-1. The water sample was collected and tested by HRES. This testing included pH, chlorides and sulfates contents and resistivity results. The FDOT Structures Manual, Volume 1, Section 1.3.2 Classification Criteria, outlines the ranges of groundwater chemical properties

considered corrosive to reinforced concrete substructure. In addition, that section environmentally classifies the superstructure based on factors located near the proposed structure(s). Based on this classification, an environment may be Slightly Aggressive, Moderately Aggressive, or Extremely Aggressive. The following table summarizes the laboratory test results:

Table 3.2.2: Corrosion Classification Test Results

Sample Location	Resistivity ohms-cm	pH	Sulfates ppm	Chlorides ppm	Classification	
					Steel	Concrete
P-1	1,435	7.4	18.0	123.0	MA	MA

The results show that the substructures will be in a Moderately Aggressive environment (for steel and concrete). Due to its location, the superstructure is considered to be in a Slightly Aggressive environment for a concrete bridge structure (non- marine structure).

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

The site conditions were observed by a geotechnical engineer during the months of September and October, 2021.

4.2 SUBSURFACE CONDITIONS

4.2.1 Miami-Dade County Soil Survey Map

The Soil Map of Miami-Dade County Area, Florida, published by the United States Department of Agriculture (USDA) was reviewed for general near-surface soil information within the general project vicinity. This information indicates that there are two mapping units in the vicinity of the project. The map soil units encountered are as follows:

Table 4.2.1 Miami-Dade County Soil Survey

Map Unit Symbol	Map Unit Name	Typical Profile
10	Udorthents, limestone substratum-Urban land complex, 0 to 2 percent slopes (0.2% of Area of Interest)	^C1 - 0 to 10 inches: very gravelly loam ^C2 - 10 to 55 inches: extremely gravelly loam 2R - 55 to 65 inches: bedrock
11	Udorthents, marl substratum-Urban land complex, 0 to 2 percent slopes (99.8% of Area of Interest)	^C1 - 0 to 12 inches: very gravelly loam ^C2 - 12 to 41 inches: very gravelly sandy loam 2Lmab - 41 to 80 inches: marly silt loam 3R - 80 to 90 inches: bedrock

A reproduction of the USDA map for the project area is included in Appendix A.

4.2.2 USGS Quadrangle Map

The Palmetto Bay/Perrine Quadrangle, Florida-Dade Topographic Map published by the United States Geological Survey (USGS) was reviewed for general existing ground surface elevation in the project area. Based on the map, the elevation ranges approximately from 5 to 8 feet, NAVD88. A reproduction of the USGS Quadrangle Map for the project area is included in Appendix A.

4.2.3 General

A graphical representation of the subsurface conditions encountered by the test borings drilled for the proposed bridge is shown on the Report of Core Borings in Appendix A. These profiles and the following soil/rock conditions highlight the major subsurface stratification. The boring profiles on these sheets should be consulted for a detailed description of the soil/rock conditions encountered at each boring location. When reviewing the subsurface profiles, it should be understood that the soil/rock conditions may vary between and away from the boring locations.

4.2.4 Geologic Conditions

The project is located on the southern flank of the Florida Plateau, a stable, carbonate platform. In the study, the upper 200 feet of this platform is composed predominately of limestone and quartz sand. The sediments were deposited during several glacial and interglacial stages during the Pleistocene Epoch. Within the explored depths of this study, two distinct geological formations were encountered. These formations are the Miami Limestone Formation and the Fort Thompson Formation.

4.2.5 Miami Limestone

The Miami Limestone can be described as a soft tan white porous to very porous fossiliferous quartz sandy fine-grained slightly oolitic limestone. The solution channels in the limestone may be up to 2 inches in diameter at some locations, are filled with quartz fine sand and uncemented calcareous materials. The limestone varies in both thickness and competency within the investigated area.

The Miami Limestone was deposited in a shallow near shore marine carbonate bank environment. Spherical carbonate sand grains called oolites formed and were deposited in this environment. Near shore, processes transported quartz sand into the area and reworked some of the carbonate material. Encrusting organisms called bryozoans were locally abundant and formed patches on the substrate. After sea level receded, the carbonate deposit was exposed to fresh water and the cementation process was initiated. The degree of cementation, and therefore the competency of the rock, was influenced by both the abundance and the type of calcareous material in the original deposit. Humic and carbonic acids percolating downward through the material etched slots up to 4 feet deep in the surface of the stratum.

4.2.6 Fort Thompson Formation

Underlying The Miami Limestone Formation, The Fort Thompson Formation was generally encountered. The Fort Thompson Formation is composed of sediments of variable lithologies. The lithologies include non-fossiliferous quartz fine sand, fossiliferous quartz sandy limestone, coralline limestone, freshwater limestone, and quartz sandstone. These lithologies alternate abruptly in thickness and lateral extent.

The Fort Thompson limestone grades downward into a gray quartz and calcareous fine to medium sand. This sand has been cemented to varying degrees by carbonate material leached out of the overlying limestone. The cementation commonly takes the form of hard spherical sandstone nodules 1 to 2 inches in diameter occurring in a sand matrix. Sandstone lenses within the sand layer are the result of a more complete cementation.

4.2.7 Generalized Subsurface Conditions Encountered at the Bridge Location

For a detailed subsurface condition at a particular borehole location, please refer to the Report of Core Borings in Appendix A.

4.2.8 Groundwater Conditions

The groundwater levels were measured at the time of drilling. The groundwater level was encountered by the boreholes at approximately elevation 3.0 feet, NGVD29. An average October Water Level of 3.0 feet, NGVD29 (1.5 feet, NAVD88) and a seasonal High Ground Water Table of 4.0 feet, NGVD29 (2.5 feet, NAVD88) were found for the project based on U.S. Geological Survey (2002) "Average Altitude of the Water Table (1990-99) and Frequency Analysis of Water Levels (1974-99) in Biscayne Aquifer, Miami-Dade County, Florida" included in Appendix A.

Fluctuation in the observed groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff and other site-specific factors such as changes of the water elevation at C-100 Canal. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

5.0 SUMMARY OF BRIDGE FOUNDATION ALTERNATIVES

5.1 GENERAL

Our foundation alternatives for support of the proposed bridge include deep foundations. Other types of foundation support have been evaluated for the proposed bridge. It is important to note that the bridge is located near residences which may preclude the use of some of the foundation support alternatives presented below due to vibration/noise issues. The following foundation alternatives are as follows:

- Shallow Foundations: Based on the results of the test borings available, a shallow foundation alternative is not feasible for support of the bridge end bents since the test borings encountered a relatively weak limestone layer or loose sand from approximate elevation of -5 to -30 feet, NGVD29 followed by a relatively strong limestone. Due to the structural loads, this foundation alternative is not recommended.

- Geosynthetic Reinforced Soil Integrated Bridge System (GRS-IBS): This is also a shallow foundation alternative. This foundation alternative is not recommended due to the relatively weak limestone layer or loose sand from approximate elevation of -5 to -30 feet, NGVD29 followed by a relatively strong limestone encountered by the borings.

- Steel H-Piles or Pipe Piles: The advantage of this type of piles is the relatively low vibration during driving when compared to concrete driven piles. However, the disadvantage in this project is that these piles provide relatively lower axial capacities when compared to concrete driven piles; also, the difficulty to estimate the length of the piles due to the uncertainty of determining the pile tip elevation during pile installation.

- Drilled Shafts: The advantage of this type of foundation is the relatively low to no vibration (when using an oscillating/rotator casing installation) during construction. This type of foundation provides high axial and lateral capacities; however, it is recommended to provide shaft redundancy. It may require a minimum of 3 shafts per end bent increasing the project cost.

  The installation of drilled shafts will require a collection system of the cuttings, slurry and extra pumped concrete to avoid contamination of the canal.

- Augercast Piles (ACIP): The advantage of this type of piles is the relatively low to no vibration during construction and relatively low noise during construction. This type of foundation is recommended for this project since vibration could damage the existing WASD force main and adjacent residences. Higher pile capacities can be achieved if need by extending the pile tip to deeper depths with no issues regarding pile installation refusal. The variability of the subsurface soil/rock conditions encountered is easier to control by selecting the proper pile tip elevation. Finally, the pile capacity could be check during pile installation based on the augercast pile equipment applied torque.

  However, this type of foundation also encounters some disadvantages. These adverse conditions include constructability issues regarding the proximity of the canal water to the end bent construction. Augercast piles require to be installed on ground having the water level a minimum of one to two pile diameters below ground to help build a grout head. The foundation system may require a minimum of 4 feet of groundwater clearance. Additional clearance can be provided by building a soil platform along the end bents.

  The pile installation requires a collection system of the cuttings, slurry and extra pumped grout to avoid contamination of the canal. If all these issues can be solved, augercast piles could be a feasible alternative.

- Concrete Driven Piles: Concrete driven piles are also recommended for foundation support of the new bridge structure. However, this alternative present greater vibration and noise issues when compared with the other foundation alternatives and should be used with extreme caution.

  This foundation system will provide the required axial and lateral capacities for the project and will be less impacted by the site environment, including corrosion, highwater elevation and proximity of the new bents to the canal. This type of foundation will not require a column extension at the end bents and the pile capacity can be easily checked using the PDA and by driving criteria.

  Due to the potential of high vibration levels during concrete pile installation, preforming should be extended to deeper elevations to help minimize the damage to nearby residences and the adjacent force main. All adjacent residences will need to be monitored for settlement and vibration during pile installation. Another disadvantage of driven piles will be that due to the soil/rock variability shown by the borings, the selection of the pile production length is more difficult and the need of longer pile production lengths may be need in order to avoid pile splicing. Finally, pile installation refusal could occur before reaching the minimum tip.

6.0 FOUNDATION EVALUATION

6.1 BASIS OF EVALUATION

Our foundation recommendations are based upon the previously presented project information and the structural conditions along with the data obtained in this exploration. The field and laboratory data have been compared with previous performances of similar structures bearing on and within soil/rock conditions similar to those encountered in this exploration. If the project information is incorrect or changes, please contact us so that our evaluation and recommendations can be reviewed.

In our evaluation of the subject project, we addressed the following geotechnical design and construction considerations:

- Alternative 1: Augercast piles are viable alternative for foundation support of the proposed bridge structure; 18 and 24-inch diameter augercast piles were included in the foundation analyses.

- Alternative 2: Providing that the vibration caused by pile installation can be controlled, 18-inch square prestressed concrete driven piles are a viable alternative for foundation support of the proposed bridge structure. The axial compression analyses are also included.

6.2 ALTERNATIVE 1 – AUGERCAST PILES

6.2.1 General

Augercast piles with diameters of 18 and 24 inches were considered for the support of the proposed bridge structure. These deep foundation systems are able to develop the necessary capacity to support the factored design loads when bearing in lower medium to hard limestone layers.

6.2.2 Augercast Piles Axial Compression Capacity Analyses

Augercast piles installed in median to hard limestone derive their axial load capacities from two components; shear transfer between the concrete and soil/rock interface, and end bearing or point resistance at the base of the pile.

The augercast pile axial capacity analyses neglected the end bearing resistance. In addition, the side friction resistance in sand and soft limestone (Ns<25 blows/ft) were not considered in the axial capacity analyses. The side friction resistance in the rock layer was estimated as follows:

$f_s = 0.1$ N (tsf) (FDOT Soils and Foundation Handbook)

Where,

f_s = ultimate unit side friction resistance.

N = SPT N-value (blows/ft.) ≥25

Based on the handbook, the maximum value of f_s is 5 tsf. However, we limited it to 4 tsf (i.e., maximum N=40) for this study.

When using the Load Resistance Factor Design method (LRFD), a resistance factor, ø is applied to the ultimate mobilized shaft capacity to yield the factored shaft/pile resistance capacity.

For augercast piles the resistance factor is 0.6. Non-redundant augercast piles are not allowed.

Augercast pile tip elevations, axial compression capacities and capacity vs. tip elevation graphs are presented in Appendix C.

6.2.3 Augercast Pile – Soil/Rock Parameters for Lateral Analysis

A lateral loading analysis may be performed to estimate the lateral soil/rock resistance of the augercast piles at each end bent.

A table of soil/rock parameters for augercast pile lateral analysis is presented in Appendix C. It is understood that computer program FB-MultiPier, developed by University of Florida Bridge Software Institute (BSI) will be used to perform the lateral loading analyses.

The parameters were estimated from accepted FDOT correlations with SPT N_S (N values obtained using a safety hammer). SPT N values obtained using an automatic hammer, SPT Na, were converted to safety hammer values, SPT Ns, by multiplying by a factor of 1.24. The following formulas and correlations with SPT (Ns) values were used:

Sands, Fills and Soft Limestone modeled as Sand:

- Friction Angle, ϕ = Ns/4+28˚ (Maximum of 38˚).
- Unit Weight γ=105pcf*friction angle of soil/30˚
- Modulus of Elasticity, E=30,000Ns (psf).
- Shear Modulus G=E/2(1+ν), where Poisson ratio, ν=0.3.
- Side friction (τ_f) estimated using β-Method for augercastpiles.
- Modulus of subgrade reaction (k), estimated using Graphs B7 and from the FB-MultiPier Help Manual.

Limestone (modeled as rock):

- Unit Weight = 120pcf.
- Side Friction, τ_f=0.1Ns (tsf).
- Unconfined compressive strength (qu), estimated using McVay's Equation for side friction, $(1/2(qu*qt)^{1/2}$ by equating to 0.1 Ns (tsf) and assuming qt=20% of qu.
- Shear Modulus G=E/2(1+ν), where Poisson ratio, ν=0.2 and the Modulus of Elasticity, E = 115qu.

The test borings performed show a layer of sandy silt (MARL) down to elevation 4.0 feet, NGVD29. For the purpose of lateral analysis, the design ground elevation should be considered at 4.0 feet, NGVD29.

6.3 ALTERNATIVE 2 - DRIVEN PILES

6.3.1 General

Augercast piles and driven 24-inch square prestressed concrete piles are feasible alternatives for the support of the new bridge. Augercast piles have been discussed in Alternative 1. This section only refers to driven concrete piles.

Driven piles are able to develop the necessary capacity to support the factored design loads when bearing in the natural limestone. As mentioned before, preforming should be extended to deeper elevations to help minimize the damage to nearby residences and the adjacent force main. However, it is difficult to assess if pile preforming alone may totally remove the potential for pipe damage.

6.3.2 Driven Pile Axial Compression Capacity Analysis

In order to evaluate the capacity of the driven pile foundations, a static analysis using the design methodology presented in FDOT Research Bulletin 121 (RB-121) developed by Professor J.H. Schmertmann, was performed. A computerized version of this method, entitled *FB-Deep v.2.06,* was used. This method generates an allowable pile capacity through the use of empirical correlations with standard penetration test (SPT) "N" values, and soil/rock end bearing and side friction curves generated for given soil/rock types. The ultimate mobilized pile capacity (Davison pile capacity) is calculated as the sum of the ultimate side friction plus one-third of the ultimate end bearing. When using the Load Resistance Factor Design method (LRFD), the estimated Davisson capacity is used to predict the ultimate bearing capacity of the pile. A resistance factor, ø is applied to the Davisson capacity to yield the factored pile resistance capacity. This resistance factor may be taken as 0.65 (with dynamic testing

of ≥5% of piles) or 0.75 (with dynamic testing of 100% of piles) when using *FB-Deep* Davisson capacity as design methodology for axial compression. To help minimize vibration, 100% dynamic testing is recommended since the pile penetration may be reduced.

Pile tip elevations and capacities are provided in the *FB-Deep* computer analysis printouts presented in Appendix C.

6.3.3 Driven Pile – Soil/Rock Parameters for Lateral Analysis

A driven pile lateral analysis is required in order to determine the pile lateral loading capacity and the pile minimum tip elevation at each bridge bent support. The bridge designer is responsible for these lateral load analyses. Our recommended soil stratigraphy and the parameters to be used for the lateral analyses, based on the available subsurface exploration are presented in Appendix C. Any computer software approved by the FDOT may be used, however, we are assuming that FB-MultiPier software by University of Florida, Bridge Software Institute will be used.

The soil elastic and strength parameters provided have been estimated from correlations with the Standard Penetration Test (SPT) values (N, blows/ft) obtained from the field exploration. The modulus of elasticity (E) was estimated from correlations with SPT N_S (N values obtained using a safety hammer). Similarly, the internal friction angle (ϕ) was estimated from accepted FDOT correlations with N_S values. SPT N values obtained using an automatic hammer, SPT Na, were converted to safety hammer values, SPT Ns, by multiplying by a factor of 1.24. The following correlations with SPT Ns values were used:

- Friction Angle, ϕ = Ns/4+28˚ for sands and limestone with Ns < 10 blows/foot (modeled as sand). Maximum friction angle of 34˚.
- Limestone with Ns > 10 blows/foot was modeled as sandy gravel with ϕ = Ns/4+33˚. Maximum friction angle of 40˚.
- For sands, fills, and weak limestone modeled as sand or sandy gravel, the Modulus of Elasticity, E was estimated as E=30,000Ns (psf).
- The Shear Modulus, G was estimated as G=E/2(1+ν), where, ν is Poisson ratio (ν=0.3 for sands, fills, and 0.2 for limestone modeled as sandy gravel).
- Unit skin friction of sands and limerock fill, τ_f=0.019Ns (tsf).
- Unit skin friction of limestone, τ_f=0.01Ns (tsf)
- Unit weight of sands and fills was estimated as γ=105pcf*friction angle of soil/30˚.
- Unit weight of limestone was assumed as 120 pcf.

- The ultimate end bearing of the sand layer was estimated as q_{ult} =6.4Ns (ksf).
- The ultimate end bearing of the limestone layer was estimated as q_{ult} = 7.2Ns (ksf).
- Modulus of subgrade reaction, k (pci) was estimated using FDOT Soils and Foundation Handbook.

6.4 DOWNDRAG AT BRIDGE ABUTMENTS

6.4.1 Alternative 1- Augercast Piles:

The top of the limestone was encountered at an elevation ranging from 4.0 to 4.6 feet, NGVD29. After silt removal and backfill with compacted limerock fill, the additional fill volume placed over is approximately 10 feet. Due to the close proximity of the natural limestone to the ground surface, it is our opinion that no significant settlements are expected at the end bents. Therefore, downdrag loads should be negligible. In addition, a pile supported slab is designed to carry the embankment loads.

6.4.2 Alternative 2 – Driven Piles:

As in Alternative 1, the driven piles at both end bents of the proposed new bridge will be installed within the same area and volume to be placed. Due to the close proximity of the natural limestone to the ground surface, it is our opinion that no significant settlements are expected at the end bents. Therefore, downdrag loads should be negligible. In addition, a pile supported slab is designed to carry the embankment loads.

6.5 SCOUR

6.5.1 Alternative 1 and 2:

Due to the close proximity to Canal C-100, scour is expected. We understand the designer is considering a revetment system to protect the end bents.

6.6 PREFORMING

6.6.1 Alternative 2:

Based on the information from Borings B-1 and B-2, a medium to hard layer of limestone is observed down to an approximately elevation -5.0 feet, NGVD29. This layer might be hard to penetrate during driving and present refusal before reaching the minimum tip elevation. HRES recommends preforming down to elevation -5.0 feet, NGVD29 to avoid damaging the pile while driving during

this layer. Due to potential for vibration levels during pile driving, this preforming elevation may require revision down to elevation -25.0 feet, NGVD29 as additional protection to the nearby force main and residences. This elevation may require further adjustment during construction in case the vibration levels have been exceeded.

6.7 SETTLEMENT AND VIBRATION MONITORING

Construction vibrations associated with casing installation (if needed), pile driving and compaction equipment and others will occur. Settlement and vibration monitoring of all nearby existing structures should be performed in accordance with Section 108 of the FDOT Standard Specifications.

All existing structures in the vicinity of pile driving and compaction operations should be monitored for settlement and vibration.

6.8 CONSTRUCTION PLANS AND SPECIFICATIONS REVIEW

It is recommended that this office be provided the opportunity to make a general review of the earthwork plans and special provisions prepared from the recommendations presented in this report. We would then suggest any modifications so that our recommendations are properly interpreted and implemented.

APPENDIX A

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SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
MIAMI-DADE COUNTY, FLORIDA

HRES
HR Engineering Services, Inc.

SITE LOCATION PLAN

A-1

DRAWN BY: CS	DATE: 10/29/21
PROJECT No: HR21-1691R	SCALE: NTS

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS HIGHWAY DIVISION
SW 87th AVENUE
AT CANAL
PROJECT NO. N/A
SHEET 5 OF 27

LEGEND:

● TEST BORING LOCATION

HRES

HR ENGINEERING SERVICES, INC.
7815 NW 72nd Avenue
Medley, Florida 33166
Ph: 305-888-8880/305-888-8770 Fax
Cert. of Authorization No. 7991

N

0 10 40
Feet

END CONSTRUCTION
BEGIN 18.75' SIDEWALK
STA. +36.33, 29.50' LT
END SIDEWALK
CONNECT TO EXIST
STA. +55.08, 29.50' LT
SW 163 TERRACE
END BRIDGE
STA. 20+33.17
END APPROACH SLAB
STA. 20+63.17
END C&G TYPE F
+10.89, 44.95' LT
R/W
+85.89
20.00 LT
+85.89
13.50 LT
25' R
8' SIDEWALK
C & G TYPE F
3' TRAFFIC SEPARATOR
TYPE "SPECIAL"
POT STA. 22+20.00
SW 87 AVENUE
50' R
+85.52
13.50 RT
+85.51
20.00 RT
+56.21
29.50 RT
+36.73
29.50 RT
END C&G TYPE F
+10.51, 45.11' RT
MATCH LINE STA. 17+40.00
MATCH LINE STA. 23+00.00
80'
20'
POT STA. 20+00.00
N 3° 59' 14" W
48" PIPE
B-1
B-2
18
19
20
21
22
COMCAST
FPL
CANAL C-100
LOW WIRE ELEV. 54.4'
LOW WIRE ELEVATION 49.6'

LEGEND

TACTILE SURFACE

BEGIN APPROACH SLAB
STA. 19+36.83

BEGIN BRIDGE
STA. 19+66.83

A-2

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

R.J. Behar & Company, Inc.
Engineers • Planners
6861 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

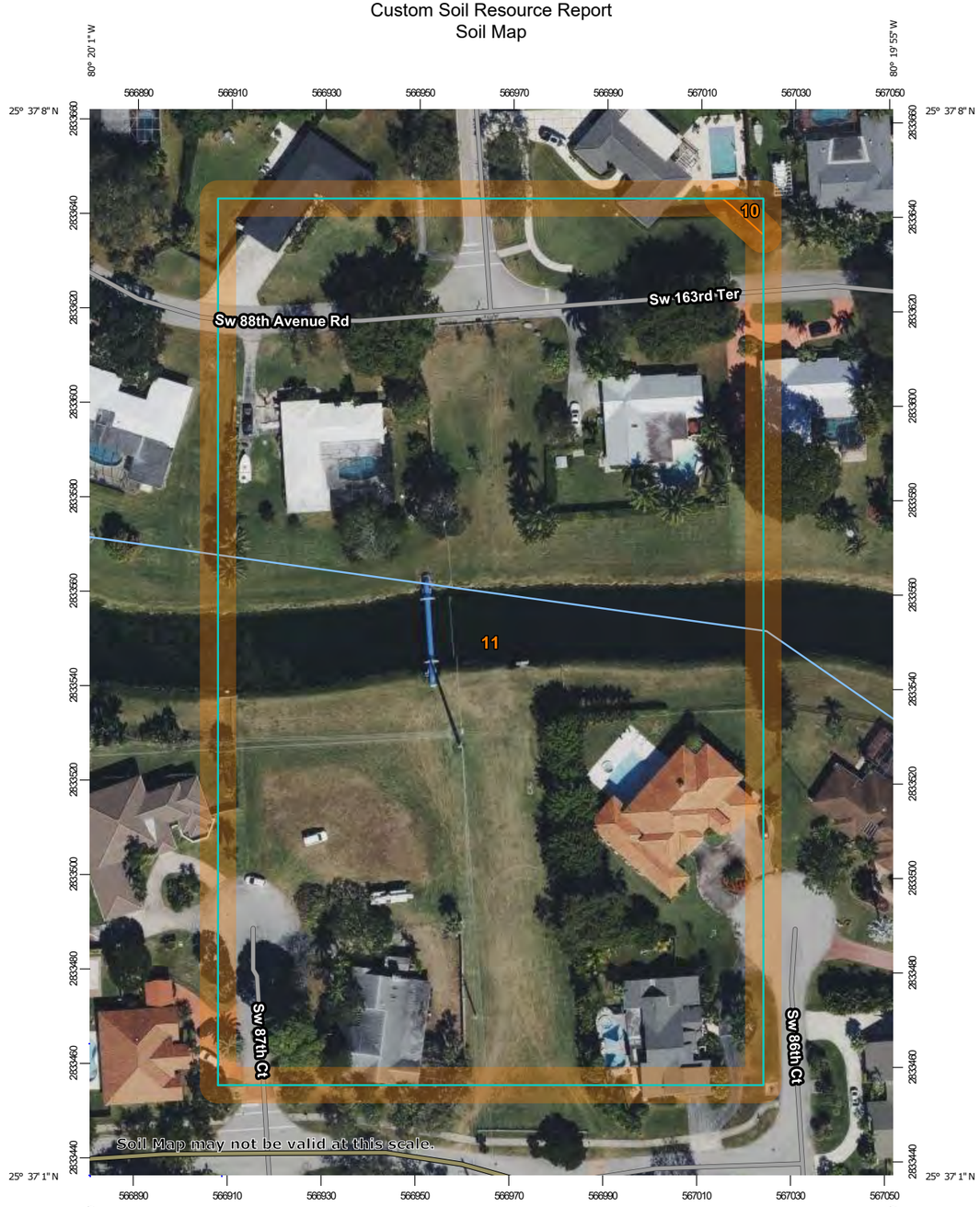
	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

ROADWAY PLAN

9/21/2021 10:04:54 AM O:\21030_SW 87 Bridge over Canal C-100\CADD\roadway\Plan\RB002.dgn

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CHECKED BY:	DESIGNED BY:	CHECKED BY:
CS 10-21	PV 10-21	CS 10-21	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

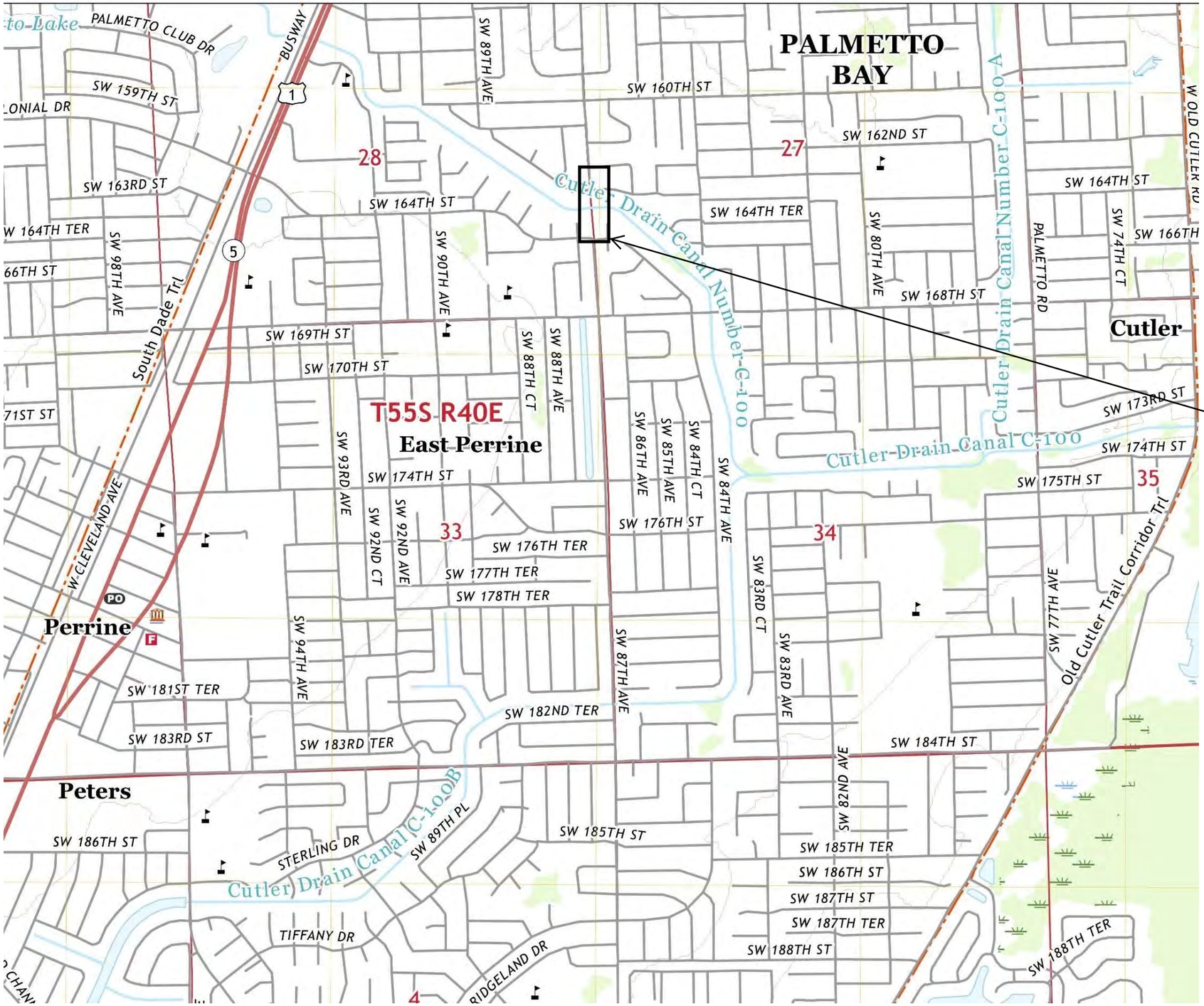
SHEET TITLE: MIAMI-DADE COUNTY SOIL SURVEY MAP

REF. DWG. NO.:

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

SHEET NO.: A-3

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CS 10-21
CHECKED BY:	PV 10-21
DESIGNED BY:	CS 10-21
CHECKED BY:	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

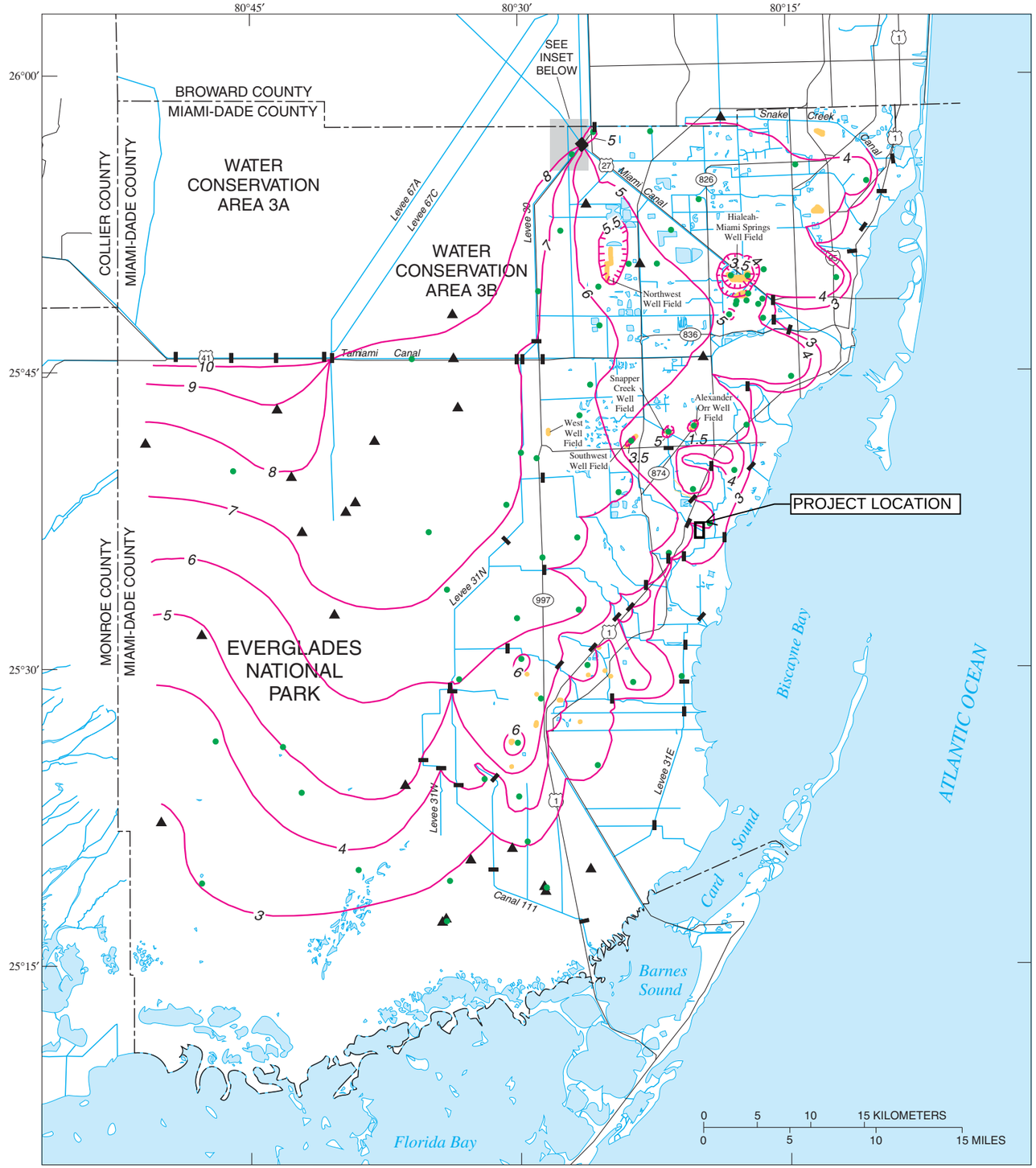
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: USGS QUADRANGLE ELEVATION MAP

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

REF. DWG. NO.

SHEET NO. A-4



AVERAGE YEARLY HIGH WATER LEVELS 1990-99

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CS 10-21
CHECKED BY:	PV 10-21
DESIGNED BY:	CS 10-21
CHECKED BY:	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: USGS AVERAGE YEARLY HIGH WATER LEVELS (1990-1999)

REF. DWG. NO.:

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

SHEET NO.: A-5

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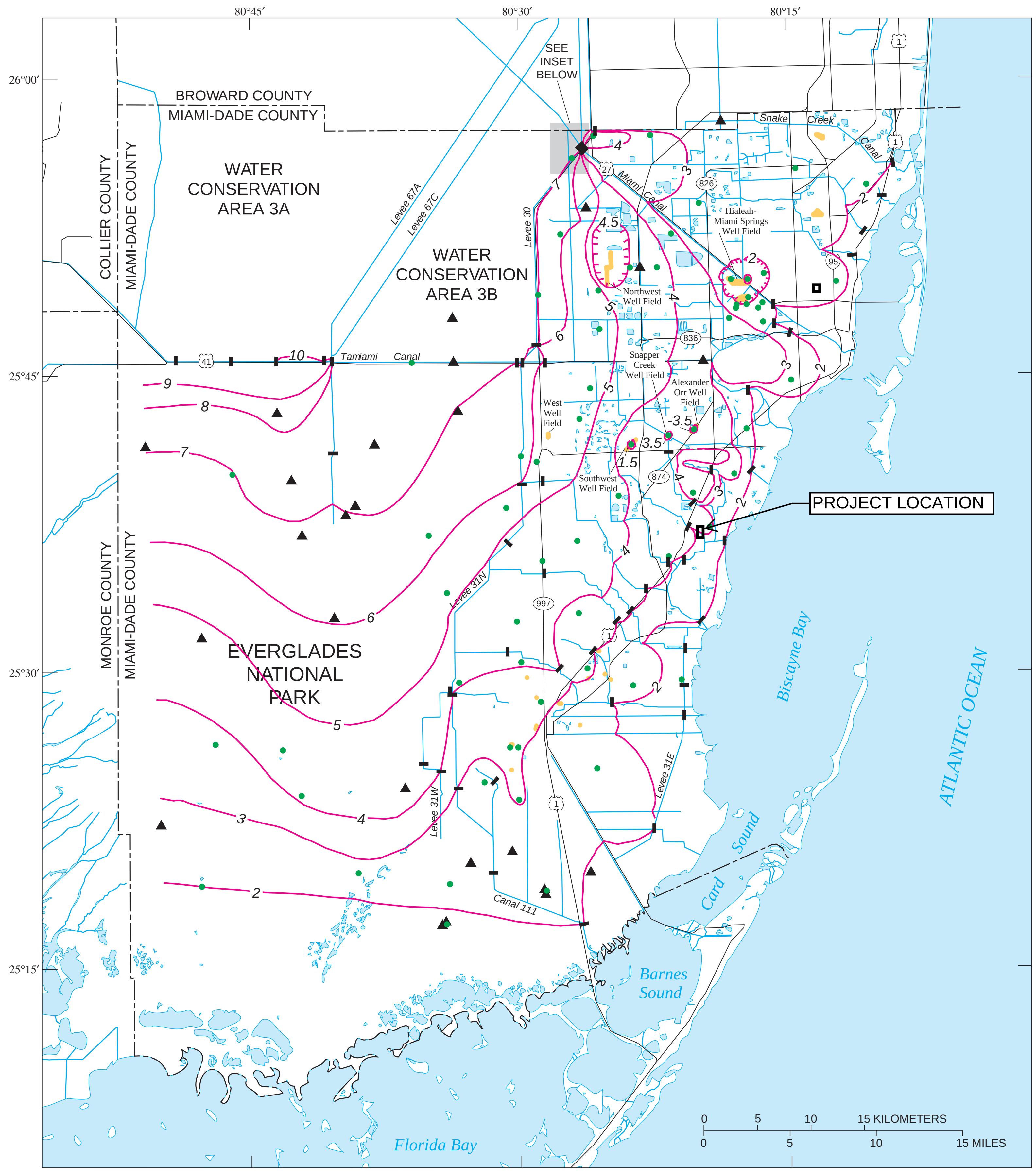
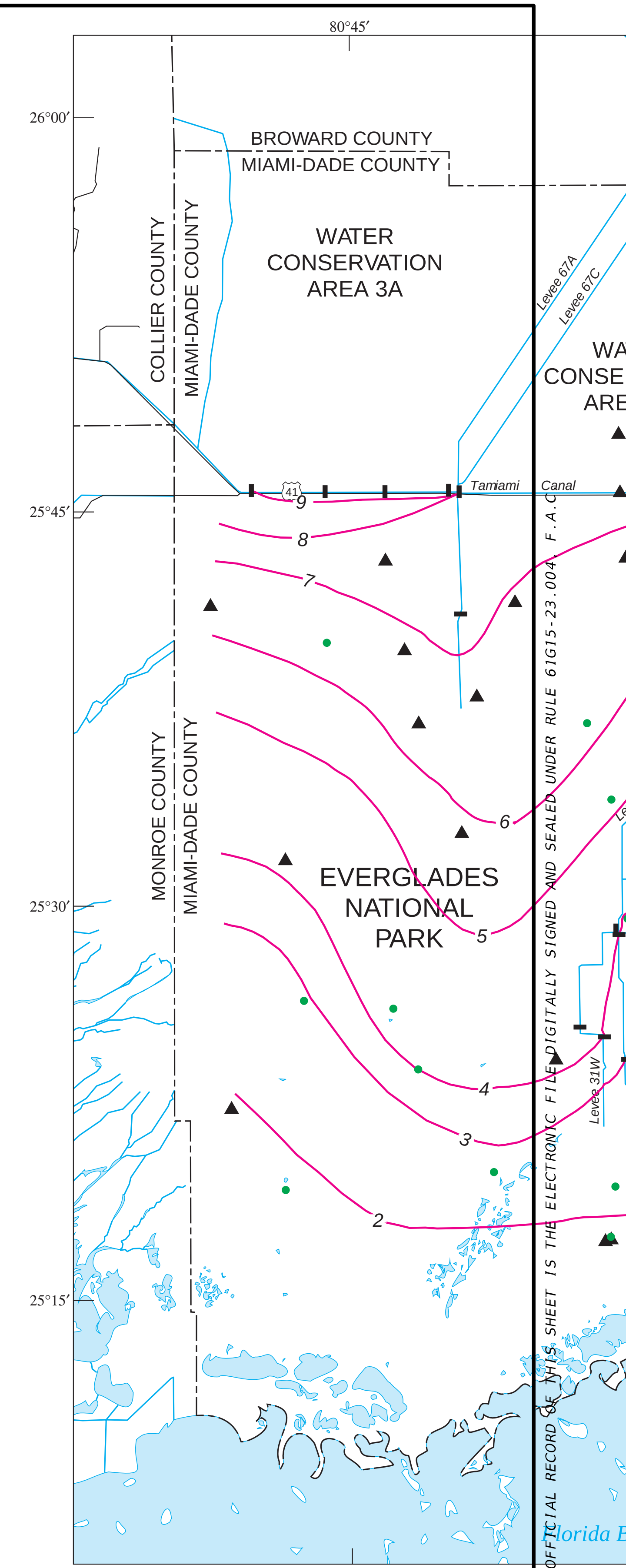


AVERAGE OCTOBER WATER LEVELS 1990-99



AVERAGE OCTOBER WATER LEVELS

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004 F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CS 10-21
CHECKED BY:	PV 10-21
DESIGNED BY:	CS 10-21
CHECKED BY:	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: USGS AVERAGE OCTOBER WATER LEVELS (1990-1999)

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

REF. DWG. NO.

SHEET NO. A-6

Lake Okeechobee
Study area
WELL FIELD
WATER-TABLE CONTOUR--Shows al... table. Hachures indicate depression. ...approximately located. Contour inte...

HRESUser 10/21/2021 9:52:49 AM D:\Driver14\HR21-1691R_SW 87th Ave Bridge over C-100 Canal - FB Driven & Auger Pile\...

