

Preliminary Report of Geotechnical Exploration - Roadway

TOWN OF BAY HARBOR ISLANDS

BROAD CAUSEWAY BRIDGE REPLACEMENT
PROJECT DEVELOPMENT & ENVIRONMENT STUDY



Prepared for:

Town of Bay
Harbor Islands, Florida

February 23, 2024





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The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being or have been carried out by Florida Department of Transportation (FDOT) pursuant to 23 U.S.C. §327 and a Memorandum of Understanding dated May 26, 2022, and executed by Federal Highway Administration (FHWA) and FDOT.



Prepared for:
Town of Bay Harbor Islands

Prepared by: AREHNA Engineering, Inc.



EXECUTIVE SUMMARY

February 23, 2024

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Subject: **Preliminary Report of Geotechnical Exploration - Roadway**
Broad Causeway Bridge Replacement
Town of Bay Harbor Islands, FL
TBHI Project No. BC-160
AREHNA Project B-22-074.REV1

AREHNA Engineering, Inc. (AREHNA) is pleased to submit this report of our geotechnical exploration for the proposed project. Services were conducted in general accordance with the Agreement between Consultant and Subconsultant for Professional Services issued on October 1, 2022.

This report presents our preliminary analyses for the Project Development and Environment (PD&E) Study for the Broad Causeway bridge replacement including our understanding of the project, an outline of our exploratory procedures, summary of field and laboratory data obtained as well as our preliminary recommendations for site preparation, design and construction of the roadway and drainage improvements. The Preliminary Geotechnical Report for the bridge and wall structures will be under a separate cover.

AREHNA appreciates the opportunity to have assisted you on this project. Should you have any questions with regards to this report, or if we can be of any further assistance, please contact this office.

Best Regards,

AREHNA ENGINEERING, INC.

FLORIDA BOARD OF PROFESSIONAL ENGINEERS CERTIFICATE OF AUTHORIZATION NO. 28410

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1.0 PROJECT SUMMARY

1.1 Project Description

The project involves the potential replacement of the Broad Causeway Bridge connecting the Town of Bay Harbor Islands (Town) with the City of North Miami, within Miami-Dade County. The bridge is part of the Broad Causeway, a roadway classified as “Urban Minor Arterial”. This arterial also begins in Bal Harbour/Surfside and connects those commuters to the mainland. The specific limits of the project extend from the Broad Causeway Island (25°53'19.41"N, 80° 8'54.52"W) on the west side and (25°53'11.30"N, 80° 8'18.93"W) to east of West Broadview Drive. The improvements include the approach spans and Broad Causeway Island. The Florida Department of Transportation (FDOT) Bridge Identification (ID) Number (No.) is 875101. A graphic depicting the location of the bridge is provided as Figure 1 1. The project is approximately 0.77 mile in length.

The existing bridge consists of four lanes, undivided (two in each direction), the four travel lanes are 10 ft. wide, without a raised median. The outside travel lanes also include shared-use markings to accommodate bicycles. In addition, pedestrians use a raised maintenance area on each side of the bridge, with a width that varies from 22 to 36 inches. There are no guardrails separating the sidewalk from the travel lane. Crossing over the Intracoastal Waterway (ICWW), the bridge has a horizontal clearance of 79.7 ft., a maximum vertical clearance of 18.0 ft. at Mean Low Water (MLW) and a minimum vertical clearance of 15.7 ft. at Mean High Water (MHW) at the Bascule crossing. The ICWW at the bridge crossings is deemed a navigable waterway by the United States Coast Guard (USCG). The bridge bascule is required by the USCG to open twice per hour on the quarter and three-quarter hour but only opens if vessels are waiting.

The existing bridge, constructed in 1951, has been determined to be functionally obsolete with fracture critical components based on a Bridge Inspection Report prepared in January 2023 and determined to be structurally deficient based on a Bridge Inspection Report prepared in January 2024 by FDOT. In 2017, major structural repairs were performed to the bridge at a construction cost of approximately \$17 million. As a result of a 2020 inspection carried out by FDOT, a design to address additional repairs has been completed and it has been determined that the cost to perform these repairs will amount to \$3.0 million. As a result of the 2024 inspection, temporary emergency repairs will be completed. One lane of the bridge is closed until repairs are complete. It is expected that major costly repairs will be needed more frequently as the bridge ages to prevent closure or severe damages. Because of the structure type, the number of structural deficiencies, and high maintenance costs, the Town is considering replacement of the bridge.