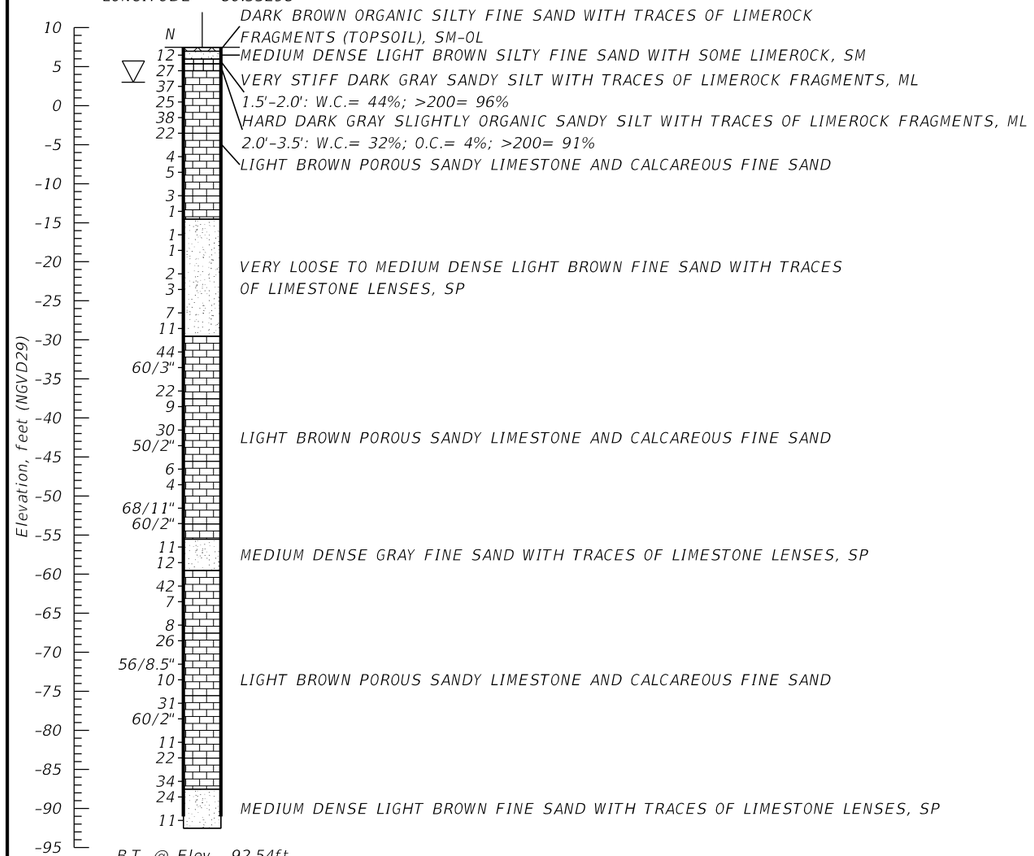
SUMMARY OF TEST BORING LOCATIONS
SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
MIAMI-DADE COUNTY, FLORIDA
HR ENGINEERING SERVICES, INC.
HRES PROJECT No. HR21-1691R
OCTOBER 29, 2021

TEST No.	GEOGRAPHIC COORDINATES		STATION	OFFSET, ft.	BASELINE REFERENCE
	LATITUDE	LONGITUDE			
B-1	25.61793	-80.33298	19+60	0.0	SW 87TH AVENUE
B-2	25.61815	-80.33299	20+40	0.0	SW 87TH AVENUE

Notes:

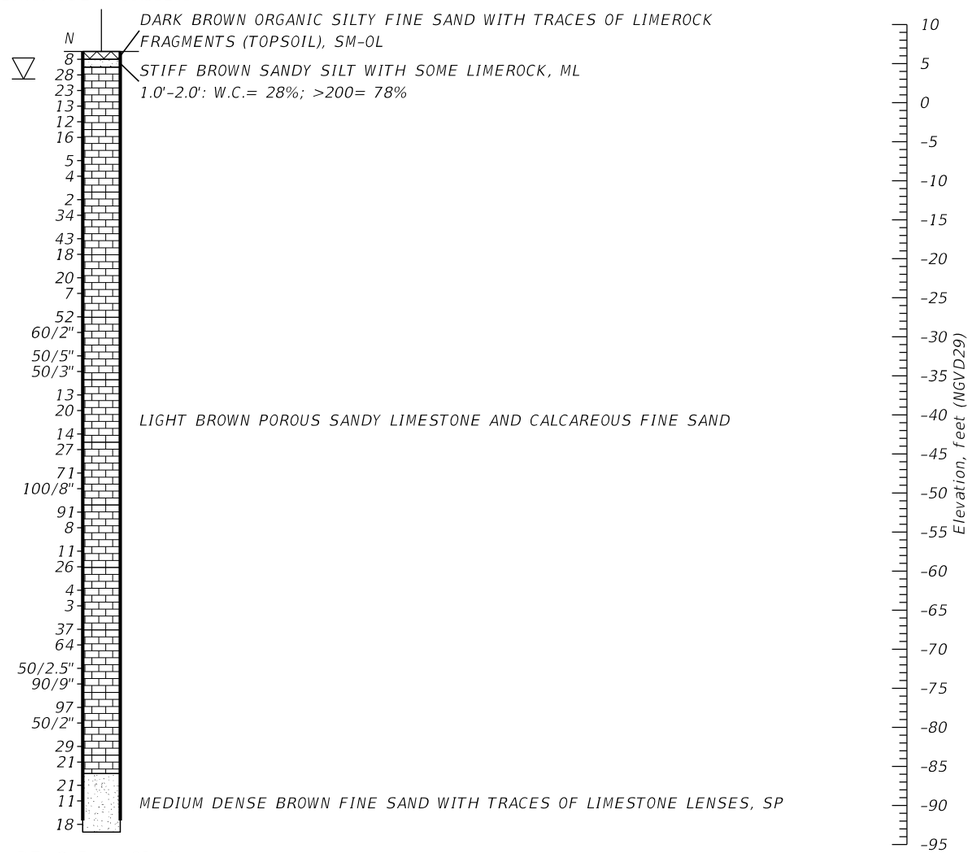
Plane coordinates were taken using a hand-held GPS and are approximate within 10 feet.

BOR # B-1
STA. 19+60
OFF. 0.0
ELEV. 7.46 FT
DATE 8/26/2021
DRILLER O. MEJIAS
HAMMER Auto
LATITUDE 25.61793
LONGITUDE -80.33298



B.T. @ Elev. -92.54ft
Casing Length 98.5ft

BOR # B-2
STA. 20+42
OFF. 0.0
ELEV. 6.56 FT
DATE 8/31/2021
DRILLER O. MEJIAS
HAMMER Auto
LATITUDE 25.61815
LONGITUDE -80.33299



B.T. @ Elev. -93.44ft
Casing Length 98.5ft

VERTICAL SCALE: 0 20
HORIZONTAL SCALE: NTS
HRES PROJECT No.: HR21-1691R

LEGEND

TOPSOIL
SAND
SILTY SAND
LIMESTONE
SILT

GROUND WATER LEVEL AT BORING COMPLETION

B.T. BORING TERMINATED

N: STANDARD PENETRATION RESISTANCE (AUTOMATIC HAMMER)

W.C.: WATER CONTENT

O.C.: ORGANIC CONTENT

>10: PERCENT PASSING #10 SIEVE

HAMMER WEIGHT = 140 LB
DROP HEIGHT = 30 IN

THE TEST BORINGS WERE PERFORMED BY HRES USING A CME-55 TRUCK MOUNTED RIG.

GRANULAR MATERIALS:

DENSITY	SPT N-VALUE (BLOWS/12 INCHES)
VERY LOOSE	<3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	>40

SILTS AND CLAYS:

CONSISTENCY	SPT N-VALUE (BLOWS/12 INCHES)
VERY SOFT	<1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	>24

ENVIRONMENTAL CLASSIFICATION

SUBSTRUCTURE:
CONCRETE: MODERATELY AGGRESSIVE
STEEL: MODERATELY AGGRESSIVE
SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE

Resistivity ohms-cm	pH	Sulfates ppm	Chlorides ppm
1,435	7.4	18.0	123.0

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	Description

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY: CS 09-21
CHECKED BY: PV 09-21
DESIGNED BY: CS 09-21
CHECKED BY: PV 09-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: REPORT OF CORE BORINGS
REF. DWG. NO.
PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL
SHEET NO. A-8

FIELD TESTING PROCEDURES

Test Borings - The test borings were made in general accordance with ASTM-D-1586, "Penetration Test and Split-Barrel Sampling of Soils." The borings were advanced using a 3-inch ID casing and a rotary drilling process. Water or bentonite drilling fluid was circulated in the boreholes to flush the cuttings. At regular intervals, the drilling tools were removed and soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140-lb hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance". The penetration resistance, when properly interpreted, is an index to the soil strength and density.

Representative portions of the soil samples, obtained from the sampler, were placed in glass jars and transported to our laboratory. An engineer then examined the samples in order to confirm the field classifications.

APPENDIX B

SUMMARY OF LABORATORY TEST RESULTS	**B-1**
LABORATORY TESTING PROCEDURES	**B-2**
LABORATORY TEST RESULTS	
– SOIL TESTING	**B-3 THRU B-6**
– CORROSION TESTING	**B-7**

SUMMARY OF LABORATORY TEST RESULTS
SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
MIAMI-DADE COUNTY, FLORIDA
HR ENGINEERING SERVICES, INC.
HRES PROJECT No. HR21-1691R
OCTOBER 29, 2021

Test Boring No.	USCS Class.	Sample Depth (ft)	Grain Size Distribution - Percent Passing									Organic Loss of Ignition, %	Moisture Content %	Material in Sample, %		
			1"	3/4"	3/8"	No. 4	No. 10	No. 40	No. 60	No. 100	No. 200			Gravel	Sand	Fines
B-1	ML	1.5-2.0	-	-	-	-	-	-	-	-	96	-	44	-	-	96
B-1	ML	2.0-3.5	-	-	-	-	-	-	-	-	91	4	32	-	-	91
B-2	ML	1.0-2.0	-	-	-	-	-	-	-	-	78	-	28	-	-	78

LABORATORY TESTING PROCEDURES

Percent Fines Content – In this test, the sample is dried and then washed over a # 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test was conducted in general accordance with ASTM D-1140.

Percent Organics (Organic Loss on Ignition) – The amount of organic material in the sample was determined in this test, by measuring the loss due to ignition. The sample was first dried and weighed, then ignited and reweighed. The amount of organic material is expressed as a percentage of the soil weight. This test was conducted in general accordance with ASTM D-2974.

Water Content – The water content is the ratio, expressed as a percentage of the weight of water in a given mass of soil to the weight of the soil particles. This test was conducted in general accordance with ASTM D-2216.

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL **Project No.:** HR21-1691R

Boring No.: B-1 **Sample No.:** 1C **Depth:** 1.5'-2.0'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	256.80
Wt. of Dry Soil + Can, grams	181.40
Wt. of Can, grams No. 405	8.90
Wt. of Dry Soil, grams	172.50
Wt. of Moisture, grams	75.40
Water Content, w%	44%
Wt. of Dry Soil + Can Before Wash, grams	181.40
Wt. of Can, grams No. 405	8.90
Wt. of Dry Soil Before Wash, grams	172.50
Time in / Out of Oven :	09/07/21 4:30 PM TO 09/08/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	16.20
Wt. of Dry Soil After Wash, grams	7.30
Total Loss, grams	165.20
Percent Finer Than No. 200 Sieve	96%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

ML

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND ORGANIC CONTENT BY LOSS ON IGNITION

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL **Project No.:** HR21-1691R

Boring No.: B-1 **Sample No.:** 2A **Depth:** 2.0'-3.5'

Date: 09/01/21

Technician:		E.M.
Date Sample Placed in Oven:		09/01/2021
Time in / Out of Oven :		09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams		253.20
Wt. of Dry Soil + Can, grams		193.90
Wt. of Can, grams	No. 406	9.10
Wt. of Dry Soil, grams		184.80
Wt. of Moisture, grams		59.30
Water Content, w%		32%
Date Sample Placed in Furnace:		09/01/21
Time in / out of furnace (minimum 6 hrs):		09/01/21 8:00 AM TO 09/01/21 2:00 PM
Weight of Crucible & Oven-Dried Sample:		26.80
Weight of Crucible and Sample After Ignition:		26.40
Weight of Crucible:	No. 13	15.70
Weight of Oven-Dried Soil:		11.10
Weight Loss due to Ignition:		0.40
Percent Organics:		4%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Organic Content Test performed in general accordance with ASTM D 2974 (AASHTO T 267)

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

ML

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL **Project No.:** HR21-1691R

Boring No.: B-1 **Sample No.:** 2A **Depth:** 2.0'-3.5'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	253.20
Wt. of Dry Soil + Can, grams	193.90
Wt. of Can, grams No. 406	9.10
Wt. of Dry Soil, grams	184.80
Wt. of Moisture, grams	59.30
Water Content, w%	32%
Wt. of Dry Soil + Can Before Wash, grams	182.40
Wt. of Can, grams No. 406	9.10
Wt. of Dry Soil Before Wash, grams	173.30
Time in / Out of Oven :	09/07/21 4:30 PM TO 09/08/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	24.90
Wt. of Dry Soil After Wash, grams	15.80
Total Loss, grams	157.50
Percent Finer Than No. 200 Sieve	91%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

ML

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL **Project No.:** HR21-1691R

Boring No.: B-2 **Sample No.:** 1B **Depth:** 1.0'-2.0'

Date: 09/07/21

Technician:	E.M.
Date Sample Placed in Oven:	09/07/2021
Time in / Out of Oven :	09/07/21 2:15 PM TO 09/08/21 2:15 PM
Wt. of Wet Soil + Can, grams	374.80
Wt. of Dry Soil + Can, grams	295.70
Wt. of Can, grams No. 607	8.90
Wt. of Dry Soil, grams	286.80
Wt. of Moisture, grams	79.10
Water Content, w%	28%
Wt. of Dry Soil + Can Before Wash, grams	295.70
Wt. of Can, grams No. 607	8.90
Wt. of Dry Soil Before Wash, grams	286.80
Time in / Out of Oven :	09/08/21 4:30 PM TO 09/09/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	71.80
Wt. of Dry Soil After Wash, grams	62.90
Total Loss, grams	223.90
Percent Finer Than No. 200 Sieve	78%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

ML

HR ENGINEERING SERVICES, INC.

CORROSION SERIES TEST RESULT

Project Name: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

Project Number: HR21-1691R **Date:** 09/02/21 **Tested by:** E.M.

Sample No.	Latitude	Longitude	Test Date	Sample Depth, ft	Soil/Water	pH	Chlorides, ppm	Sulfates, ppm	Resistivity, ohm-cm.	Sub-Structure Environmental	
										Steel	Concrete
P-1	25.61735	-80.33285	8/30/2021	5.6	Water	7.4	123.0	18.0	1,435	MA	MA

MA: Moderately Aggressive

Tests performed by HRES in accordance with Florida Method of Test Corrosion Series in Soil and Water, Designation FM 5-550 through FM 5-553

APPENDIX C

ALTERNATIVE 1

AUGERCAST PILE COMPRESSION CAPACITIES AND GRAPHS FOR
18-INCH DIAMETER AUGERCAST PILES **C-1 THRU C-14**
24-INCH DIAMETER AUGERCAST PILES **C-15 THRU C-28**

SOIL/ROCK PARAMETERS FOR AUGERCAST PILE LATERAL ANALYSIS **C-29**

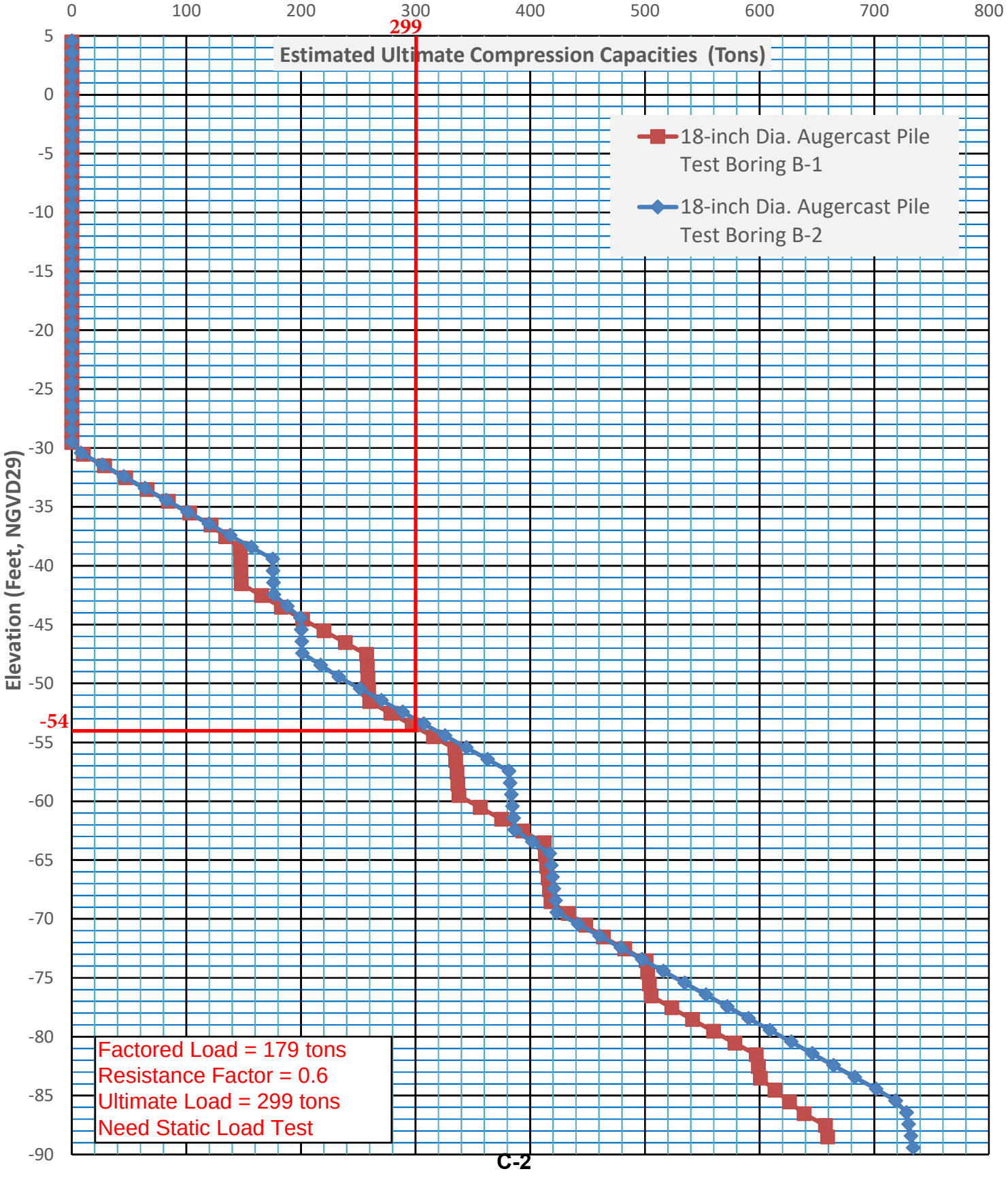
ALTERNATIVE 2

COMPRESSION CAPACITIES AND GRAPHS FOR
18-INCH DRIVEN SQUARE PRESTRESSED CONCRETE PILES **C-30 THRU C-38**

SOIL/ROCK PARAMETERS FOR 24-INCH DRIVEN PILES LATERAL ANALYSIS **C-39**

AUGERCAST PILE COMPRESSION CAPACITIES AND GRAPHS FOR 18-INCH DIAMETER AUGERCAST PILES

SW 87TH AVENUE BRIDGE OVER C-100 CANAL
HR ENGINEERING SERVICES, INC.
HRES PROJECT NO. HR21-1691R
ESTIMATED ULTIMATE COMPRESSION CAPACITIES FOR
18-INCH DIAMETER AUGERCAST PILES
TEST BORINGS: B-1 AND B-2



C-2

General Information:
====================
Input file: ..... to -30\B-1_18-inch Auger Cast Piles - 4 tsf & 0 N for Sand.in
Project number: HR21-1691R
Job name: SW 87TH AVE BRIDGE OVER C-100 CANAL
Engineer: CS
Units: English

Analysis Information:
=====================
Analysis Type: Drilled Shaft Analysis

Soil Information:
=================
Boring date: 8/26/2021
Boring number: B-1
Station number: 19+60 Offset: 0.0

Ground Elevation: 7.46(ft)
Water table Elevation = 0.76(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	7.46	N/A	120.00	5- Cavity layer
2	1.00	6.46	N/A	120.00	5- Cavity layer
3	3.00	4.46	N/A	120.00	5- Cavity layer
4	4.00	3.46	N/A	120.00	5- Cavity layer
5	4.00	3.46	N/A	120.00	5- Cavity layer
6	5.00	2.46	N/A	120.00	5- Cavity layer
7	7.00	0.46	N/A	120.00	5- Cavity layer
8	9.00	-1.54	N/A	120.00	5- Cavity layer
9	11.00	-3.54	N/A	120.00	5- Cavity layer
10	14.00	-6.54	N/A	120.00	5- Cavity layer
11	14.00	-6.54	N/A	120.00	5- Cavity layer
12	14.00	-6.54	N/A	120.00	5- Cavity layer
13	16.00	-8.54	N/A	120.00	5- Cavity layer
14	19.00	-11.54	N/A	120.00	5- Cavity layer
15	21.00	-13.54	N/A	120.00	5- Cavity layer
16	22.00	-14.54	N/A	120.00	5- Cavity layer
17	22.00	-14.54	N/A	99.09	5- Cavity layer
18	26.00	-18.54	N/A	99.09	5- Cavity layer
19	29.00	-21.54	N/A	99.09	5- Cavity layer
20	29.00	-21.54	N/A	100.17	5- Cavity layer
21	31.00	-23.54	N/A	101.26	5- Cavity layer
22	34.00	-26.54	N/A	105.60	5- Cavity layer
23	36.00	-28.54	N/A	109.94	5- Cavity layer
24	37.46	-30.00	N/A	109.94	5- Cavity layer
25	37.46	-30.00	N/A	120.00	4- Lime Stone/Very shelly sand
26	39.00	-31.54	N/A	120.00	4- Lime Stone/Very shelly sand
27	41.00	-33.54	N/A	120.00	4- Lime Stone/Very shelly sand
28	44.00	-36.54	N/A	120.00	4- Lime Stone/Very shelly sand
29	46.00	-38.54	0.00	120.00	3- Clean sand
30	49.00	-41.54	N/A	120.00	4- Lime Stone/Very shelly sand
31	51.00	-43.54	N/A	120.00	4- Lime Stone/Very shelly sand
32	54.00	-46.54	N/A	120.00	4- Lime Stone/Very shelly sand
33	55.00	-47.54	0.00	120.00	3- Clean sand
34	55.00	-47.54	0.00	120.00	3- Clean sand
35	55.00	-47.54	0.00	120.00	3- Clean sand
36	56.00	-48.54	0.00	120.00	3- Clean sand
37	59.00	-51.54	N/A	120.00	4- Lime Stone/Very shelly sand
38	61.00	-53.54	N/A	120.00	4- Lime Stone/Very shelly sand
39	63.00	-55.54	N/A	120.00	4- Lime Stone/Very shelly sand
40	63.00	-55.54	0.00	109.94	3- Clean sand
41	64.00	-56.54	0.00	109.94	3- Clean sand
42	66.00	-58.54	0.00	111.02	3- Clean sand
43	67.00	-59.54	0.00	111.02	3- Clean sand
44	67.00	-59.54	N/A	120.00	4- Lime Stone/Very shelly sand
45	69.00	-61.54	N/A	120.00	4- Lime Stone/Very shelly sand
46	71.00	-63.54	0.00	120.00	3- Clean sand
47	74.00	-66.54	0.00	120.00	3- Clean sand
48	74.00	-66.54	0.00	120.00	3- Clean sand
49	76.00	-68.54	N/A	120.00	4- Lime Stone/Very shelly sand
50	79.00	-71.54	N/A	120.00	4- Lime Stone/Very shelly sand
51	79.00	-71.54	N/A	120.00	4- Lime Stone/Very shelly sand
52	81.00	-73.54	0.00	120.00	3- Clean sand
53	84.00	-76.54	N/A	120.00	4- Lime Stone/Very shelly sand
54	86.00	-78.54	N/A	120.00	4- Lime Stone/Very shelly sand
55	89.00	-81.54	0.00	120.00	3- Clean sand
56	91.00	-83.54	N/A	120.00	4- Lime Stone/Very shelly sand
57	94.00	-86.54	N/A	120.00	4- Lime Stone/Very shelly sand

58	95.00	-87.54	N/A	120.00	4- Lime Stone/Very shelly sand
59	95.00	-87.54	0.00	115.00	3- Clean sand
60	96.00	-88.54	0.00	115.00	3- Clean sand
61	100.00	-92.54	0.00	109.94	3- Clean sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A	N/A
20	N/A	N/A	N/A	N/A	N/A
21	N/A	N/A	N/A	N/A	N/A
22	N/A	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	17.74	3.50	0.00	0.00
26	N/A	17.74	3.50	0.00	0.00
27	N/A	17.74	3.50	0.00	0.00
28	N/A	12.19	2.40	0.00	0.00
29	N/A	N/A	N/A	N/A	N/A
30	N/A	16.63	3.30	0.00	0.00
31	N/A	17.74	3.50	0.00	0.00
32	N/A	17.74	3.50	0.00	0.00
33	N/A	N/A	N/A	N/A	N/A
34	N/A	N/A	N/A	N/A	N/A
35	N/A	N/A	N/A	N/A	N/A
36	N/A	N/A	N/A	N/A	N/A
37	N/A	17.74	3.50	0.00	0.00
38	N/A	17.74	3.50	0.00	0.00
39	N/A	17.74	3.50	0.00	0.00
40	N/A	N/A	N/A	N/A	N/A
41	N/A	N/A	N/A	N/A	N/A
42	N/A	N/A	N/A	N/A	N/A
43	N/A	N/A	N/A	N/A	N/A
44	N/A	17.74	3.50	0.00	0.00
45	N/A	17.74	3.50	0.00	0.00
46	N/A	N/A	N/A	N/A	N/A
47	N/A	N/A	N/A	N/A	N/A
48	N/A	N/A	N/A	N/A	N/A
49	N/A	14.41	2.90	0.00	0.00
50	N/A	14.41	2.90	0.00	0.00
51	N/A	17.74	3.50	0.00	0.00
52	N/A	N/A	N/A	N/A	N/A
53	N/A	17.18	3.40	0.00	0.00
54	N/A	17.74	3.50	0.00	0.00
55	N/A	N/A	N/A	N/A	N/A
56	N/A	12.19	2.40	0.00	0.00
57	N/A	17.74	3.50	0.00	0.00
58	N/A	17.74	3.50	0.00	0.00
59	N/A	N/A	N/A	N/A	N/A
60	N/A	N/A	N/A	N/A	N/A
61	N/A	N/A	N/A	N/A	N/A

ID	RQD F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A
14	N/A	N/A	N/A
15	N/A	N/A	N/A
16	N/A	N/A	N/A
17	N/A	N/A	N/A
18	N/A	N/A	N/A

19	N/A	N/A	N/A
20	N/A	N/A	N/A
21	N/A	N/A	N/A
22	N/A	N/A	N/A
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	1.00	ROUGH	1.000
26	1.00	ROUGH	1.000
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	N/A	N/A	N/A
30	1.00	ROUGH	1.000
31	1.00	ROUGH	1.000
32	1.00	ROUGH	1.000
33	N/A	N/A	N/A
34	N/A	N/A	N/A
35	N/A	N/A	N/A
36	N/A	N/A	N/A
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	N/A	N/A	N/A
41	N/A	N/A	N/A
42	N/A	N/A	N/A
43	N/A	N/A	N/A
44	1.00	ROUGH	1.000
45	1.00	ROUGH	1.000
46	N/A	N/A	N/A
47	N/A	N/A	N/A
48	N/A	N/A	N/A
49	1.00	ROUGH	1.000
50	1.00	ROUGH	1.000
51	1.00	ROUGH	1.000
52	N/A	N/A	N/A
53	1.00	ROUGH	1.000
54	1.00	ROUGH	1.000
55	N/A	N/A	N/A
56	1.00	ROUGH	1.000
57	1.00	ROUGH	1.000
58	1.00	ROUGH	1.000
59	N/A	N/A	N/A
60	N/A	N/A	N/A
61	N/A	N/A	N/A

Drilled Shaft Data:
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Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	6.46	0.00	18.00	18.00	0.00
2	2.00	5.46	0.00	18.00	18.00	0.00
3	3.00	4.46	0.00	18.00	18.00	0.00
4	4.00	3.46	0.00	18.00	18.00	0.00
5	5.00	2.46	0.00	18.00	18.00	0.00
6	6.00	1.46	0.00	18.00	18.00	0.00
7	7.00	0.46	0.00	18.00	18.00	0.00
8	8.00	-0.54	0.00	18.00	18.00	0.00
9	9.00	-1.54	0.00	18.00	18.00	0.00
10	10.00	-2.54	0.00	18.00	18.00	0.00
11	11.00	-3.54	0.00	18.00	18.00	0.00
12	12.00	-4.54	0.00	18.00	18.00	0.00
13	13.00	-5.54	0.00	18.00	18.00	0.00
14	14.00	-6.54	0.00	18.00	18.00	0.00
15	15.00	-7.54	0.00	18.00	18.00	0.00
16	16.00	-8.54	0.00	18.00	18.00	0.00
17	17.00	-9.54	0.00	18.00	18.00	0.00
18	18.00	-10.54	0.00	18.00	18.00	0.00
19	19.00	-11.54	0.00	18.00	18.00	0.00
20	20.00	-12.54	0.00	18.00	18.00	0.00
21	21.00	-13.54	0.00	18.00	18.00	0.00
22	22.00	-14.54	0.00	18.00	18.00	0.00
23	23.00	-15.54	0.00	18.00	18.00	0.00
24	24.00	-16.54	0.00	18.00	18.00	0.00
25	25.00	-17.54	0.00	18.00	18.00	0.00
26	26.00	-18.54	0.00	18.00	18.00	0.00
27	27.00	-19.54	0.00	18.00	18.00	0.00
28	28.00	-20.54	0.00	18.00	18.00	0.00
29	29.00	-21.54	0.00	18.00	18.00	0.00
30	30.00	-22.54	0.00	18.00	18.00	0.00
31	31.00	-23.54	0.00	18.00	18.00	0.00
32	32.00	-24.54	0.00	18.00	18.00	0.00
33	33.00	-25.54	0.00	18.00	18.00	0.00
34	34.00	-26.54	0.00	18.00	18.00	0.00
35	35.00	-27.54	0.00	18.00	18.00	0.00
36	36.00	-28.54	0.00	18.00	18.00	0.00

37	37.00	-29.54	0.00	18.00	18.00	0.00
38	38.00	-30.54	0.00	18.00	18.00	0.00
39	39.00	-31.54	0.00	18.00	18.00	0.00
40	40.00	-32.54	0.00	18.00	18.00	0.00
41	41.00	-33.54	0.00	18.00	18.00	0.00
42	42.00	-34.54	0.00	18.00	18.00	0.00
43	43.00	-35.54	0.00	18.00	18.00	0.00
44	44.00	-36.54	0.00	18.00	18.00	0.00
45	45.00	-37.54	0.00	18.00	18.00	0.00
46	46.00	-38.54	0.00	18.00	18.00	0.00
47	47.00	-39.54	0.00	18.00	18.00	0.00
48	48.00	-40.54	0.00	18.00	18.00	0.00
49	49.00	-41.54	0.00	18.00	18.00	0.00
50	50.00	-42.54	0.00	18.00	18.00	0.00
51	51.00	-43.54	0.00	18.00	18.00	0.00
52	52.00	-44.54	0.00	18.00	18.00	0.00
53	53.00	-45.54	0.00	18.00	18.00	0.00
54	54.00	-46.54	0.00	18.00	18.00	0.00
55	55.00	-47.54	0.00	18.00	18.00	0.00
56	56.00	-48.54	0.00	18.00	18.00	0.00
57	57.00	-49.54	0.00	18.00	18.00	0.00
58	58.00	-50.54	0.00	18.00	18.00	0.00
59	59.00	-51.54	0.00	18.00	18.00	0.00
60	60.00	-52.54	0.00	18.00	18.00	0.00
61	61.00	-53.54	0.00	18.00	18.00	0.00
62	62.00	-54.54	0.00	18.00	18.00	0.00
63	63.00	-55.54	0.00	18.00	18.00	0.00
64	64.00	-56.54	0.00	18.00	18.00	0.00
65	65.00	-57.54	0.00	18.00	18.00	0.00
66	66.00	-58.54	0.00	18.00	18.00	0.00
67	67.00	-59.54	0.00	18.00	18.00	0.00
68	68.00	-60.54	0.00	18.00	18.00	0.00
69	69.00	-61.54	0.00	18.00	18.00	0.00
70	70.00	-62.54	0.00	18.00	18.00	0.00
71	71.00	-63.54	0.00	18.00	18.00	0.00
72	72.00	-64.54	0.00	18.00	18.00	0.00
73	73.00	-65.54	0.00	18.00	18.00	0.00
74	74.00	-66.54	0.00	18.00	18.00	0.00
75	75.00	-67.54	0.00	18.00	18.00	0.00
76	76.00	-68.54	0.00	18.00	18.00	0.00
77	77.00	-69.54	0.00	18.00	18.00	0.00
78	78.00	-70.54	0.00	18.00	18.00	0.00
79	79.00	-71.54	0.00	18.00	18.00	0.00
80	80.00	-72.54	0.00	18.00	18.00	0.00
81	81.00	-73.54	0.00	18.00	18.00	0.00
82	82.00	-74.54	0.00	18.00	18.00	0.00
83	83.00	-75.54	0.00	18.00	18.00	0.00
84	84.00	-76.54	0.00	18.00	18.00	0.00
85	85.00	-77.54	0.00	18.00	18.00	0.00
86	86.00	-78.54	0.00	18.00	18.00	0.00
87	87.00	-79.54	0.00	18.00	18.00	0.00
88	88.00	-80.54	0.00	18.00	18.00	0.00
89	89.00	-81.54	0.00	18.00	18.00	0.00
90	90.00	-82.54	0.00	18.00	18.00	0.00
91	91.00	-83.54	0.00	18.00	18.00	0.00
92	92.00	-84.54	0.00	18.00	18.00	0.00
93	93.00	-85.54	0.00	18.00	18.00	0.00
94	94.00	-86.54	0.00	18.00	18.00	0.00
95	95.00	-87.54	0.00	18.00	18.00	0.00
96	96.00	-88.54	0.00	18.00	18.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	18.00	1.00	0.000	0.000	0.000
2	18.00	2.00	0.000	0.000	0.000
3	18.00	3.00	0.000	0.000	0.000
4	18.00	4.00	0.000	0.000	0.000
5	18.00	5.00	0.000	0.000	0.000
6	18.00	6.00	0.000	0.000	0.000
7	18.00	7.00	0.000	0.000	0.000
8	18.00	8.00	0.000	0.000	0.000
9	18.00	9.00	0.000	0.000	0.000
10	18.00	10.00	0.000	0.000	0.000
11	18.00	11.00	0.000	0.000	0.000
12	18.00	12.00	0.000	0.000	0.000
13	18.00	13.00	0.000	0.000	0.000
14	18.00	14.00	0.000	0.000	0.000
15	18.00	15.00	0.000	0.000	0.000
16	18.00	16.00	0.000	0.000	0.000
17	18.00	17.00	0.000	0.000	0.000
18	18.00	18.00	0.000	0.000	0.000
19	18.00	19.00	0.000	0.000	0.000
20	18.00	20.00	0.000	0.000	0.000
21	18.00	21.00	0.000	0.000	0.000
22	18.00	22.00	0.000	0.000	0.000

23	18.00	23.00	0.000	0.000	0.000
24	18.00	24.00	0.000	0.000	0.000
25	18.00	25.00	0.000	0.000	0.000
26	18.00	26.00	0.000	0.000	0.000
27	18.00	27.00	0.000	0.000	0.000
28	18.00	28.00	0.000	0.000	0.000
29	18.00	29.00	0.000	0.000	0.000
30	18.00	30.00	0.000	0.000	0.000
31	18.00	31.00	0.000	0.000	0.000
32	18.00	32.00	0.000	0.000	0.000
33	18.00	33.00	0.000	0.000	0.000
34	18.00	34.00	0.000	0.000	0.000
35	18.00	35.00	0.000	0.000	0.000
36	18.00	36.00	0.000	0.000	0.000
37	18.00	37.00	0.000	0.000	0.000
38	18.00	38.00	10.026	0.000	10.026
39	18.00	39.00	28.592	0.000	28.592
40	18.00	40.00	47.158	0.000	47.158
41	18.00	41.00	65.724	0.000	65.724
42	18.00	42.00	84.290	0.000	84.290
43	18.00	43.00	102.857	0.000	102.857
44	18.00	44.00	121.423	0.000	121.423
45	18.00	45.00	134.167	0.000	134.167
46	18.00	46.00	146.911	0.000	146.911
47	18.00	47.00	147.218	0.000	147.218
48	18.00	48.00	147.559	0.000	147.559
49	18.00	49.00	147.933	0.000	147.933
50	18.00	50.00	165.388	0.000	165.388
51	18.00	51.00	182.843	0.000	182.843
52	18.00	52.00	201.409	0.000	201.409
53	18.00	53.00	219.975	0.000	219.975
54	18.00	54.00	238.541	0.000	238.541
55	18.00	55.00	257.108	0.000	257.108
56	18.00	56.00	257.720	0.000	257.720
57	18.00	57.00	258.366	0.000	258.366
58	18.00	58.00	259.046	0.000	259.046
59	18.00	59.00	259.759	0.000	259.759
60	18.00	60.00	278.326	0.000	278.326
61	18.00	61.00	296.892	0.000	296.892
62	18.00	62.00	315.458	0.000	315.458
63	18.00	63.00	334.024	0.000	334.024
64	18.00	64.00	334.905	0.000	334.905
65	18.00	65.00	335.813	0.000	335.813
66	18.00	66.00	336.750	0.000	336.750
67	18.00	67.00	337.715	0.000	337.715
68	18.00	68.00	356.281	0.000	356.281
69	18.00	69.00	374.847	0.000	374.847
70	18.00	70.00	393.413	0.000	393.413
71	18.00	71.00	411.979	0.000	411.979
72	18.00	72.00	413.111	0.000	413.111
73	18.00	73.00	414.277	0.000	414.277
74	18.00	74.00	415.477	0.000	415.477
75	18.00	75.00	416.710	0.000	416.710
76	18.00	76.00	417.978	0.000	417.978
77	18.00	77.00	433.209	0.000	433.209
78	18.00	78.00	448.441	0.000	448.441
79	18.00	79.00	463.672	0.000	463.672
80	18.00	80.00	482.239	0.000	482.239
81	18.00	81.00	500.805	0.000	500.805
82	18.00	82.00	502.276	0.000	502.276
83	18.00	83.00	503.781	0.000	503.781
84	18.00	84.00	505.320	0.000	505.320
85	18.00	85.00	523.328	0.000	523.328
86	18.00	86.00	541.336	0.000	541.336
87	18.00	87.00	559.902	0.000	559.902
88	18.00	88.00	578.468	0.000	578.468
89	18.00	89.00	597.034	0.000	597.034
90	18.00	90.00	598.777	0.000	598.777
91	18.00	91.00	600.553	0.000	600.553
92	18.00	92.00	613.298	0.000	613.298
93	18.00	93.00	626.042	0.000	626.042
94	18.00	94.00	638.786	0.000	638.786
95	18.00	95.00	657.353	0.000	657.353
96	18.00	96.00	659.297	0.000	659.297

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	18.00	1.00	0.000	0.000	0.000
2	18.00	2.00	0.000	0.000	0.000
3	18.00	3.00	0.000	0.000	0.000
4	18.00	4.00	0.000	0.000	0.000
5	18.00	5.00	0.000	0.000	0.000

6	18.00	6.00	0.000	0.000	0.000
7	18.00	7.00	0.000	0.000	0.000
8	18.00	8.00	0.000	0.000	0.000
9	18.00	9.00	0.000	0.000	0.000
10	18.00	10.00	0.000	0.000	0.000
11	18.00	11.00	0.000	0.000	0.000
12	18.00	12.00	0.000	0.000	0.000
13	18.00	13.00	0.000	0.000	0.000
14	18.00	14.00	0.000	0.000	0.000
15	18.00	15.00	0.000	0.000	0.000
16	18.00	16.00	0.000	0.000	0.000
17	18.00	17.00	0.000	0.000	0.000
18	18.00	18.00	0.000	0.000	0.000
19	18.00	19.00	0.000	0.000	0.000
20	18.00	20.00	0.000	0.000	0.000
21	18.00	21.00	0.000	0.000	0.000
22	18.00	22.00	0.000	0.000	0.000
23	18.00	23.00	0.000	0.000	0.000
24	18.00	24.00	0.000	0.000	0.000
25	18.00	25.00	0.000	0.000	0.000
26	18.00	26.00	0.000	0.000	0.000
27	18.00	27.00	0.000	0.000	0.000
28	18.00	28.00	0.000	0.000	0.000
29	18.00	29.00	0.000	0.000	0.000
30	18.00	30.00	0.000	0.000	0.000
31	18.00	31.00	0.000	0.000	0.000
32	18.00	32.00	0.000	0.000	0.000
33	18.00	33.00	0.000	0.000	0.000
34	18.00	34.00	0.000	0.000	0.000
35	18.00	35.00	0.000	0.000	0.000
36	18.00	36.00	0.000	0.000	0.000
37	18.00	37.00	0.000	0.000	0.000
38	18.00	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	18.00	39.00	-nan(ind)	-nan(ind)	-nan(ind)
40	18.00	40.00	-nan(ind)	-nan(ind)	-nan(ind)
41	18.00	41.00	-nan(ind)	-nan(ind)	-nan(ind)
42	18.00	42.00	-nan(ind)	-nan(ind)	-nan(ind)
43	18.00	43.00	-nan(ind)	-nan(ind)	-nan(ind)
44	18.00	44.00	-nan(ind)	-nan(ind)	-nan(ind)
45	18.00	45.00	-nan(ind)	-nan(ind)	-nan(ind)
46	18.00	46.00	-nan(ind)	0.000	-nan(ind)
47	18.00	47.00	-nan(ind)	0.000	-nan(ind)
48	18.00	48.00	-nan(ind)	0.000	-nan(ind)
49	18.00	49.00	-nan(ind)	-nan(ind)	-nan(ind)
50	18.00	50.00	-nan(ind)	-nan(ind)	-nan(ind)
51	18.00	51.00	-nan(ind)	-nan(ind)	-nan(ind)
52	18.00	52.00	-nan(ind)	-nan(ind)	-nan(ind)
53	18.00	53.00	-nan(ind)	-nan(ind)	-nan(ind)
54	18.00	54.00	-nan(ind)	-nan(ind)	-nan(ind)
55	18.00	55.00	-nan(ind)	0.000	-nan(ind)
56	18.00	56.00	-nan(ind)	0.000	-nan(ind)
57	18.00	57.00	-nan(ind)	0.000	-nan(ind)
58	18.00	58.00	-nan(ind)	0.000	-nan(ind)
59	18.00	59.00	-nan(ind)	-nan(ind)	-nan(ind)
60	18.00	60.00	-nan(ind)	-nan(ind)	-nan(ind)
61	18.00	61.00	-nan(ind)	-nan(ind)	-nan(ind)
62	18.00	62.00	-nan(ind)	-nan(ind)	-nan(ind)
63	18.00	63.00	-nan(ind)	0.000	-nan(ind)
64	18.00	64.00	-nan(ind)	0.000	-nan(ind)
65	18.00	65.00	-nan(ind)	0.000	-nan(ind)
66	18.00	66.00	-nan(ind)	0.000	-nan(ind)
67	18.00	67.00	-nan(ind)	-nan(ind)	-nan(ind)
68	18.00	68.00	-nan(ind)	-nan(ind)	-nan(ind)
69	18.00	69.00	-nan(ind)	-nan(ind)	-nan(ind)
70	18.00	70.00	-nan(ind)	-nan(ind)	-nan(ind)
71	18.00	71.00	-nan(ind)	0.000	-nan(ind)
72	18.00	72.00	-nan(ind)	0.000	-nan(ind)
73	18.00	73.00	-nan(ind)	0.000	-nan(ind)
74	18.00	74.00	-nan(ind)	0.000	-nan(ind)
75	18.00	75.00	-nan(ind)	0.000	-nan(ind)
76	18.00	76.00	-nan(ind)	-nan(ind)	-nan(ind)
77	18.00	77.00	-nan(ind)	-nan(ind)	-nan(ind)
78	18.00	78.00	-nan(ind)	-nan(ind)	-nan(ind)
79	18.00	79.00	-nan(ind)	-nan(ind)	-nan(ind)
80	18.00	80.00	-nan(ind)	-nan(ind)	-nan(ind)
81	18.00	81.00	-nan(ind)	0.000	-nan(ind)
82	18.00	82.00	-nan(ind)	0.000	-nan(ind)
83	18.00	83.00	-nan(ind)	0.000	-nan(ind)
84	18.00	84.00	-nan(ind)	-nan(ind)	-nan(ind)
85	18.00	85.00	-nan(ind)	-nan(ind)	-nan(ind)
86	18.00	86.00	-nan(ind)	-nan(ind)	-nan(ind)
87	18.00	87.00	-nan(ind)	-nan(ind)	-nan(ind)
88	18.00	88.00	-nan(ind)	-nan(ind)	-nan(ind)
89	18.00	89.00	-nan(ind)	0.000	-nan(ind)
90	18.00	90.00	-nan(ind)	0.000	-nan(ind)
91	18.00	91.00	-nan(ind)	-nan(ind)	-nan(ind)
92	18.00	92.00	-nan(ind)	-nan(ind)	-nan(ind)
93	18.00	93.00	-nan(ind)	-nan(ind)	-nan(ind)
94	18.00	94.00	-nan(ind)	-nan(ind)	-nan(ind)
95	18.00	95.00	-nan(ind)	0.000	-nan(ind)
96	18.00	96.00	-nan(ind)	0.000	-nan(ind)