This Project Development and Environment (PD&E) Study has been conducted to address the structural and functional deficiencies of the existing Broad Causeway Bridge and to evaluate and compare the feasibility of continued rehabilitation and repair versus replacement of the bridge.



Figure 1-1 Project Location Map



Bridge concepts will include provisions for new pedestrian and bicycle accommodations to comply with Americans with Disabilities Act (ADA) requirements and guardrails for the safety of pedestrians.

Existing right-of way (ROW), owned by the Town, is anticipated to accommodate the replacement bridge and approaches. Included in the Town Charter by the 1953 Senate Bill No. 865, the State of Florida surrendered and granted to the Town any claim or control over all tidewaters and other lands, and all bayous and bay bottoms, beaches, waters, waterways and water bottoms, and all riparian rights within and adjacent to the Town limits for municipal purposes only, a strip of 300 ft. wide from Kane Concourse, westwardly across Biscayne Bay to approximately 123rd Street in the City of North Miami. This 300-ft. wide strip is shown in **Figure 1-2** as a bright yellow highlight. Therefore, the replacement bridge will be built within the 300 ft. strip over Biscayne Bay under claim or control by the Town.

Figure 1-2 *Depiction of 300-ft. wide-strip from Kane Concourse to North Miami*



1.2 Purpose and Need

The purpose of this project is to address the structural and functional deficiencies of the existing Broad Causeway Bridge. The need for the project is to improve bridge deficiencies because the 73-year-old bridge is structurally deficient, functionally obsolete, and contains fracture critical components; improve safety since there have been several vehicular crashes in the project corridor, many involving bicycles and pedestrians that resulted in injuries; improve flow of traffic along the project corridor which has high traffic volumes and frequent bridge openings; and to maintain emergency evacuation.

This report presents our preliminary geotechnical evaluation and recommendations for the PD&E Study; including our understanding of the project, a review of existing subsurface information, an outline of our exploratory procedures, summary of field and laboratory data obtained as well as our preliminary recommendations for site preparation, foundation design and construction for the roadway



improvements. Preliminary Geotechnical Report for the bridge and wall structures will be provided under a separate cover.

1.3 Scope of Work

The purpose of our limited geotechnical exploration was to obtain preliminary information on the general subsurface conditions at the project site for the planned roadway and drainage improvements. The subsurface materials encountered were evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

- General location and description of potentially deleterious materials encountered in the borings which may have an impact on the proposed project.
- Identification of the existing ground water levels.
- Assess soil suitability along project alignment.

The following services were performed to achieve the above-outlined objectives:

- Requested utility location services from Sunshine 811.
- Reviewed published topographic and soils information from the United States Geological Survey (USGS) and the 'Soil Survey of Miami Dade County, Florida' published the United States Department of Agriculture (USDA) Soil Conservation Service (SCS).
- Performed 13 Standard Penetration Test (SPT) borings extending to depths of approximately 20 to 25 feet below existing grade. Samples were collected and Standard Penetration Test resistances measured in the SPT borings continuously for the top 10 feet and at approximate intervals of 5 feet thereafter.
- Utilized 9 borings performed for the wall and bridge structures. Only the upper 20 feet are shown for this report.
- Performed one auger boring extending to depths of approximately 6 feet below existing grade.
- Performed two pavement cores with associated 2 foot hand augers.
- Three Limerock Bearing Ratio (LBR) tests were performed on representative samples of subgrade soils.
- Measured groundwater levels in the soil borings, if present, and estimated seasonal high groundwater levels along the project alignment.
- Conducted nine South Florida Water Management District (SFWMD) Open Hole, percolation/exfiltration tests to depths of 10, 15, and 20 feet below the existing ground surface at three locations.
- Visually classified and stratified soil samples in the laboratory using the Unified Soil Classification System.