General Information:
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Input file: ..... to -30\B-2_18-inch Auger Cast Piles - 4 tsf & 0 N for Sand.in
Project number: HR21-1691R
Job name: SW 87TH AVE BRIDGE OVER C-100 CANAL
Engineer: CS
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 8/31/2021
Boring number: B-2
Station number: 20+42 Offset: 0.0

Ground Elevation: 6.56(ft)
Water table Elevation = -0.14(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	6.56	N/A	120.00	5- Cavity layer
2	1.00	5.56	N/A	120.00	5- Cavity layer
3	3.00	3.56	N/A	120.00	5- Cavity layer
4	5.00	1.56	N/A	120.00	5- Cavity layer
5	7.00	-0.44	N/A	120.00	5- Cavity layer
6	9.00	-2.44	N/A	120.00	5- Cavity layer
7	11.00	-4.44	N/A	120.00	5- Cavity layer
8	14.00	-7.44	N/A	120.00	5- Cavity layer
9	16.00	-9.44	N/A	120.00	5- Cavity layer
10	19.00	-12.44	N/A	120.00	5- Cavity layer
11	21.00	-14.44	N/A	120.00	5- Cavity layer
12	24.00	-17.44	N/A	120.00	5- Cavity layer
13	26.00	-19.44	N/A	120.00	5- Cavity layer
14	29.00	-22.44	N/A	120.00	5- Cavity layer
15	31.00	-24.44	N/A	120.00	5- Cavity layer
16	34.00	-27.44	N/A	120.00	5- Cavity layer
17	36.56	-30.00	N/A	0.00	5- Cavity layer
18	36.56	-30.00	N/A	120.00	4- Lime Stone/Very shelly sand
19	39.00	-32.44	N/A	120.00	4- Lime Stone/Very shelly sand
20	41.00	-34.44	N/A	120.00	4- Lime Stone/Very shelly sand
21	44.00	-37.44	N/A	120.00	4- Lime Stone/Very shelly sand
22	46.00	-39.44	0.00	120.00	3- Clean sand
23	49.00	-42.44	N/A	120.00	4- Lime Stone/Very shelly sand
24	51.00	-44.44	0.00	120.00	3- Clean sand
25	54.00	-47.44	N/A	120.00	4- Lime Stone/Very shelly sand
26	56.00	-49.44	N/A	120.00	4- Lime Stone/Very shelly sand
27	59.00	-52.44	N/A	120.00	4- Lime Stone/Very shelly sand
28	61.00	-54.44	N/A	120.00	4- Lime Stone/Very shelly sand
29	64.00	-57.44	0.00	120.00	3- Clean sand
30	66.00	-59.44	0.00	120.00	3- Clean sand
31	69.00	-62.44	N/A	120.00	4- Lime Stone/Very shelly sand
32	71.00	-64.44	0.00	120.00	3- Clean sand
33	74.00	-67.44	0.00	120.00	3- Clean sand
34	76.00	-69.44	N/A	120.00	4- Lime Stone/Very shelly sand
35	79.00	-72.44	N/A	120.00	4- Lime Stone/Very shelly sand
36	81.00	-74.44	N/A	120.00	4- Lime Stone/Very shelly sand
37	84.00	-77.44	N/A	120.00	4- Lime Stone/Very shelly sand
38	86.00	-79.44	N/A	120.00	4- Lime Stone/Very shelly sand
39	89.00	-82.44	N/A	120.00	4- Lime Stone/Very shelly sand
40	91.00	-84.44	N/A	120.00	4- Lime Stone/Very shelly sand
41	92.50	-85.94	N/A	120.00	4- Lime Stone/Very shelly sand
42	92.50	-85.94	0.00	115.00	3- Clean sand
43	94.00	-87.44	0.00	115.00	3- Clean sand
44	96.00	-89.44	0.00	109.94	3- Clean sand
45	99.00	-92.44	0.00	115.00	3- Clean sand
46	100.00	-93.44	0.00	115.00	3- Clean sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A

8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	17.74	3.50	0.00	0.00
19	N/A	17.74	3.50	0.00	0.00
20	N/A	17.74	3.50	0.00	0.00
21	N/A	17.74	3.50	0.00	0.00
22	N/A	N/A	N/A	N/A	N/A
23	N/A	11.09	2.20	0.00	0.00
24	N/A	N/A	N/A	N/A	N/A
25	N/A	14.97	3.00	0.00	0.00
26	N/A	17.74	3.50	0.00	0.00
27	N/A	17.74	3.50	0.00	0.00
28	N/A	17.74	3.50	0.00	0.00
29	N/A	N/A	N/A	N/A	N/A
30	N/A	N/A	N/A	N/A	N/A
31	N/A	14.41	2.90	0.00	0.00
32	N/A	N/A	N/A	N/A	N/A
33	N/A	N/A	N/A	N/A	N/A
34	N/A	17.74	3.50	0.00	0.00
35	N/A	17.74	3.50	0.00	0.00
36	N/A	17.74	3.50	0.00	0.00
37	N/A	17.74	3.50	0.00	0.00
38	N/A	17.74	3.50	0.00	0.00
39	N/A	17.74	3.50	0.00	0.00
40	N/A	16.07	3.20	0.00	0.00
41	N/A	11.64	2.30	0.00	0.00
42	N/A	N/A	N/A	N/A	N/A
43	N/A	N/A	N/A	N/A	N/A
44	N/A	N/A	N/A	N/A	N/A
45	N/A	N/A	N/A	N/A	N/A
46	N/A	N/A	N/A	N/A	N/A

ID	RQD	F.M.	S.R.I.	Rock Recovery
1	N/A		N/A	N/A
2	N/A		N/A	N/A
3	N/A		N/A	N/A
4	N/A		N/A	N/A
5	N/A		N/A	N/A
6	N/A		N/A	N/A
7	N/A		N/A	N/A
8	N/A		N/A	N/A
9	N/A		N/A	N/A
10	N/A		N/A	N/A
11	N/A		N/A	N/A
12	N/A		N/A	N/A
13	N/A		N/A	N/A
14	N/A		N/A	N/A
15	N/A		N/A	N/A
16	N/A		N/A	N/A
17	N/A		N/A	N/A
18	1.00		ROUGH	1.000
19	1.00		ROUGH	1.000
20	1.00		ROUGH	1.000
21	1.00		ROUGH	1.000
22	N/A		N/A	N/A
23	1.00		ROUGH	1.000
24	N/A		N/A	N/A
25	1.00		ROUGH	1.000
26	1.00		ROUGH	1.000
27	1.00		ROUGH	1.000
28	1.00		ROUGH	1.000
29	N/A		N/A	N/A
30	N/A		N/A	N/A
31	1.00		ROUGH	1.000
32	N/A		N/A	N/A
33	N/A		N/A	N/A
34	1.00		ROUGH	1.000
35	1.00		ROUGH	1.000
36	1.00		ROUGH	1.000
37	1.00		ROUGH	1.000
38	1.00		ROUGH	1.000
39	1.00		ROUGH	1.000
40	1.00		ROUGH	1.000
41	1.00		ROUGH	1.000
42	N/A		N/A	N/A
43	N/A		N/A	N/A
44	N/A		N/A	N/A
45	N/A		N/A	N/A
46	N/A		N/A	N/A

Drilled Shaft Data:
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Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	5.56	0.00	18.00	18.00	0.00
2	2.00	4.56	0.00	18.00	18.00	0.00
3	3.00	3.56	0.00	18.00	18.00	0.00
4	4.00	2.56	0.00	18.00	18.00	0.00
5	5.00	1.56	0.00	18.00	18.00	0.00
6	6.00	0.56	0.00	18.00	18.00	0.00
7	7.00	-0.44	0.00	18.00	18.00	0.00
8	8.00	-1.44	0.00	18.00	18.00	0.00
9	9.00	-2.44	0.00	18.00	18.00	0.00
10	10.00	-3.44	0.00	18.00	18.00	0.00
11	11.00	-4.44	0.00	18.00	18.00	0.00
12	12.00	-5.44	0.00	18.00	18.00	0.00
13	13.00	-6.44	0.00	18.00	18.00	0.00
14	14.00	-7.44	0.00	18.00	18.00	0.00
15	15.00	-8.44	0.00	18.00	18.00	0.00
16	16.00	-9.44	0.00	18.00	18.00	0.00
17	17.00	-10.44	0.00	18.00	18.00	0.00
18	18.00	-11.44	0.00	18.00	18.00	0.00
19	19.00	-12.44	0.00	18.00	18.00	0.00
20	20.00	-13.44	0.00	18.00	18.00	0.00
21	21.00	-14.44	0.00	18.00	18.00	0.00
22	22.00	-15.44	0.00	18.00	18.00	0.00
23	23.00	-16.44	0.00	18.00	18.00	0.00
24	24.00	-17.44	0.00	18.00	18.00	0.00
25	25.00	-18.44	0.00	18.00	18.00	0.00
26	26.00	-19.44	0.00	18.00	18.00	0.00
27	27.00	-20.44	0.00	18.00	18.00	0.00
28	28.00	-21.44	0.00	18.00	18.00	0.00
29	29.00	-22.44	0.00	18.00	18.00	0.00
30	30.00	-23.44	0.00	18.00	18.00	0.00
31	31.00	-24.44	0.00	18.00	18.00	0.00
32	32.00	-25.44	0.00	18.00	18.00	0.00
33	33.00	-26.44	0.00	18.00	18.00	0.00
34	34.00	-27.44	0.00	18.00	18.00	0.00
35	35.00	-28.44	0.00	18.00	18.00	0.00
36	36.00	-29.44	0.00	18.00	18.00	0.00
37	37.00	-30.44	0.00	18.00	18.00	0.00
38	38.00	-31.44	0.00	18.00	18.00	0.00
39	39.00	-32.44	0.00	18.00	18.00	0.00
40	40.00	-33.44	0.00	18.00	18.00	0.00
41	41.00	-34.44	0.00	18.00	18.00	0.00
42	42.00	-35.44	0.00	18.00	18.00	0.00
43	43.00	-36.44	0.00	18.00	18.00	0.00
44	44.00	-37.44	0.00	18.00	18.00	0.00
45	45.00	-38.44	0.00	18.00	18.00	0.00
46	46.00	-39.44	0.00	18.00	18.00	0.00
47	47.00	-40.44	0.00	18.00	18.00	0.00
48	48.00	-41.44	0.00	18.00	18.00	0.00
49	49.00	-42.44	0.00	18.00	18.00	0.00
50	50.00	-43.44	0.00	18.00	18.00	0.00
51	51.00	-44.44	0.00	18.00	18.00	0.00
52	52.00	-45.44	0.00	18.00	18.00	0.00
53	53.00	-46.44	0.00	18.00	18.00	0.00
54	54.00	-47.44	0.00	18.00	18.00	0.00
55	55.00	-48.44	0.00	18.00	18.00	0.00
56	56.00	-49.44	0.00	18.00	18.00	0.00
57	57.00	-50.44	0.00	18.00	18.00	0.00
58	58.00	-51.44	0.00	18.00	18.00	0.00
59	59.00	-52.44	0.00	18.00	18.00	0.00
60	60.00	-53.44	0.00	18.00	18.00	0.00
61	61.00	-54.44	0.00	18.00	18.00	0.00
62	62.00	-55.44	0.00	18.00	18.00	0.00
63	63.00	-56.44	0.00	18.00	18.00	0.00
64	64.00	-57.44	0.00	18.00	18.00	0.00
65	65.00	-58.44	0.00	18.00	18.00	0.00
66	66.00	-59.44	0.00	18.00	18.00	0.00
67	67.00	-60.44	0.00	18.00	18.00	0.00
68	68.00	-61.44	0.00	18.00	18.00	0.00
69	69.00	-62.44	0.00	18.00	18.00	0.00
70	70.00	-63.44	0.00	18.00	18.00	0.00
71	71.00	-64.44	0.00	18.00	18.00	0.00
72	72.00	-65.44	0.00	18.00	18.00	0.00
73	73.00	-66.44	0.00	18.00	18.00	0.00
74	74.00	-67.44	0.00	18.00	18.00	0.00
75	75.00	-68.44	0.00	18.00	18.00	0.00
76	76.00	-69.44	0.00	18.00	18.00	0.00
77	77.00	-70.44	0.00	18.00	18.00	0.00
78	78.00	-71.44	0.00	18.00	18.00	0.00
79	79.00	-72.44	0.00	18.00	18.00	0.00
80	80.00	-73.44	0.00	18.00	18.00	0.00
81	81.00	-74.44	0.00	18.00	18.00	0.00

82	82.00	-75.44	0.00	18.00	18.00	0.00
83	83.00	-76.44	0.00	18.00	18.00	0.00
84	84.00	-77.44	0.00	18.00	18.00	0.00
85	85.00	-78.44	0.00	18.00	18.00	0.00
86	86.00	-79.44	0.00	18.00	18.00	0.00
87	87.00	-80.44	0.00	18.00	18.00	0.00
88	88.00	-81.44	0.00	18.00	18.00	0.00
89	89.00	-82.44	0.00	18.00	18.00	0.00
90	90.00	-83.44	0.00	18.00	18.00	0.00
91	91.00	-84.44	0.00	18.00	18.00	0.00
92	92.00	-85.44	0.00	18.00	18.00	0.00
93	93.00	-86.44	0.00	18.00	18.00	0.00
94	94.00	-87.44	0.00	18.00	18.00	0.00
95	95.00	-88.44	0.00	18.00	18.00	0.00
96	96.00	-89.44	0.00	18.00	18.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	18.00	1.00	0.000	0.000	0.000
2	18.00	2.00	0.000	0.000	0.000
3	18.00	3.00	0.000	0.000	0.000
4	18.00	4.00	0.000	0.000	0.000
5	18.00	5.00	0.000	0.000	0.000
6	18.00	6.00	0.000	0.000	0.000
7	18.00	7.00	0.000	0.000	0.000
8	18.00	8.00	0.000	0.000	0.000
9	18.00	9.00	0.000	0.000	0.000
10	18.00	10.00	0.000	0.000	0.000
11	18.00	11.00	0.000	0.000	0.000
12	18.00	12.00	0.000	0.000	0.000
13	18.00	13.00	0.000	0.000	0.000
14	18.00	14.00	0.000	0.000	0.000
15	18.00	15.00	0.000	0.000	0.000
16	18.00	16.00	0.000	0.000	0.000
17	18.00	17.00	0.000	0.000	0.000
18	18.00	18.00	0.000	0.000	0.000
19	18.00	19.00	0.000	0.000	0.000
20	18.00	20.00	0.000	0.000	0.000
21	18.00	21.00	0.000	0.000	0.000
22	18.00	22.00	0.000	0.000	0.000
23	18.00	23.00	0.000	0.000	0.000
24	18.00	24.00	0.000	0.000	0.000
25	18.00	25.00	0.000	0.000	0.000
26	18.00	26.00	0.000	0.000	0.000
27	18.00	27.00	0.000	0.000	0.000
28	18.00	28.00	0.000	0.000	0.000
29	18.00	29.00	0.000	0.000	0.000
30	18.00	30.00	0.000	0.000	0.000
31	18.00	31.00	0.000	0.000	0.000
32	18.00	32.00	0.000	0.000	0.000
33	18.00	33.00	0.000	0.000	0.000
34	18.00	34.00	0.000	0.000	0.000
35	18.00	35.00	0.000	0.000	0.000
36	18.00	36.00	0.000	0.000	0.000
37	18.00	37.00	8.169	0.000	8.169
38	18.00	38.00	26.735	0.000	26.735
39	18.00	39.00	45.301	0.000	45.301
40	18.00	40.00	63.868	0.000	63.868
41	18.00	41.00	82.434	0.000	82.434
42	18.00	42.00	101.000	0.000	101.000
43	18.00	43.00	119.566	0.000	119.566
44	18.00	44.00	138.132	0.000	138.132
45	18.00	45.00	156.698	0.000	156.698
46	18.00	46.00	175.264	0.000	175.264
47	18.00	47.00	175.602	0.000	175.602
48	18.00	48.00	175.973	0.000	175.973
49	18.00	49.00	176.378	0.000	176.378
50	18.00	50.00	188.016	0.000	188.016
51	18.00	51.00	199.655	0.000	199.655
52	18.00	52.00	200.161	0.000	200.161
53	18.00	53.00	200.702	0.000	200.702
54	18.00	54.00	201.277	0.000	201.277
55	18.00	55.00	217.067	0.000	217.067
56	18.00	56.00	232.857	0.000	232.857
57	18.00	57.00	251.423	0.000	251.423
58	18.00	58.00	269.989	0.000	269.989
59	18.00	59.00	288.556	0.000	288.556
60	18.00	60.00	307.122	0.000	307.122
61	18.00	61.00	325.688	0.000	325.688
62	18.00	62.00	344.254	0.000	344.254
63	18.00	63.00	362.820	0.000	362.820
64	18.00	64.00	381.386	0.000	381.386
65	18.00	65.00	382.334	0.000	382.334
66	18.00	66.00	383.316	0.000	383.316
67	18.00	67.00	384.332	0.000	384.332

68	18.00	68.00	385.382	0.000	385.382
69	18.00	69.00	386.466	0.000	386.466
70	18.00	70.00	401.697	0.000	401.697
71	18.00	71.00	416.928	0.000	416.928
72	18.00	72.00	418.114	0.000	418.114
73	18.00	73.00	419.333	0.000	419.333
74	18.00	74.00	420.587	0.000	420.587
75	18.00	75.00	421.874	0.000	421.874
76	18.00	76.00	423.195	0.000	423.195
77	18.00	77.00	441.761	0.000	441.761
78	18.00	78.00	460.328	0.000	460.328
79	18.00	79.00	478.894	0.000	478.894
80	18.00	80.00	497.460	0.000	497.460
81	18.00	81.00	516.026	0.000	516.026
82	18.00	82.00	534.592	0.000	534.592
83	18.00	83.00	553.158	0.000	553.158
84	18.00	84.00	571.724	0.000	571.724
85	18.00	85.00	590.291	0.000	590.291
86	18.00	86.00	608.857	0.000	608.857
87	18.00	87.00	627.423	0.000	627.423
88	18.00	88.00	645.989	0.000	645.989
89	18.00	89.00	664.555	0.000	664.555
90	18.00	90.00	683.121	0.000	683.121
91	18.00	91.00	701.688	0.000	701.688
92	18.00	92.00	718.584	0.000	718.584
93	18.00	93.00	727.985	0.000	727.985
94	18.00	94.00	729.914	0.000	729.914
95	18.00	95.00	731.874	0.000	731.874
96	18.00	96.00	733.865	0.000	733.865

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

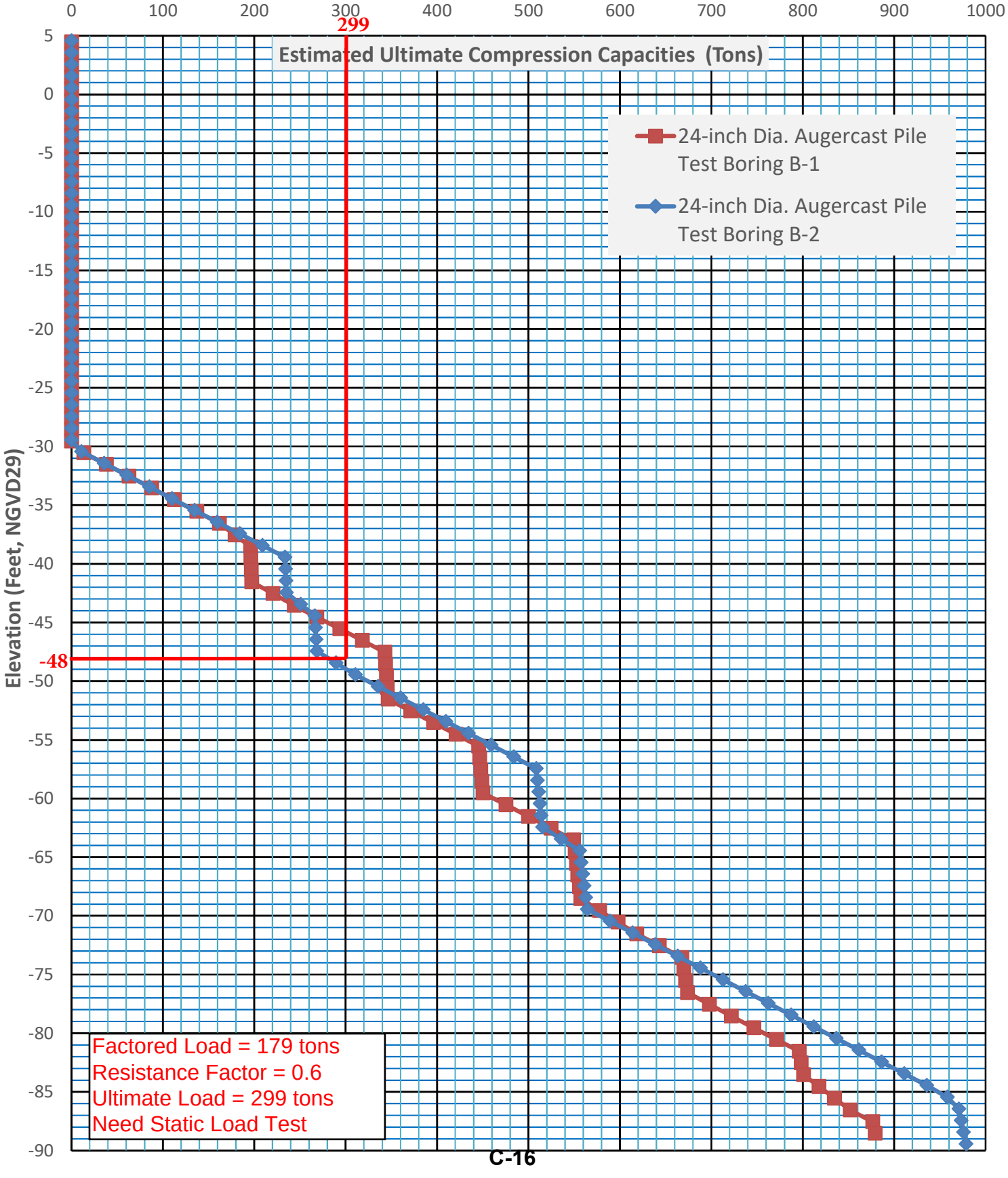
User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	18.00	1.00	0.000	0.000	0.000
2	18.00	2.00	0.000	0.000	0.000
3	18.00	3.00	0.000	0.000	0.000
4	18.00	4.00	0.000	0.000	0.000
5	18.00	5.00	0.000	0.000	0.000
6	18.00	6.00	0.000	0.000	0.000
7	18.00	7.00	0.000	0.000	0.000
8	18.00	8.00	0.000	0.000	0.000
9	18.00	9.00	0.000	0.000	0.000
10	18.00	10.00	0.000	0.000	0.000
11	18.00	11.00	0.000	0.000	0.000
12	18.00	12.00	0.000	0.000	0.000
13	18.00	13.00	0.000	0.000	0.000
14	18.00	14.00	0.000	0.000	0.000
15	18.00	15.00	0.000	0.000	0.000
16	18.00	16.00	0.000	0.000	0.000
17	18.00	17.00	0.000	0.000	0.000
18	18.00	18.00	0.000	0.000	0.000
19	18.00	19.00	0.000	0.000	0.000
20	18.00	20.00	0.000	0.000	0.000
21	18.00	21.00	0.000	0.000	0.000
22	18.00	22.00	0.000	0.000	0.000
23	18.00	23.00	0.000	0.000	0.000
24	18.00	24.00	0.000	0.000	0.000
25	18.00	25.00	0.000	0.000	0.000
26	18.00	26.00	0.000	0.000	0.000
27	18.00	27.00	0.000	0.000	0.000
28	18.00	28.00	0.000	0.000	0.000
29	18.00	29.00	0.000	0.000	0.000
30	18.00	30.00	0.000	0.000	0.000
31	18.00	31.00	0.000	0.000	0.000
32	18.00	32.00	0.000	0.000	0.000
33	18.00	33.00	0.000	0.000	0.000
34	18.00	34.00	0.000	0.000	0.000
35	18.00	35.00	0.000	0.000	0.000
36	18.00	36.00	0.000	0.000	0.000
37	18.00	37.00	-nan(ind)	-nan(ind)	-nan(ind)
38	18.00	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	18.00	39.00	-nan(ind)	-nan(ind)	-nan(ind)
40	18.00	40.00	-nan(ind)	-nan(ind)	-nan(ind)
41	18.00	41.00	-nan(ind)	-nan(ind)	-nan(ind)
42	18.00	42.00	-nan(ind)	-nan(ind)	-nan(ind)
43	18.00	43.00	-nan(ind)	-nan(ind)	-nan(ind)
44	18.00	44.00	-nan(ind)	-nan(ind)	-nan(ind)
45	18.00	45.00	-nan(ind)	-nan(ind)	-nan(ind)
46	18.00	46.00	-nan(ind)	0.000	-nan(ind)
47	18.00	47.00	-nan(ind)	0.000	-nan(ind)
48	18.00	48.00	-nan(ind)	0.000	-nan(ind)
49	18.00	49.00	-nan(ind)	-nan(ind)	-nan(ind)
50	18.00	50.00	-nan(ind)	-nan(ind)	-nan(ind)

51	18.00	51.00	-nan(ind)	0.000	-nan(ind)
52	18.00	52.00	-nan(ind)	0.000	-nan(ind)
53	18.00	53.00	-nan(ind)	0.000	-nan(ind)
54	18.00	54.00	-nan(ind)	-nan(ind)	-nan(ind)
55	18.00	55.00	-nan(ind)	-nan(ind)	-nan(ind)
56	18.00	56.00	-nan(ind)	-nan(ind)	-nan(ind)
57	18.00	57.00	-nan(ind)	-nan(ind)	-nan(ind)
58	18.00	58.00	-nan(ind)	-nan(ind)	-nan(ind)
59	18.00	59.00	-nan(ind)	-nan(ind)	-nan(ind)
60	18.00	60.00	-nan(ind)	-nan(ind)	-nan(ind)
61	18.00	61.00	-nan(ind)	-nan(ind)	-nan(ind)
62	18.00	62.00	-nan(ind)	-nan(ind)	-nan(ind)
63	18.00	63.00	-nan(ind)	-nan(ind)	-nan(ind)
64	18.00	64.00	-nan(ind)	0.000	-nan(ind)
65	18.00	65.00	-nan(ind)	0.000	-nan(ind)
66	18.00	66.00	-nan(ind)	0.000	-nan(ind)
67	18.00	67.00	-nan(ind)	0.000	-nan(ind)
68	18.00	68.00	-nan(ind)	0.000	-nan(ind)
69	18.00	69.00	-nan(ind)	-nan(ind)	-nan(ind)
70	18.00	70.00	-nan(ind)	-nan(ind)	-nan(ind)
71	18.00	71.00	-nan(ind)	0.000	-nan(ind)
72	18.00	72.00	-nan(ind)	0.000	-nan(ind)
73	18.00	73.00	-nan(ind)	0.000	-nan(ind)
74	18.00	74.00	-nan(ind)	0.000	-nan(ind)
75	18.00	75.00	-nan(ind)	0.000	-nan(ind)
76	18.00	76.00	-nan(ind)	-nan(ind)	-nan(ind)
77	18.00	77.00	-nan(ind)	-nan(ind)	-nan(ind)
78	18.00	78.00	-nan(ind)	-nan(ind)	-nan(ind)
79	18.00	79.00	-nan(ind)	-nan(ind)	-nan(ind)
80	18.00	80.00	-nan(ind)	-nan(ind)	-nan(ind)
81	18.00	81.00	-nan(ind)	-nan(ind)	-nan(ind)
82	18.00	82.00	-nan(ind)	-nan(ind)	-nan(ind)
83	18.00	83.00	-nan(ind)	-nan(ind)	-nan(ind)
84	18.00	84.00	-nan(ind)	-nan(ind)	-nan(ind)
85	18.00	85.00	-nan(ind)	-nan(ind)	-nan(ind)
86	18.00	86.00	-nan(ind)	-nan(ind)	-nan(ind)
87	18.00	87.00	-nan(ind)	-nan(ind)	-nan(ind)
88	18.00	88.00	-nan(ind)	-nan(ind)	-nan(ind)
89	18.00	89.00	-nan(ind)	-nan(ind)	-nan(ind)
90	18.00	90.00	-nan(ind)	-nan(ind)	-nan(ind)
91	18.00	91.00	-nan(ind)	-nan(ind)	-nan(ind)
92	18.00	92.00	-nan(ind)	-nan(ind)	-nan(ind)
93	18.00	93.00	-nan(ind)	0.000	-nan(ind)
94	18.00	94.00	-nan(ind)	0.000	-nan(ind)
95	18.00	95.00	-nan(ind)	0.000	-nan(ind)
96	18.00	96.00	-nan(ind)	0.000	-nan(ind)

AUGERCAST PILE COMPRESSION CAPACITIES AND GRAPHS FOR 24-INCH DIAMETER AUGERCAST PILES

SW 87TH AVENUE BRIDGE OVER C-100 CANAL
HR ENGINEERING SERVICES, INC.
HRES PROJECT NO. HR21-1691R
ESTIMATED ULTIMATE COMPRESSION CAPACITIES FOR
24-INCH DIAMETER AUGERCAST PILES
TEST BORINGS: B-1 AND B-2



General Information:
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Input file: ..... to -30\B-1_24-inch Auger Cast Piles - 4 tsf & 0 N for Sand.in
Project number: HR21-1691R
Job name: SW 87TH AVE BRIDGE OVER C-100 CANAL
Engineer: CS
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 8/26/2021
Boring number: B-1
Station number: 19+60 Offset: 0.0

Ground Elevation: 7.46(ft)
Water table Elevation = 0.76(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	7.46	N/A	120.00	5- Cavity layer
2	1.00	6.46	N/A	120.00	5- Cavity layer
3	3.00	4.46	N/A	120.00	5- Cavity layer
4	4.00	3.46	N/A	120.00	5- Cavity layer
5	4.00	3.46	N/A	120.00	5- Cavity layer
6	5.00	2.46	N/A	120.00	5- Cavity layer
7	7.00	0.46	N/A	120.00	5- Cavity layer
8	9.00	-1.54	N/A	120.00	5- Cavity layer
9	11.00	-3.54	N/A	120.00	5- Cavity layer
10	14.00	-6.54	N/A	120.00	5- Cavity layer
11	14.00	-6.54	N/A	120.00	5- Cavity layer
12	14.00	-6.54	N/A	120.00	5- Cavity layer
13	16.00	-8.54	N/A	120.00	5- Cavity layer
14	19.00	-11.54	N/A	120.00	5- Cavity layer
15	21.00	-13.54	N/A	120.00	5- Cavity layer
16	22.00	-14.54	N/A	120.00	5- Cavity layer
17	22.00	-14.54	N/A	99.09	5- Cavity layer
18	26.00	-18.54	N/A	99.09	5- Cavity layer
19	29.00	-21.54	N/A	99.09	5- Cavity layer
20	29.00	-21.54	N/A	100.17	5- Cavity layer
21	31.00	-23.54	N/A	101.26	5- Cavity layer
22	34.00	-26.54	N/A	105.60	5- Cavity layer
23	36.00	-28.54	N/A	109.94	5- Cavity layer
24	37.46	-30.00	N/A	109.94	5- Cavity layer
25	37.46	-30.00	N/A	120.00	4- Lime Stone/Very shelly sand
26	39.00	-31.54	N/A	120.00	4- Lime Stone/Very shelly sand
27	41.00	-33.54	N/A	120.00	4- Lime Stone/Very shelly sand
28	44.00	-36.54	N/A	120.00	4- Lime Stone/Very shelly sand
29	46.00	-38.54	0.00	120.00	3- Clean sand
30	49.00	-41.54	N/A	120.00	4- Lime Stone/Very shelly sand
31	51.00	-43.54	N/A	120.00	4- Lime Stone/Very shelly sand
32	54.00	-46.54	N/A	120.00	4- Lime Stone/Very shelly sand
33	55.00	-47.54	0.00	120.00	3- Clean sand
34	55.00	-47.54	0.00	120.00	3- Clean sand
35	55.00	-47.54	0.00	120.00	3- Clean sand
36	56.00	-48.54	0.00	120.00	3- Clean sand
37	59.00	-51.54	N/A	120.00	4- Lime Stone/Very shelly sand
38	61.00	-53.54	N/A	120.00	4- Lime Stone/Very shelly sand
39	63.00	-55.54	N/A	120.00	4- Lime Stone/Very shelly sand
40	63.00	-55.54	0.00	109.94	3- Clean sand
41	64.00	-56.54	0.00	109.94	3- Clean sand
42	66.00	-58.54	0.00	111.02	3- Clean sand
43	67.00	-59.54	0.00	111.02	3- Clean sand
44	67.00	-59.54	N/A	120.00	4- Lime Stone/Very shelly sand
45	69.00	-61.54	N/A	120.00	4- Lime Stone/Very shelly sand
46	71.00	-63.54	0.00	120.00	3- Clean sand
47	74.00	-66.54	0.00	120.00	3- Clean sand
48	74.00	-66.54	0.00	120.00	3- Clean sand
49	76.00	-68.54	N/A	120.00	4- Lime Stone/Very shelly sand
50	79.00	-71.54	N/A	120.00	4- Lime Stone/Very shelly sand
51	79.00	-71.54	N/A	120.00	4- Lime Stone/Very shelly sand
52	81.00	-73.54	0.00	120.00	3- Clean sand
53	84.00	-76.54	N/A	120.00	4- Lime Stone/Very shelly sand
54	86.00	-78.54	N/A	120.00	4- Lime Stone/Very shelly sand
55	89.00	-81.54	0.00	120.00	3- Clean sand
56	91.00	-83.54	N/A	120.00	4- Lime Stone/Very shelly sand
57	94.00	-86.54	N/A	120.00	4- Lime Stone/Very shelly sand

58	95.00	-87.54	N/A	120.00	4- Lime Stone/Very shelly sand
59	95.00	-87.54	0.00	115.00	3- Clean sand
60	96.00	-88.54	0.00	115.00	3- Clean sand
61	100.00	-92.54	0.00	109.94	3- Clean sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A	N/A
20	N/A	N/A	N/A	N/A	N/A
21	N/A	N/A	N/A	N/A	N/A
22	N/A	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A	N/A
25	N/A	17.74	3.50	0.00	0.00
26	N/A	17.74	3.50	0.00	0.00
27	N/A	17.74	3.50	0.00	0.00
28	N/A	12.19	2.40	0.00	0.00
29	N/A	N/A	N/A	N/A	N/A
30	N/A	16.63	3.30	0.00	0.00
31	N/A	17.74	3.50	0.00	0.00
32	N/A	17.74	3.50	0.00	0.00
33	N/A	N/A	N/A	N/A	N/A
34	N/A	N/A	N/A	N/A	N/A
35	N/A	N/A	N/A	N/A	N/A
36	N/A	N/A	N/A	N/A	N/A
37	N/A	17.74	3.50	0.00	0.00
38	N/A	17.74	3.50	0.00	0.00
39	N/A	17.74	3.50	0.00	0.00
40	N/A	N/A	N/A	N/A	N/A
41	N/A	N/A	N/A	N/A	N/A
42	N/A	N/A	N/A	N/A	N/A
43	N/A	N/A	N/A	N/A	N/A
44	N/A	17.74	3.50	0.00	0.00
45	N/A	17.74	3.50	0.00	0.00
46	N/A	N/A	N/A	N/A	N/A
47	N/A	N/A	N/A	N/A	N/A
48	N/A	N/A	N/A	N/A	N/A
49	N/A	14.41	2.90	0.00	0.00
50	N/A	14.41	2.90	0.00	0.00
51	N/A	17.74	3.50	0.00	0.00
52	N/A	N/A	N/A	N/A	N/A
53	N/A	17.18	3.40	0.00	0.00
54	N/A	17.74	3.50	0.00	0.00
55	N/A	N/A	N/A	N/A	N/A
56	N/A	12.19	2.40	0.00	0.00
57	N/A	17.74	3.50	0.00	0.00
58	N/A	17.74	3.50	0.00	0.00
59	N/A	N/A	N/A	N/A	N/A
60	N/A	N/A	N/A	N/A	N/A
61	N/A	N/A	N/A	N/A	N/A

ID	RQD F.M.	S.R.I.	Rock Recovery
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
11	N/A	N/A	N/A
12	N/A	N/A	N/A
13	N/A	N/A	N/A
14	N/A	N/A	N/A
15	N/A	N/A	N/A
16	N/A	N/A	N/A
17	N/A	N/A	N/A
18	N/A	N/A	N/A

19	N/A	N/A	N/A
20	N/A	N/A	N/A
21	N/A	N/A	N/A
22	N/A	N/A	N/A
23	N/A	N/A	N/A
24	N/A	N/A	N/A
25	1.00	ROUGH	1.000
26	1.00	ROUGH	1.000
27	1.00	ROUGH	1.000
28	1.00	ROUGH	1.000
29	N/A	N/A	N/A
30	1.00	ROUGH	1.000
31	1.00	ROUGH	1.000
32	1.00	ROUGH	1.000
33	N/A	N/A	N/A
34	N/A	N/A	N/A
35	N/A	N/A	N/A
36	N/A	N/A	N/A
37	1.00	ROUGH	1.000
38	1.00	ROUGH	1.000
39	1.00	ROUGH	1.000
40	N/A	N/A	N/A
41	N/A	N/A	N/A
42	N/A	N/A	N/A
43	N/A	N/A	N/A
44	1.00	ROUGH	1.000
45	1.00	ROUGH	1.000
46	N/A	N/A	N/A
47	N/A	N/A	N/A
48	N/A	N/A	N/A
49	1.00	ROUGH	1.000
50	1.00	ROUGH	1.000
51	1.00	ROUGH	1.000
52	N/A	N/A	N/A
53	1.00	ROUGH	1.000
54	1.00	ROUGH	1.000
55	N/A	N/A	N/A
56	1.00	ROUGH	1.000
57	1.00	ROUGH	1.000
58	1.00	ROUGH	1.000
59	N/A	N/A	N/A
60	N/A	N/A	N/A
61	N/A	N/A	N/A

Drilled Shaft Data:
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Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	6.46	0.00	24.00	24.00	0.00
2	2.00	5.46	0.00	24.00	24.00	0.00
3	3.00	4.46	0.00	24.00	24.00	0.00
4	4.00	3.46	0.00	24.00	24.00	0.00
5	5.00	2.46	0.00	24.00	24.00	0.00
6	6.00	1.46	0.00	24.00	24.00	0.00
7	7.00	0.46	0.00	24.00	24.00	0.00
8	8.00	-0.54	0.00	24.00	24.00	0.00
9	9.00	-1.54	0.00	24.00	24.00	0.00
10	10.00	-2.54	0.00	24.00	24.00	0.00
11	11.00	-3.54	0.00	24.00	24.00	0.00
12	12.00	-4.54	0.00	24.00	24.00	0.00
13	13.00	-5.54	0.00	24.00	24.00	0.00
14	14.00	-6.54	0.00	24.00	24.00	0.00
15	15.00	-7.54	0.00	24.00	24.00	0.00
16	16.00	-8.54	0.00	24.00	24.00	0.00
17	17.00	-9.54	0.00	24.00	24.00	0.00
18	18.00	-10.54	0.00	24.00	24.00	0.00
19	19.00	-11.54	0.00	24.00	24.00	0.00
20	20.00	-12.54	0.00	24.00	24.00	0.00
21	21.00	-13.54	0.00	24.00	24.00	0.00
22	22.00	-14.54	0.00	24.00	24.00	0.00
23	23.00	-15.54	0.00	24.00	24.00	0.00
24	24.00	-16.54	0.00	24.00	24.00	0.00
25	25.00	-17.54	0.00	24.00	24.00	0.00
26	26.00	-18.54	0.00	24.00	24.00	0.00
27	27.00	-19.54	0.00	24.00	24.00	0.00
28	28.00	-20.54	0.00	24.00	24.00	0.00
29	29.00	-21.54	0.00	24.00	24.00	0.00
30	30.00	-22.54	0.00	24.00	24.00	0.00
31	31.00	-23.54	0.00	24.00	24.00	0.00
32	32.00	-24.54	0.00	24.00	24.00	0.00
33	33.00	-25.54	0.00	24.00	24.00	0.00
34	34.00	-26.54	0.00	24.00	24.00	0.00
35	35.00	-27.54	0.00	24.00	24.00	0.00
36	36.00	-28.54	0.00	24.00	24.00	0.00