- Performed a laboratory testing program consisting of natural moisture content tests, full grain-size analyses, Atterberg Limits, and organics contents test to supplement the engineer's visual classifications. Corrosion tests were also performed.
- Reported the results of the field exploration and engineering analysis in a written preliminary report, signed and sealed by a professional engineer specializing in geotechnical engineering.



2.0 FIELD EXPLORATION & LABORATORY TESTING

2.1 Field Exploration

We performed 14 borings to explore subsurface conditions encountered along the roadway and drainage improvement study areas during the period of March 2023 through May 2023. The borings extended to depths of approximately 6 to 25 feet below existing ground surface. Two pavement cores with associated hand auger borings to depths of 2 feet, and a total of nine SFWMD percolation/exfiltration tests were performed at three locations to depths of 10, 15, and 20 feet. Borings survey information was provided to us by Aktins. The locations of the borings are shown on the **Boring Location Plan** and **Roadway Boring Profiles**, in **Appendix A**. Underground utility clearances were coordinated by AREHNA and updated, as needed.

The SPT borings were performed with the use of a Power Truck Mounted Drill Rig equipped with an automatic hammer using Bentonite “Mud” drilling procedures and 3-inch ID casing. Samples for the drainage and roadway borings were collected and Standard Penetration Test resistances were measured at approximate intervals of two feet for the top 10 feet and at approximate intervals of 5 feet, thereafter. The soil sampling was performed in general accordance with ASTM Test Designation D-1586, entitled “Penetration Test and Split-Barrel Sampling of Soils.” Representative samples from the borings were sealed in glass jars, labeled and transferred for appropriate classification by a geotechnical engineer.

The auger boring was performed by manually advancing a 3-inch diameter, 6-inch long sampler into the soil until the sampler was full. The sampler was then retrieved and the soils in the sampler were removed and visually classified.

Nine SFWMD percolation/exfiltration tests were performed to a depth of approximately 10, 15, and 20 feet below the existing ground surface at three locations. The SFWMD percolation/exfiltration test locations and results are shown in **Appendix A**. **Appendix A** provides a boring location plan showing the relationship of existing features to the exploration borings.

Two pavement cores were performed with the use of a 6-inch inside diameter core bit. At the completion of the coring, the pavement core was removed, and the core hole was advanced to a depth of 2 feet below the bottom of the pavement with the use manual hand augers to identify the underlying subgrade material. In addition, bulk samples were retrieved at three locations along the roadway alignment. Limerock bearing ratio (LBR) test was performed on the samples. The test results are provided in **Appendix B**.



2.2 Laboratory Testing

Our laboratory testing program included natural moisture content tests (AASHTO T-265/ASTM D-2216), full sieve gradation (AASHTO T-088/ASTM D-422), Atterberg limits (AASHTO T-090/ASTM D4318), and organic content tests (AASHTO T-267/ASTM D-2974). To determine the corrosion parameters of representative soil samples, we performed pH, chlorides, sulfates, and resistivity testing. The results of these tests are summarized in **Tables 2 and 3** of **Appendix B**. Additionally, three bulk samples were collected at the locations indicated on the **Boring Location Plan, Appendix A**, and a Limerock Bearing Ratio test was performed on each bulk sample. LBR test results are presented in **Appendix B**.



3.0 SUBSURFACE CONDITIONS

3.1 USGS Topographic Data

The topographic survey map published by the United States Geological Survey was reviewed for ground surface features at the project location (Appendix A). Based on this review, the pre-development ground surface elevation at the project site is approximately 0 to +5 National Geodetic Vertical Datum of 1929 (NGVD).

3.2 USDA Natural Resources Conservation Service Data

The United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey for the area is attached in Appendix A. This survey indicates that the soils along the project alignment consist of Udorthents-Water-Urban land complex, 0 to 60 percent slopes (9), Urban land, 0 to 2 percent slopes (15), and Water (99). A summary of the USDA soil type is provided on Table 1 in Appendix B.

3.3 Regional Geology

The Miami Limestone Formation extends from Palm Beach County to Dade and Monroe Counties. The Miami Limestone Formation generally is recognized from the Atlantic Coastal Ridge and extends to the Everglades. The Miami Formation is composed of white to orangish gray, poorly to moderately indurated, sandy limestones. The Miami Limestone Formation forms much of the Biscayne Aquifer.

3.4 Subsurface Conditions

In general, the borings encountered select fill soils that extend from the existing ground surface down to approximately 2 to 4 feet below ground surface (bgs). A layer of sandy silt and silty shelly sand was encountered down to the existing natural limestone layer, approximately 10 to 22 bgs. This layer is not uniform throughout the site and it's occasionally organic and clayey. The causeway island was probably backfilled with dredge material from the bay; therefore, the high variability of the layer. In addition, petroleum odor was reported during the performance of boring BB-3, which is located near the existing gas station.

The soils were visually classified by a Geotechnical Engineer with index property tests performed on select samples to verify visual classification. In this regard, the near surface soils were categorized into five strata groups. The groups were determined based on their engineering properties regarding suitability for roadway construction per FDOT Standard Plans Index 120-001.



Table 3.4.1 Summary of Near Surface Soils

STRATUM	SOIL DESCRIPTION	AASHTO SOIL CLASSIFICATION
1	Topsoil	A-8
2	Brown Silty Fine SAND with Limerock	A-1-b
3	Brown to Gray SAND	A-3
4	Brown to Gray Fine Silty SAND	A-2-4
5	Gray to Dark Gray Very Silty SAND to Sandy SILT to Sandy CLAY	A-4/A-7-6
6	Gray to Dark Gray Sandy SILT to Sandy CLAY	A-7-5/A-7-6
7	Dark Gray Organic Sandy SILT	A-8
8	Tan Sandy Limestone	-

Pictorial representation of the subsurface conditions encountered in the boring is shown on the **Roadway Boring Profiles** in **Appendix A**. These profiles and the following soil conditions highlight the general subsurface stratification. The Roadway Boring Profiles should be consulted for a detailed description of the subsurface conditions encountered at each boring location. When reviewing the boring records and the subsurface profiles, it should be understood that soil conditions may vary between, and away from, boring locations.



It should be noted that Stratum No. 5 (A-4/A-7-6, silty sand to sandy silt to sandy clay) and Stratum No. 6 (A-7-5/A-7-6, sandy silt to sandy clay) were encountered at the following locations:

Table 3.4.2 Summary of Plastic Soils Encountered (Approximate)

Boring ID	Station No.	Depth Plastic Soils Encountered (ft)		Elevation, feet Navd88	
	(Approximate)	From	To	From	To
RB-01	106+45	0.3	4	2.3	-1.4
RB-02	107+18	6	15	-3.5	-12.5
RB-03	107+69	4	18	1.5	-12.5
RD-01	108+41	0.3	15	5.3	-9.4
RB-04	109+17	6	18	-1.1	-13.1
RB-05	109+40	0.3	15	4.6	-10.10
RB-06	110+82	9	14	-4.1	-9.10
RB-07	111+37	8	13	-3.1	-8.10
RB-08	113+49	6	14	-1.8	-9.80
BB-01	111+65	10	13	-5.1	-8.1
RB-09*	115+68	5.5	6	-4.6	-5.10
RB-10	117+71	6	13	-3.2	-10.20
RD-02	118+48	2	15	2.7	-10.30
BB-02	118+90	4	6	0.2	-2.2
BB-03	121+53	4	6	0.6	-1.4
RB-11	122+46	2	16	-0.1	-14.10
BB-04	123+79	8	12	-5.3	-9.3



Boring ID	Station No.	Depth Plastic Soils Encountered (ft)		Elevation, feet Navd88	
	(Approximate)	From	To	From	To
RD-03	140+68	4	15	0.6	-10.40
BB-12	140+71	2	10	0.7	-7.30
WB-04	141+60	4	17	-0.74	-13.74

Notes: 1: Depths shown above are approximate.