37	37.00	-29.54	0.00	24.00	24.00	0.00
38	38.00	-30.54	0.00	24.00	24.00	0.00
39	39.00	-31.54	0.00	24.00	24.00	0.00
40	40.00	-32.54	0.00	24.00	24.00	0.00
41	41.00	-33.54	0.00	24.00	24.00	0.00
42	42.00	-34.54	0.00	24.00	24.00	0.00
43	43.00	-35.54	0.00	24.00	24.00	0.00
44	44.00	-36.54	0.00	24.00	24.00	0.00
45	45.00	-37.54	0.00	24.00	24.00	0.00
46	46.00	-38.54	0.00	24.00	24.00	0.00
47	47.00	-39.54	0.00	24.00	24.00	0.00
48	48.00	-40.54	0.00	24.00	24.00	0.00
49	49.00	-41.54	0.00	24.00	24.00	0.00
50	50.00	-42.54	0.00	24.00	24.00	0.00
51	51.00	-43.54	0.00	24.00	24.00	0.00
52	52.00	-44.54	0.00	24.00	24.00	0.00
53	53.00	-45.54	0.00	24.00	24.00	0.00
54	54.00	-46.54	0.00	24.00	24.00	0.00
55	55.00	-47.54	0.00	24.00	24.00	0.00
56	56.00	-48.54	0.00	24.00	24.00	0.00
57	57.00	-49.54	0.00	24.00	24.00	0.00
58	58.00	-50.54	0.00	24.00	24.00	0.00
59	59.00	-51.54	0.00	24.00	24.00	0.00
60	60.00	-52.54	0.00	24.00	24.00	0.00
61	61.00	-53.54	0.00	24.00	24.00	0.00
62	62.00	-54.54	0.00	24.00	24.00	0.00
63	63.00	-55.54	0.00	24.00	24.00	0.00
64	64.00	-56.54	0.00	24.00	24.00	0.00
65	65.00	-57.54	0.00	24.00	24.00	0.00
66	66.00	-58.54	0.00	24.00	24.00	0.00
67	67.00	-59.54	0.00	24.00	24.00	0.00
68	68.00	-60.54	0.00	24.00	24.00	0.00
69	69.00	-61.54	0.00	24.00	24.00	0.00
70	70.00	-62.54	0.00	24.00	24.00	0.00
71	71.00	-63.54	0.00	24.00	24.00	0.00
72	72.00	-64.54	0.00	24.00	24.00	0.00
73	73.00	-65.54	0.00	24.00	24.00	0.00
74	74.00	-66.54	0.00	24.00	24.00	0.00
75	75.00	-67.54	0.00	24.00	24.00	0.00
76	76.00	-68.54	0.00	24.00	24.00	0.00
77	77.00	-69.54	0.00	24.00	24.00	0.00
78	78.00	-70.54	0.00	24.00	24.00	0.00
79	79.00	-71.54	0.00	24.00	24.00	0.00
80	80.00	-72.54	0.00	24.00	24.00	0.00
81	81.00	-73.54	0.00	24.00	24.00	0.00
82	82.00	-74.54	0.00	24.00	24.00	0.00
83	83.00	-75.54	0.00	24.00	24.00	0.00
84	84.00	-76.54	0.00	24.00	24.00	0.00
85	85.00	-77.54	0.00	24.00	24.00	0.00
86	86.00	-78.54	0.00	24.00	24.00	0.00
87	87.00	-79.54	0.00	24.00	24.00	0.00
88	88.00	-80.54	0.00	24.00	24.00	0.00
89	89.00	-81.54	0.00	24.00	24.00	0.00
90	90.00	-82.54	0.00	24.00	24.00	0.00
91	91.00	-83.54	0.00	24.00	24.00	0.00
92	92.00	-84.54	0.00	24.00	24.00	0.00
93	93.00	-85.54	0.00	24.00	24.00	0.00
94	94.00	-86.54	0.00	24.00	24.00	0.00
95	95.00	-87.54	0.00	24.00	24.00	0.00
96	96.00	-88.54	0.00	24.00	24.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	24.00	1.00	0.000	0.000	0.000
2	24.00	2.00	0.000	0.000	0.000
3	24.00	3.00	0.000	0.000	0.000
4	24.00	4.00	0.000	0.000	0.000
5	24.00	5.00	0.000	0.000	0.000
6	24.00	6.00	0.000	0.000	0.000
7	24.00	7.00	0.000	0.000	0.000
8	24.00	8.00	0.000	0.000	0.000
9	24.00	9.00	0.000	0.000	0.000
10	24.00	10.00	0.000	0.000	0.000
11	24.00	11.00	0.000	0.000	0.000
12	24.00	12.00	0.000	0.000	0.000
13	24.00	13.00	0.000	0.000	0.000
14	24.00	14.00	0.000	0.000	0.000
15	24.00	15.00	0.000	0.000	0.000
16	24.00	16.00	0.000	0.000	0.000
17	24.00	17.00	0.000	0.000	0.000
18	24.00	18.00	0.000	0.000	0.000
19	24.00	19.00	0.000	0.000	0.000
20	24.00	20.00	0.000	0.000	0.000
21	24.00	21.00	0.000	0.000	0.000
22	24.00	22.00	0.000	0.000	0.000

23	24.00	23.00	0.000	0.000	0.000
24	24.00	24.00	0.000	0.000	0.000
25	24.00	25.00	0.000	0.000	0.000
26	24.00	26.00	0.000	0.000	0.000
27	24.00	27.00	0.000	0.000	0.000
28	24.00	28.00	0.000	0.000	0.000
29	24.00	29.00	0.000	0.000	0.000
30	24.00	30.00	0.000	0.000	0.000
31	24.00	31.00	0.000	0.000	0.000
32	24.00	32.00	0.000	0.000	0.000
33	24.00	33.00	0.000	0.000	0.000
34	24.00	34.00	0.000	0.000	0.000
35	24.00	35.00	0.000	0.000	0.000
36	24.00	36.00	0.000	0.000	0.000
37	24.00	37.00	0.000	0.000	0.000
38	24.00	38.00	13.368	0.000	13.368
39	24.00	39.00	38.123	0.000	38.123
40	24.00	40.00	62.877	0.000	62.877
41	24.00	41.00	87.632	0.000	87.632
42	24.00	42.00	112.387	0.000	112.387
43	24.00	43.00	137.142	0.000	137.142
44	24.00	44.00	161.897	0.000	161.897
45	24.00	45.00	178.889	0.000	178.889
46	24.00	46.00	195.882	0.000	195.882
47	24.00	47.00	196.291	0.000	196.291
48	24.00	48.00	196.745	0.000	196.745
49	24.00	49.00	197.244	0.000	197.244
50	24.00	50.00	220.518	0.000	220.518
51	24.00	51.00	243.791	0.000	243.791
52	24.00	52.00	268.545	0.000	268.545
53	24.00	53.00	293.300	0.000	293.300
54	24.00	54.00	318.055	0.000	318.055
55	24.00	55.00	342.810	0.000	342.810
56	24.00	56.00	343.626	0.000	343.626
57	24.00	57.00	344.488	0.000	344.488
58	24.00	58.00	345.394	0.000	345.394
59	24.00	59.00	346.346	0.000	346.346
60	24.00	60.00	371.101	0.000	371.101
61	24.00	61.00	395.856	0.000	395.856
62	24.00	62.00	420.611	0.000	420.611
63	24.00	63.00	445.365	0.000	445.365
64	24.00	64.00	446.539	0.000	446.539
65	24.00	65.00	447.751	0.000	447.751
66	24.00	66.00	449.000	0.000	449.000
67	24.00	67.00	450.286	0.000	450.286
68	24.00	68.00	475.041	0.000	475.041
69	24.00	69.00	499.796	0.000	499.796
70	24.00	70.00	524.551	0.000	524.551
71	24.00	71.00	549.306	0.000	549.306
72	24.00	72.00	550.815	0.000	550.815
73	24.00	73.00	552.369	0.000	552.369
74	24.00	74.00	553.969	0.000	553.969
75	24.00	75.00	555.614	0.000	555.614
76	24.00	76.00	557.304	0.000	557.304
77	24.00	77.00	577.613	0.000	577.613
78	24.00	78.00	597.921	0.000	597.921
79	24.00	79.00	618.230	0.000	618.230
80	24.00	80.00	642.985	0.000	642.985
81	24.00	81.00	667.740	0.000	667.740
82	24.00	82.00	669.701	0.000	669.701
83	24.00	83.00	671.708	0.000	671.708
84	24.00	84.00	673.760	0.000	673.760
85	24.00	85.00	697.770	0.000	697.770
86	24.00	86.00	721.781	0.000	721.781
87	24.00	87.00	746.536	0.000	746.536
88	24.00	88.00	771.291	0.000	771.291
89	24.00	89.00	796.046	0.000	796.046
90	24.00	90.00	798.369	0.000	798.369
91	24.00	91.00	800.738	0.000	800.738
92	24.00	92.00	817.730	0.000	817.730
93	24.00	93.00	834.723	0.000	834.723
94	24.00	94.00	851.715	0.000	851.715
95	24.00	95.00	876.470	0.000	876.470
96	24.00	96.00	879.063	0.000	879.063

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	24.00	1.00	0.000	0.000	0.000
2	24.00	2.00	0.000	0.000	0.000
3	24.00	3.00	0.000	0.000	0.000
4	24.00	4.00	0.000	0.000	0.000
5	24.00	5.00	0.000	0.000	0.000

6	24.00	6.00	0.000	0.000	0.000
7	24.00	7.00	0.000	0.000	0.000
8	24.00	8.00	0.000	0.000	0.000
9	24.00	9.00	0.000	0.000	0.000
10	24.00	10.00	0.000	0.000	0.000
11	24.00	11.00	0.000	0.000	0.000
12	24.00	12.00	0.000	0.000	0.000
13	24.00	13.00	0.000	0.000	0.000
14	24.00	14.00	0.000	0.000	0.000
15	24.00	15.00	0.000	0.000	0.000
16	24.00	16.00	0.000	0.000	0.000
17	24.00	17.00	0.000	0.000	0.000
18	24.00	18.00	0.000	0.000	0.000
19	24.00	19.00	0.000	0.000	0.000
20	24.00	20.00	0.000	0.000	0.000
21	24.00	21.00	0.000	0.000	0.000
22	24.00	22.00	0.000	0.000	0.000
23	24.00	23.00	0.000	0.000	0.000
24	24.00	24.00	0.000	0.000	0.000
25	24.00	25.00	0.000	0.000	0.000
26	24.00	26.00	0.000	0.000	0.000
27	24.00	27.00	0.000	0.000	0.000
28	24.00	28.00	0.000	0.000	0.000
29	24.00	29.00	0.000	0.000	0.000
30	24.00	30.00	0.000	0.000	0.000
31	24.00	31.00	0.000	0.000	0.000
32	24.00	32.00	0.000	0.000	0.000
33	24.00	33.00	0.000	0.000	0.000
34	24.00	34.00	0.000	0.000	0.000
35	24.00	35.00	0.000	0.000	0.000
36	24.00	36.00	0.000	0.000	0.000
37	24.00	37.00	0.000	0.000	0.000
38	24.00	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	24.00	39.00	-nan(ind)	-nan(ind)	-nan(ind)
40	24.00	40.00	-nan(ind)	-nan(ind)	-nan(ind)
41	24.00	41.00	-nan(ind)	-nan(ind)	-nan(ind)
42	24.00	42.00	-nan(ind)	-nan(ind)	-nan(ind)
43	24.00	43.00	-nan(ind)	-nan(ind)	-nan(ind)
44	24.00	44.00	-nan(ind)	-nan(ind)	-nan(ind)
45	24.00	45.00	-nan(ind)	-nan(ind)	-nan(ind)
46	24.00	46.00	-nan(ind)	0.000	-nan(ind)
47	24.00	47.00	-nan(ind)	0.000	-nan(ind)
48	24.00	48.00	-nan(ind)	0.000	-nan(ind)
49	24.00	49.00	-nan(ind)	-nan(ind)	-nan(ind)
50	24.00	50.00	-nan(ind)	-nan(ind)	-nan(ind)
51	24.00	51.00	-nan(ind)	-nan(ind)	-nan(ind)
52	24.00	52.00	-nan(ind)	-nan(ind)	-nan(ind)
53	24.00	53.00	-nan(ind)	-nan(ind)	-nan(ind)
54	24.00	54.00	-nan(ind)	-nan(ind)	-nan(ind)
55	24.00	55.00	-nan(ind)	0.000	-nan(ind)
56	24.00	56.00	-nan(ind)	0.000	-nan(ind)
57	24.00	57.00	-nan(ind)	0.000	-nan(ind)
58	24.00	58.00	-nan(ind)	0.000	-nan(ind)
59	24.00	59.00	-nan(ind)	-nan(ind)	-nan(ind)
60	24.00	60.00	-nan(ind)	-nan(ind)	-nan(ind)
61	24.00	61.00	-nan(ind)	-nan(ind)	-nan(ind)
62	24.00	62.00	-nan(ind)	-nan(ind)	-nan(ind)
63	24.00	63.00	-nan(ind)	0.000	-nan(ind)
64	24.00	64.00	-nan(ind)	0.000	-nan(ind)
65	24.00	65.00	-nan(ind)	0.000	-nan(ind)
66	24.00	66.00	-nan(ind)	0.000	-nan(ind)
67	24.00	67.00	-nan(ind)	-nan(ind)	-nan(ind)
68	24.00	68.00	-nan(ind)	-nan(ind)	-nan(ind)
69	24.00	69.00	-nan(ind)	-nan(ind)	-nan(ind)
70	24.00	70.00	-nan(ind)	-nan(ind)	-nan(ind)
71	24.00	71.00	-nan(ind)	0.000	-nan(ind)
72	24.00	72.00	-nan(ind)	0.000	-nan(ind)
73	24.00	73.00	-nan(ind)	0.000	-nan(ind)
74	24.00	74.00	-nan(ind)	0.000	-nan(ind)
75	24.00	75.00	-nan(ind)	0.000	-nan(ind)
76	24.00	76.00	-nan(ind)	-nan(ind)	-nan(ind)
77	24.00	77.00	-nan(ind)	-nan(ind)	-nan(ind)
78	24.00	78.00	-nan(ind)	-nan(ind)	-nan(ind)
79	24.00	79.00	-nan(ind)	-nan(ind)	-nan(ind)
80	24.00	80.00	-nan(ind)	-nan(ind)	-nan(ind)
81	24.00	81.00	-nan(ind)	0.000	-nan(ind)
82	24.00	82.00	-nan(ind)	0.000	-nan(ind)
83	24.00	83.00	-nan(ind)	0.000	-nan(ind)
84	24.00	84.00	-nan(ind)	-nan(ind)	-nan(ind)
85	24.00	85.00	-nan(ind)	-nan(ind)	-nan(ind)
86	24.00	86.00	-nan(ind)	-nan(ind)	-nan(ind)
87	24.00	87.00	-nan(ind)	-nan(ind)	-nan(ind)
88	24.00	88.00	-nan(ind)	-nan(ind)	-nan(ind)
89	24.00	89.00	-nan(ind)	0.000	-nan(ind)
90	24.00	90.00	-nan(ind)	0.000	-nan(ind)
91	24.00	91.00	-nan(ind)	-nan(ind)	-nan(ind)
92	24.00	92.00	-nan(ind)	-nan(ind)	-nan(ind)
93	24.00	93.00	-nan(ind)	-nan(ind)	-nan(ind)
94	24.00	94.00	-nan(ind)	-nan(ind)	-nan(ind)
95	24.00	95.00	-nan(ind)	0.000	-nan(ind)
96	24.00	96.00	-nan(ind)	0.000	-nan(ind)

General Information:
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Input file: ..... to -30\B-2_24-inch Auger Cast Piles - 4 tsf & 0 N for Sand.in
Project number: HR21-1691R
Job name: SW 87TH AVE BRIDGE OVER C-100 CANAL
Engineer: CS
Units: English

Analysis Information:
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Analysis Type: Drilled Shaft Analysis

Soil Information:
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Boring date: 8/31/2021
Boring number: B-2
Station number: 20+42 Offset: 0.0

Ground Elevation: 6.56(ft)
Water table Elevation = -0.14(ft)

Rock side-friction is calculated using: McVay's method
Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	Elevation (ft)	SPT Blows (Blows/ft)	Unit Weight (pcf)	Soil Type
1	0.00	6.56	N/A	120.00	5- Cavity layer
2	1.00	5.56	N/A	120.00	5- Cavity layer
3	3.00	3.56	N/A	120.00	5- Cavity layer
4	5.00	1.56	N/A	120.00	5- Cavity layer
5	7.00	-0.44	N/A	120.00	5- Cavity layer
6	9.00	-2.44	N/A	120.00	5- Cavity layer
7	11.00	-4.44	N/A	120.00	5- Cavity layer
8	14.00	-7.44	N/A	120.00	5- Cavity layer
9	16.00	-9.44	N/A	120.00	5- Cavity layer
10	19.00	-12.44	N/A	120.00	5- Cavity layer
11	21.00	-14.44	N/A	120.00	5- Cavity layer
12	24.00	-17.44	N/A	120.00	5- Cavity layer
13	26.00	-19.44	N/A	120.00	5- Cavity layer
14	29.00	-22.44	N/A	120.00	5- Cavity layer
15	31.00	-24.44	N/A	120.00	5- Cavity layer
16	34.00	-27.44	N/A	120.00	5- Cavity layer
17	36.56	-30.00	N/A	0.00	5- Cavity layer
18	36.56	-30.00	N/A	120.00	4- Lime Stone/Very shelly sand
19	39.00	-32.44	N/A	120.00	4- Lime Stone/Very shelly sand
20	41.00	-34.44	N/A	120.00	4- Lime Stone/Very shelly sand
21	44.00	-37.44	N/A	120.00	4- Lime Stone/Very shelly sand
22	46.00	-39.44	0.00	120.00	3- Clean sand
23	49.00	-42.44	N/A	120.00	4- Lime Stone/Very shelly sand
24	51.00	-44.44	0.00	120.00	3- Clean sand
25	54.00	-47.44	N/A	120.00	4- Lime Stone/Very shelly sand
26	56.00	-49.44	N/A	120.00	4- Lime Stone/Very shelly sand
27	59.00	-52.44	N/A	120.00	4- Lime Stone/Very shelly sand
28	61.00	-54.44	N/A	120.00	4- Lime Stone/Very shelly sand
29	64.00	-57.44	0.00	120.00	3- Clean sand
30	66.00	-59.44	0.00	120.00	3- Clean sand
31	69.00	-62.44	N/A	120.00	4- Lime Stone/Very shelly sand
32	71.00	-64.44	0.00	120.00	3- Clean sand
33	74.00	-67.44	0.00	120.00	3- Clean sand
34	76.00	-69.44	N/A	120.00	4- Lime Stone/Very shelly sand
35	79.00	-72.44	N/A	120.00	4- Lime Stone/Very shelly sand
36	81.00	-74.44	N/A	120.00	4- Lime Stone/Very shelly sand
37	84.00	-77.44	N/A	120.00	4- Lime Stone/Very shelly sand
38	86.00	-79.44	N/A	120.00	4- Lime Stone/Very shelly sand
39	89.00	-82.44	N/A	120.00	4- Lime Stone/Very shelly sand
40	91.00	-84.44	N/A	120.00	4- Lime Stone/Very shelly sand
41	92.50	-85.94	N/A	120.00	4- Lime Stone/Very shelly sand
42	92.50	-85.94	0.00	115.00	3- Clean sand
43	94.00	-87.44	0.00	115.00	3- Clean sand
44	96.00	-89.44	0.00	109.94	3- Clean sand
45	99.00	-92.44	0.00	115.00	3- Clean sand
46	100.00	-93.44	0.00	115.00	3- Clean sand

ID	Cu-DIR (tsf)	qu (tsf)	qt (tsf)	Em (ksi)	qb (tsf)
1	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A	N/A

8	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A	N/A
18	N/A	17.74	3.50	0.00	0.00
19	N/A	17.74	3.50	0.00	0.00
20	N/A	17.74	3.50	0.00	0.00
21	N/A	17.74	3.50	0.00	0.00
22	N/A	N/A	N/A	N/A	N/A
23	N/A	11.09	2.20	0.00	0.00
24	N/A	N/A	N/A	N/A	N/A
25	N/A	14.97	3.00	0.00	0.00
26	N/A	17.74	3.50	0.00	0.00
27	N/A	17.74	3.50	0.00	0.00
28	N/A	17.74	3.50	0.00	0.00
29	N/A	N/A	N/A	N/A	N/A
30	N/A	N/A	N/A	N/A	N/A
31	N/A	14.41	2.90	0.00	0.00
32	N/A	N/A	N/A	N/A	N/A
33	N/A	N/A	N/A	N/A	N/A
34	N/A	17.74	3.50	0.00	0.00
35	N/A	17.74	3.50	0.00	0.00
36	N/A	17.74	3.50	0.00	0.00
37	N/A	17.74	3.50	0.00	0.00
38	N/A	17.74	3.50	0.00	0.00
39	N/A	17.74	3.50	0.00	0.00
40	N/A	16.07	3.20	0.00	0.00
41	N/A	11.64	2.30	0.00	0.00
42	N/A	N/A	N/A	N/A	N/A
43	N/A	N/A	N/A	N/A	N/A
44	N/A	N/A	N/A	N/A	N/A
45	N/A	N/A	N/A	N/A	N/A
46	N/A	N/A	N/A	N/A	N/A

ID	RQD	F.M.	S.R.I.	Rock Recovery
1	N/A		N/A	N/A
2	N/A		N/A	N/A
3	N/A		N/A	N/A
4	N/A		N/A	N/A
5	N/A		N/A	N/A
6	N/A		N/A	N/A
7	N/A		N/A	N/A
8	N/A		N/A	N/A
9	N/A		N/A	N/A
10	N/A		N/A	N/A
11	N/A		N/A	N/A
12	N/A		N/A	N/A
13	N/A		N/A	N/A
14	N/A		N/A	N/A
15	N/A		N/A	N/A
16	N/A		N/A	N/A
17	N/A		N/A	N/A
18	1.00		ROUGH	1.000
19	1.00		ROUGH	1.000
20	1.00		ROUGH	1.000
21	1.00		ROUGH	1.000
22	N/A		N/A	N/A
23	1.00		ROUGH	1.000
24	N/A		N/A	N/A
25	1.00		ROUGH	1.000
26	1.00		ROUGH	1.000
27	1.00		ROUGH	1.000
28	1.00		ROUGH	1.000
29	N/A		N/A	N/A
30	N/A		N/A	N/A
31	1.00		ROUGH	1.000
32	N/A		N/A	N/A
33	N/A		N/A	N/A
34	1.00		ROUGH	1.000
35	1.00		ROUGH	1.000
36	1.00		ROUGH	1.000
37	1.00		ROUGH	1.000
38	1.00		ROUGH	1.000
39	1.00		ROUGH	1.000
40	1.00		ROUGH	1.000
41	1.00		ROUGH	1.000
42	N/A		N/A	N/A
43	N/A		N/A	N/A
44	N/A		N/A	N/A
45	N/A		N/A	N/A
46	N/A		N/A	N/A

Drilled Shaft Data:
==========
Unit weight of concrete = 150.00(pcf), Concrete Slump = 6.00(in)
Modulus of Elasticity of concrete = 4000.00(ksi)

Shaft Geometry:

ID	Length (ft)	Tip Elev. (ft)	Case Len. (ft)	Diameter (in)	Base Diam. (in)	Bell Len. (ft)
1	1.00	5.56	0.00	24.00	24.00	0.00
2	2.00	4.56	0.00	24.00	24.00	0.00
3	3.00	3.56	0.00	24.00	24.00	0.00
4	4.00	2.56	0.00	24.00	24.00	0.00
5	5.00	1.56	0.00	24.00	24.00	0.00
6	6.00	0.56	0.00	24.00	24.00	0.00
7	7.00	-0.44	0.00	24.00	24.00	0.00
8	8.00	-1.44	0.00	24.00	24.00	0.00
9	9.00	-2.44	0.00	24.00	24.00	0.00
10	10.00	-3.44	0.00	24.00	24.00	0.00
11	11.00	-4.44	0.00	24.00	24.00	0.00
12	12.00	-5.44	0.00	24.00	24.00	0.00
13	13.00	-6.44	0.00	24.00	24.00	0.00
14	14.00	-7.44	0.00	24.00	24.00	0.00
15	15.00	-8.44	0.00	24.00	24.00	0.00
16	16.00	-9.44	0.00	24.00	24.00	0.00
17	17.00	-10.44	0.00	24.00	24.00	0.00
18	18.00	-11.44	0.00	24.00	24.00	0.00
19	19.00	-12.44	0.00	24.00	24.00	0.00
20	20.00	-13.44	0.00	24.00	24.00	0.00
21	21.00	-14.44	0.00	24.00	24.00	0.00
22	22.00	-15.44	0.00	24.00	24.00	0.00
23	23.00	-16.44	0.00	24.00	24.00	0.00
24	24.00	-17.44	0.00	24.00	24.00	0.00
25	25.00	-18.44	0.00	24.00	24.00	0.00
26	26.00	-19.44	0.00	24.00	24.00	0.00
27	27.00	-20.44	0.00	24.00	24.00	0.00
28	28.00	-21.44	0.00	24.00	24.00	0.00
29	29.00	-22.44	0.00	24.00	24.00	0.00
30	30.00	-23.44	0.00	24.00	24.00	0.00
31	31.00	-24.44	0.00	24.00	24.00	0.00
32	32.00	-25.44	0.00	24.00	24.00	0.00
33	33.00	-26.44	0.00	24.00	24.00	0.00
34	34.00	-27.44	0.00	24.00	24.00	0.00
35	35.00	-28.44	0.00	24.00	24.00	0.00
36	36.00	-29.44	0.00	24.00	24.00	0.00
37	37.00	-30.44	0.00	24.00	24.00	0.00
38	38.00	-31.44	0.00	24.00	24.00	0.00
39	39.00	-32.44	0.00	24.00	24.00	0.00
40	40.00	-33.44	0.00	24.00	24.00	0.00
41	41.00	-34.44	0.00	24.00	24.00	0.00
42	42.00	-35.44	0.00	24.00	24.00	0.00
43	43.00	-36.44	0.00	24.00	24.00	0.00
44	44.00	-37.44	0.00	24.00	24.00	0.00
45	45.00	-38.44	0.00	24.00	24.00	0.00
46	46.00	-39.44	0.00	24.00	24.00	0.00
47	47.00	-40.44	0.00	24.00	24.00	0.00
48	48.00	-41.44	0.00	24.00	24.00	0.00
49	49.00	-42.44	0.00	24.00	24.00	0.00
50	50.00	-43.44	0.00	24.00	24.00	0.00
51	51.00	-44.44	0.00	24.00	24.00	0.00
52	52.00	-45.44	0.00	24.00	24.00	0.00
53	53.00	-46.44	0.00	24.00	24.00	0.00
54	54.00	-47.44	0.00	24.00	24.00	0.00
55	55.00	-48.44	0.00	24.00	24.00	0.00
56	56.00	-49.44	0.00	24.00	24.00	0.00
57	57.00	-50.44	0.00	24.00	24.00	0.00
58	58.00	-51.44	0.00	24.00	24.00	0.00
59	59.00	-52.44	0.00	24.00	24.00	0.00
60	60.00	-53.44	0.00	24.00	24.00	0.00
61	61.00	-54.44	0.00	24.00	24.00	0.00
62	62.00	-55.44	0.00	24.00	24.00	0.00
63	63.00	-56.44	0.00	24.00	24.00	0.00
64	64.00	-57.44	0.00	24.00	24.00	0.00
65	65.00	-58.44	0.00	24.00	24.00	0.00
66	66.00	-59.44	0.00	24.00	24.00	0.00
67	67.00	-60.44	0.00	24.00	24.00	0.00
68	68.00	-61.44	0.00	24.00	24.00	0.00
69	69.00	-62.44	0.00	24.00	24.00	0.00
70	70.00	-63.44	0.00	24.00	24.00	0.00
71	71.00	-64.44	0.00	24.00	24.00	0.00
72	72.00	-65.44	0.00	24.00	24.00	0.00
73	73.00	-66.44	0.00	24.00	24.00	0.00
74	74.00	-67.44	0.00	24.00	24.00	0.00
75	75.00	-68.44	0.00	24.00	24.00	0.00
76	76.00	-69.44	0.00	24.00	24.00	0.00
77	77.00	-70.44	0.00	24.00	24.00	0.00
78	78.00	-71.44	0.00	24.00	24.00	0.00
79	79.00	-72.44	0.00	24.00	24.00	0.00
80	80.00	-73.44	0.00	24.00	24.00	0.00
81	81.00	-74.44	0.00	24.00	24.00	0.00

82	82.00	-75.44	0.00	24.00	24.00	0.00
83	83.00	-76.44	0.00	24.00	24.00	0.00
84	84.00	-77.44	0.00	24.00	24.00	0.00
85	85.00	-78.44	0.00	24.00	24.00	0.00
86	86.00	-79.44	0.00	24.00	24.00	0.00
87	87.00	-80.44	0.00	24.00	24.00	0.00
88	88.00	-81.44	0.00	24.00	24.00	0.00
89	89.00	-82.44	0.00	24.00	24.00	0.00
90	90.00	-83.44	0.00	24.00	24.00	0.00
91	91.00	-84.44	0.00	24.00	24.00	0.00
92	92.00	-85.44	0.00	24.00	24.00	0.00
93	93.00	-86.44	0.00	24.00	24.00	0.00
94	94.00	-87.44	0.00	24.00	24.00	0.00
95	95.00	-88.44	0.00	24.00	24.00	0.00
96	96.00	-89.44	0.00	24.00	24.00	0.00

Drilled Shaft Capacity (sorted by shaft diameter):

Strength reduction factors: Skin-friction = 1.00, End-bearing = 0.00

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	24.00	1.00	0.000	0.000	0.000
2	24.00	2.00	0.000	0.000	0.000
3	24.00	3.00	0.000	0.000	0.000
4	24.00	4.00	0.000	0.000	0.000
5	24.00	5.00	0.000	0.000	0.000
6	24.00	6.00	0.000	0.000	0.000
7	24.00	7.00	0.000	0.000	0.000
8	24.00	8.00	0.000	0.000	0.000
9	24.00	9.00	0.000	0.000	0.000
10	24.00	10.00	0.000	0.000	0.000
11	24.00	11.00	0.000	0.000	0.000
12	24.00	12.00	0.000	0.000	0.000
13	24.00	13.00	0.000	0.000	0.000
14	24.00	14.00	0.000	0.000	0.000
15	24.00	15.00	0.000	0.000	0.000
16	24.00	16.00	0.000	0.000	0.000
17	24.00	17.00	0.000	0.000	0.000
18	24.00	18.00	0.000	0.000	0.000
19	24.00	19.00	0.000	0.000	0.000
20	24.00	20.00	0.000	0.000	0.000
21	24.00	21.00	0.000	0.000	0.000
22	24.00	22.00	0.000	0.000	0.000
23	24.00	23.00	0.000	0.000	0.000
24	24.00	24.00	0.000	0.000	0.000
25	24.00	25.00	0.000	0.000	0.000
26	24.00	26.00	0.000	0.000	0.000
27	24.00	27.00	0.000	0.000	0.000
28	24.00	28.00	0.000	0.000	0.000
29	24.00	29.00	0.000	0.000	0.000
30	24.00	30.00	0.000	0.000	0.000
31	24.00	31.00	0.000	0.000	0.000
32	24.00	32.00	0.000	0.000	0.000
33	24.00	33.00	0.000	0.000	0.000
34	24.00	34.00	0.000	0.000	0.000
35	24.00	35.00	0.000	0.000	0.000
36	24.00	36.00	0.000	0.000	0.000
37	24.00	37.00	10.892	0.000	10.892
38	24.00	38.00	35.647	0.000	35.647
39	24.00	39.00	60.402	0.000	60.402
40	24.00	40.00	85.157	0.000	85.157
41	24.00	41.00	109.912	0.000	109.912
42	24.00	42.00	134.666	0.000	134.666
43	24.00	43.00	159.421	0.000	159.421
44	24.00	44.00	184.176	0.000	184.176
45	24.00	45.00	208.931	0.000	208.931
46	24.00	46.00	233.686	0.000	233.686
47	24.00	47.00	234.136	0.000	234.136
48	24.00	48.00	234.631	0.000	234.631
49	24.00	49.00	235.171	0.000	235.171
50	24.00	50.00	250.688	0.000	250.688
51	24.00	51.00	266.206	0.000	266.206
52	24.00	52.00	266.882	0.000	266.882
53	24.00	53.00	267.603	0.000	267.603
54	24.00	54.00	268.369	0.000	268.369
55	24.00	55.00	289.423	0.000	289.423
56	24.00	56.00	310.476	0.000	310.476
57	24.00	57.00	335.231	0.000	335.231
58	24.00	58.00	359.986	0.000	359.986
59	24.00	59.00	384.741	0.000	384.741
60	24.00	60.00	409.496	0.000	409.496
61	24.00	61.00	434.250	0.000	434.250
62	24.00	62.00	459.005	0.000	459.005
63	24.00	63.00	483.760	0.000	483.760
64	24.00	64.00	508.515	0.000	508.515
65	24.00	65.00	509.779	0.000	509.779
66	24.00	66.00	511.088	0.000	511.088
67	24.00	67.00	512.443	0.000	512.443

68	24.00	68.00	513.842	0.000	513.842
69	24.00	69.00	515.287	0.000	515.287
70	24.00	70.00	535.596	0.000	535.596
71	24.00	71.00	555.905	0.000	555.905
72	24.00	72.00	557.485	0.000	557.485
73	24.00	73.00	559.111	0.000	559.111
74	24.00	74.00	560.782	0.000	560.782
75	24.00	75.00	562.499	0.000	562.499
76	24.00	76.00	564.260	0.000	564.260
77	24.00	77.00	589.015	0.000	589.015
78	24.00	78.00	613.770	0.000	613.770
79	24.00	79.00	638.525	0.000	638.525
80	24.00	80.00	663.280	0.000	663.280
81	24.00	81.00	688.035	0.000	688.035
82	24.00	82.00	712.790	0.000	712.790
83	24.00	83.00	737.544	0.000	737.544
84	24.00	84.00	762.299	0.000	762.299
85	24.00	85.00	787.054	0.000	787.054
86	24.00	86.00	811.809	0.000	811.809
87	24.00	87.00	836.564	0.000	836.564
88	24.00	88.00	861.319	0.000	861.319
89	24.00	89.00	886.074	0.000	886.074
90	24.00	90.00	910.829	0.000	910.829
91	24.00	91.00	935.583	0.000	935.583
92	24.00	92.00	958.112	0.000	958.112
93	24.00	93.00	970.647	0.000	970.647
94	24.00	94.00	973.219	0.000	973.219
95	24.00	95.00	975.832	0.000	975.832
96	24.00	96.00	978.487	0.000	978.487

Drilled Shaft Capacity at User-Defined Settlement (sorted by shaft diameter):

***** Capacity is NOT modified by the strength reduction factors *****

User-Defined Settlement = 0.00%

ID	Diameter (in)	Length (ft)	Skin Fric. (tons)	End Bearing (tons)	Capacity (tons)
1	24.00	1.00	0.000	0.000	0.000
2	24.00	2.00	0.000	0.000	0.000
3	24.00	3.00	0.000	0.000	0.000
4	24.00	4.00	0.000	0.000	0.000
5	24.00	5.00	0.000	0.000	0.000
6	24.00	6.00	0.000	0.000	0.000
7	24.00	7.00	0.000	0.000	0.000
8	24.00	8.00	0.000	0.000	0.000
9	24.00	9.00	0.000	0.000	0.000
10	24.00	10.00	0.000	0.000	0.000
11	24.00	11.00	0.000	0.000	0.000
12	24.00	12.00	0.000	0.000	0.000
13	24.00	13.00	0.000	0.000	0.000
14	24.00	14.00	0.000	0.000	0.000
15	24.00	15.00	0.000	0.000	0.000
16	24.00	16.00	0.000	0.000	0.000
17	24.00	17.00	0.000	0.000	0.000
18	24.00	18.00	0.000	0.000	0.000
19	24.00	19.00	0.000	0.000	0.000
20	24.00	20.00	0.000	0.000	0.000
21	24.00	21.00	0.000	0.000	0.000
22	24.00	22.00	0.000	0.000	0.000
23	24.00	23.00	0.000	0.000	0.000
24	24.00	24.00	0.000	0.000	0.000
25	24.00	25.00	0.000	0.000	0.000
26	24.00	26.00	0.000	0.000	0.000
27	24.00	27.00	0.000	0.000	0.000
28	24.00	28.00	0.000	0.000	0.000
29	24.00	29.00	0.000	0.000	0.000
30	24.00	30.00	0.000	0.000	0.000
31	24.00	31.00	0.000	0.000	0.000
32	24.00	32.00	0.000	0.000	0.000
33	24.00	33.00	0.000	0.000	0.000
34	24.00	34.00	0.000	0.000	0.000
35	24.00	35.00	0.000	0.000	0.000
36	24.00	36.00	0.000	0.000	0.000
37	24.00	37.00	-nan(ind)	-nan(ind)	-nan(ind)
38	24.00	38.00	-nan(ind)	-nan(ind)	-nan(ind)
39	24.00	39.00	-nan(ind)	-nan(ind)	-nan(ind)
40	24.00	40.00	-nan(ind)	-nan(ind)	-nan(ind)
41	24.00	41.00	-nan(ind)	-nan(ind)	-nan(ind)
42	24.00	42.00	-nan(ind)	-nan(ind)	-nan(ind)
43	24.00	43.00	-nan(ind)	-nan(ind)	-nan(ind)
44	24.00	44.00	-nan(ind)	-nan(ind)	-nan(ind)
45	24.00	45.00	-nan(ind)	-nan(ind)	-nan(ind)
46	24.00	46.00	-nan(ind)	0.000	-nan(ind)
47	24.00	47.00	-nan(ind)	0.000	-nan(ind)
48	24.00	48.00	-nan(ind)	0.000	-nan(ind)
49	24.00	49.00	-nan(ind)	-nan(ind)	-nan(ind)
50	24.00	50.00	-nan(ind)	-nan(ind)	-nan(ind)

51	24.00	51.00	-nan(ind)	0.000	-nan(ind)
52	24.00	52.00	-nan(ind)	0.000	-nan(ind)
53	24.00	53.00	-nan(ind)	0.000	-nan(ind)
54	24.00	54.00	-nan(ind)	-nan(ind)	-nan(ind)
55	24.00	55.00	-nan(ind)	-nan(ind)	-nan(ind)
56	24.00	56.00	-nan(ind)	-nan(ind)	-nan(ind)
57	24.00	57.00	-nan(ind)	-nan(ind)	-nan(ind)
58	24.00	58.00	-nan(ind)	-nan(ind)	-nan(ind)
59	24.00	59.00	-nan(ind)	-nan(ind)	-nan(ind)
60	24.00	60.00	-nan(ind)	-nan(ind)	-nan(ind)
61	24.00	61.00	-nan(ind)	-nan(ind)	-nan(ind)
62	24.00	62.00	-nan(ind)	-nan(ind)	-nan(ind)
63	24.00	63.00	-nan(ind)	-nan(ind)	-nan(ind)
64	24.00	64.00	-nan(ind)	0.000	-nan(ind)
65	24.00	65.00	-nan(ind)	0.000	-nan(ind)
66	24.00	66.00	-nan(ind)	0.000	-nan(ind)
67	24.00	67.00	-nan(ind)	0.000	-nan(ind)
68	24.00	68.00	-nan(ind)	0.000	-nan(ind)
69	24.00	69.00	-nan(ind)	-nan(ind)	-nan(ind)
70	24.00	70.00	-nan(ind)	-nan(ind)	-nan(ind)
71	24.00	71.00	-nan(ind)	0.000	-nan(ind)
72	24.00	72.00	-nan(ind)	0.000	-nan(ind)
73	24.00	73.00	-nan(ind)	0.000	-nan(ind)
74	24.00	74.00	-nan(ind)	0.000	-nan(ind)
75	24.00	75.00	-nan(ind)	0.000	-nan(ind)
76	24.00	76.00	-nan(ind)	-nan(ind)	-nan(ind)
77	24.00	77.00	-nan(ind)	-nan(ind)	-nan(ind)
78	24.00	78.00	-nan(ind)	-nan(ind)	-nan(ind)
79	24.00	79.00	-nan(ind)	-nan(ind)	-nan(ind)
80	24.00	80.00	-nan(ind)	-nan(ind)	-nan(ind)
81	24.00	81.00	-nan(ind)	-nan(ind)	-nan(ind)
82	24.00	82.00	-nan(ind)	-nan(ind)	-nan(ind)
83	24.00	83.00	-nan(ind)	-nan(ind)	-nan(ind)
84	24.00	84.00	-nan(ind)	-nan(ind)	-nan(ind)
85	24.00	85.00	-nan(ind)	-nan(ind)	-nan(ind)
86	24.00	86.00	-nan(ind)	-nan(ind)	-nan(ind)
87	24.00	87.00	-nan(ind)	-nan(ind)	-nan(ind)
88	24.00	88.00	-nan(ind)	-nan(ind)	-nan(ind)
89	24.00	89.00	-nan(ind)	-nan(ind)	-nan(ind)
90	24.00	90.00	-nan(ind)	-nan(ind)	-nan(ind)
91	24.00	91.00	-nan(ind)	-nan(ind)	-nan(ind)
92	24.00	92.00	-nan(ind)	-nan(ind)	-nan(ind)
93	24.00	93.00	-nan(ind)	0.000	-nan(ind)
94	24.00	94.00	-nan(ind)	0.000	-nan(ind)
95	24.00	95.00	-nan(ind)	0.000	-nan(ind)
96	24.00	96.00	-nan(ind)	0.000	-nan(ind)

SOIL/ROCK PARAMETERS FOR LATERAL ANALYSIS OF AUGERCAST PILE WITH FB-MULTIPIER

SW 87TH AVENUE BRIDGE OVER C-100 CANAL

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

MIAMI-DADE COUNTY, FLORIDA

HR ENGINEERING SERVICES. INC.

HRES PROJECT No. HR21-1691R

OCTOBER 29, 2021

Bent	Foundation Type	Borings	Layer No.	Top of Layer Elev. (ft.)	Bottom of Layer Elev. (ft.)	Soil Description	Soil Type	Average SPT N (blows/ft)	Lateral					Axial			Torsional					Tip	
									Soil Model	Internal Friction Angle (Deg.)	Total Unit Weight (lb/ft^3)	Lateral Soil Modulus, (lb/in^3)	Unconfined Compressive Strength, qu (psf)	Soil Model	Total Unit Weight (lb/ft3)	Ult. Unit Skin Friction (psf)	Soil Model	Internal Friction Angle (Deg.)	Total Unit Weight (lb/ft3)	Shear Modulus (k/in^2)	Torsional Shear Stress (lb/ft^2)	Soil Model	Undrained Shear Strength (lb/ft^2)
End Bents 1 and 2	Augercast Pile	B-1 and B-2	1	4.0	-5.0	Limestone	Cohesionless	22	Sand Reese	39	120	56	-	Drilled Shaft Sand	120	270	Hyperbolic	39	120	1.8	270	Drilled Shaft Clay	0
			2	-5.0	-30.0	Soft Limestone Sand	Cohesionless	6	Sand Reese	29	103	12	-	Drilled Shaft Sand	103	370	Hyperbolic	29	103	0.5	370	Drilled Shaft Clay	0
			3	-30.0	-55.0	Limestone	Cohesionless	40	Limestone (McVay)	-	120	-	35776	DS Limestone (McVay)	120	8000	Hyperbolic	-	120	11.9	8000	Drilled Shaft Clay	0
			4	-55.0	-70.0	Limestone	Cohesionless	10	Sand Reese	31	120	20	-	Drilled Shaft Sand	120	900	Hyperbolic	31	120	0.8	900	Drilled Shaft Clay	0

Notes:

ϕ = 28+N(safety)/4 for sand and soft limestone.