2: Hand auger was performed at RB-09 due to access issues and utility conflicts.

It should be noted that Stratum No. 7 (A-8, organic silt) was encountered at the following locations:

Table 3.4.2 Summary of Organic Soils Encountered (Approximate)

Boring ID	Station No.	Depth Plastic Soils Encountered (ft)		Elevation, feet Navd88	
	(Approximate)	From	To	From	To
RB-03	107+69	6	8	-0.5	-2.50
BB-01	111+65	4	10	0.9	-5.10
WB-03	115+82	4	7	1.2	-1.80

3.5 Groundwater Conditions

The groundwater level was encountered at approximate depths ranging from approximately 3.3 to 5.8 (EL. +1.1 to -2.4 feet, NAVD88) feet below existing grades. Fluctuation in ground water levels should be expected due to seasonal climatic changes, construction activity, rainfall variations, surface water runoff, tidal activity, and other site-specific factors. Since ground water 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.

3.6 Estimated Seasonal High Water Level

The Seasonal High-Water Table (SHWT) is the highest average depth of soil saturation during the wet season in a normal year. A review of the Miami-Dade County NRCS Soil Survey indicated that the project is located within an area classified as Udorthents-Water-Urban land complex, 0 to 60 percent slopes (9), Urban land, 0 to 2 percent slopes (15), and Water (99). The depth of the water table is noted as 5 to 6.7



feet below the ground surface for these soil types. Groundwater measurements at the location of the roadway borings align with the NRCS soil survey values.

Since the groundwater measurements at the test boring locations may not necessarily reflect the SHWT, a review of historical groundwater data was conducted.

Table 3.6.1 USGS Well Data Summary

Source	Location	Distance from Site	Groundwater Level	
			Elevation (feet, NAVD)	Duration
USGS Well No. G-894/ USGS ID 255350080105801	25°53'51.7", 80°10'57.2"	Approx. 2 miles NW	1.2 (Average)	Wet Season (2022)
			-1.0 (Lowest)	2001
			4.4 (Highest)	2020
USGS Well No. F-279/ USGS ID 255315080111501	25°53'17.79", 80°11'14.66"	Approx. 2 miles W	0.2 (Average)	Wet Season (2022)
			-0.5 (Lowest)	1998
			2.4 (Highest)	2020

Based on the groundwater table encountered within the borings, the Miami-Dade County NRCS Soil Survey and USGS well information, the preliminary SHWT is estimated to be at approximately 3 to 4 feet below the existing ground surface and/or approximately elevation +1 foot, NAVD and will be heavily tidally influenced.

3.7 Existing Pavement Conditions

Two pavement cores were performed within the existing pavement. Thicknesses measurements of the base, subgrade and asphalt were measured in the field and laboratory. Asphalt pavement thicknesses varied from 3.3 to 3.9 inches and base material (limerock) thicknesses varied from 6 to 8 inches. The existing pavement conditions appeared to be in good condition. The subgrade consisted of grey SAND with limerock (A-1-b). Note that at PC-02 a sample of the subgrade could not be obtained using a hand auger due to larger limerock fragments that could not be broken up.

A summary table presenting the pavement section data at each core location is shown on the **Summary of Pavement Core Results (Table 5) in Appendix B.**



4.0 ENGINEERING EVALUATION AND RECOMMENDATIONS

4.1 General Information

In general, the existing shallow subsurface soils are suitable to support the proposed roadway after proper subgrade preparation. If the final roadway alignment or system improvements are significantly different from those described, or if the subsurface conditions during construction are different from those revealed by our borings, we should be notified immediately so that we might review our recommendations presented in this report.

4.2 Pavement Design Considerations

In accordance with the FDOT's Florida Design Manual (FDM) section 210.10.3 a minimum separation of 3 feet should be maintained between the bottom of the roadway base course and the Base Clearance Water Elevation except for the following facilities:

- 2-lane roadways in context classification C1 (Natural), C2 (Rural), C2T (Rural Town), and C3 (Suburban), and all ramps may be reduced to a 2-foot clearance.
- Low points on ramps at crossroads may be reduced to a 1-foot clearance.
- All other facilities in context classifications C4 through C6 (Urban General, Urban Center, and Urban Core, respectively) may be reduced to a 1-foot clearance.