γ = 105*ϕ/30 for sand and 120 pcf for limestone.

Axial unit skin friction and Torsional shear stress estimated using β-Method for drilled shafts in sand and soft limestone and fs=0.1 N (tsf) in limestone,

Lateral soil modulus (k) was estimated using FDOT Soils and Foundation Handbook -sand and soft limestone

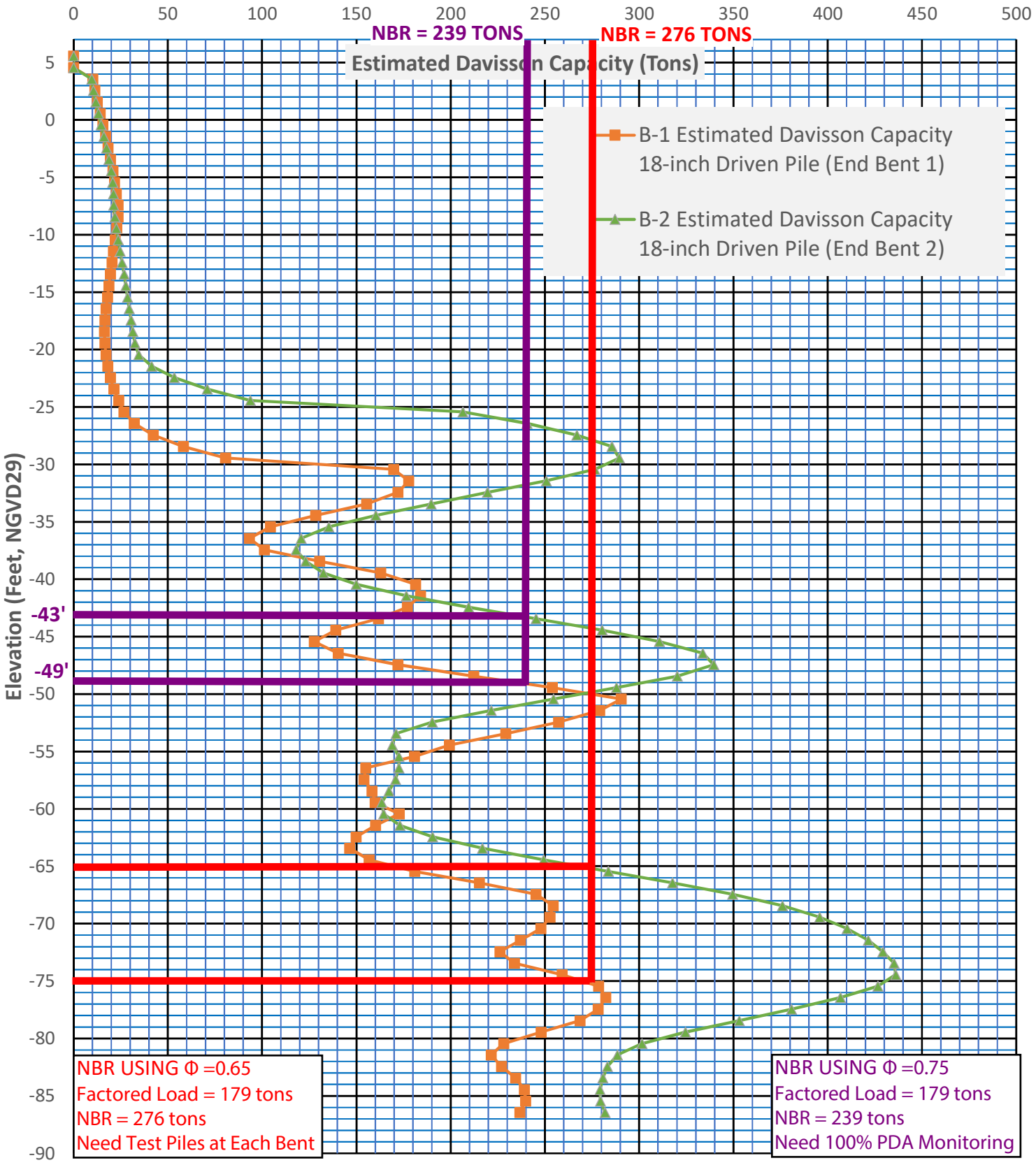
Shear Modulus G = E/2(1+ν)

E(ksf) = 30*N for sand and soft limestone and , E = 115qu for limestone ν = 0.3 for sand and soft limestone, 0.2 for limestone.

qu for limestone estimated by equating the side friction obtained by 0.1 N (tsf) and McVay's equation (0.5 (qu.qt)^.5). It is assumed that qt=20% of qu.

Clay with Cu value of 0 has been provided for tip modeling (no tip contribution on DS/MP axial capacity). A Cu value, as required for analysis convergence, may be used for lateral stability analysis purposes.

SW 87TH AVENUE BRIDGE OVER C-100 CANAL
HR ENGINEERING SERVICES, INC.
HRES PROJECT NO. HR21-1691R
ESTIMATED DAVISSON CAPACITY FOR
18-INCH SQUARE PRESTRESSED DRIVEN PILES
TEST BORINGS: B-1 AND B-2



General Information:
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Input file: .....E\Bridge\Driven Pile\Preforming Case\B-1_16-inch Diven Pile.in
Project number: HR21-1691R
Job name: SW 87TH AVE BRIDGE OVER C-100 CANAL
Engineer: CS
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 8/26/2021, Boring Number: B-1
Station number: 19+60 Offset: 0.0

Ground Elevation: 7.460(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	12.00	5- Cavity layer
2	1.00	12.00	5- Cavity layer
3	2.46	12.00	5- Cavity layer
4	2.46	6.45	3- Clean sand
5	3.00	6.45	3- Clean sand
6	5.00	6.45	3- Clean sand
7	7.00	6.45	3- Clean sand
8	9.00	6.45	3- Clean sand
9	11.00	6.45	3- Clean sand
10	14.00	4.00	3- Clean sand
11	16.00	5.00	3- Clean sand
12	19.00	3.00	3- Clean sand
13	21.00	1.00	3- Clean sand
14	22.00	1.00	3- Clean sand
15	24.00	1.00	3- Clean sand
16	26.00	1.00	3- Clean sand
17	29.00	2.00	3- Clean sand
18	31.00	3.00	3- Clean sand
19	34.00	7.00	3- Clean sand
20	36.00	11.00	3- Clean sand
21	37.00	11.00	3- Clean sand
22	37.00	11.00	4- Lime Stone/Very shelly sand
23	39.00	44.00	4- Lime Stone/Very shelly sand
24	41.00	100.00	4- Lime Stone/Very shelly sand
25	44.00	22.00	4- Lime Stone/Very shelly sand
26	46.00	9.00	4- Lime Stone/Very shelly sand
27	49.00	30.00	4- Lime Stone/Very shelly sand
28	51.00	100.00	4- Lime Stone/Very shelly sand
29	54.00	6.00	4- Lime Stone/Very shelly sand
30	56.00	4.00	4- Lime Stone/Very shelly sand
31	59.00	74.00	4- Lime Stone/Very shelly sand
32	61.00	100.00	4- Lime Stone/Very shelly sand
33	63.00	100.00	4- Lime Stone/Very shelly sand
34	63.00	11.00	3- Clean sand
35	64.00	11.00	3- Clean sand
36	66.00	12.00	3- Clean sand
37	67.00	12.00	3- Clean sand
38	67.00	42.00	4- Lime Stone/Very shelly sand
39	69.00	42.00	4- Lime Stone/Very shelly sand
40	71.00	7.00	4- Lime Stone/Very shelly sand
41	74.00	8.00	4- Lime Stone/Very shelly sand
42	76.00	26.00	4- Lime Stone/Very shelly sand
43	79.00	79.00	4- Lime Stone/Very shelly sand
44	81.00	10.00	4- Lime Stone/Very shelly sand
45	84.00	31.00	4- Lime Stone/Very shelly sand
46	86.00	100.00	4- Lime Stone/Very shelly sand
47	89.00	11.00	4- Lime Stone/Very shelly sand
48	91.00	22.00	4- Lime Stone/Very shelly sand
49	94.00	34.00	4- Lime Stone/Very shelly sand
50	95.00	34.00	4- Lime Stone/Very shelly sand
51	95.00	24.00	3- Clean sand
52	96.00	24.00	3- Clean sand
53	99.00	11.00	3- Clean sand
54	100.00	11.00	3- Clean sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	7.46	5.00	2.46	12.00	5-Void
2	5.00	-29.54	34.54	4.33	3-Clean Sand
3	-29.54	-55.54	26.00	46.65	4-Limestone, Very Shelly Sand
4	-55.54	-59.54	4.00	11.25	3-Clean Sand
5	-59.54	-87.54	28.00	34.11	4-Limestone, Very Shelly Sand
6	-87.54	-92.54	5.00	21.40	3-Clean Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	6.46
18.00	2.00	5.46
18.00	3.00	4.46
18.00	4.00	3.46
18.00	5.00	2.46
18.00	6.00	1.46
18.00	7.00	0.46
18.00	8.00	-0.54
18.00	9.00	-1.54
18.00	10.00	-2.54
18.00	11.00	-3.54
18.00	12.00	-4.54
18.00	13.00	-5.54
18.00	14.00	-6.54
18.00	15.00	-7.54
18.00	16.00	-8.54
18.00	17.00	-9.54
18.00	18.00	-10.54
18.00	19.00	-11.54
18.00	20.00	-12.54
18.00	21.00	-13.54
18.00	22.00	-14.54
18.00	23.00	-15.54
18.00	24.00	-16.54
18.00	25.00	-17.54
18.00	26.00	-18.54
18.00	27.00	-19.54
18.00	28.00	-20.54
18.00	29.00	-21.54
18.00	30.00	-22.54
18.00	31.00	-23.54
18.00	32.00	-24.54
18.00	33.00	-25.54
18.00	34.00	-26.54
18.00	35.00	-27.54
18.00	36.00	-28.54
18.00	37.00	-29.54
18.00	38.00	-30.54
18.00	39.00	-31.54
18.00	40.00	-32.54
18.00	41.00	-33.54
18.00	42.00	-34.54
18.00	43.00	-35.54
18.00	44.00	-36.54
18.00	45.00	-37.54
18.00	46.00	-38.54
18.00	47.00	-39.54
18.00	48.00	-40.54
18.00	49.00	-41.54
18.00	50.00	-42.54
18.00	51.00	-43.54
18.00	52.00	-44.54
18.00	53.00	-45.54
18.00	54.00	-46.54
18.00	55.00	-47.54
18.00	56.00	-48.54
18.00	57.00	-49.54
18.00	58.00	-50.54
18.00	59.00	-51.54
18.00	60.00	-52.54
18.00	61.00	-53.54
18.00	62.00	-54.54
18.00	63.00	-55.54
18.00	64.00	-56.54
18.00	65.00	-57.54
18.00	66.00	-58.54
18.00	67.00	-59.54
18.00	68.00	-60.54
18.00	69.00	-61.54
18.00	70.00	-62.54

18.00	71.00	-63.54
18.00	72.00	-64.54
18.00	73.00	-65.54
18.00	74.00	-66.54
18.00	75.00	-67.54
18.00	76.00	-68.54
18.00	77.00	-69.54
18.00	78.00	-70.54
18.00	79.00	-71.54
18.00	80.00	-72.54
18.00	81.00	-73.54
18.00	82.00	-74.54
18.00	83.00	-75.54
18.00	84.00	-76.54
18.00	85.00	-77.54
18.00	86.00	-78.54
18.00	87.00	-79.54
18.00	88.00	-80.54
18.00	89.00	-81.54
18.00	90.00	-82.54
18.00	91.00	-83.54
18.00	92.00	-84.54
18.00	93.00	-85.54
18.00	94.00	-86.54

Driven Pile Capacity:
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Section Type: Square
Pile Width: 18.00 (in)

Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.42	9.70	10.12	5.06	29.52
4.00	18.0	1.05	10.23	11.28	5.64	31.74
5.00	18.0	1.65	10.97	12.62	6.31	34.57
6.00	18.0	2.27	11.82	14.09	7.04	37.73
7.00	18.0	2.94	12.65	15.59	7.79	40.88
8.00	18.0	3.70	13.33	17.03	8.51	43.68
9.00	18.0	4.54	13.79	18.32	9.16	45.90
10.00	18.0	5.43	14.15	19.58	9.79	47.89
11.00	18.0	6.35	14.53	20.88	10.44	49.93
12.00	18.0	7.23	14.48	21.72	10.86	50.69
13.00	18.0	8.00	14.74	22.73	11.37	52.21
14.00	18.0	8.66	14.93	23.58	11.79	53.43
15.00	18.0	9.29	14.35	23.64	11.82	52.33
16.00	18.0	9.98	12.91	22.89	11.45	48.71
17.00	18.0	10.66	11.37	22.02	11.01	44.76
18.00	18.0	11.25	9.93	21.18	10.59	41.03
19.00	18.0	11.75	8.60	20.35	10.17	37.54
20.00	18.0	12.11	7.44	19.55	9.78	34.43
21.00	18.0	12.27	6.52	18.79	9.40	31.83
22.00	18.0	12.33	5.72	18.05	9.02	29.49
23.00	18.0	12.38	4.92	17.30	8.65	27.14
24.00	18.0	12.43	4.18	16.61	8.31	24.98
25.00	18.0	12.47	3.85	16.33	8.16	24.04
26.00	18.0	12.51	4.05	16.56	8.28	24.66
27.00	18.0	12.55	4.66	17.20	8.60	26.52
28.00	18.0	12.58	5.58	18.16	9.08	29.32
29.00	18.0	12.61	6.90	19.51	9.75	33.30
30.00	18.0	12.74	8.69	21.43	10.71	38.81
31.00	18.0	13.07	10.88	23.94	11.97	45.70
32.00	18.0	13.58	13.09	26.67	13.34	52.86
33.00	18.0	14.28	17.91	32.19	16.10	68.01
34.00	18.0	15.15	27.08	42.24	21.12	96.41
35.00	18.0	16.25	42.04	58.29	29.15	142.36
36.00	18.0	17.63	62.94	80.57	40.28	206.45
37.00	18.0	20.04	149.75	169.79	84.89	469.29
38.00	18.0	21.47	156.23	177.70	88.85	490.17
39.00	18.0	24.13	147.96	172.09	86.05	468.01
40.00	18.0	28.09	127.27	155.36	77.68	409.89
41.00	18.0	33.40	95.04	128.44	64.22	318.51
42.00	18.0	38.68	65.68	104.36	52.18	235.72
43.00	18.0	42.50	50.75	93.24	46.62	194.74
44.00	18.0	44.86	56.35	101.21	50.60	213.90
45.00	18.0	46.25	84.25	130.50	65.25	299.00
46.00	18.0	47.17	115.70	162.86	81.43	394.26
47.00	18.0	48.10	133.40	181.49	90.75	448.29
48.00	18.0	49.55	134.47	184.02	92.01	452.96
49.00	18.0	51.52	125.52	177.04	88.52	428.09

50.00	18.0	54.69	107.05	161.75	80.87	375.85
51.00	18.0	59.75	79.26	139.01	69.51	297.54
52.00	18.0	64.82	62.88	127.70	63.85	253.45
53.00	18.0	68.05	72.32	140.37	70.18	285.00
54.00	18.0	69.42	102.67	172.09	86.05	377.44
55.00	18.0	69.83	142.43	212.26	106.13	497.12
56.00	18.0	70.16	183.77	253.94	126.97	621.49
57.00	18.0	71.33	219.19	290.52	145.26	728.90
58.00	18.0	74.23	204.80	279.04	139.52	688.64
59.00	18.0	78.87	178.30	257.17	128.59	613.78
60.00	18.0	84.50	144.73	229.23	114.61	518.68
61.00	18.0	90.37	108.86	199.24	99.62	416.97
62.00	18.0	96.37	84.39	180.76	90.38	349.54
63.00	18.0	102.37	52.58	154.95	77.48	260.10
64.00	18.0	103.93	50.00	153.93	76.96	253.92
65.00	18.0	105.43	52.81	158.25	79.12	263.88
66.00	18.0	107.07	52.88	159.95	79.98	265.72
67.00	18.0	108.88	63.83	172.70	86.35	300.36
68.00	18.0	112.00	48.24	160.24	80.12	256.72
69.00	18.0	115.13	34.62	149.75	74.88	219.00
70.00	18.0	117.60	28.80	146.40	73.20	204.01
71.00	18.0	118.77	38.03	156.81	78.40	232.88
72.00	18.0	119.31	61.56	180.87	90.43	303.99
73.00	18.0	119.86	95.34	215.20	107.60	405.88
74.00	18.0	120.45	124.68	245.13	122.56	494.50
75.00	18.0	121.38	133.06	254.44	127.22	520.56
76.00	18.0	122.98	129.66	252.64	126.32	511.96
77.00	18.0	125.57	122.22	247.79	123.89	492.23
78.00	18.0	129.47	107.46	236.94	118.47	451.86
79.00	18.0	134.69	91.36	226.05	113.03	408.77
80.00	18.0	139.29	94.57	233.86	116.93	423.00
81.00	18.0	141.32	117.81	259.13	129.56	494.76
82.00	18.0	142.32	136.09	278.41	139.20	550.58
83.00	18.0	143.85	138.36	282.21	141.10	558.93
84.00	18.0	145.89	132.27	278.16	139.08	542.69
85.00	18.0	149.12	119.45	268.58	134.29	507.49
86.00	18.0	154.20	93.73	247.92	123.96	435.38
87.00	18.0	159.33	68.83	228.16	114.08	365.82
88.00	18.0	162.74	58.73	221.48	110.74	338.95
89.00	18.0	164.43	62.51	226.94	113.47	351.96
90.00	18.0	165.45	69.04	234.49	117.24	372.56
91.00	18.0	166.88	72.17	239.05	119.53	383.39
92.00	18.0	168.67	71.06	239.73	119.86	381.85
93.00	18.0	170.75	65.93	236.68	118.34	368.55
94.00	18.0	173.13	57.86	230.99	115.50	346.71

NOTES
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1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

General Information:
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Input file: .....E\Bridge\Driven Pile\Preforming Case\B-2_16-inch Diven Pile.in
Project number: HR21-1691R
Job name: SW 87TH AVE BRIDGE OVER C-100 CANAL
Engineer: CS
Units: English

Analysis Information:
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Analysis Type: SPT

Soil Information:
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Boring date: 8/31/2021, Boring Number: B-2
Station number: 20+42 Offset: 0.0

Ground Elevation: 6.560(ft)

Hammer type: Automatic Hammer, Correction factor = 1.24

ID	Depth (ft)	No. of Blows (Blows/ft)	Soil Type
1	0.00	8.00	5- Cavity layer
2	3.00	6.45	5- Cavity layer
3	3.00	6.45	3- Clean sand
4	5.00	6.45	3- Clean sand
5	7.00	6.45	3- Clean sand
6	9.00	6.45	3- Clean sand
7	11.00	6.45	3- Clean sand
8	14.00	5.00	3- Clean sand
9	16.00	4.00	3- Clean sand
10	19.00	2.00	3- Clean sand
11	21.00	6.45	3- Clean sand
12	24.00	6.45	3- Clean sand
13	26.00	6.45	3- Clean sand
14	29.00	6.45	3- Clean sand
15	31.00	6.45	3- Clean sand
16	31.56	6.45	3- Clean sand
17	31.56	7.00	4- Lime Stone/Very shelly sand
18	34.00	52.00	4- Lime Stone/Very shelly sand
19	36.00	100.00	4- Lime Stone/Very shelly sand
20	39.00	100.00	4- Lime Stone/Very shelly sand
21	41.00	100.00	4- Lime Stone/Very shelly sand
22	44.00	13.00	4- Lime Stone/Very shelly sand
23	46.00	20.00	4- Lime Stone/Very shelly sand
24	49.00	14.00	4- Lime Stone/Very shelly sand
25	51.00	27.00	4- Lime Stone/Very shelly sand
26	54.00	71.00	4- Lime Stone/Very shelly sand
27	56.00	100.00	4- Lime Stone/Very shelly sand
28	59.00	91.00	4- Lime Stone/Very shelly sand
29	61.00	8.00	4- Lime Stone/Very shelly sand
30	64.00	11.00	4- Lime Stone/Very shelly sand
31	66.00	26.00	4- Lime Stone/Very shelly sand
32	69.00	4.00	4- Lime Stone/Very shelly sand
33	71.00	3.00	4- Lime Stone/Very shelly sand
34	74.00	37.00	4- Lime Stone/Very shelly sand
35	76.00	64.00	4- Lime Stone/Very shelly sand
36	79.00	100.00	4- Lime Stone/Very shelly sand
37	81.00	100.00	4- Lime Stone/Very shelly sand
38	84.00	97.00	4- Lime Stone/Very shelly sand
39	86.00	100.00	4- Lime Stone/Very shelly sand
40	89.00	29.00	4- Lime Stone/Very shelly sand
41	91.00	21.00	4- Lime Stone/Very shelly sand
42	92.50	21.00	4- Lime Stone/Very shelly sand
43	92.50	21.00	3- Clean sand
44	94.00	21.00	3- Clean sand
45	96.00	11.00	3- Clean sand
46	99.00	18.00	3- Clean sand
47	100.00	18.00	3- Clean sand

Blowcount Average Per Soil Layer

Layer Num.	Starting Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Average Blowcount (Blows/ft)	Soil Type
1	6.56	3.56	3.00	8.00	5-Void
2	3.56	-25.00	28.56	5.78	3-Clean Sand
3	-25.00	-85.94	60.94	53.01	4-Limestone, Very Shelly Sand

4	-85.94	-93.44	7.50	16.60	3-Clean Sand

Driven Pile Data:
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Pile unit weight = 150.00(pcf), Section Type: Square

Pile Geometry:

Width (in)	Length (ft)	Tip Elev. (ft)
18.00	1.00	5.56
18.00	2.00	4.56
18.00	3.00	3.56
18.00	4.00	2.56
18.00	5.00	1.56
18.00	6.00	0.56
18.00	7.00	-0.44
18.00	8.00	-1.44
18.00	9.00	-2.44
18.00	10.00	-3.44
18.00	11.00	-4.44
18.00	12.00	-5.44
18.00	13.00	-6.44
18.00	14.00	-7.44
18.00	15.00	-8.44
18.00	16.00	-9.44
18.00	17.00	-10.44
18.00	18.00	-11.44
18.00	19.00	-12.44
18.00	20.00	-13.44
18.00	21.00	-14.44
18.00	22.00	-15.44
18.00	23.00	-16.44
18.00	24.00	-17.44
18.00	25.00	-18.44
18.00	26.00	-19.44
18.00	27.00	-20.44
18.00	28.00	-21.44
18.00	29.00	-22.44
18.00	30.00	-23.44
18.00	31.00	-24.44
18.00	32.00	-25.44
18.00	33.00	-26.44
18.00	34.00	-27.44
18.00	35.00	-28.44
18.00	36.00	-29.44
18.00	37.00	-30.44
18.00	38.00	-31.44
18.00	39.00	-32.44
18.00	40.00	-33.44
18.00	41.00	-34.44
18.00	42.00	-35.44
18.00	43.00	-36.44
18.00	44.00	-37.44
18.00	45.00	-38.44
18.00	46.00	-39.44
18.00	47.00	-40.44
18.00	48.00	-41.44
18.00	49.00	-42.44
18.00	50.00	-43.44
18.00	51.00	-44.44
18.00	52.00	-45.44
18.00	53.00	-46.44
18.00	54.00	-47.44
18.00	55.00	-48.44
18.00	56.00	-49.44
18.00	57.00	-50.44
18.00	58.00	-51.44
18.00	59.00	-52.44
18.00	60.00	-53.44
18.00	61.00	-54.44
18.00	62.00	-55.44
18.00	63.00	-56.44
18.00	64.00	-57.44
18.00	65.00	-58.44
18.00	66.00	-59.44
18.00	67.00	-60.44
18.00	68.00	-61.44
18.00	69.00	-62.44
18.00	70.00	-63.44
18.00	71.00	-64.44
18.00	72.00	-65.44
18.00	73.00	-66.44
18.00	74.00	-67.44
18.00	75.00	-68.44
18.00	76.00	-69.44
18.00	77.00	-70.44
18.00	78.00	-71.44
18.00	79.00	-72.44

18.00	80.00	-73.44
18.00	81.00	-74.44
18.00	82.00	-75.44
18.00	83.00	-76.44
18.00	84.00	-77.44
18.00	85.00	-78.44
18.00	86.00	-79.44
18.00	87.00	-80.44
18.00	88.00	-81.44
18.00	89.00	-82.44
18.00	90.00	-83.44
18.00	91.00	-84.44
18.00	92.00	-85.44
18.00	93.00	-86.44
18.00	94.00	-87.44

Driven Pile Capacity:
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Test Pile Length (ft)	Pile Width (in)	Ultimate Side Friction (tons)	Mobilized End Bearing (tons)	Estimated Davisson Capacity (tons)	Allowable Pile Capacity (tons)	Ultimate Pile Capacity (tons)
1.00	18.0	0.00	0.00	0.00	0.00	0.00
2.00	18.0	0.00	0.00	0.00	0.00	0.00
3.00	18.0	0.00	9.60	9.60	4.80	28.79
4.00	18.0	0.74	9.86	10.60	5.30	30.33
5.00	18.0	1.36	10.45	11.81	5.91	32.71
6.00	18.0	1.98	11.20	13.17	6.59	35.56
7.00	18.0	2.63	11.99	14.62	7.31	38.59
8.00	18.0	3.34	12.74	16.08	8.04	41.55
9.00	18.0	4.12	13.38	17.50	8.75	44.26
10.00	18.0	4.97	13.86	18.82	9.41	46.54
11.00	18.0	5.89	14.11	20.00	10.00	48.21
12.00	18.0	6.90	13.95	20.85	10.42	48.74
13.00	18.0	7.72	13.51	21.23	10.61	48.25
14.00	18.0	8.48	12.81	21.29	10.64	46.91
15.00	18.0	9.18	12.74	21.91	10.96	47.39
16.00	18.0	9.81	12.83	22.64	11.32	48.30
17.00	18.0	10.32	13.33	23.64	11.82	50.30
18.00	18.0	10.65	14.04	24.69	12.34	52.76
19.00	18.0	10.80	14.96	25.76	12.88	55.68
20.00	18.0	11.07	15.73	26.80	13.40	58.26
21.00	18.0	11.76	15.99	27.75	13.87	59.72
22.00	18.0	12.66	15.99	28.64	14.32	60.62
23.00	18.0	13.55	15.99	29.54	14.77	61.51
24.00	18.0	14.45	16.02	30.47	15.24	62.50
25.00	18.0	15.35	16.11	31.46	15.73	63.67
26.00	18.0	16.26	16.26	32.51	16.26	65.03
27.00	18.0	17.16	17.44	34.60	17.30	69.49
28.00	18.0	18.06	23.37	41.44	20.72	88.19
29.00	18.0	18.97	34.46	53.42	26.71	122.34
30.00	18.0	19.87	51.01	70.88	35.44	172.89
31.00	18.0	20.78	72.96	93.74	46.87	239.65
32.00	18.0	22.74	183.77	206.52	103.26	574.06
33.00	18.0	24.56	215.89	240.45	120.22	672.22
34.00	18.0	27.74	239.21	266.95	133.48	745.38
35.00	18.0	32.14	253.41	285.55	142.77	792.37
36.00	18.0	37.61	251.81	289.42	144.71	793.04
37.00	18.0	43.61	232.81	276.42	138.21	742.04
38.00	18.0	49.61	201.15	250.76	125.38	653.05
39.00	18.0	55.61	163.89	219.50	109.75	547.28
40.00	18.0	61.61	128.11	189.72	94.86	445.93
41.00	18.0	67.61	92.64	160.25	80.12	345.53
42.00	18.0	72.77	62.66	135.43	67.71	260.74
43.00	18.0	76.25	44.49	120.75	60.37	209.73
44.00	18.0	78.06	39.99	118.05	59.02	198.03
45.00	18.0	79.15	43.92	123.08	61.54	210.93
46.00	18.0	80.51	51.97	132.48	66.24	236.41
47.00	18.0	81.93	68.02	149.95	74.98	286.00
48.00	18.0	83.19	93.26	176.45	88.23	362.97
49.00	18.0	84.31	125.24	209.54	104.77	460.01
50.00	18.0	85.59	159.67	245.26	122.63	564.61
51.00	18.0	87.36	193.00	280.35	140.18	666.35
52.00	18.0	89.91	220.74	310.65	155.32	752.12
53.00	18.0	93.56	240.15	333.71	166.85	814.00
54.00	18.0	98.29	241.23	339.52	169.76	821.98
55.00	18.0	103.76	216.42	320.17	160.09	753.01
56.00	18.0	109.58	178.35	287.93	143.96	644.63
57.00	18.0	115.58	138.95	254.53	127.26	532.42
58.00	18.0	121.58	99.95	221.52	110.76	421.41
59.00	18.0	127.58	62.75	190.33	95.16	315.82
60.00	18.0	132.23	38.77	171.00	85.50	248.54
61.00	18.0	134.17	34.87	169.05	84.52	238.80
62.00	18.0	134.80	37.72	172.53	86.26	247.97
63.00	18.0	135.51	37.11	172.63	86.31	246.86
64.00	18.0	136.29	34.49	170.78	85.39	239.76

65.00	18.0	137.39	29.87	167.26	83.63	226.99
66.00	18.0	139.05	24.41	163.45	81.73	212.27
67.00	18.0	140.71	23.81	164.52	82.26	212.15
68.00	18.0	141.82	31.23	173.05	86.52	235.50
69.00	18.0	142.39	48.04	190.43	95.22	286.51
70.00	18.0	142.67	74.22	216.89	108.45	365.33
71.00	18.0	142.91	106.39	249.30	124.65	462.08
72.00	18.0	143.56	140.04	283.59	141.80	563.66
73.00	18.0	145.05	172.59	317.64	158.82	662.83
74.00	18.0	147.38	202.13	349.51	174.75	753.77
75.00	18.0	150.63	225.32	375.96	187.98	826.61
76.00	18.0	154.89	240.77	395.67	197.83	877.21
77.00	18.0	159.86	250.42	410.28	205.14	911.13
78.00	18.0	165.24	256.21	421.45	210.73	933.88
79.00	18.0	171.03	258.14	429.18	214.59	945.46
80.00	18.0	177.03	258.14	435.18	217.59	951.46
81.00	18.0	183.03	252.98	436.02	218.01	941.98
82.00	18.0	189.03	237.49	426.53	213.26	901.52
83.00	18.0	195.03	211.68	406.72	203.36	830.09
84.00	18.0	201.03	179.80	380.84	190.42	740.45
85.00	18.0	207.03	146.10	353.14	176.57	645.35
86.00	18.0	213.03	111.50	324.53	162.27	547.52
87.00	18.0	218.39	83.05	301.44	150.72	467.54
88.00	18.0	222.47	65.93	288.40	144.20	420.26
89.00	18.0	225.27	57.89	283.16	141.58	398.94
90.00	18.0	227.28	53.44	280.72	140.36	387.61
91.00	18.0	228.99	50.15	279.14	139.57	379.45
92.00	18.0	230.55	48.93	279.48	139.74	377.34
93.00	18.0	232.66	49.16	281.82	140.91	380.13
94.00	18.0	235.40	49.49	284.89	142.44	383.86

NOTES
---

1. MOBILIZED END BEARING IS 1/3 OF THE ORIGINAL RB-121 VALUES.

2. DAVISSON PILE CAPACITY IS AN ESTIMATE BASED ON FAILURE CRITERIA, AND EQUALS ULTIMATE SIDE FRICTION PLUS MOBILIZED END BEARING.

3. ALLOWABLE PILE CAPACITY IS 1/2 THE DAVISSON PILE CAPACITY.

4. ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 3 x THE MOBILIZED END BEARING.
   EXCEPTION: FOR H-PILES TIPPED IN SAND OR LIMESTONE, THE ULTIMATE PILE CAPACITY IS ULTIMATE SIDE FRICTION PLUS 2 x THE MOBILIZED END BEARING.

SOIL/ROCK PARAMETERS FOR LATERAL ANALYSIS WITH FB-MULTIPIER FOR DRIVEN PILES
SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
MIAMI-DADE COUNTY, FLORIDA
HR ENGINEERING SERVICES. INC.
HRES PROJECT No. HR21-1691R
OCTOBER 29, 2021

Preforming Elevation (ft) : -- See Table Below for Specific Preforming if required

Pile Size (in) : 18

End Bent	Pile Size (in)	Test Boring No.	Layer No.	Range of Elevation, ft		Soil Description	Soil Type	SPT N_{avg} Auto	SPT N_{avg} Safety	Lateral					Axial					Torsion				Tip			
				From	To					Soil Model	Angle of Internal Friction, ϕ (Deg.)	Total Unit Weight, γ (pcf)	Subgrade Modulus, k (pci)	Unconfined Compressive Strength (psf)	Soil Model	Total Unit Weight, γ (pcf)	Shear Modulus, G (ksi)	Poisson's Ratio, ν	Ult. Skin Friction (psf)	Soil Model	Total Unit Weight, γ (pcf)	Shear Modulus, G (ksi)	Torsional Shear Stress (psf)	Soil Model	Shear Modulus, G (ksi)	Poisson's Ratio, ν	18-inch Pile Axial Bearing Failure (kips)
End Bents 1 and 2	18	B-1 and B-2	1	4.0	-25.0	Sand (Preform)	Cohesionless	6	8	Sand (Reese)	30	105	16	--	Driven Pile	105	0.6	0.3	304	Hyperbolic	105	0.6	304	Driven Pile (McVay)	0.6	0.3	--
			2	-25.0	-30.0	Sand	Cohesionless	5	6	Sand (Reese)	29	103	12	--	Driven Pile	103	0.5	0.3	226	Hyperbolic	103	0.5	226	Driven Pile (McVay)	0.5	0.3	86
			3	-30.0	-55.0	Limestone	Cohesionless	32	40	Sand (Reese)	40	120	110	--	Driven Pile	120	3.5	0.2	800	Hyperbolic	120	3.5	800	Driven Pile (McVay)	3.5	0.2	648
			4	-55.0	-70.0	Limestone	Cohesionless	8	10	Sand (Reese)	31	120	20	--	Driven Pile	120	0.8	0.3	200	Hyperbolic	120	0.8	200	Driven Pile (McVay)	0.8	0.3	162

Notes:

Friction Angle

ϕ = 28+N(safety)/4 with maximum of 34° for fill and sand

ϕ = 33+N(safety)/4 with maximum of 40° for limestone or sandstone

Total Unit Weight

γ = 105*ϕ/30 with maximum 119 pcf for sand and fill

γ = 120 pcf for limestone and sandstone

Subgrade Modulus

The subgrade modulus (k) for cohesionless material was estimated using the FB-Multipier Help Manual Figure 12.3b.

Shear Modulus (G)

G (ksi) = E/[2(1+ν)]

E (psf) = 30000*N(safety) for fill and sand , from FB-Multipier Manual

E (psf) = 30000*N(safety) for limestone (conservative approach)

Poisson's Ratio (ν)

ν=0.3 for sand, fill and soft limestone

ν=0.2 for medium to strong limestone and sandstone

Ultimate Skin Friction and Torsional Shear Stress

t_f = 0.019 N(safety) (tsf) = 38N (psf) for sand and fill

t_f = 0.01 N(safety) (tsf) = 20N (psf) for limestone and sandstone

Pile Axial Bearing Failure

Pile Axial Bearing Failure (kips) = q_{ult}*Pile Tip Area

End Bearing (q_{ult}) = 6.4N(safety) in ksf for sand and fill

End Bearing (q_{ult}) = 7.2N(safety) in ksf for limestone and sandstone

APPENDIX D

CORRESPONDENCE WITH R.J. BEHAR **D-1 THRU D-6**

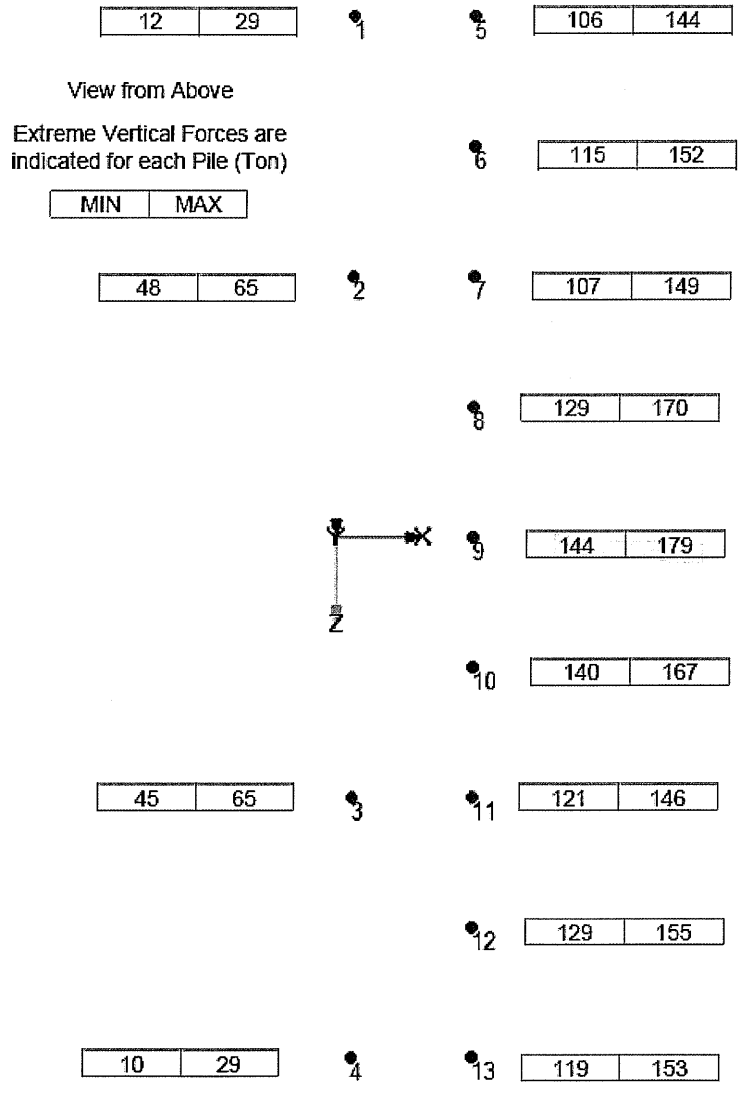
Hernando R Ramos. PE

From: Jose Pena <jpena@rjbehar.com>
Sent: Monday, October 18, 2021 2:09 PM
To: Hernando R Ramos. PE
Cc: 'Chollada Soonyakanit'
Subject: RE: HR21-1691R_SW 87th Ave Bridge over C-100 Canal - Driven & Auger Cast Piles

Hi Hernando,

Here are the latest piles factored loads.

3.3 – Pile Numbering and Forces



Jose A. Pena Ramos, ME, PE
Civil & Structural Department Manager

R.J.Behar & Company, Inc.
Engineers • Planners

6861 SW 196th Avenue, Suite 302
Pembroke Pines, FL 33332
954-680-7771; Ext: 202
954-680-7781 Fax

From: Jose Pena
Sent: Monday, October 18, 2021 12:05 PM
To: 'Hernando R Ramos. PE' <hramos@hrescorp.com>
Cc: 'Chollada Soonyakanit' <csoonyakanit@hrescorp.com>
Subject: RE: HR21-1691R_SW 87th Ave Bridge over C-100 Canal - Driven & Auger Cast Piles

Hi Hernando,

How are we doing with the Geotech report?

Please let me know.

Jose A. Pena Ramos, ME, PE
Civil & Structural Department Manager

R.J.Behar & Company, Inc.
Engineers · Planners

6861 SW 196th Avenue, Suite 302
Pembroke Pines, FL 33332
954-680-7771; Ext: 202
954-680-7781 Fax

From: Hernando R Ramos. PE <hramos@hrescorp.com>
Sent: Wednesday, September 29, 2021 3:31 PM
To: Jose Pena <jpena@rjbehar.com>
Cc: 'Chollada Soonyakanit' <csoonyakanit@hrescorp.com>
Subject: RE: HR21-1691R_SW 87th Ave Bridge over C-100 Canal - Driven & Auger Cast Piles

Hi Jose:

This information is fine with us. Based on this, we will provide two reports: roadway and structures report. The structures report will include both the bridge and the MSE walls. I will preliminarily send the percolation test results soon.

Best Regards,

Hernando R. Ramos, P.E.
Principal Geotechnical Engineer/President

HR Engineering Services, Inc.
7815 NW 72nd Avenue,
Medley, Florida 33166
Phone: 305-888-8880
Fax: 305-888-8770

From: Jose Pena [mailto:jpena@rjbehar.com]
Sent: Wednesday, September 29, 2021 3:18 PM
To: Hernando R Ramos. PE
Cc: 'Chollada Soonyakanit'
Subject: RE: HR21-1691R_SW 87th Ave Bridge over C-100 Canal - Driven & Auger Cast Piles

Hi Hernando,

I'm including the 30% Plans where you can obtain most the information requested.
Do you need cad files too?

For the foundation selection I'm going to be using the auger piles, but I going need these recommendations of piles vs. auger written in the report.

I will be providing you a more detail loads values by the end of this week.

I hope this information help you for now.

Regards,

Jose A. Pena Ramos, ME, PE
Civil & Structural Department Manager

R.J.Behar & Company, Inc.
Engineers • Planners

6861 SW 196th Avenue, Suite 302
Pembroke Pines, FL 33332
954-680-7771
954-680-7781 Fax

From: Hernando R Ramos. PE <hramos@hrescorp.com>
Sent: Wednesday, September 29, 2021 2:51 PM
To: Jose Pena <jpena@rjbehar.com>
Cc: 'Chollada Soonyakanit' <csoonyakanit@hrescorp.com>
Subject: RE: HR21-1691R_SW 87th Ave Bridge over C-100 Canal - Driven & Auger Cast Piles

Hi Jose:

Welcome back. In order for us to provide a final report, we need the following:

1. A set of plans: roadway and structures
2. What information you need in the structural report? I sent you two foundation alternatives. I need to know which one you are going to finally use.
3. I need to know the factored loads. I understand you sent me previously 125 tons/pile. I don't know if you have revised your loads.
4. I need your MSE wall plans with elevations to be able to prepare the wall geotechnical information
5. I can send the percolation test results tomorrow.