The project is within context classification, C4 and minimum separation of 1 foot should be maintained for the proposed roadway improvements. The base clearance water elevation is typically considered the normal seasonal high. The base should also remain at this minimum separation above water levels within roadside ditches to allow for positive drainage. The Roadway Designer needs to determine the minimum required base clearance.

Due to the proximity of the project to the intracoastal and the likelihood of higher groundwater elevations in the future, it is advisable for the designer to assess the suitability of Type B-12.5 base material (black base). It is important to note that geosynthetic should not be placed immediately below the black base unless it is specified by the manufacturer to be heat tolerant.

4.2.1 LBR Results

Three laboratory LBR tests were performed on remolded representative samples of existing subgrade soils. LBR values varied from 31 to 60. AREHNA recommends an LBR of 30 be used in pavement design, unless we evaluate any clean fill soils that are proposed to be utilized. Applying the relationship between resilient modulus (MR) and LBR values that is found in the FDOT Flexible Pavement Design Manual, this LBR is equivalent to a MR of approximately 10,000 psi. The LBR value of the unstabilized sandy subgrades can be typically increased to values of approximately LBR = 40 to achieve the stabilized subgrade requirements by blending approximately 4 inches of limerock into the upper 8 inches of subgrade soils.



4.3 Exfiltration/Percolation Testing

As requested, nine exfiltration/percolation tests at three different locations (P-01 through P-03) were performed in conjunction with the subsurface exploration at the site in order to determine the hydraulic conductivity characteristics of the subsurface soils. The calculated coefficient of hydraulic conductivity was obtained in accordance with the SFWMD Constant Head Open Hole Test Method. The percolation tests were performed to depths of 10, 15, and 20 feet below the existing ground surface. The following table summarizes the calculated hydraulic conductivity coefficient:

Table 4.3.1 Open-Hole Test Constant Head Results

<i>Test No.</i>	<i>k, Hydraulic Conductivity (cfs/ft² – ft of Head)</i>
<i>P-01A</i>	<i>2.7E-04</i>
<i>P-01B</i>	<i>6.1E-04</i>
<i>P-01C</i>	<i>7.4E-05</i>
<i>P-02A</i>	<i>2.9E-04</i>
<i>P-02B</i>	<i>5.0E-04</i>
<i>P-02C</i>	<i>8.8E-05</i>
<i>P-03A</i>	<i>2.5E-05</i>
<i>P-03B</i>	<i>5.9E-05</i>
<i>P-03C</i>	<i>1.8E-04</i>

It should be noted that the percolation tests “A” were performed to depths of 0 to 10 feet, tests “B” to depths of 10 to 15 feet, and tests “C” to depths of 15 to 20 feet. The additional test “C” was performed to better characterize the in-situ hydraulic conductivity due to the upper silt layer in the soil profile. As shown above, the hydraulic conductivity ranged from 2.5×10^{-5} to 6.1×10^{-4} cfs/ft² - ft Head. The Exfiltration/Percolation Field Data Sheets along with a table including the test results is presented in **Appendix A** of this report. Due to the subsurface soil conditions (fill, sandy, silty, organic layers), we recommend to use a temporary retaining system to support the French drain excavations and minimize damage to the nearby underground utilities. The designer should decide on the required factor of safety.



4.4 Soil Suitability

FDOT Standard Plan Indices 120-001 and 120-002 should be followed for soil suitability along the vertical and horizontal extent of the alignment. In this regard, the soil strata encountered during our geotechnical exploration and their suitability have been summarized and are presented on the Roadway Soil Survey sheet presented in **Appendix B**.