In summary, please send me a list of things you want to see in the structures report. I can't provide a final report without knowing where you are going with your plans; otherwise, I will revising the report several times.

For roadway, I need to know the roadway limits. Shown on roadway plans. I don't have this information yet. In general, the plans don't need to be final; however, we need the minimal information for us to be able to provide a formal report for structures and a second for roadway.

Best Regards,

Hernando R. Ramos, P.E.
Principal Geotechnical Engineer/President

HR Engineering Services, Inc.
7815 NW 72nd Avenue,
Medley, Florida 33166
Phone: 305-888-8880
Fax: 305-888-8770

From: Jose Pena [mailto:jpena@rjbehar.com]
Sent: Wednesday, September 29, 2021 2:13 PM
To: Hernando R Ramos. PE
Cc: 'Chollada Soonyakanit'
Subject: RE: HR21-1691R_SW 87th Ave Bridge over C-100 Canal - Driven & Auger Cast Piles

Hi Hernando,

How you doing?

When should I be receiving the draft final report?
We are needing some geotech data for the drainage and H&H analysis.

Let me know.

Regards,

Jose A. Pena Ramos, ME, PE
Civil & Structural Department Manager

R.J.Behar & Company, Inc.
Engineers · Planners

6861 SW 196th Avenue, Suite 302
Pembroke Pines, FL 33332
954-680-7771
954-680-7781 Fax

From: Hernando R Ramos. PE <hramos@hrescorp.com>
Sent: Wednesday, September 15, 2021 3:10 PM
To: Jose Pena <jpena@rjbehar.com>

Cc: 'Chollada Soonyakanit' <csoonyakanit@hrescorp.com>
Subject: RE: HR21-1691R_SW 87th Ave Bridge over C-100 Canal - Driven & Auger Cast Piles

Hi Jose:

Please see attached the following information for the project:

- Bridge Borings
- Pile Capacity Graphs for 18-inch square prestressed concrete piles - Borings B-1 and B-2.
- Pile Capacity Graphs for 18 and 24-inch diameter augercast piles – Borings B-1 and B-2.

Driven Piles

- For a factored load of 125 tons/pile, the NBR is 193 tons, using a resistance factor of 0.65.
- Each end bent requires a test pile.
- Based on the results of Boring B-1, the NBR may be achieved at an estimated pile tip elevation at -28.4 feet.
- Based on the results of Boring B-2, the NBR may be achieved at an estimated pile tip elevation at -41.5 feet.

There is a difference of 13 feet between the estimated pile tips. This is caused by the geological inconsistency of the subsurface soil/rock.

Augercast Piles

- For a factored load of 125 tons/pile, the Ultimate Pile Capacity is 209 tons, using a resistance factor of 0.6.
- The project requires one static load test.
- Based on the results of Borings B-1 and B-2, the Ultimate Pile Capacity may be achieved at an estimated pile tip elevation at -47 feet and -41 feet for 18-inch and 24-inch diameter augercast piles, respectively.
- At this time FDOT has approved the use of augercast piles for bridge support for a minimum pile diameter of 24 inches. The county may accept 18-inch diameter piles.

Advantages and Disadvantages – Driven Piles

Advantages –

- The driven piles don't require a column extension at the end bents.
- The pile capacity can be easily checked with the PDA and by driving criteria.

Disadvantages-

- Vibration – there is a force main pipe within the footprint of the project and pile driving may damage the FM. Require pile preforming. There are nearby residences that may be affected by the pile driving. Also, noise is a problem.
- Due to the soil/rock variability shown by the bridge borings, the selection of pile production lengths is very difficult. Pile production lengths may be selected using extra lengths to avoid pile splicing.
- Issues regarding pile installation refusal before reaching the minimum tip.

Advantages and Disadvantages – Augercast Piles

Advantages –

- Low vibration during augercast pile installation. No vibration issues with the WASAD FM and nearby residences. Low noise during construction.
- The pile capacity can be easily checked during pile installation based on the augercast pile equipment applied torque.
- Higher pile capacities can be achieved if needed by extending the pile tip to deeper depths. Driven piles present drivability issues for higher pile loads.
- The variability of the subsurface soil/rock can be controlled by a proper selection of the pile tip elevation.
- No issues regarding pile installation refusal.

Disadvantages-

- The augercast piles require a column extension at the end bents.
- The piles present higher downdrag loads when compared to driven piles.

As informed you before, we finished all field work. I need to have the MSE wall plans to work on the report. Also, please send us the roadway plans to prepare the roadway report.

If you have any questions please call me.

Best Regards,

Hernando R. Ramos, P.E.
Principal Geotechnical Engineer/President

HR Engineering Services, Inc.
7815 NW 72nd Avenue,
Medley, Florida 33166
Phone: 305-888-8880
Fax: 305-888-8770

October 29, 2021

Mr. Jose A. Pena Ramos, P.E.
Project Manager
R.J. Behar & Company, Inc.
6861 SW 196th Avenue, Suite 302
Pembroke Pines, Florida 33332

Subject: Report of a Geotechnical Exploration – MSE Walls
SW 87th Avenue, from South of SW 164th Street to SW 163rd Street
Miami-Dade County Department of Transportation and Public Works
Project No. N/A
Miami-Dade County, Florida
HRES Project No. HR21-1691R

Dear Jose:

HR Engineering Services, Inc. (HRES) is presenting this Report of a Geotechnical Exploration – MSE Walls for the subject project. This report presents our understanding of the project, outlines our exploratory procedures and documents the field and laboratory test data obtained for the proposed project.

We have enjoyed assisting you on this project and look forward to serving as your geotechnical consultant on the remainder of this project and on future projects. If you have any questions concerning this report, please call our office at (305) 888-8880.

Sincerely,

HR ENGINEERING SERVICES, INC.
(Certificate of Authorization No. 7991)

HERNANDO R. RAMOS LICENSE No 42045 STATE OF FLORIDA PROFESSIONAL ENGINEER

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

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.

Paola Vargas, P.E.
Geotechnical Engineer
Florida Registration 90928

Hernando R. Ramos, P.E.
Principal Geotechnical Engineer
Florida Registration 42045

Distribution: Addressee (1)
File (1)

7815 N.W. 72nd Avenue
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Phone: (305) 888-8880
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1.0 INTRODUCTION

The purpose of the field exploration was to obtain information concerning the site and subsurface conditions along the proposed MSE walls and provide an evaluation of the suitability of the in-situ materials and recommendations for design and construction, including technically feasible foundation bearing depths and factored bearing capacities. This report discusses our exploratory and testing procedures, presents our findings and includes the following items:

Field Data

- Four (4) SPT borings were performed by HRES, each to a depth of 20 feet, for the foundation evaluation of the proposed MSE walls.
- Two (2) SPT borings performed by HRES for the bridges were utilized; Borings B-1 and B-2. HRES utilized these borings for the evaluation of the proposed MSE walls.
- The test borings subsurface information is presented in the Report of Core Borings in Appendix A.

Laboratory Testing

- The results of laboratory tests performed on selected soil samples obtained from the test borings.
- Environmental corrosion classification based on FDOT guidelines.
- A brief description of our laboratory testing procedures.

Evaluation

- A general review of area and site geologic conditions.
- A general review of existing surface features and site conditions.
- Report of core borings which illustrate the estimated subsurface conditions in the area of the proposed retaining walls.
- Evaluation and recommendation of the planned MSE walls.

2.0 PROJECT INFORMATION

2.1 GENERAL

Project information for this subsurface exploration has been provided to us by Mr. Jose A. Pena Ramos, PE, Engineer of Record of R.J. Behar & Company, Inc.

During our geotechnical study, we have been furnished with the following project-related plans and information:

- 30% Plans: SW 87th Avenue, from South of SW 164th Street to SW 163rd Terrace
- Prepared by: R.J. Behar & Company, Inc.
- Dated: September 21, 2021

2.2 PROJECT DESCRIPTION

The project consists of the construction of a new section of SW 87th Avenue, from south of SW 164th Street to SW 163rd Terrace in Miami, Florida. The project includes the construction of a new section of SW 87th Avenue, and a new bridge over C-100 Canal with associated MSE Walls. Drainage improvements are also planned.

This report provides our foundation recommendations for the proposed MSE walls.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The field exploration was conducted by HRES. The locations of the test borings are provided in the Summary of Test Boring Locations in Appendix A and at the approximate locations shown on the Field Exploration Plans in Appendix A.

The Report of Core Borings in Appendix A summarize the approximate boundary between soil types. In some instances, the transition between material types may be gradual. A discussion of the subsurface conditions encountered along the project alignment is provided in Section 4.2 of this report.

The boring elevations shown on the Report of Core Borings were provided by R.J. Behar & Company, Inc.

3.2 LABORATORY TESTING

3.2.1 Soil Testing

In order to aid in classifying and estimate engineering characteristics of the subsurface materials encountered, laboratory classification tests were performed on representative soil samples obtained from the test borings. The laboratory testing program included the following:

- 9 Fines Content Tests
- 1 Organic Content Test

In addition, a total of 9 moisture content tests were performed on the samples. The soil laboratory test results were classified following the USCS Classification System. The test results are presented in Appendix B.

3.2.2 Corrosivity Classification Testing

Corrosivity classification testing was performed on a representative water sample obtained from Percolation Test P-1. The water sample was collected and tested by HRES. This testing included pH, chlorides and sulfates contents and resistivity results. The FDOT Structures Manual, Volume 1, Section 1.3.2 Classification Criteria, outlines the ranges of groundwater chemical properties considered corrosive to reinforced concrete substructure. In addition, that section environmentally

classifies the superstructure based on factors located near the proposed structure(s). Based on this classification, an environment may be Slightly Aggressive, Moderately Aggressive, or Extremely Aggressive. The following table summarizes the laboratory test results:

Table 3.2.2: Corrosion Classification Test Results

Sample Location	Resistivity ohms-cm	pH	Sulfates ppm	Chlorides ppm	Classification	
					Steel	Concrete
P-1	1,435	7.4	18.0	123.0	MA	MA

The results show that the substructures will be in a Moderately Aggressive environment (for steel and concrete). Due to its location, the superstructure is considered to be in a Slightly Aggressive environment for a concrete bridge structure (non- marine structure).

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

The site conditions were observed by a geotechnical engineer during the months of September and October, 2021.

4.2 SUBSURFACE CONDITIONS

4.2.1 Miami-Dade County Soil Survey Map

The Soil Map of Miami-Dade County Area, Florida, published by the United States Department of Agriculture (USDA) was reviewed for general near-surface soil information within the general project vicinity. This information indicates that there are two mapping units in the vicinity of the project. The map soil units encountered are as follows:

Table 4.2.1 Miami-Dade County Soil Survey

Map Unit Symbol	Map Unit Name	Typical Profile
10	Udorthents, limestone substratum-Urban land complex, 0 to 2 percent slopes (0.2% of Area of Interest)	^C1 - 0 to 10 inches: very gravelly loam ^C2 - 10 to 55 inches: extremely gravelly loam 2R - 55 to 65 inches: bedrock
11	Udorthents, marl substratum-Urban land complex, 0 to 2 percent slopes (99.8% of Area of Interest)	^C1 - 0 to 12 inches: very gravelly loam ^C2 - 12 to 41 inches: very gravelly sandy loam 2Lmab - 41 to 80 inches: marly silt loam 3R - 80 to 90 inches: bedrock

A reproduction of the USDA map for the project area is included in Appendix A.

4.2.2 USGS Quadrangle Map

The Palmetto Bay/Perrine Quadrangle, Florida-Dade Topographic Map published by the United States Geological Survey (USGS) was reviewed for general existing ground surface elevation in the project area. Based on the map, the elevation ranges approximately from 5 to 8 feet, NAVD88. A reproduction of the USGS Quadrangle Map for the project area is included in Appendix A.

4.2.3 Geologic Conditions

Miami is located on the southern flank of the Florida Plateau, a stable, carbonate platform on which thick deposits of limestones, dolomites, and evaporites have accumulated. In the study, the upper 200 feet of this platform is composed predominately of limestone and quartz sand. The sediments were deposited during several glacial and interglacial stages during the Pleistocene Epoch.

Within the explored depths of this study, two distinct geological formations were encountered, the Miami Limestone Formation and the Fort Thompson Formation.

4.2.4 Miami Limestone

The Miami Limestone can be described as a soft tan white porous to very porous fossiliferous quartz sandy fine-grained slightly oolitic limestone. The solution channels in the limestone may be up to 2 inches in diameter at some locations, are filled with quartz fine sand and uncemented calcareous materials. The limestone varies in both thickness and competency within the investigated area.

The Miami Limestone was deposited in a shallow near-shore marine carbonate bank environment. Spherical carbonate sand grains called oolites formed and were deposited in this environment. Near shore, processes transported quartz sand into the area and reworked some of the carbonate material. Encrusting organisms called bryozoans were locally abundant and formed patches on the substrate. After sea level receded, the carbonate deposit was exposed to fresh water and the cementation process was initiated. The degree of cementation, and therefore the competency of the rock, was influenced by both the abundance and the type of calcareous material in the original deposit.

4.2.5 Fort Thompson Formation

Underlying the Miami Limestone Formation, the Fort Thompson Formation was generally encountered. The Fort Thompson Formation is composed of sediments of variable lithologies. The lithologies include non-fossiliferous quartz fine sand, fossiliferous quartz sandy limestone, coralline limestone, freshwater limestone and quartz sandstone. These lithologies alternate abruptly in thickness and lateral extent.

The Fort Thompson limestone grades downward into a gray quartz and calcareous fine to medium sand. This sand has been cemented to varying degrees by carbonate material leached out of the

overlying limestone. The cementation commonly takes the form of hard spherical sandstone nodules 1 to 2 inches in diameter occurring in a sand matrix. Sandstone lenses within the sand layer are the result of a more complete cementation.

4.2.6 Generalized Subsurface Conditions Encountered Within the Project Area

For a detailed subsurface condition at a particular borehole location, please refer to the Report of Core Borings in Appendix A.

4.2.7 Groundwater Conditions

The groundwater levels were measured at the time of drilling. The groundwater level was encountered by the boreholes at approximately elevation 3.0 feet, NGVD29. An average October Water Level of 3.0 feet, NGVD29 (1.5 feet, NAVD88) and a seasonal High Ground Water Table of 4.0 feet, NGVD29 (2.5 feet, NAVD88) were found for the project based on U.S. Geological Survey (2002) "Average Altitude of the Water Table (1990-99) and Frequency Analysis of Water Levels (1974-99) in Biscayne Aquifer, Miami-Dade County, Florida" included in Appendix A.

Fluctuation in the observed groundwater levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff and other site-specific factors such as changes of the water elevation at C-100 Canal. Since groundwater level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

5.0 EVALUATION

5.1 BASIS OF EVALUATION

The following evaluation is based upon the previously presented project information and the structural conditions along with the data obtained in this exploration. The field and laboratory data have been compared with previous performances of similar structures bearing on and within soil/rock conditions similar to those encountered in this exploration. If the project information is incorrect or changes, please contact us so that our evaluation and recommendations can be reviewed.

In our evaluation of the subject project, we addressed the following geotechnical design and construction considerations:

- Shallow foundation support of the MSE retaining walls bearing on top of suitable materials, after the removal of the sandy silt (MARL) and its replacement with limerock fill.

5.2 RETAINING WALLS

5.2.1 General

Our retaining wall evaluation includes mechanisms to prevent embankment instability as follows:

- Bearing capacity failure;
- Rotational slip surface failure;
- Lateral sliding, and
- Overturning.

Four (4) MSE walls are planned for this phase of the project. The borings performed for the project show a sandy silt (MARL) material down to elevation 3.7 feet, NGVD29. As presented in the roadway report prepared for the project (a separate report). This material shall be removed under the new MSE walls down to the material limestone, extending a minimum of 5 feet beyond the footing of the retaining walls and replaced with compacted limerock fill. Therefore, the walls will be constructed above suitable materials.

A summary of soil parameters used for the analysis of all MSE walls are presented in Table 5.2.1.

Table 5.2.1: Geotechnical Information Table – Permanent MSE Walls

Wall No.		Reinforced Soil and Random Backfill (2)	Foundation Soil		
			Fill	Limestone	Sand or Soft Limestone
Depth Below Existing Ground Line (ft.) (1)	Wall 1	--	0-3	3-12	12-25
	Wall 2		0-3	3-12	12-25
	Wall 3	--	0-2	2-11	11-25
	Wall 4	--	0-2	2-11	11-25
Effective Unit Weight (pcf)		115	52.6	57.6	42.6
Cohesion (psf)		0	0	0	0
Internal Friction Angle (degrees)		34	34	39	30

Notes:

(1) Depth measured below the lowest leveling pad elevation for each wall.

(2) The contractor will demuck below the wall base in accordance with the roadway cross-sections and will backfill with select material with the minimum angle of internal friction of 34 degrees and effective unit weight of 52.6 pcf.

(3) The parameters provided for Reinforced Soil/ Random Backfill correspond to those of limerock fill. If limerock fill is not used, the parameters must be verified by laboratory testing. Backfill material used in the MSE wall volume should meet the requirements of Section 548-2.6.

(4) Design Groundwater Elevation = 4.0 feet, NGVD29.

5.2.2 MSE Walls – Stability and Settlement Analyses

5.2.2.1 Global Stability:

A global stability analysis was carried out using the computer program *STABL6H* developed by Purdue University. This program computes the slope stability of various circular failures through the embankments, which include reinforcement, using the Simplified Janbu, Simplified Bishop or Spencer's method of slices. The soil profiles and parameters provided on Table 5.2.1 were used in the analysis.

The computer analysis outputs for all global stability analyses are included in Appendix C.

5.2.2.2 External Stability:

The external stability analyses of the planned MSE walls were performed using the LRFD External Stability Analysis FDOT spreadsheet, version 2.5.1 (in accordance with AASHTO LRFD Bridge Design Specifications, 2006).

External stability analyses for the permanent MSE walls were performed using reinforced soil, random backfill and foundation soil properties as follows:

Walls 1 thru 4:

- Reinforced soil and random backfill: ϕ =34º and γ= 115 pcf.
- Foundation soil (average) ϕ = 32º and γ = 112 pcf.

Our recommendations for reinforcing strap lengths and bearing resistances versus wall heights for both the temporary and permanent walls are presented in Chapter 6 of this report.

5.2.2.3 Settlement Analysis:

Settlement analysis was performed for the MSE walls using the computer program Settle3, developed by Rocscience. Settle3 is a 3-dimensional program for the analysis of settlement and consolidation under foundations, embankments and surface excavations. The required foundation soil parameters for the settlement calculations were estimated as follows:

- Modulus of Elasticity, *E* for the sand/rock layers was estimated using the SPT based correlation given in the FB-MultiPier Help Manual (E=30000N psf).

Settlement analyses were performed at one cross-section. The results are presented in Appendix C. A summary of estimated wall settlements is presented in Chapter 6 of this report.

The settlement for Walls 1 thru 4 were performed assuming the complete removal of the marl material and its replacement with limerock fill before the construction of the proposed MSE wall takes place.

6.0 RECOMMENDATIONS

6.1 BASIS FOR RECOMMENDATIONS

The following recommendations are based upon our understanding of the structural design information available at the writing of this report and the data gathered during our subsurface exploration. If revised structural information is developed, we should be notified so that or recommendation can be reviewed.

The stratification and consistency of the subsurface materials underlying the site may vary within even short lateral distance; therefore, any subsurface condition encountered which differs from those documented in this study should be reported to us so that our recommendations can be reviewed.

6.2 MSE WALLS RECOMMENDATIONS

The following tables present the footing widths/strap lengths, estimated settlements, Capacity Demand Ratio (CDR), global factor of safety against rotational failure, and factored bearing resistance of the MSE walls.

Table 6.2a: Retaining Wall Variables - MSE Walls

Wall No.	Wall Settlement(1)			
	Long Term (in.) (2)	Short Term (in.)	Differential	
			Longitudinal (%) (ft. /100 ft.)	Transverse (in.)
Wall 1	0.5	1.0	0.1	0.5
Wall 2	0.5	1.0	0.1	0.5
Wall 3	0.5	1.0	0.1	0.5
Wall 4	0.5	1.0	0.1	0.5

Notes:
(1) Settlements were calculated for the unit fill weight of 115 pcf.
(2) Long term settlements are measured from the end of wall fill placement.

Since the foundations consist of limestone and sandy soils, we expect the majority of wall settlements to be short term. The estimated short term settlement of the MSE walls is approximately 1.0 inch. The long term settlement may be an additional 0.5 inch. The longitudinal

differential settlement is 0.1% (i.e., 0.1 ft./100 feet of wall) and the transverse differential settlement estimated is estimated to be around 0.5 inch.

Construction of MSE walls may require excavation of the existing embankments. Any excavation not supported by a temporary support system must have a safe slope of 2H:1V or flatter. Construction of French drains near the new MSE walls/embankments has to be performed before the construction of the MSE walls/embankments. Excavations performed near MSE walls/embankments will cause unwanted slope stability issues.

Table 6.2b: Summary of Bearing and Stability Analyses - MSE Walls 1 thru 4

Wall No.	Wall Height (H), ft.	Factored Bearing Resistance psf	Reinforcement Length (L), ft	AASHTO LRFD 2006 Requirements				Global
				Overturning CDR	Sliding CDR	Bearing Resistance	Eccentricity CDR	
Walls 1 thru 4	≤ 10	5,529	8	> =1	> =1	> =1	< =1	>1.5
	11-12	5,737	9	> =1	> =1	> =1	< =1	>1.5

Notes:
(1) A minimum front face embedment depth of 2 feet is required for all permanent walls.
(2) H is the total wall height measured from the wall leveling pad to top of coping elevation.

The proprietary wall company is responsible for internal stability of the permanent MSE walls. The reinforcing lengths used in construction of the walls shall be the longest of those required for internal and external stability. The minimum front face embedment for the permanent walls should comply with the FDOT Structures Design Guidelines with the minimum of 2.0 feet.

Results of our External Stability and Global Stability Analyses are presented in Appendix C.

6.3 SETTLEMENT AND VIBRATION MONITORING

Construction vibrations associated with pile installation, compaction equipment and others will occur. Settlement is expected due to the construction of the new MSE walls. Existing structures in the vicinity of pile driving and compaction operations should be monitored for settlement and vibration in accordance with Section 108-2.2 of FDOT Standard Specifications. The contractor should prepare a monitoring program to satisfy the requirements of this section.

6.4 DEWATERING ISSUES

Due to the elevation of the proposed leveling pads (from 6.19 to 7.19 feet, NGVD29), it appears that the need for significant groundwater control is not anticipated since the design water elevation is approximately 4.0 feet, NGVD29.

If the leveling pads are lowered, the Designer should be aware that an unknown quantity of groundwater may have to be pumped from the excavations to help lower the water table to the required depths for the construction of the MSE wall structures. When constructing the shallow foundation for the MSE walls, dewatering to below the excavation subgrade may be necessary to ensure dry and stable working conditions.

6.5 CONSTRUCTION PLANS AND SPECIFICATIONS REVIEW

It is recommended that this office be provided the opportunity to make a general review of the foundation and earthwork plans and special provisions prepared from the recommendations presented in this report. We would then suggest any modifications so that our recommendations are properly interpreted and implemented. Our report has been written in a guideline recommendation format and is not appropriate for use as a specification without in-part being reworded into a specification-type format. It is recommended that this report not be made a part of the contract documents; however, it should be made available to prospective contractors for information purposes.

APPENDIX A

SITE LOCATION MAP	**A-1**
FIELD EXPLORATION PLAN	**A-2**
MIAMI-DADE COUNTY SOIL SURVEY MAP	**A-3**
USGS QUADRANGLE ELEVATION MAP	**A-4**
MIAMI-DADE COUNTY USGS WATER LEVELS MAPS	**A-5 AND A-6**
SUMMARY OF TEST BORING LOCATIONS	**A-7**
REPORT OF CORE BORINGS	**A-8 AND A-9**
FIELD TESTING PROCEDURES	**A-10**

SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
MIAMI-DADE COUNTY, FLORIDA

HRES
HR Engineering Services, Inc.

SITE LOCATION PLAN

A-1

DRAWN BY: CS	DATE: 10/29/21
PROJECT No: HR21-1691R	SCALE: NTS

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS HIGHWAY DIVISION
SW 87th AVENUE
AT CANAL
PROJECT NO. N/A SHEET 5 OF 27

LEGEND:

● TEST BORING LOCATION

HRES
HR ENGINEERING SERVICES, INC.
7815 NW 72nd Avenue
Medley, Florida 33166
Ph: 305-888-8880/305-888-8770 Fax
Cert. of Authorization No. 7991

N

0 10 40
Feet

END CONSTRUCTION
BEGIN 18.75' SIDEWALK
STA. +36.33, 29.50' LT
END SIDEWALK
CONNECT TO EXIST
STA. +55.08, 29.50' LT
SW 163 TERRACE
END BRIDGE
STA. 20+33.17
END APPROACH SLAB
STA. 20+63.17
END C&G TYPE F
+10.89, 44.95' LT
R/W
MSE-1
MSE-3
8' SIDEWALK
C & G TYPE F
3' TRAFFIC SEPARATOR
TYPE "SPECIAL"
+85.89
20.00 LT
+85.89
13.50 LT
25' R
1.50' R
POT STA. 20+00.00
POT STA. 22+20.00
POT STA. 23+00.00
MATCH LINE STA. 17+40.00
MATCH LINE STA. 23+00.00
80'
20'
18
19
20
21
22
N 3° 59' 14" W
B-1
B-2
48" PIPE
MSE-2
MSE-4
P-1
+85.52
13.50 RT
+85.51
20.00 RT
+56.21
29.50 RT
+36.73
29.50 RT
SW 87 AVENUE
BEGIN APPROACH SLAB
STA. 19+36.83
BEGIN BRIDGE
STA. 19+66.83
CANAL C-100
END C&G TYPE F
+10.51, 45.11' RT
END CONSTRUCTION

LEGEND
TACTILE SURFACE

A-2

REVISIONS								
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

R.J. Behar & Company, Inc.
Engineers • Planners
6861 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

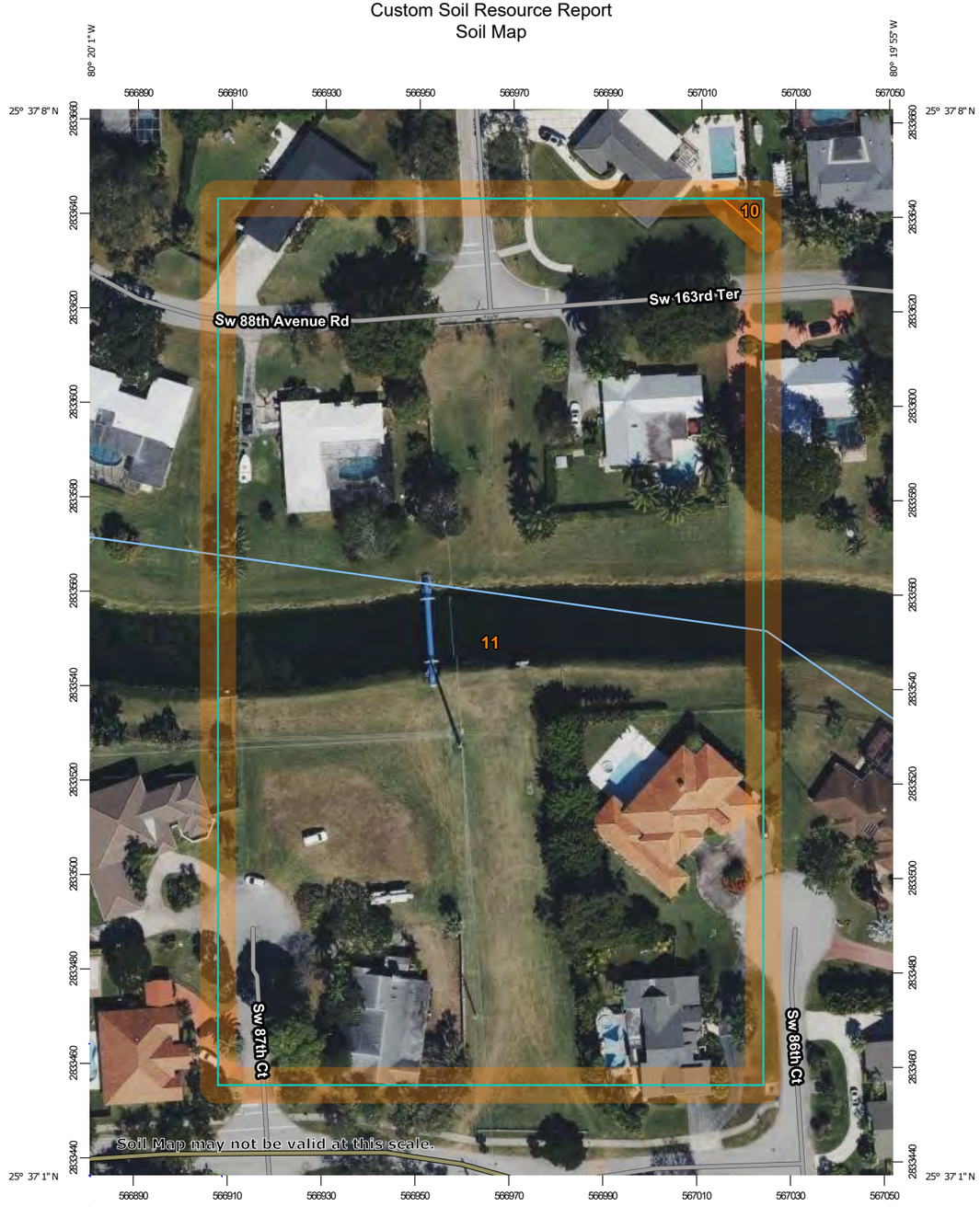
	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

ROADWAY PLAN

9/21/2021 10:04:54 AM O:\21030_SW 87 Bridge over Canal C-100\CADD\roadway\PLANS02.dgn

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CHECKED BY:	DESIGNED BY:	CHECKED BY:
CS 10-21	PV 10-21	CS 10-21	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

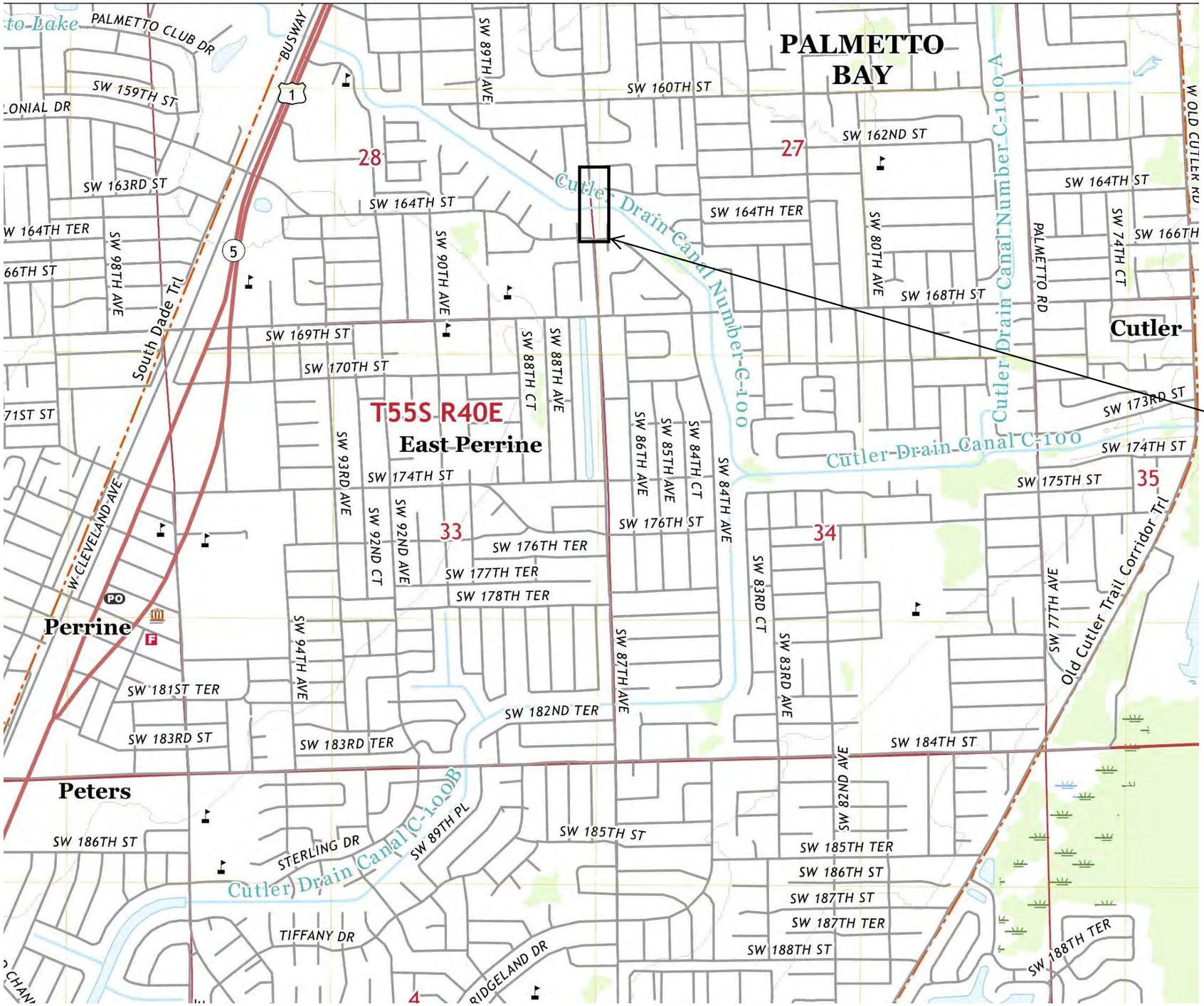
SHEET TITLE: MIAMI-DADE COUNTY SOIL SURVEY MAP

REF. DWG. NO.:

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

SHEET NO.: A-3

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.



THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CS 10-21
CHECKED BY:	PV 10-21
DESIGNED BY:	CS 10-21
CHECKED BY:	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

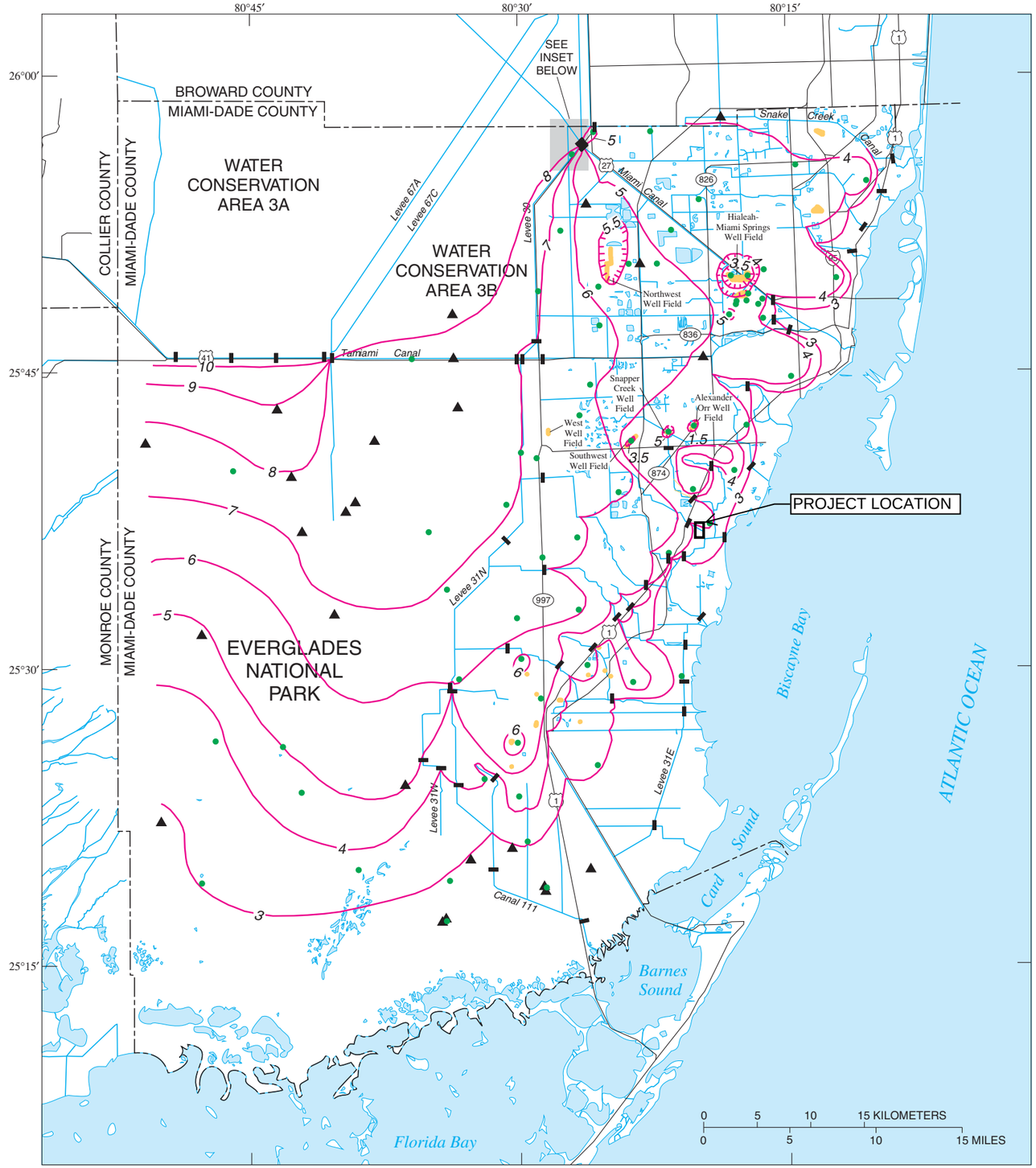
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: USGS QUADRANGLE ELEVATION MAP

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

REF. DWG. NO.

SHEET NO. A-4



AVERAGE YEARLY HIGH WATER LEVELS 1990-99

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CS 10-21
CHECKED BY:	PV 10-21
DESIGNED BY:	CS 10-21
CHECKED BY:	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: USGS AVERAGE YEARLY HIGH WATER LEVELS (1990-1999)

REF. DWG. NO.:

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

SHEET NO.: A-5

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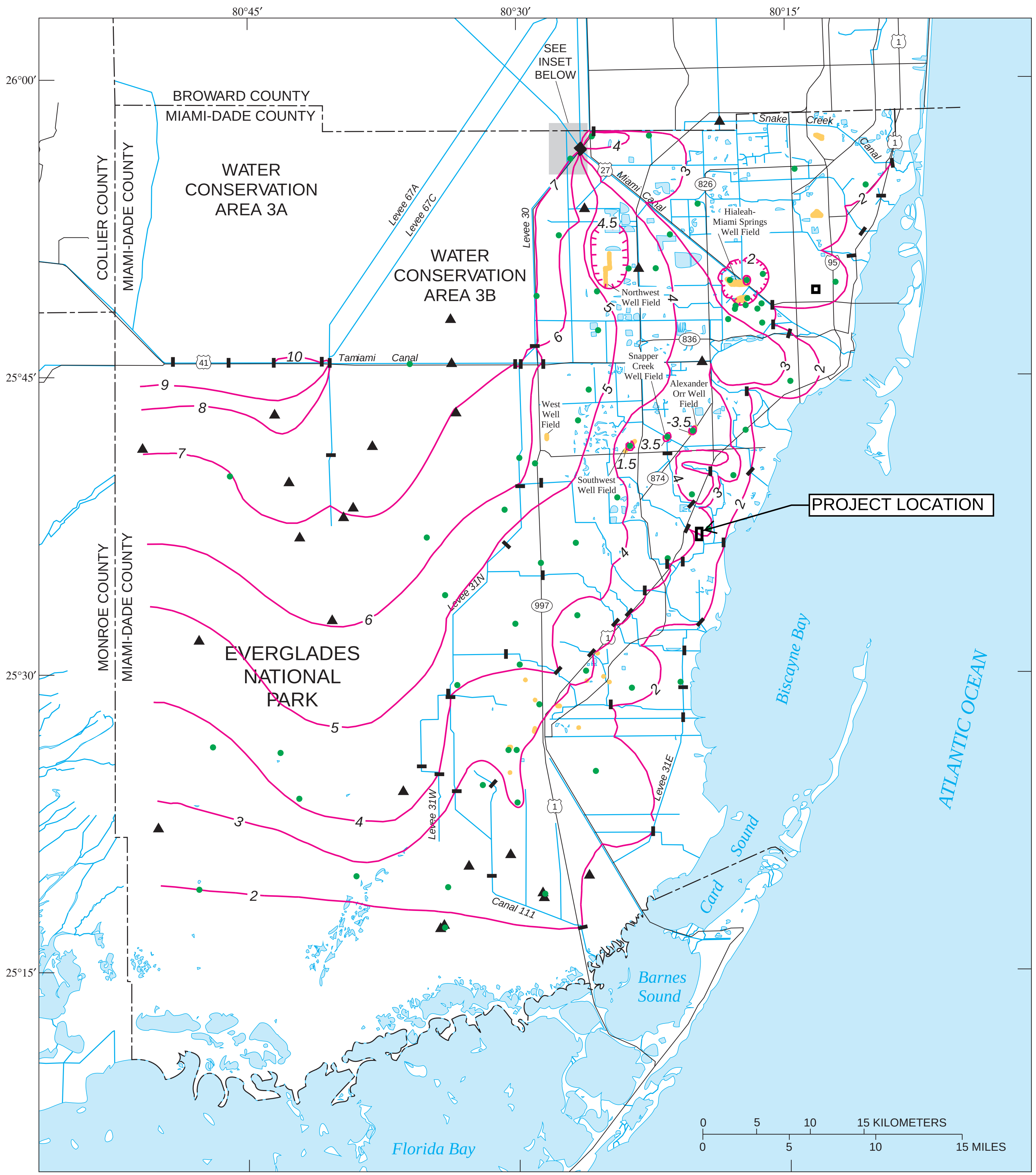
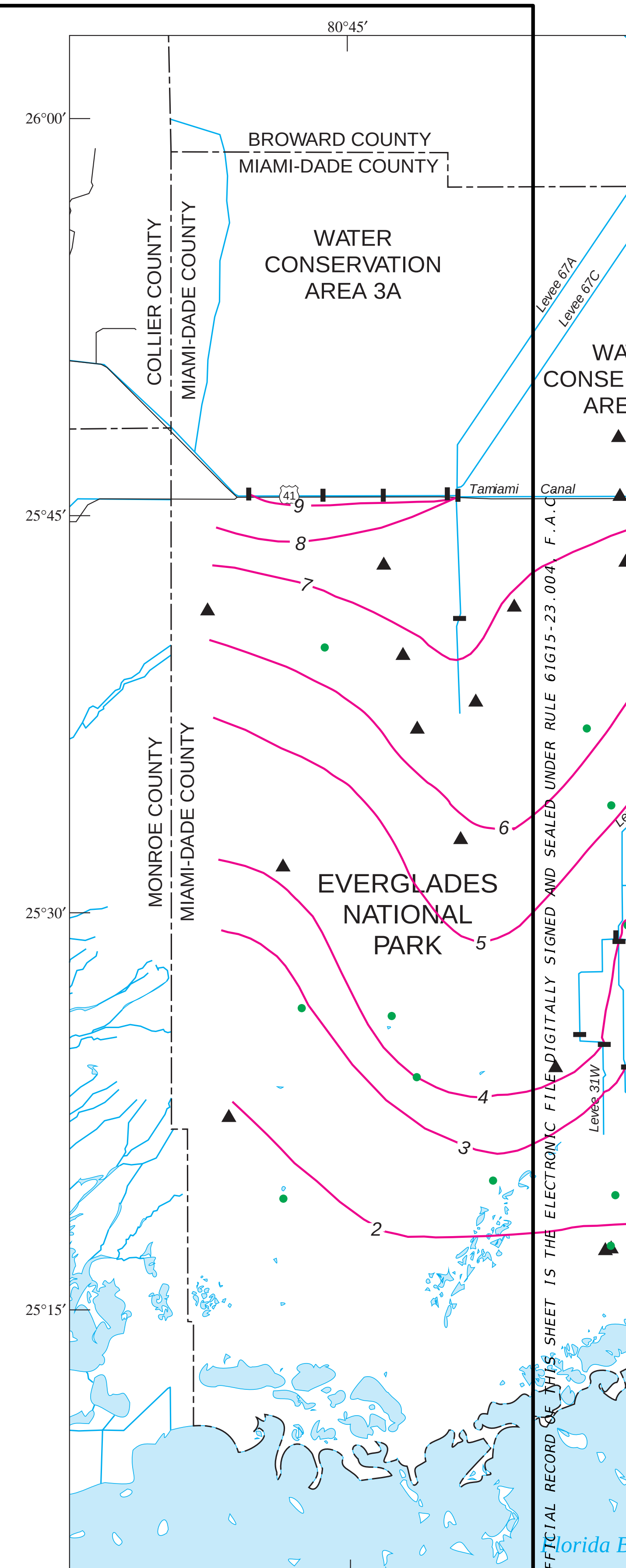


AVERAGE OCTOBER WATER LEVELS 1990-99



AVERAGE OCTO

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

DRAWN BY:	CS 10-21
CHECKED BY:	PV 10-21
DESIGNED BY:	CS 10-21
CHECKED BY:	HRR 10-21

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: USGS AVERAGE OCTOBER WATER LEVELS (1990-1999)

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

REF. DWG. NO.

SHEET NO. A-6

Lake Okeechobee
Study area

WELL FIELD

WATER-TABLE CONTOUR--Shows al
table. Hachures indicate depression.
approximately located. Contour inte

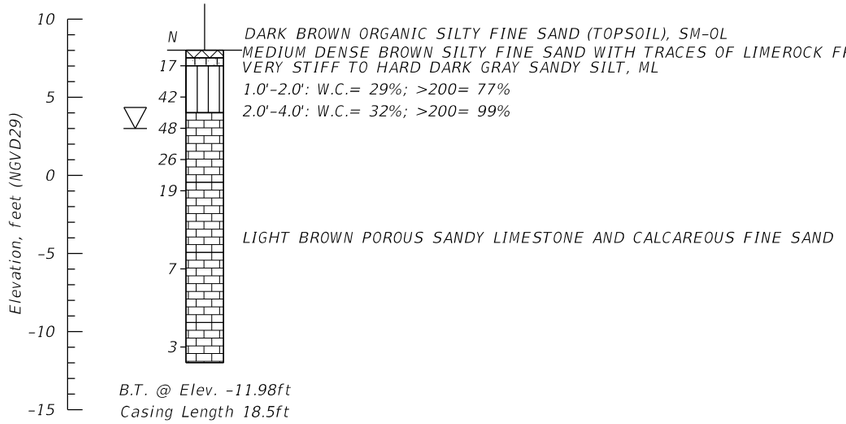
SUMMARY OF TEST BORING LOCATIONS
SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
MIAMI-DADE COUNTY, FLORIDA
HR ENGINEERING SERVICES, INC.
HRES PROJECT No. HR21-1691R
OCTOBER 29, 2021

TEST No.	GEOGRAPHIC COORDINATES		STATION	OFFSET, ft.	BASELINE REFERENCE
	LATITUDE	LONGITUDE			
MSE-1	25.61753	-80.33303	18+20	30.0 LT	SW 87TH AVENUE
MSE-2	25.61754	-80.33287	18+20	25.0 RT	SW 87TH AVENUE
MSE-3	25.61830	-80.33309	20+95	30.0 LT	SW 87TH AVENUE
MSE-4	25.61831	-80.33292	20+95	23.0 RT	SW 87TH AVENUE
B-1	25.61793	-80.33298	19+60	0.0	SW 87TH AVENUE
B-2	25.61815	-80.33299	20+40	0.0	SW 87TH AVENUE

Notes:

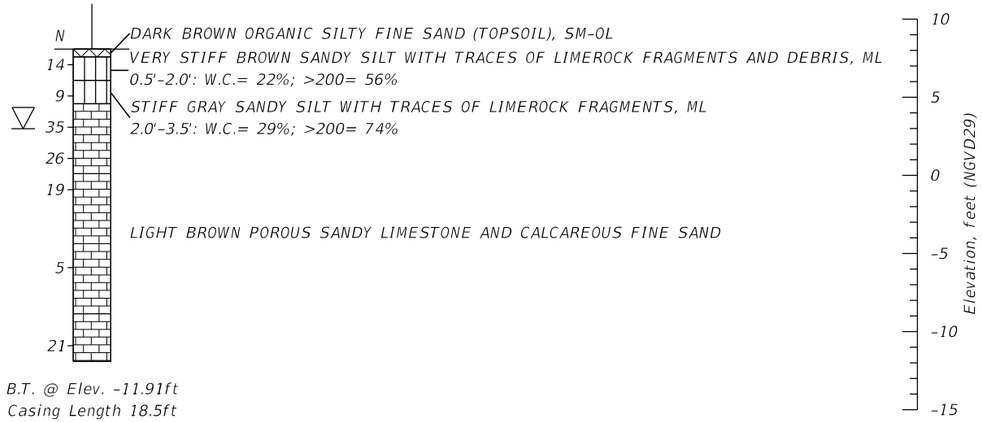
Plane coordinates were taken using a hand-held GPS and are approximate within 10 feet.

BOR # MSE-1
STA. 18+20
OFF. 30.0 LT
ELEV. 8.02 FT
DATE 8/27/2021
DRILLER O. MEJIAS
LATITUDE 25.61753
LONGITUDE -80.33303



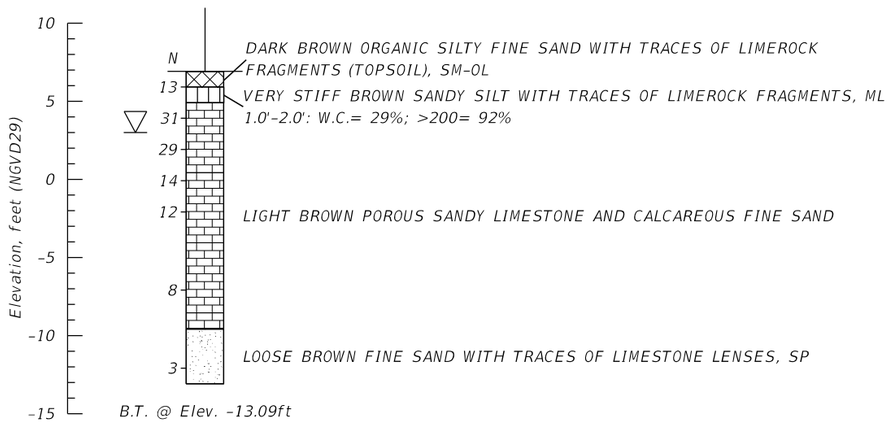
B.T. @ Elev. -11.98ft
Casing Length 18.5ft

BOR # MSE-2
STA. 18+20
OFF. 25.0 RT
ELEV. 8.09 FT
DATE 8/27/2021
DRILLER O. MEJIAS
LATITUDE 25.61754
LONGITUDE -80.33287



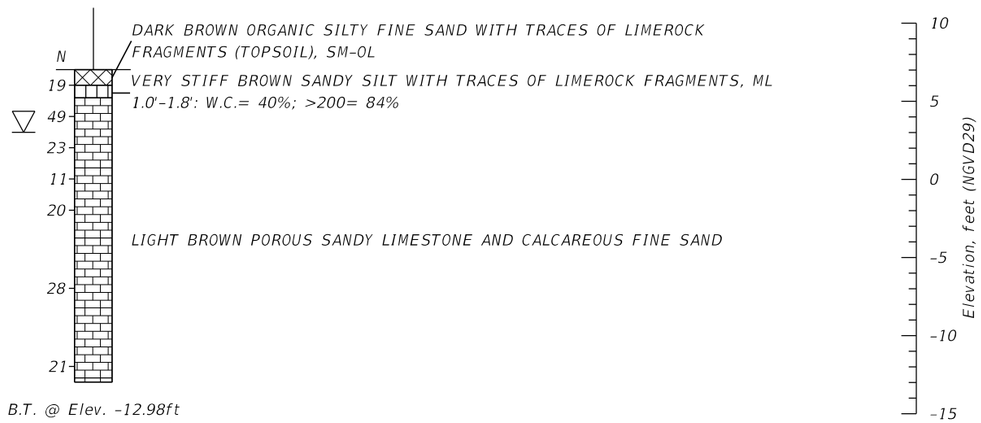
B.T. @ Elev. -11.91ft
Casing Length 18.5ft

BOR # MSE-3
STA. 20+95
OFF. 30.0 LT
ELEV. 6.91 FT
DATE 9/1/2021
DRILLER O. MEJIAS
LATITUDE 25.61830
LONGITUDE -80.33309



B.T. @ Elev. -13.09ft
Casing Length 18.5ft

BOR # MSE-4
STA. 20+95
OFF. 23.0 RT
ELEV. 7.02 FT
DATE 9/1/2021
DRILLER O. MEJIAS
LATITUDE 25.61831
LONGITUDE -80.33292



B.T. @ Elev. -12.98ft
Casing Length 18.5ft

VERTICAL SCALE: 0 10
HORIZONTAL SCALE: NTS
HRES PROJECT No.: HR21-1691R

LEGEND

TOPSOIL
LIMESTONE
SILT
SAND
SILTY SAND

GROUND WATER LEVEL AT BORING COMPLETION

GNE: GROUND WATER NOT ENCOUNTERED AT BORING COMPLETION

B.T. BORING TERMINATED

N: STANDARD PENETRATION RESISTANCE (AUTOMATIC HAMMER)

W.C.: WATER CONTENT

>200: PERCENT PASSING #200 SIEVE

HAMMER WEIGHT = 140 LB
DROP HEIGHT = 30 IN

THE TEST BORINGS WERE PERFORMED BY HRES USING A CME-55 TRUCK MOUNTED RIG.

GRANULAR MATERIALS:

DENSITY	SPT N-VALUE (BLOWS/12 INCHES)
VERY LOOSE	<3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	>40

SILTS AND CLAYS:

CONSISTENCY	SPT N-VALUE (BLOWS/12 INCHES)
VERY SOFT	<1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	>24

ENVIRONMENTAL CLASSIFICATION

SUBSTRUCTURE:
CONCRETE: MODERATELY AGGRESSIVE
STEEL: MODERATELY AGGRESSIVE
SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE

Resistivity ohms-cm	pH	Sulfates ppm	Chlorides ppm
1,435	7.4	18.0	123.0

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HERNANDO R. RAMOS, P.E.
P.E. LICENSE NUMBER 42045
HR ENGINEERING SERVICES, INC.
7815 NW 72ND AVENUE
MEDLEY, FLORIDA 33166

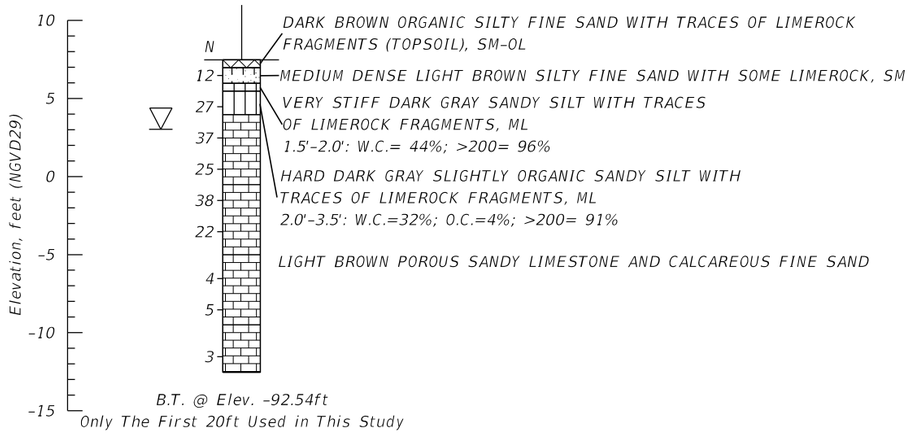
DRAWN BY: CS 10-21
CHECKED BY: PV 10-21
DESIGNED BY: CS 10-21
CHECKED BY: HRR 10-21

MIAMI DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORK

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

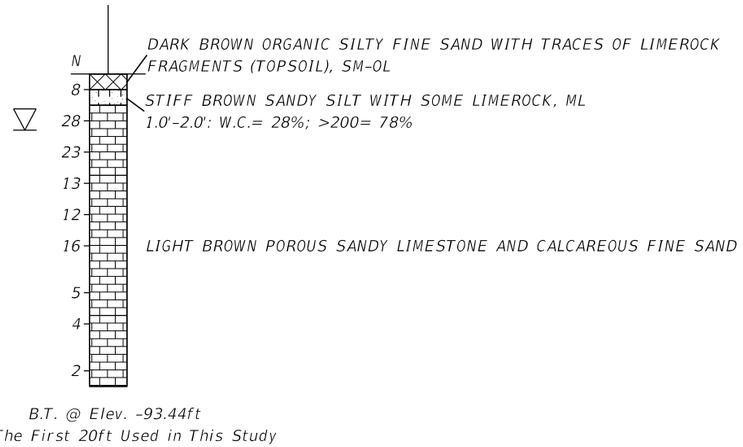
SHEET TITLE: REPORT OF CORE BORINGS
REF. DWG. NO.
PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL
SHEET NO. A-8

BOR # B-1
STA. 19+60
OFF. 0.0
ELEV. 7.46 FT
DATE 8/26/2021
DRILLER O. MEJIAS
HAMMER Auto
LATITUDE 25.61793
LONGITUDE -80.33298



B.T. @ Elev. -92.54ft
Only The First 20ft Used in This Study

BOR # B-2
STA. 20+42
OFF. 0.0
ELEV. 6.56 FT
DATE 8/26/2021
DRILLER O. MEJIAS
HAMMER Auto
LATITUDE 25.61815
LONGITUDE -80.33299



B.T. @ Elev. -93.44ft
Only The First 20ft Used in This Study

VERTICAL SCALE: 0 10
HORIZONTAL SCALE: NTS
HRES PROJECT No.: HR21-1691R

LEGEND

TOPSOIL
SILTY SAND
SILT
LIMESTONE

GROUND WATER LEVEL AT BORING COMPLETION

GNE: GROUND WATER NOT ENCOUNTERED AT BORING COMPLETION

B.T. BORING TERMINATED

N: STANDARD PENETRATION RESISTANCE (AUTOMATIC HAMMER)

W.C.: WATER CONTENT

O.C.: ORGANIC CONTENT

>200: PERCENT PASSING #200 SIEVE

HAMMER WEIGHT = 140 LB

DROP HEIGHT = 30 IN

THE TEST BORINGS WERE PERFORMED BY HRES USING A CME-55 TRUCK MOUNTED RIG.

GRANULAR MATERIALS:

DENSITY	SPT N-VALUE (BLOWS/12 INCHES)
VERY LOOSE	<3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	>40

SILTS AND CLAYS:

CONSISTENCY	SPT N-VALUE (BLOWS/12 INCHES)
VERY SOFT	<1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	>24

ENVIRONMENTAL CLASSIFICATION

SUBSTRUCTURE:
CONCRETE: MODERATELY AGGRESSIVE
STEEL: MODERATELY AGGRESSIVE
SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE

Resistivity ohms-cm	pH	Sulfates ppm	Chlorides ppm
1,435	7.4	18.0	123.0

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE DIGITALLY SIGNED AND SEALED UNDER RULE 61G15-23.004, F.A.C.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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DRAWN BY: CS 10-21
CHECKED BY: PV 10-21
DESIGNED BY: CS 10-21
CHECKED BY: HRR 10-21

MIAMI DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORK

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
-	MIAMI-DADE	-

SHEET TITLE: REPORT OF CORE BORINGS

REF. DWG. NO.

PROJECT NAME: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

SHEET NO. A-9

FIELD TESTING PROCEDURES

Test Borings – The test borings were made in general accordance with ASTM-D-1586, "Penetration Test and Split-Barrel Sampling of Soils." Each boring was advanced using a 3-inch ID casing using a tripod drilling equipment. After driving each spoon, the drilling tools were removed and soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated six inches and then driven an additional foot with blows of a 140-lb safety hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is designated the "Penetration Resistance". The penetration resistance, when properly interpreted, is an index to the soil strength and density.

APPENDIX B

SUMMARY OF LABORATORY TEST RESULTS	**B-1**
LABORATORY TESTING PROCEDURES	**B-2**
LABORATORY TEST RESULTS	
SOIL TESTING	**B-3 THRU B-12**
CORROSIVITY CLASSIFICATION TESTING	**B-13**

SUMMARY OF LABORATORY TEST RESULTS
SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
MIAMI-DADE COUNTY, FLORIDA
HR ENGINEERING SERVICES, INC.
HRES PROJECT No. HR21-1691R
OCTOBER 29, 2021

Test Boring No.	USCS Class.	Sample Depth (ft)	Grain Size Distribution - Percent Passing									Organic Loss of Ignition, %	Moisture Content %	Material in Sample, %		
			1"	3/4"	3/8"	No. 4	No. 10	No. 40	No. 60	No. 100	No. 200			Gravel	Sand	Fines
MSE-1	ML	1.0-2.0	-	-	-	-	-	-	-	-	77	-	29	-	-	77
MSE-1	ML	2.0-4.0	-	-	-	-	-	-	-	-	99	-	32	-	-	99
MSE-2	ML	0.5-2.0	-	-	-	-	-	-	-	-	56	-	22	-	-	56
MSE-2	ML	2.0-3.5	-	-	-	-	-	-	-	-	74	-	29	-	-	74
MSE-3	ML	1.0-2.0	-	-	-	-	-	-	-	-	92	-	29	-	-	92
MSE-4	ML	1.0-1.8	-	-	-	-	-	-	-	-	84	-	40	-	-	84
B-1	ML	1.5-2.0	-	-	-	-	-	-	-	-	96	-	44	-	-	96
B-1	ML	2.0-3.5	-	-	-	-	-	-	-	-	91	4	32	-	-	91
B-2	ML	1.0-2.0	-	-	-	-	-	-	-	-	78	-	28	-	-	78

LABORATORY TESTING PROCEDURES

Percent Fines Content – In this test, the sample is dried and then washed over a # 200 mesh sieve. The percentage of soil by weight passing the sieve is the percentage of fines or portion of the sample in the silt and clay size range. This test was conducted in general accordance with ASTM D-1140.

Percent Organics (Organic Loss on Ignition) – The amount of organic material in a sample is determined in this test. The sample is first dried and weighed, then ignited and reweighed. The amount of organic material is expressed as a percentage. This test was conducted in general accordance with ASTM D-2974.

Water Content – The water content is the ratio, expressed as a percentage of the weight of water in a given mass of soil to the weight of the soil particles. This test was conducted in general accordance with ASTM D-2216.

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: MSE-1 Sample No.: 1C Depth: 1.0'-2.0'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	302.50
Wt. of Dry Soil + Can, grams	237.20
Wt. of Can, grams No. 401	8.70
Wt. of Dry Soil, grams	228.50
Wt. of Moisture, grams	65.30
Water Content, w%	29%
Wt. of Dry Soil + Can Before Wash, grams	237.20
Wt. of Can, grams No. 401	8.70
Wt. of Dry Soil Before Wash, grams	228.50
Time in / Out of Oven :	09/07/21 4:30 PM TO 09/08/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	61.70
Wt. of Dry Soil After Wash, grams	53.00
Total Loss, grams	175.50
Percent Finer Than No. 200 Sieve	77%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

Hernando R. Ramos, P.E.
Florida Registration No. 42045

USCS Classification:

ML

HR ENGINEERING SERVICES, INC.

7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: MSE-1 Sample No.: 2 Depth: 2.0'-4.0'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	484.30
Wt. of Dry Soil + Can, grams	368.80
Wt. of Can, grams No. 402	6.80
Wt. of Dry Soil, grams	362.00
Wt. of Moisture, grams	115.50
Water Content, w%	32%
Wt. of Dry Soil + Can Before Wash, grams	368.80
Wt. of Can, grams No. 402	6.80
Wt. of Dry Soil Before Wash, grams	362.00
Time in / Out of Oven :	09/07/21 4:30 PM TO 09/08/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	10.70
Wt. of Dry Soil After Wash, grams	3.90
Total Loss, grams	358.10
Percent Finer Than No. 200 Sieve	99%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

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USCS Classification:

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7815 N.W. 72nd Avenue - Medley, Florida 33166
Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: MSE-2 Sample No.: 1B Depth: 0.5'-2.0'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	397.20
Wt. of Dry Soil + Can, grams	325.90
Wt. of Can, grams No. 403	8.90
Wt. of Dry Soil, grams	317.00
Wt. of Moisture, grams	71.30
Water Content, w%	22%
Wt. of Dry Soil + Can Before Wash, grams	325.90
Wt. of Can, grams No. 403	8.90
Wt. of Dry Soil Before Wash, grams	317.00
Time in / Out of Oven :	09/07/21 4:30 PM TO 09/08/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	149.50
Wt. of Dry Soil After Wash, grams	140.60
Total Loss, grams	176.40
Percent Finer Than No. 200 Sieve	56%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

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Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: MSE-2 Sample No.: 2A Depth: 2.0'-3.5'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	426.20
Wt. of Dry Soil + Can, grams	331.70
Wt. of Can, grams No. 404	6.80
Wt. of Dry Soil, grams	324.90
Wt. of Moisture, grams	94.50
Water Content, w%	29%
Wt. of Dry Soil + Can Before Wash, grams	331.70
Wt. of Can, grams No. 404	6.80
Wt. of Dry Soil Before Wash, grams	324.90
Time in / Out of Oven :	09/07/21 4:30 PM TO 09/08/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	89.70
Wt. of Dry Soil After Wash, grams	82.90
Total Loss, grams	242.00
Percent Finer Than No. 200 Sieve	74%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

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REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: MSE-3 Sample No.: 1B Depth: 1.0'-2.0'

Date: 09/07/21

Technician:	E.M.
Date Sample Placed in Oven:	09/07/2021
Time in / Out of Oven :	09/07/21 2:15 PM TO 09/08/21 2:15 PM
Wt. of Wet Soil + Can, grams	420.30
Wt. of Dry Soil + Can, grams	328.20
Wt. of Can, grams No. 611	8.80
Wt. of Dry Soil, grams	319.40
Wt. of Moisture, grams	92.10
Water Content, w%	29%
Wt. of Dry Soil + Can Before Wash, grams	328.20
Wt. of Can, grams No. 611	8.80
Wt. of Dry Soil Before Wash, grams	319.40
Time in / Out of Oven :	09/08/21 4:30 PM TO 09/09/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	35.90
Wt. of Dry Soil After Wash, grams	27.10
Total Loss, grams	292.30
Percent Finer Than No. 200 Sieve	92%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

USCS Classification:

ML

Hernando R. Ramos, P.E.
Florida Registration No. 42045

HR ENGINEERING SERVICES, INC.

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Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: MSE-4 Sample No.: 1B Depth: 1.0'-1.8'

Date: 09/07/21

Technician:	E.M.
Date Sample Placed in Oven:	09/07/2021
Time in / Out of Oven :	09/07/21 2:15 PM TO 09/08/21 2:15 PM
Wt. of Wet Soil + Can, grams	328.10
Wt. of Dry Soil + Can, grams	236.30
Wt. of Can, grams No. 612	8.90
Wt. of Dry Soil, grams	227.40
Wt. of Moisture, grams	91.80
Water Content, w%	40%
Wt. of Dry Soil + Can Before Wash, grams	236.30
Wt. of Can, grams No. 612	8.90
Wt. of Dry Soil Before Wash, grams	227.40
Time in / Out of Oven :	09/08/21 4:30 PM TO 09/09/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	45.40
Wt. of Dry Soil After Wash, grams	36.50
Total Loss, grams	190.90
Percent Finer Than No. 200 Sieve	84%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

USCS Classification:

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REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: B-1 Sample No.: 1C Depth: 1.5'-2.0'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	256.80
Wt. of Dry Soil + Can, grams	181.40
Wt. of Can, grams No. 405	8.90
Wt. of Dry Soil, grams	172.50
Wt. of Moisture, grams	75.40
Water Content, w%	44%
Wt. of Dry Soil + Can Before Wash, grams	181.40
Wt. of Can, grams No. 405	8.90
Wt. of Dry Soil Before Wash, grams	172.50
Time in / Out of Oven :	09/07/21 4:30 PM TO 09/08/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	16.20
Wt. of Dry Soil After Wash, grams	7.30
Total Loss, grams	165.20
Percent Finer Than No. 200 Sieve	96%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

HR Engineering Services, Inc.

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USCS Classification:

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Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: B-1 Sample No.: 2A Depth: 2.0'-3.5'

Date: 09/01/21

Technician:	E.M.					
Date Sample Placed in Oven:	09/01/2021					
Time in / Out of Oven :	09/01/21	12:00 PM	TO	09/02/21	12:00 PM	
Wt. of Wet Soil + Can, grams	253.20					
Wt. of Dry Soil + Can, grams	193.90					
Wt. of Can, grams No. 406	9.10					
Wt. of Dry Soil, grams	184.80					
Wt. of Moisture, grams	59.30					
Water Content, w%	32%					
Wt. of Dry Soil + Can Before Wash, grams	182.40					
Wt. of Can, grams No. 406	9.10					
Wt. of Dry Soil Before Wash, grams	173.30					
Time in / Out of Oven :	09/07/21	4:30 PM	TO	09/08/21	4:30 PM	
Wt. of Dry Soil + Can After Wash, grams	24.90					
Wt. of Dry Soil After Wash, grams	15.80					
Total Loss, grams	157.50					
Percent Finer Than No. 200 Sieve	91%					

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,

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Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND ORGANIC CONTENT BY LOSS ON IGNITION

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: B-1 Sample No.: 2A Depth: 2.0'-3.5'

Date: 09/01/21

Technician:	E.M.
Date Sample Placed in Oven:	09/01/2021
Time in / Out of Oven :	09/01/21 12:00 PM TO 09/02/21 12:00 PM
Wt. of Wet Soil + Can, grams	253.20
Wt. of Dry Soil + Can, grams	193.90
Wt. of Can, grams No. 406	9.10
Wt. of Dry Soil, grams	184.80
Wt. of Moisture, grams	59.30
Water Content, w%	32%
Date Sample Placed in Furnace:	09/01/21
Time in / out of furnace (minimum 6 hrs):	09/01/21 8:00 AM TO 09/01/21 2:00 PM
Weight of Crucible & Oven-Dried Sample:	26.80
Weight of Crucible and Sample After Ignition:	26.40
Weight of Crucible: No. 13	15.70
Weight of Oven-Dried Soil:	11.10
Weight Loss due to Ignition:	0.40
Percent Organics:	4%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Organic Content Test performed in general accordance with ASTM D 2974 (AASHTO T 267)

Respectfully Submitted,

HR Engineering Services, Inc.

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Phone (305) 888-8880, Fax (305) 888-8770

REPORT OF MOISTURE AND PERCENT PASSING THE No. 200 SIEVE

Project Name: SW 87TH AVE BRIDGE OVER C-100 CANAL Project No.: HR21-1691R

Boring No.: B-2 Sample No.: 1B Depth: 1.0'-2.0'

Date: 09/07/21

Technician:	E.M.
Date Sample Placed in Oven:	09/07/2021
Time in / Out of Oven :	09/07/21 2:15 PM TO 09/08/21 2:15 PM
Wt. of Wet Soil + Can, grams	374.80
Wt. of Dry Soil + Can, grams	295.70
Wt. of Can, grams No. 607	8.90
Wt. of Dry Soil, grams	286.80
Wt. of Moisture, grams	79.10
Water Content, w%	28%
Wt. of Dry Soil + Can Before Wash, grams	295.70
Wt. of Can, grams No. 607	8.90
Wt. of Dry Soil Before Wash, grams	286.80
Time in / Out of Oven :	09/08/21 4:30 PM TO 09/09/21 4:30 PM
Wt. of Dry Soil + Can After Wash, grams	71.80
Wt. of Dry Soil After Wash, grams	62.90
Total Loss, grams	223.90
Percent Finer Than No. 200 Sieve	78%

Moisture Content Test performed in general accordance with ASTM D 2216 (AASHTO T 265)
Fines Content Test performed in general accordance with ASTM D 1140

Respectfully Submitted,
HR Engineering Services, Inc.

USCS Classification:
ML

Hernando R. Ramos, P.E.
Florida Registration No. 42045

HR ENGINEERING SERVICES, INC.

CORROSION SERIES TEST RESULT

Project Name: SW 87TH AVENUE BRIDGE OVER C-100 CANAL

Project Number: HR21-1691R **Date:** 09/02/21 **Tested by:** E.M.

Sample No.	Latitude	Longitude	Test Date	Sample Depth, ft	Soil/Water	pH	Chlorides, ppm	Sulfates, ppm	Resistivity, ohm-cm.	Sub-Structure Environmental	
										Steel	Concrete
P-1	25.61735	-80.33285	8/30/2021	5.6	Water	7.4	123.0	18.0	1,435	MA	MA

MA: Moderately Aggressive

Tests performed by HRES in accordance with Florida Method of Test Corrosion Series in Soil and Water, Designation FM 5-550 through FM 5-553

APPENDIX C

MSE WALLS – LRFD EXTERNAL STABILITY ANALYSIS	**C-1 THRU C-3**
MSE WALLS – GLOBAL STABILITY ANALYSIS	**C-4 THRU C-9**
MSE WALLS – SETTLEMENT ANALYSIS	**C-10 THRU C-17**
MSE WALLS – SOIL PARAMETERS ESTIMATION	**C-18 AND C-19**
MSE WALLS PLANS BY R.J. BEHAR	**C-20 THRU C-27**

MSE WALLS – LRFD EXTERNAL STABILITY ANALYSIS

MSE WALL - LRFD External Stability Analysis

version 2.5.1

Reinf. Fill Unit Wt=115 pcf, and Backfill: (Unit Wt = 115 pcf, friction angle = 34 degree)

	H (ft)	* Ho (ft)	* D (ft)	* L (ft)	Minimum Reinforcement Length Requirement	Over-turning CDR > = 1	Eccen-tricity CDR < = 1	Sliding CDR > = 1	Bearing Resitance CDR > = 1	* β (deg)	* λ (ft)	* Water d (ft)	* γ[rf] (pcf)	* γ[bf] (pcf)	* ϕ [bf] (deg)	* γ[fs] (pcf)	* ϕ [fs] (deg)	* c[fs] (psf)	* ϕ u (deg)	* q1 (psf)	* q2 (psf)	CW
1	**10.0**	8.0	2.0	**8.0**	**OK**	**2.57**	**0.78**	**1.56**	**2.24**	0.0	0.0	0.0	115.0	115.0	34.0	112.0	32.0	0.0	32.0	250	250	0.50
2	**12.0**	10.0	2.0	**9.0**	**OK**	**2.44**	**0.82**	**1.55**	**1.97**	0.0	0.0	0.0	115.0	115.0	34.0	112.0	32.0	0.0	32.0	250	250	0.50
3	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
4	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
5	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
6	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
7	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
8	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
9	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
10	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
11	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
12	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
13	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
14	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
15	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
16	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
17	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
18	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
19	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!
20	**0.0**					**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**													#DIV/0!

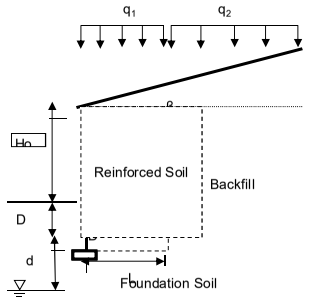
* Indicates required input

Note:

Disclaimer: No Warranty, expressed or implied, is made by the author or the Florida Department of Transportation (FDOT) as to the accuracy and the functioning of this program or the results it produces; nor shall the fact of distribution constitute any such warranty, and no responsibility is assumed by the author or the FDOT in any connection therewith.

H Wall Height H = Ho + D
Ho Wall Height above ground (feet)
D Wall Embeddment Depth (feet)
L Reinforcing Strap Length (feet)
CDR Capacity-Demand Ratio for :
Overturning = Mr / Mo => 1.0
Eccentricity = e / (L/4) =< 1.0
Sliding = Fr / Fd => 1.0
Bearing Resistance = qr / q_{vb} => 1.0

β Slope of backfill soil (degrees)
λ Horizontal distance from the back of the wall to the top of the slope (for broken-back slopes) (feet)
Use λ >= 2*H when modeling infinite slopes
d Water depth below base of leveling pad (feet)
γ[rf] Reinforced fill unit weight (pounds per cubic foot)
γ[bf] Backfill soil unit weight (pounds per cubic foot)
ϕ[bf] Backfill soil angle of internal friction (degrees)
γ[fs] Foundation Soil unit weight (pounds per cubic foot)
ϕ[fs] Foundation Soil angle of internal friction (degrees)
c[fs] Foundation Soil cohesion (pounds per square foot)
ϕu Base Angle of Internal Friction (degrees) (Sliding)
q1 Surcharge load over reinforced soil mass (pounds per square foot) - Should be zero when modeling infinite slopes
q2 Surcharge load behind reinforced soil mass (pounds per square foot) - Should be zero when modeling infinite slopes
Cw Cw = 0.5 for d =< 0, Cw=1.0 for d => 1.5*L + D



MSE WALL - LRFD External Stability Analysis
version 2.5.1

qvb (psf)	**qr (psf)**	h (ft)	W1 (lbs/ft)	W2 (lbs/ft)	W3 (lbs/ft)	q_{1V} (lbs/ft)	α (deg)	Ft (lbs/ft)	qt (lbs/ft)	Fd (lbs/ft)	Fr (lbs/ft)	Rv (lbs/ft)	Rv2 (lbs/ft)	Mr (lbs-ft/ft)	Mr_2	Mo (lbs-ft/ft)	Mo_2 (lbs-ft/ft)	e (ft)	e_2 (ft)	L' (ft)	Nc [fs]	Nq [fs]	Ng [fs]	Kabh [bf]	Kabs [bf]	Kabs2 [bf]
2567	**5529**	0.00	9200	0	0	3500	0.0	1626	707	2438	5749	9200	15920	36800	63680	14312	14312	1.56	0.90	6.20	35.49	23.18	30.21	0.283	0.000	0.000
3052	**5737**	0.00	12420	0	0	3938	0.0	2341	848	3511	7761	12420	20705	55890	93170	22951	22951	1.85	1.11	6.78	35.49	23.18	30.21	0.283	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000
#DIV/0!	**#DIV/0!**	0.00	0	0	0	0	#DIV/0!	0	0	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	5.14	1.00	0.00	1.000	0.000	0.000

** **Note: This spreadsheet does not analyze Global Stability or Wall Settlement.**

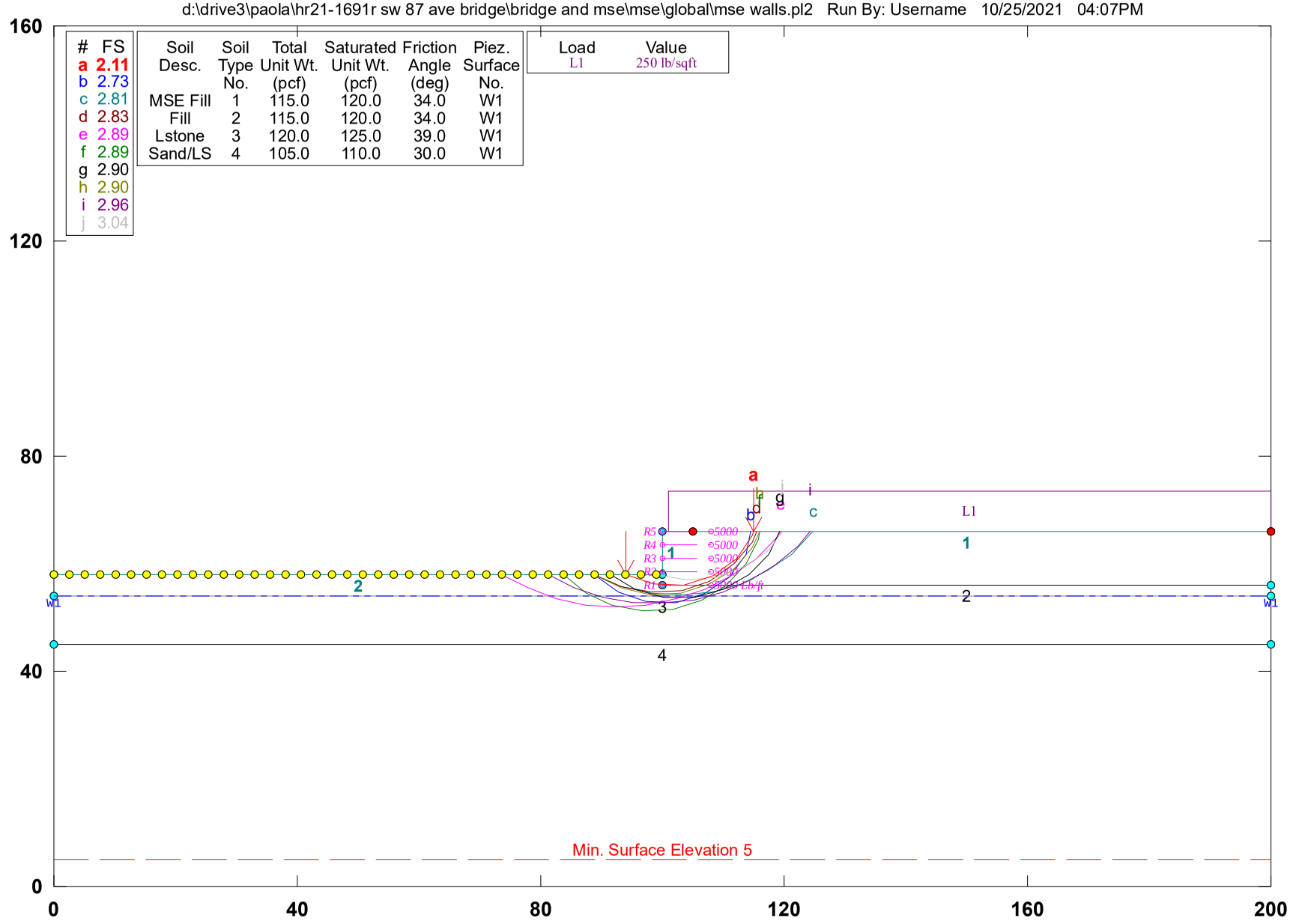
qvb Maximum Vertical Pressure at base of the structure (psf): qvb = Rv_2 / L'
qr Minimum Factored bearing resistance including footing embedment (i.e. overburden) term (qNq)
h h = Wall height for backfill stress calculations (H+Ltanβ for infinite slopes and H+λTanα for broken back slopes with λ < 2*H) (ft)
W_1 Reinforced fill weight (lbs/ft)
W_2 Sloped backfill weight over reinforced area (lbs/ft)
W_3 Flat backfill weight over reinforced area (lbs/ft)
q_{1V} Surcharge vertical force over reinforced area (lbs/ft)
α Resultant earth pressure inclination (deg)
Ft Total resultant horizontal backfill force (lbs/ft)
qt Total resultant horizontal surcharge force (q_2) (lbs/ft)
Fd Driving force (Sum of factored horizontal components of total horizontal foces) (lbs/ft)
Fr Resisting foce (Sum of factored resisting foces * Tan ϕ_u) (lbs/ft)
Rv Sum of factored vertical forces acting within reingorced soil mass without live load (q1L) used in sliding CDR calculation (lbs/ft)
Rv_2 Sum of factored vertical forces acting within reingorced soil mass including live load - used in calculation of qvb for bearing CDR (lbs/ft)
Mr Sum of Resisting Moments without live load (lbs-ft/ft)
Mr_2 Sum of Resisting Moments including live load - used in calculation of e_2 for bearing CDR (lbs-ft/ft)
Mo Sum of Overturning Moments(lbs-ft/ft)
Mo_2 Sum of Overturning Moments from case S-1-b (lbs-ft/ft)
e Eccentricity {L/2 - [(Mr-Mo)/Rv]} (ft) [for overturning]
e_2 Eccentricity {L/2 - [(Mr_2-Mo_2)/Rv_2]} (ft) [for bearing stress calculation]
L' Effective foundation width (feet): L'= L - 2*e_2

Nc Cohesion Bearing Resistance Factor : Nc = (Nq-1)cot(ϕ) if f>0; for f=0 Nc=5.14
Ng Footing Width Bearing Resistance Factor : Ng = 2*(Nq+1)*tan(ϕ)
Nq Embedment Bearing Resistance Factor : Nq = [e^PI*tan(ϕ)]*N(ϕ); N(ϕ)=tan^2(PI/4 + ϕ/2)
Kabh Backfill earth pressure coefficient when retained soil is horizontal
Kabs Backfill earth pressure coefficient when retained soil is at slope β (infinite slope)
Kabs2 Backfill earth pressure coefficient for broken back slopes

MSE WALLS – GLOBAL STABILITY ANALYSIS

SW 87th Ave Bridge over C-100 Canal MSE Walls Height <= 10 feet

d:\drive3\paola\hr21-1691r sw 87 ave bridge\bridge and mse\mse\global\mse walls.pl2 Run By: Username 10/25/2021 04:07PM



STABL6H FSmin=2.11

Safety Factors Are Calculated By The Modified Bishop Method

C-5

** STABL6H **
by
Purdue University
--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices
Run Date: 10/25/2021
Time of Run: 04:09PM
Run By: Username
Input Data Filename: D:mse walls.in
Output Filename: D:mse walls.OUT
Plotted Output Filename: D:mse walls.PLT
PROBLEM DESCRIPTION SW 87th Ave Bridge over C-100 Canal
MSE Walls Height <= 10 feet
BOUNDARY COORDINATES
3 Top Boundaries
6 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	58.00	100.00	58.00	2
2	100.00	58.00	100.10	66.00	1
3	100.10	66.00	200.00	66.00	1
4	100.00	56.00	200.00	56.00	2
5	0.00	54.00	200.00	54.00	3
6	0.00	45.00	200.00	45.00	4