4.5 Plastic Soils

It should be noted that Strata No. 5 (A-4/A-7-6, silty sand to sandy silt to sandy clay) and Strata No. 6 (A-7-5/A-7-6, sandy silt to sandy clay) were encountered surficially at the following locations:

Table 4.5.1 Summary of Plastic to Highly Plastic Soils Encountered (Approximate)

Boring ID	Station No.	Depth Plastic Soils Encountered (ft)		Elevation, feet Navd88	
	(Approximate)	From	To	From	To
RB-01	106+45	0.3	4	2.3	-1.4
RD-01	108+41	0.3	15	5.3	-9.4
RB-05	109+40	0.3	15	4.6	-10.10
RD-02	118+48	2	15	2.7	-10.30
RB-11	122+46	2	16	-0.1	-14.10
BB-12	140+71	2	10	0.7	-7.30

Plastic soils (Strata No. 5, A-4/A-7-6, silty sand to sandy silt to sandy clay and No. 6 A-7-5/A-7-6 sandy silt to sandy clay) were encountered within the top four feet of the soil borings mentioned above from approximately Station 106+45 to 140+71 along the project alignment. The depths of these soils ranged from 0.3 to 16 feet below the existing ground surface.

The material from Strata 5 and 6 is plastic (P) and highly plastic (HP), respectively, and should be removed per FDOT Standard Plans Index 120-002. However, due to the depths encountered, extensive utilities throughout the alignment, and potential environmental concerns, removal is impractical. In lieu of removal, ground improvement techniques such as, surcharging, soil mixing, rigid inclusions, and/or geosynthetic reinforcement will be evaluated. Additional recommendations for ground improvements in lieu of removal of plastic material will be provided after additional borings are performed and design is advanced.



4.6 Organic Soils

It should be noted that Strata No. 7 (A-8, Organic Silt) was encountered at the following locations:

Table 4.6.1 Summary of Organic Soils Encountered (Approximate)

Boring ID	Station No.	Depth Plastic Soils Encountered (ft)		Elevation, feet Navd88	
	(Approximate)	From	To	From	To
RB-03	107+69	6	8	-0.5	-2.50
BB-01	111+65	4	10	0.9	-5.10
WB-03	115+82	4	7	1.2	-1.80

The material from Stratum 7 is organic silt (A-8) and should be removed per FDOT Standard Plans Index 120-002. However, due to the depths encountered, extensive utilities throughout the alignment, and potential environmental concerns, removal is impractical. In lieu of removal, ground improvement techniques such as, surcharging, soil mixing, rigid inclusions, and/or geosynthetic reinforcement will be evaluated. Additional recommendations for ground improvements in lieu of removal of organic material will be provided after additional borings are performed and design is advanced.



5.0 ENVIRONMENTAL CLASSIFICATION

Corrosion parameter tests were performed by AREHNA on a select water and soil sample obtained for the project site. The water sample was collected from waterway. The results are provided on **the Soil Survey Sheet in Appendix A and Table 3 in Appendix B**. According to the soil test results, the environmental classification is moderately and extremely aggressive for substructure concrete and steel, respectively. Based on the water test results, the environmental classification is extremely aggressive for substructure concrete and steel (resistivity = 26 ohm-cm, chlorides = 49,950 ppm). Since the project is located within 2,500 feet of a major water body with chlorides content more than 12,000 ppm, the superstructure and substructure are classified as extremely aggressive.



6.0 PRELIMINARY CONSTRUCTION CONSIDERATIONS

The proposed roadway improvements and associated structures should be installed in accordance with the current FDOT Standard Specifications for Road and Bridge Construction (SSRBC).

6.1 Protection of Existing Structures and Vibration Monitoring

After the final design option is selected, recommendations for protection of the existing structures and vibrations monitoring program should be provided. During construction near the existing bridge, and/or existing buildings, precautions need to be taken to protect the existing structures. Some of the existing buildings are located as close as approximately 50 feet from the edge of existing pavement. To avoid impacting and damaging the existing structures with vibrations, we recommend the following:

- Protection of the existing structures in accordance with Section 108 of the specifications.
- Vibrations monitoring in accordance with FDM Chapter 117.

6.2 Site Preparation

6.2.1 *Clearing and Grubbing*

The initial step in new pavement, embankment and/or subgrade preparation within the subject construction area should generally consist of the removal of existing asphalt. The asphalt should be removed from the construction areas in accordance with Section 110 of the FDOT Standard Specifications for Road and Bridge Construction.