ISOTROPIC SOIL PARAMETERS
4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	115.0	120.0	0.0	34.0	0.00	0.0	1
2	115.0	120.0	0.0	34.0	0.00	0.0	1
3	120.0	125.0	0.0	39.0	0.00	0.0	1
4	105.0	110.0	0.0	30.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED
Unit Weight of Water = 62.40
Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	54.00
2	200.00	54.00

BOUNDARY LOAD(S)
1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (lb/sqft)	Deflection (deg)
1	101.00	200.00	250.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed
Force Acting On A Horizontally Projected Surface.
REINFORCING LAYER(S)
5 REINFORCING LAYER(S) SPECIFIED
REINFORCING LAYER NO. 1
2 POINTS DEFINE THIS LAYER

POINT NO.	X-COORD	Y-COORD	FORCE	INCLINATION FACTOR
1	100.00	56.00	5000.00	0.000
2	108.00	56.00	5000.00	0.000

REINFORCING LAYER NO. 2
2 POINTS DEFINE THIS LAYER

POINT NO.	X-COORD	Y-COORD	FORCE	INCLINATION FACTOR
1	100.01	58.50	5000.00	0.000
2	108.01	58.50	5000.00	0.000

REINFORCING LAYER NO. 3
2 POINTS DEFINE THIS LAYER

POINT NO.	X-COORD	Y-COORD	FORCE	INCLINATION FACTOR
1	100.04	61.00	5000.00	0.000
2	108.04	61.00	5000.00	0.000

REINFORCING LAYER NO. 4
2 POINTS DEFINE THIS LAYER

POINT NO.	X-COORD	Y-COORD	FORCE	INCLINATION FACTOR
1	100.07	63.50	5000.00	0.000
2	108.07	63.50	5000.00	0.000

REINFORCING LAYER NO. 5
2 POINTS DEFINE THIS LAYER

POINT NO.	X-COORD	Y-COORD	FORCE	INCLINATION FACTOR
1	100.10	66.00	5000.00	0.000
2	108.10	66.00	5000.00	0.000

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
400 Trial Surfaces Have Been Generated.
10 Surfaces Initiate From Each Of 40 Points Equally Spaced
Along The Ground Surface Between X = 0.00 ft.
and X = 99.00 ft.
Each Surface Terminates Between X = 105.00 ft.
and X = 200.00 ft.
Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 5.00 ft.
5.00 ft. Line Segments Define Each Trial Failure Surface.
Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	93.92	58.00
2	98.59	56.20
3	103.59	56.10
4	108.31	57.74
5	112.19	60.89
6	114.75	65.19
7	114.90	66.00

Circle Center At X = 101.3 ; Y = 70.3 and Radius, 14.3
*** 2.111 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.85	58.00
2	92.64	54.75
3	97.31	52.96
4	102.31	52.85
5	107.05	54.44
6	110.98	57.53
7	113.64	61.76
8	114.58	66.00

Circle Center At X = 100.1 ; Y = 67.3 and Radius, 14.6
*** 2.731 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.85	58.00
2	93.36	55.85
3	98.20	54.58
4	103.18	54.23
5	108.15	54.82
6	112.92	56.33

7	117.32	58.69
8	121.21	61.84
9	124.44	65.66
10	124.63	66.00

Circle Center At X = 102.5 ; Y = 80.9 and Radius, 26.7

*** 2.811 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.85	58.00
2	93.26	55.64
3	98.15	54.63
4	103.13	55.04
5	107.80	56.84
6	111.76	59.88
7	114.71	63.93
8	115.44	66.00

Circle Center At X = 99.2 ; Y = 72.1 and Radius, 17.5

*** 2.834 ***

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	73.62	58.00
2	77.90	55.43
3	82.53	53.54
4	87.39	52.37
5	92.38	51.95
6	97.37	52.29
7	102.24	53.38
8	106.90	55.20
9	111.23	57.70
10	115.13	60.83
11	118.51	64.52
12	119.51	66.00

Circle Center At X = 92.6 ; Y = 84.9 and Radius, 32.9

*** 2.890 ***

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.77	58.00
2	87.42	54.58
3	91.85	52.27
4	96.74	51.23
5	101.73	51.55
6	106.45	53.20
7	110.55	56.06
8	113.74	59.92
9	115.76	64.49
10	115.98	66.00

Circle Center At X = 98.1 ; Y = 69.6 and Radius, 18.4

*** 2.892 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.39	58.00
2	95.55	55.23
3	100.34	53.78
4	105.34	53.78
5	110.12	55.22
6	114.29	57.98
7	117.49	61.83
8	119.25	66.00

Circle Center At X = 102.9 ; Y = 70.7 and Radius, 17.1

*** 2.899 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.85	58.00
2	93.16	55.48
3	98.02	54.29
4	103.02	54.52
5	107.74	56.16
6	111.80	59.07
7	114.88	63.02
8	116.05	66.00

Circle Center At X = 99.7 ; Y = 71.7 and Radius, 17.5

*** 2.904 ***

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	81.23	58.00
2	85.58	55.54
3	90.27	53.80
4	95.18	52.84
5	100.18	52.67
6	105.14	53.30
7	109.93	54.72
8	114.44	56.89
9	118.54	59.74
10	122.13	63.22
11	124.21	66.00

Circle Center At X = 98.7 ; Y = 83.8 and Radius, 31.2

*** 2.958 ***

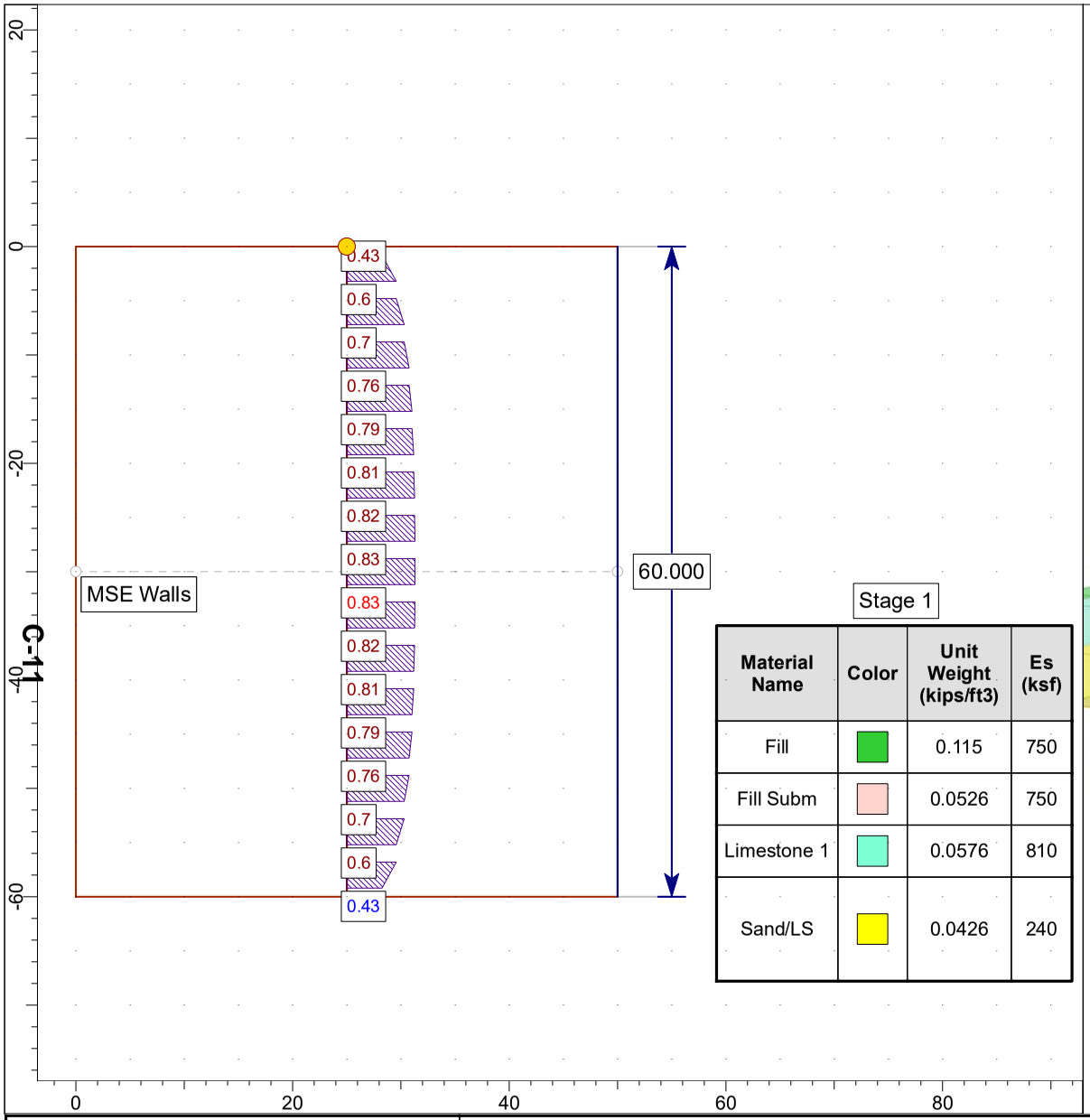
Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	99.00	58.00
2	103.92	57.11
3	108.89	57.62
4	113.52	59.51
5	117.44	62.62
6	119.83	66.00

Circle Center At X = 104.6 ; Y = 74.8 and Radius, 17.7

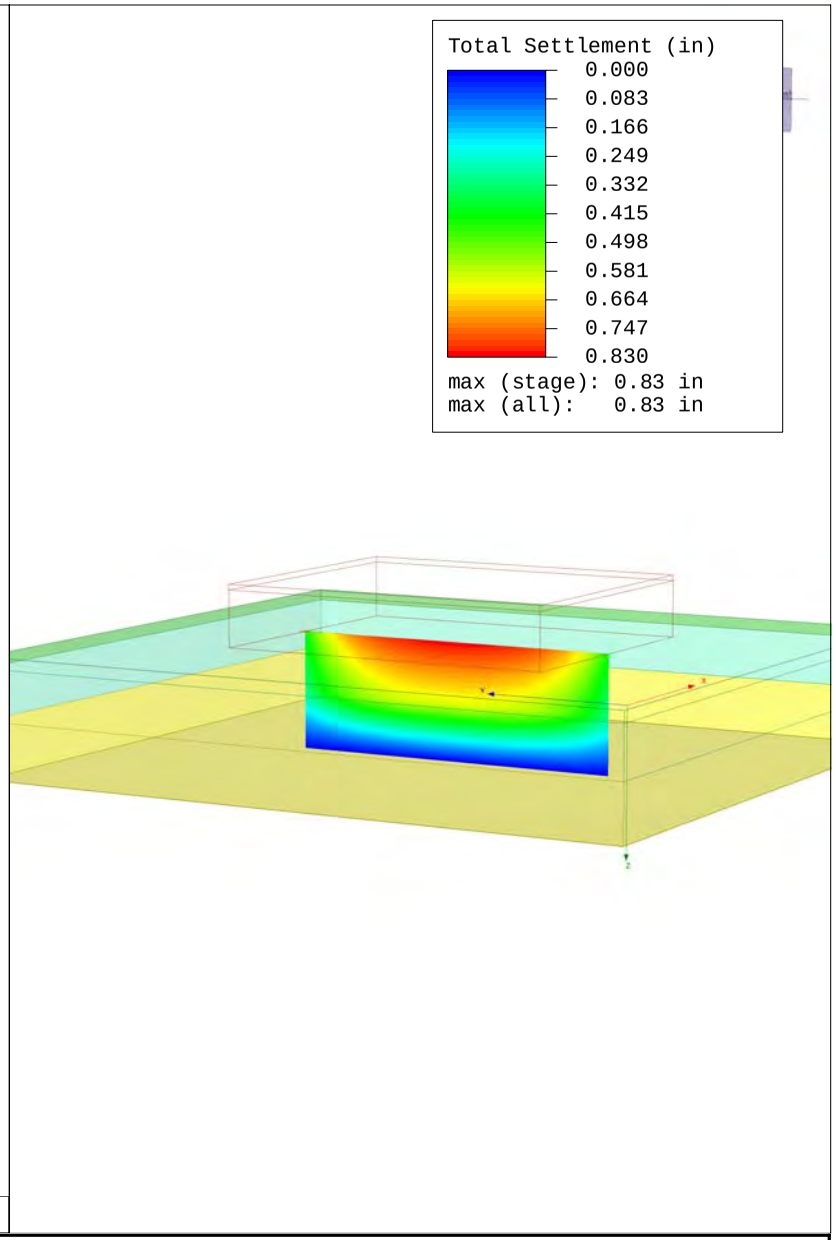
*** 3.037 ***

MSE WALLS – SETTLEMENT ANALYSIS



Stage 1

Material Name	Color	Unit Weight (kips/ft3)	Es (ksf)
Fill		0.115	750
Fill Subm		0.0526	750
Limestone 1		0.0576	810
Sand/LS		0.0426	240



Project	HR21-1691R SW 87 Avenue over C-100 Canal		
Analysis Description	Settlement at Height <=10 feet		
Drawn By	HRES	Company	HR Engineering Services, Inc
Date	10-25-21	File Name	General_MSE Wall.s3z

SETTLE3 5.010

Settle3 Analysis Information

HR21-1691R SW 87 Avenue over C-100 Canal

Project Settings

Document Name	General_MSE Wall
Project Title	HR21-1691R SW 87 Avenue over C-100 Canal
Analysis	Settlement at Height <=10 feet
Author	HRES
Company	HR Engineering Services, Inc
Date Created	10-25-21
Stress Computation Method	Boussinesq
Minimum settlement ratio for subgrade modulus	0.9
Use average properties to calculate layered stresses	
Improve consolidation accuracy	
Ignore negative effective stresses in settlement calculations	

Stage Settings

Stage #	Name
1	Stage 1

Results

Time taken to compute: 0 seconds

Stage: Stage 1

Data Type	Minimum	Maximum
Total Settlement [in]	0	0.827829
Total Consolidation Settlement [in]	0	0
Virgin Consolidation Settlement [in]	0	0
Recompression Consolidation Settlement [in]	0	0
Immediate Settlement [in]	0	0.827829
Loading Stress ZZ [ksf]	0.586545	1.39189
Loading Stress XX [ksf]	0.103102	0.930436
Loading Stress YY [ksf]	0.11576	0.912717
Total Stress ZZ [ksf]	0.69706	2.26584
Total Stress XX [ksf]	0.543882	1.30907
Total Stress YY [ksf]	0.360144	1.31012
Modulus of Subgrade Reaction (Total) [ksf/ft]	0	0
Modulus of Subgrade Reaction (Immediate) [ksf/ft]	0	0
Modulus of Subgrade Reaction (Consolidation) [ksf/ft]	0	0
Total Strain	0.000821599	0.00543544
Degree of Consolidation [%]	0	0
Pre-consolidation Stress [ksf]	0.70848	2.26566
Over-consolidation Ratio	1	1
Void Ratio	0	0
Hydroconsolidation Settlement [in]	0	0
Undrained Shear Strength	0	0.0340153

Embankments

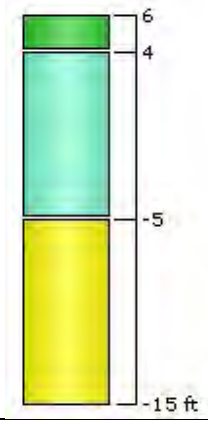
1. Embankment: "MSE Walls"

Label	MSE Walls
Center Line	(-7.10543e-15, -30) to (50, -30)
Near End Angle	90 degrees
Far End Angle	90 degrees
Number of Layers	2
Base Width	60

Layer	Stage	Left Bench Width (ft)	Left Angle (deg)	Height (ft)	Unit Weight (kips/ft3)	Right Angle (deg)	Right Bench Width (ft)
1	Stage 1	0	90	10	0.115	90	0
2	Stage 1	0	90	1	0.25	90	0

Soil Layers

Layer #	Type	Thickness [ft]	Elevation [ft]
1	Fill	2	6
2	Limestone 1	9	4
3	Sand/LS	10	-5



Soil Properties

Property	Fill	Limestone 1	Sand/LS
Color			
Unit Weight [kips/ft3]	0.115	0.0576	0.0426
K0	1	1	1
Immediate Settlement	Enabled	Enabled	Enabled
Es [ksf]	750	810	240
Esur [ksf]	750	810	240
Undrained Su A [kips/ft2]	0	0	0
Undrained Su S	0.2	0.2	0.2
Undrained Su m	0.8	0.8	0.8

MSE WALLS – SOIL PARAMETERS ESTIMATION

SOIL/ROCK PARAMETERS - MSE WALL
SW 87TH AVENUE BRIDGE OVER C-100 CANAL
MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORATION AND PUBLIC WORKS
MIAMI-DADE COUNTY
HRES PROJECT No. HR21-1691R

MSE WALLS

Boring No.	Range of Elevation (ft.) NAVD88		Material Type	Automatic Hammer N Value, N_a (blows/ft.)	Safety Hammer N Value, Ns (blows/ft.)	ø for soils (ø=28+N/4 ≤ 38) for Rock (ø=33+N/4 ≤ 40) (degrees)	Cohesion C (psf)	γ, Total Unit Weight (lb/ft^3)	γ', Effective Unit Weight (lb/ft^3)
	From	To							
Fills									
MSE-1	-	4.0	Fill	20	25	34	0	115	52.6
MSE-2	-	4.5	Fill	20	25	34	0	115	52.6
MSE-3	-	5.0	Fill	20	25	34	0	115	52.6
MSE-4	-	5.0	Fill	20	25	34	0	115	52.6
B-1	-	4.0	Fill	20	25	34	0	115	52.6
B-2	-	4.5	Fill	8	10	30	0	107	44.3
RB-1	-	3.7	Fill	20	25	34	0	115	52.6
RB-2	-	3.9	Fill	20	25	34	0	115	52.6
RB-3	-	4.8	Fill	26	32	36	0	115	52.6
RB-4	-	6.0	Fill	26	32	36	0	115	52.6
Average		**4**			**25**	**34**		**115**	**52.6**
Limestone									
MSE-1	4.0	-4.0	Limestone	30	37	40	0	120	57.6
MSE-2	4.5	-4.0	Limestone	27	33	40	0	120	57.6
MSE-3	5.0	-5.0	Limestone	22	27	40	0	120	57.6
MSE-4	5.0	-12.0	Limestone	25	31	40	0	120	57.6
B-1	4.0	-5.0	Limestone	25	31	40	0	120	57.6
B-2	4.5	-6.0	Limestone	18	22	39	0	120	57.6
RB-1	3.7	-2.3	Limestone	14	17	37	0	120	57.6
RB-2	3.9	-2.6	Limestone	18	22	39	0	120	57.6
RB-3	4.8	-3.2	Limestone	23	29	40	0	120	57.6
RB-4	6.0	-1.9	Limestone	19	24	39	0	120	57.6
Average	**4**	**-5**			**27**	**39**	**0**	**120**	**57.6**
Sand or Soft Limestone (modeled as Sand)									
MSE-1	-4.0	-12.0	Limestone	5	6	30	0	103	41.0
MSE-2	-4.0	-12.0	Limestone	13	16	32	0	112	49.7
MSE-3	-5.0	-13.0	Limestone/Sand	6	7	30	0	104	41.6
B-1	-5.0	-12.5	Soft Limestone	4	5	29	0	102	39.9
B-2	-6.0	-13.5	Soft Limestone	4	5	29	0	102	39.6
Average	**-5**	**-14**			**8**	**30**	**0**	**105**	**42.6**

SUMMARY PARAMETERS TABLE

Range of Elevation, ft.		Material Type	ø (degrees)	Cohesion, C (psf)	Total unit weight, γ(lb/ft^3)
From	To				
--	4	Fills	34	0	115
4	-5	Limestone	39	0	120
-5	-14	Sand/Soft Limestone	30	0	105

EQUIVALENT SOIL PARAMETER ESTIMATION FOR EXTERNAL STABILITY ANALYSIS:

Soil Type	Elevation (ft.)		ϕ (deg.)	γ_{total} (pcf)
	From	to		
Fills	6	4	34	115
Limestone	4	-5	39	120
Sand/Soft Limestone	-5	-14	30	105
Equivalent Soil Parameters			**35**	**113**
Use			**32**	**112**

MSE WALLS PLANS BY R.J. BEHAR

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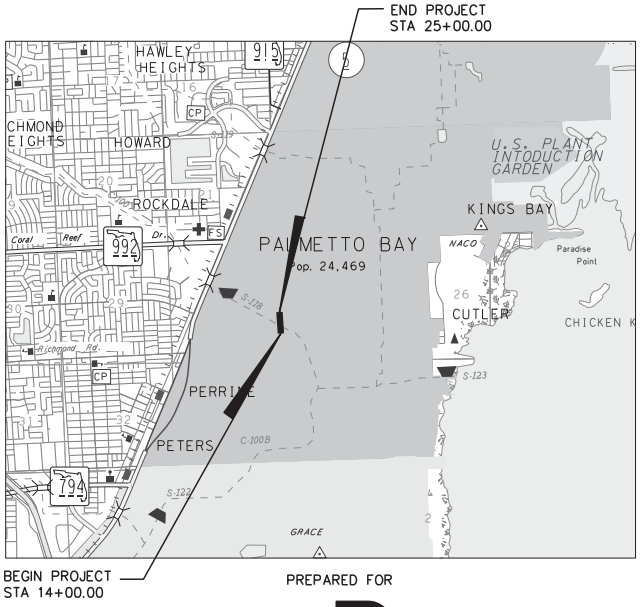
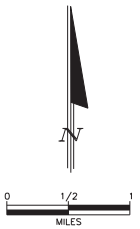
INDEX OF SHEETS

SHT. No.	SHEET DESCRIPTION
1	KEY SHEET
2	ROADWAY TYPICAL SECTION
3	GENERAL NOTES
4–6	ROADWAY PLAN
7–9	ROADWAY PROFILE
10	BRIDGE GENERAL NOTES
11	PLAN AND ELEVATION
12	BRIDGE TYPICAL SECTION
13	FOUNDATION LAYOUT
14	PILE DATA TABLE
15	END BENT 01
16	END BENT 02
17	END BENT DETAIL
18	FRAMING PLAN
19	BEAM DATA TABLE
20	SUPER STRUCTURE PLAN
21	APPROACH SLAB
22–27	MSE WALLS

PLANS FOR PROPOSED
IMPROVEMENTS TO
SW 87th AVENUE
OVER THE C–100 CANAL

MIAMI–DADE COUNTY PROJECT NO. 20210098





NOTE:

ATTENTION IS DIRECTED TO THE FACT THAT THESE PLANS MAY HAVE BEEN REDUCED IN SIZE BY REPRODUCTION. THIS MUST BE CONSIDERED WHEN OBTAINING SCALED DATA.

THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

ENGINEER OF RECORD:

GOVERNING STANDARD PLANS:

Florida Department of Transportation, FY2021–22 Standard Plans for Road and Bridge Construction and applicable Interim Revisions (IRs).

Standard Plans for Road Construction and associated IRs are available at the following website: http://www.fdot.gov/design/standardplans

Standard Plans for Bridge Construction are included in the Structures Plans Component

GOVERNING STANDARD SPECIFICATIONS:

Florida Department of Transportation, JULY 2021 Standard Specifications for Road and Bridge Construction at the following website:
http://www.fdot.gov/programmanagement/Implemented/SpecBooks

THESE PLANS HAVE BEEN PREPARED IN ACCORDANCE WITH AND ARE GOVERNED BY THE MIAMI–DADE COUNTY PUBLIC WORKS DEPARTMENT STANDARDS AND SPECIFICATIONS PARTS 1, 2 AND 3. THE MANUAL OF UNIFORM MINIMUM STANDARDS FOR DESIGN, CONSTRUCTION AND MAINTENANCE FOR STREETS AND HIGHWAYS. THE FLORIDA DEPARTMENT OF TRANSPORTATION ROADWAY AND TRAFFIC STANDARD PLANS, AND THE FLORIDA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS, AS AMENDED BY CONTRACT DOCUMENTS.

PREPARED FOR

MIAMI–DADE

MIAMI–DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION

STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

BY

R.J. Behar & Company, Inc.
Engineers • Planners
6861 SW 196 AV., SUITE 302
PEMBROKE PINE, FLORIDA 33332
CERTIFICATE OF AUTHORIZATION NO. 00008365
Phone: (954) 680-7771

LENGTH OF JOB		
	LIN. FT.	MILES
ROADWAY	1,033.66	0.196
BRIDGE	66.34	0.012
GROSS LENGTH OF JOB	1,100.00	0.208
EXCEPTIONS	N/A	N/A
NET LENGTH OF JOB	1,100.00	0.208

30% PLANS
SEPTEMBER 21, 2021

APPROVED _____ COUNTY ENGINEER

RECOMMENDED _____ ASSISTANT DIRECTOR

SUBMITTED _____ HIGHWAY DIVISION

PROPOSED _____	CHECK _____
DESIGN _____	DRAWN _____
DATE _____	SHEET 1 OF 26

PERMANENT MSE RETAINING WALL SYSTEM DATA TABLES

GEOTECHNICAL INFORMATION						Table Date 1-01-11
		Reinforced Soil & Random Backfill	Loose Fine Sand	Firm Fine Sand	Loose Clayey Fine Sand	Firm Clayey Fine Sand
Depth Below Existing Ground Line (ft.)	Wall No. 1	——				
	Wall No. 2	——				
Effective Unit Weight (pcf)						
Cohesion (psf)		0				
Internal Friction Angle						

NOTE:
If the unit weight and/or internal friction angle of the fill proposed by the Contractor differs from that shown above, the Project Engineer will contact both the District Geotechnical Engineer and the Wall Designer for a possible redesign.

RETAINING WALL VARIABLES					Table Date 7-01-13
Wall No.	Wall Settlement				Design High Water Elevation (ft.)
	Long Term Settlement (in.)	Short Term Settlement (in.)	Differential Settlement		
			Longitudinal (%) (ft./100ft.)	Transverse (in.)	
1				N/A	
2				N/A	

NOTE:
Design walls for the settlements noted in the table.
Long term settlement is measured from the end of wall fill placement.
Transverse differential settlement is measured from the face of wall to the end of the soil reinforcement.

SOIL REINFORCEMENT LENGTHS FOR EXTERNAL STABILITY												Table Date 1-01-11
Wall No. 1	Wall Height (ft.)											
	Reinforcement Length (ft.)											
	Factored Bearing Resistance (psf)											
Wall No. 2	Wall Height (ft.)											
	Reinforcement Length (ft.)											
	Factored Bearing Resistance (psf)											

NOTES:
1. The reinforcement strap lengths shown above are the minimum lengths required for external stability. The reinforcement lengths used in the construction of the retaining walls will be the longer of that required for external or internal stability (determined by proprietary wall companies).
2. The Factored Bearing Resistances shown above are the critical (lowest) values from all the load cases analyzed using LRFD methodology.

NOTES [Notes Date 09-01-19]:

1. Concrete facing panel surfaces treatment will be _____ .
2. If required, the soil reinforcement and fasteners for the abutment back wall will be designed and furnished by the proprietary wall company. The soil reinforcement will be designed to resist a factored horizontal load of _____ kips/ft. of back wall width. The cost of soil reinforcement and fasteners (if required) will be included in the cost of the Retaining Wall System.
3. Applicable FDOT Wall Types for each wall location are listed below. See the Approved Products List for approved Wall Systems and Standard Plans Index 548-020 for allowable Wall Type substitutions.
   Wall No. 1 – FDOT Wall Type _____
   Wall No. 2 – FDOT Wall Type _____
4. Concrete for Coping and/or Junction Slab shall be Class _____ (f'c = _____ psi) with/without highly reactive pozzolans.
5. See Standard Plans Index 548-020 for General Notes and Details.

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REVISIONS

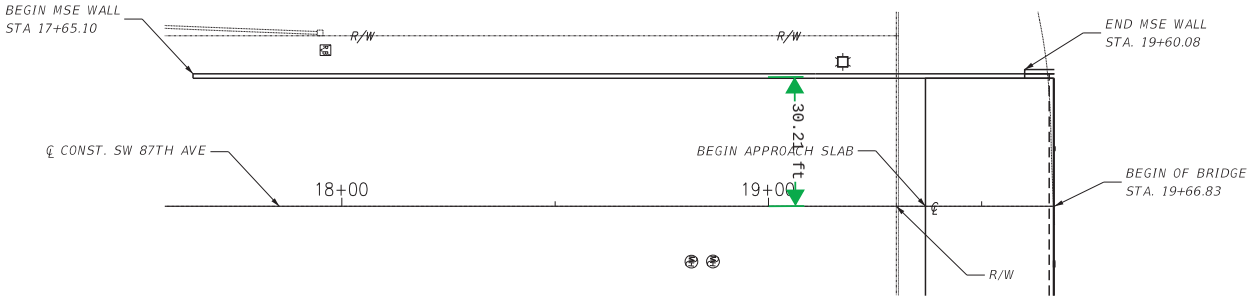
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

R.J. Behar & Company, Inc.
Engineers • Planners
6961 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

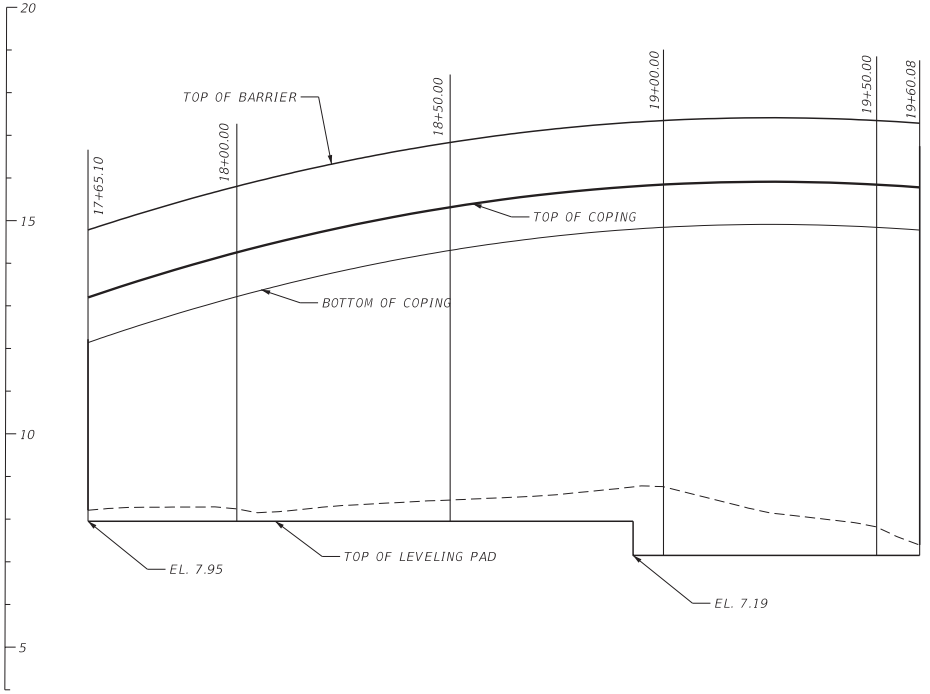
	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

WALL DATA TABLES



PLAN



ELEVATION

1. FOR TOP OF COPING ELEVATIONS SEE SHEET.
2. TOP OF LEVELING PAD SHALL BE A MINIMUM OF 2'-00" BELOW PROPOSED GROUND LINE
3. PROVIDE 3/4" OPEN JPOINTS IN TRAFFIC RAILING AT A MAXIMUM OF 90 FT. INTERVALS.
4. ⊕ INDICATES SOILBORING. SEE CORE BORING REPORT FOR BORING DATA.
5. FOR ADDITIONAL INFORMATION REGARDING DRAINAGE STRUCTURES AND UTILITY LOCATIONS, SEE ROADWAY PLANS.

N
0 30
Feet

C-23

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REVISIONS

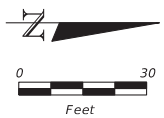
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

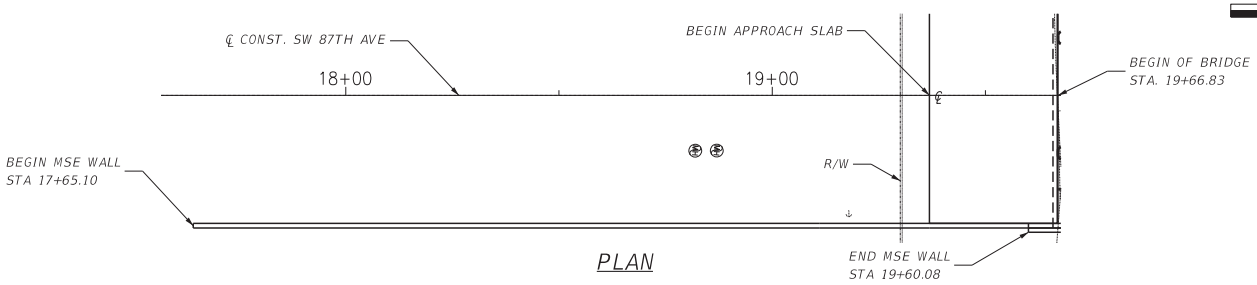
R.J. Behar & Company, Inc.
Engineers • Planners
6961 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

MSE WALLS (SHEET 2 OF 6) WALL CONTROL DRAWINGS (WALL NO.1)





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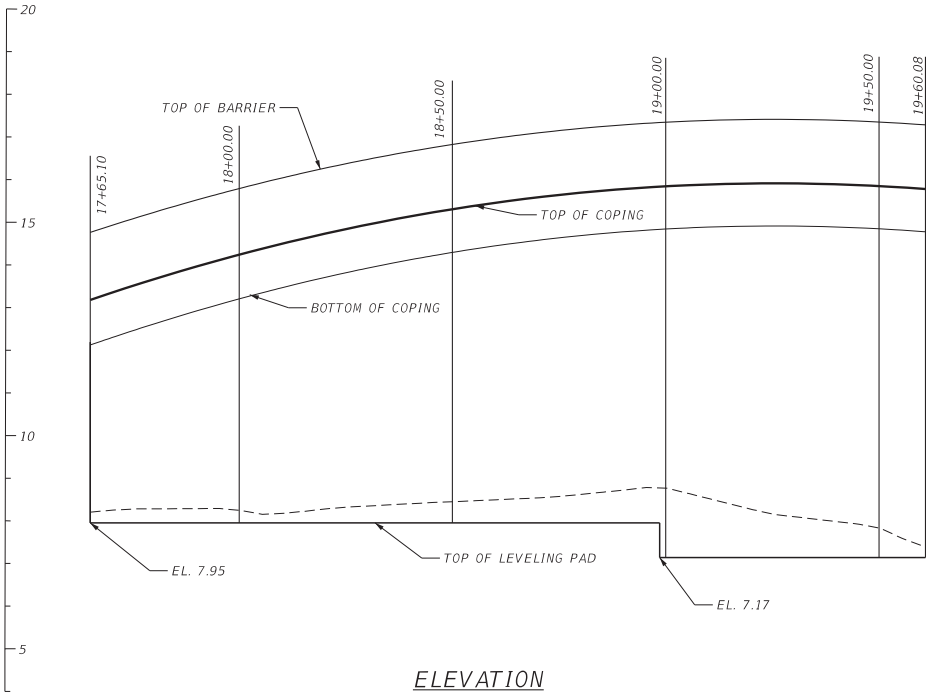

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9/21/2021

REVISIONS								
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

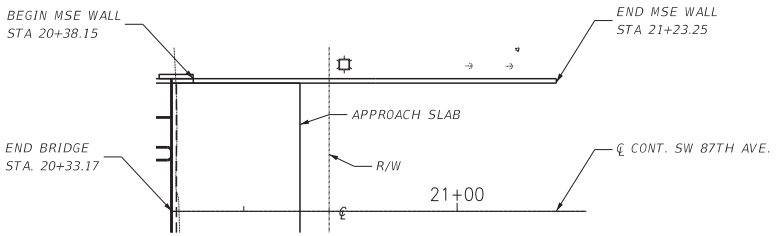
R.J. Behar & Company, Inc.
Engineers • Planners
6961 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

MIAMI-DADE COUNTY

DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

MSE WALLS (SHEET 3 OF 6) WALL CONTROL DRAWINGS (WALL NO.2)



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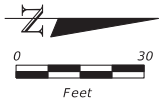

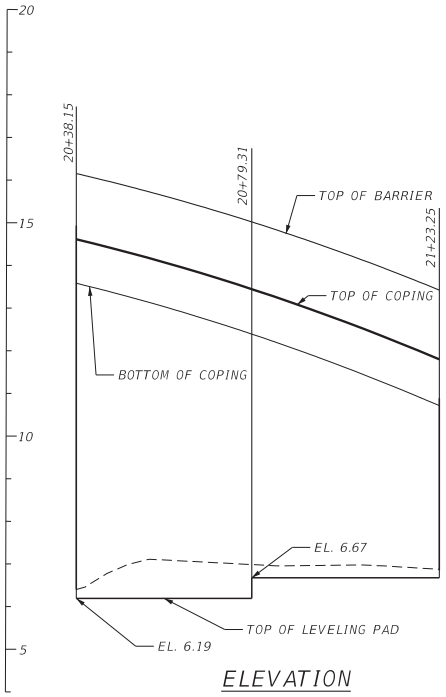

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C-25

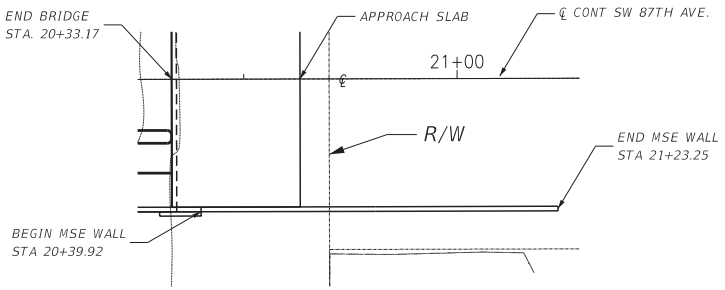
REVISIONS								
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

R.J. Behar & Company, Inc.
Engineers • Planners
6961 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

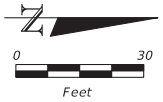
	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

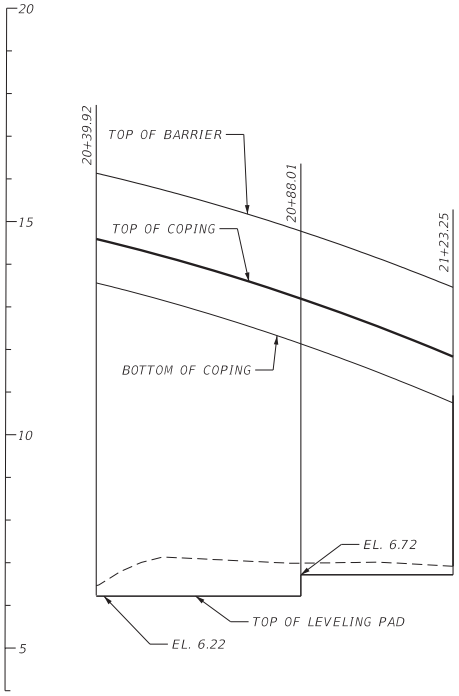
MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

MSE WALLS (SHEET 4 OF 6) WALL CONTROL DRAWINGS (WALL NO.3)



PLAN





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C-26

REVISIONS								
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

R.J. Behar & Company, Inc.
Engineers • Planners
6961 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		
SUPERVISED BY:					

MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

MSE WALLS (SHEET 5 OF 6) WALL CONTROL DRAWINGS (WALL NO.4)

MIAMI-DADE COUNTY DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS HIGHWAY DIVISION
SW 87th AVENUE
AT CANAL

PROJECT NO. N/A SHEET 27 OF 27

WALL No. 1

℄ SW 87TH AVE	Exposed Face of Wall 1 Offset from ℄ SW 87th Ave. (ft.)	Top of Coping Elevation @ Wall 1 (ft.)
17+65.10	-	-
17+70.00	-	-
17+80.00	-	-
17+90.00	-	-
18+00.00	-	-
18+10.00	-	-
18+20.00	-	-
18+30.00	-	-
18+40.00	-	-
18+50.00	-	-
18+60.00	-	-
18+70.00	-	-
18+80.00	-	-
18+90.00	-	-
19+00.00	-	-
19+10.00	-	-
19+20.00	-	-
19+30.00	-	-
19+40.00	-	-
19+50.00	-	-
19+60.08	-	-

WALL No. 2

℄ SW 87TH AVE	Exposed Face of Wall 2 Offset from ℄ SW 87th Ave. (ft.)	Top of Coping Elevation @ Wall 2 (ft.)
17+65.10	-	-
17+70.00	-	-
17+80.00	-	-
17+90.00	-	-
18+00.00	-	-
18+10.00	-	-
18+20.00	-	-
18+30.00	-	-
18+40.00	-	-
18+50.00	-	-
18+60.00	-	-
18+70.00	-	-
18+80.00	-	-
18+90.00	-	-
19+00.00	-	-
19+10.00	-	-
19+20.00	-	-
19+30.00	-	-
19+40.00	-	-
19+50.00	-	-
19+60.08	-	-

WALL No. 3

℄ SW 87TH AVE	Exposed Face of Wall 3 Offset from ℄ SW 87th Ave. (ft.)	Top of Coping Elevation @ Wall 3 (ft.)
20+39.92	-	-
20+40.00	-	-
20+50.00	-	-
20+60.00	-	-
20+70.00	-	-
20+80.00	-	-
20+90.00	-	-
21+00.00	-	-
21+10.00	-	-
21+20.00	-	-
21+23.25	-	-

WALL No. 4

℄ SW 87TH AVE	Exposed Face of Wall 4 Offset from ℄ SW 87th Ave. (ft.)	Top of Coping Elevation @ Wall 4 (ft.)
20+39.92	-	-
20+40.00	-	-
20+50.00	-	-
20+60.00	-	-
20+70.00	-	-
20+80.00	-	-
20+90.00	-	-
21+00.00	-	-
21+10.00	-	-
21+20.00	-	-
21+23.25	-	-

C-27

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REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

R.J. Behar & Company, Inc.
Engineers • Planners
6961 SW 196 Avenue, Suite 302
Pembroke Pines, Florida 33332

	NAME	DATE		NAME	DATE
DESIGNED BY			DRAWN BY		
CHECKED BY			CHECKED BY		

SUPERVISED BY:

MIAMI-DADE COUNTY
DEPARTMENT OF TRANSPORTATION AND PUBLIC WORKS
HIGHWAY DIVISION
STEPHEN P. CLARK CENTER
111 NW 1 ST
MIAMI, FLORIDA 33128

MSE WALL CONTROL DRAWINGS