The stripping operations should be observed and documented by qualified personnel (defined as a geotechnical engineer or engineering technician working under the direction of a geotechnical engineer or CEI/FDOT construction personnel) in order to confirm that conditions are as anticipated and to evaluate the acceptability of the exposed materials as well as the unacceptability of the removed material.

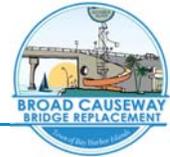
6.2.2 *Surface Water and Shallow Groundwater Control*

Dewatering may be required depending on groundwater levels at the time of construction to achieve compaction requirements or trench excavations for utilities or drainage structures, if needed. It should be performed in accordance with Section 455-28 of the Standard Specifications.

Excavations should be made in accordance with Section 125 and 455-29 of the Standard Specifications. If compaction cannot be achieved due to pumping soils, these soils may be removed to depths of 1 to 2 feet below design grades and backfilled with structural fill as long as FDOT Standard Plans Indices 120-001 and 120-002 are followed.

6.2.3 *Exposed Soil Treatment*

Following stripping operations and documentation of the acceptability of the exposed surface by qualified personnel, the exposed sandy soils should be compacted in accordance with Section 120-9 of the Standard Specifications.



Structural Fill Placement and Compaction – Structural fill or backfill, as required in accordance with Index 120-001, should be placed and compacted in accordance with Sections 120-7, 120-8 and 120-9 of the Standard Specifications. Certain types of A-2-4 materials may be more difficult to compact than the cleaner sands due to their fines content and associated moisture sensitivity.

6.2.4 Erosion Control

Erosion control should be established in accordance with Section 104 of the Standard Specifications.

6.2.5 Temporary Excavation Stability

Excavations shall be performed in accordance with Section 104 of the FDOT Standard Specifications.



7.0 RECOMMENDATIONS FOR ADDITIONAL GEOTECHNICAL EXPLORATION

This preliminary geotechnical exploration was based on limited soil borings and exfiltration testing for a PD&E Study at this site. We recommend performing a detailed geotechnical exploration in accordance with FDOT Soil and Foundation Handbook and Structures Design Guidelines once a final design option is selected. We also recommend that an environmental study be performed to evaluate the extent of any petroleum product on the site that may be present as indicated by the petroleum odor in some of the borings.



8.0 FHWA Checklist

We have completed the FHWA Checklist for this exploration in accordance with the Structure Design Guidelines. We have included Section A, Site Investigation Information in **Appendix C**.



9.0 BASIS FOR RECOMMENDATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions may be different from those at specific boring locations and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process itself may alter soil conditions. AREHNA is not responsible for the conclusions, opinions or recommendations made by others based on the data presented in this report.

The assessment of site environmental conditions or the presence of contaminants in the soil, rock, surface water or groundwater of the site was beyond the scope of this exploration. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of AtkinsRéalis and Town of Bay Harbor Islands.

This report was prepared exclusively for AtkinsRéalis and Town of Bay Harbor Islands by AREHNA. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in AREHNA's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by AtkinsRéalis and Town of Bay Harbor Islands only, subject to the terms and conditions of its contract with AtkinsRéalis. Any other use of, or reliance on, this report by any third party is at that party's sole risk.



10.0 APPENDICES

- APPENDIX A: USGS Topographic Survey and USDA Soil Survey Maps
Report of Core Borings
Exfiltration/ Percolation Test Results
Exfiltration/ Percolation Test Data Sheet
- APPENDIX B: Summary of USDA Soil Survey – Table 1
Summary of Laboratory Test Results – Table 2
Summary of USDA Soil Survey – Table 2
Summary of Corrosion Test Results – Table 3
Summary of Seasonal High Water Table Estimate – Table 4
Summary of Pavement Core Conditions Table 5
Pavement Core Photographs
Laboratory Test Results
- APPENDIX C: FHWA CHECKLIST (SECTION A)

APPENDIX A

USGS Topographic Survey and USDA Soil Survey Maps

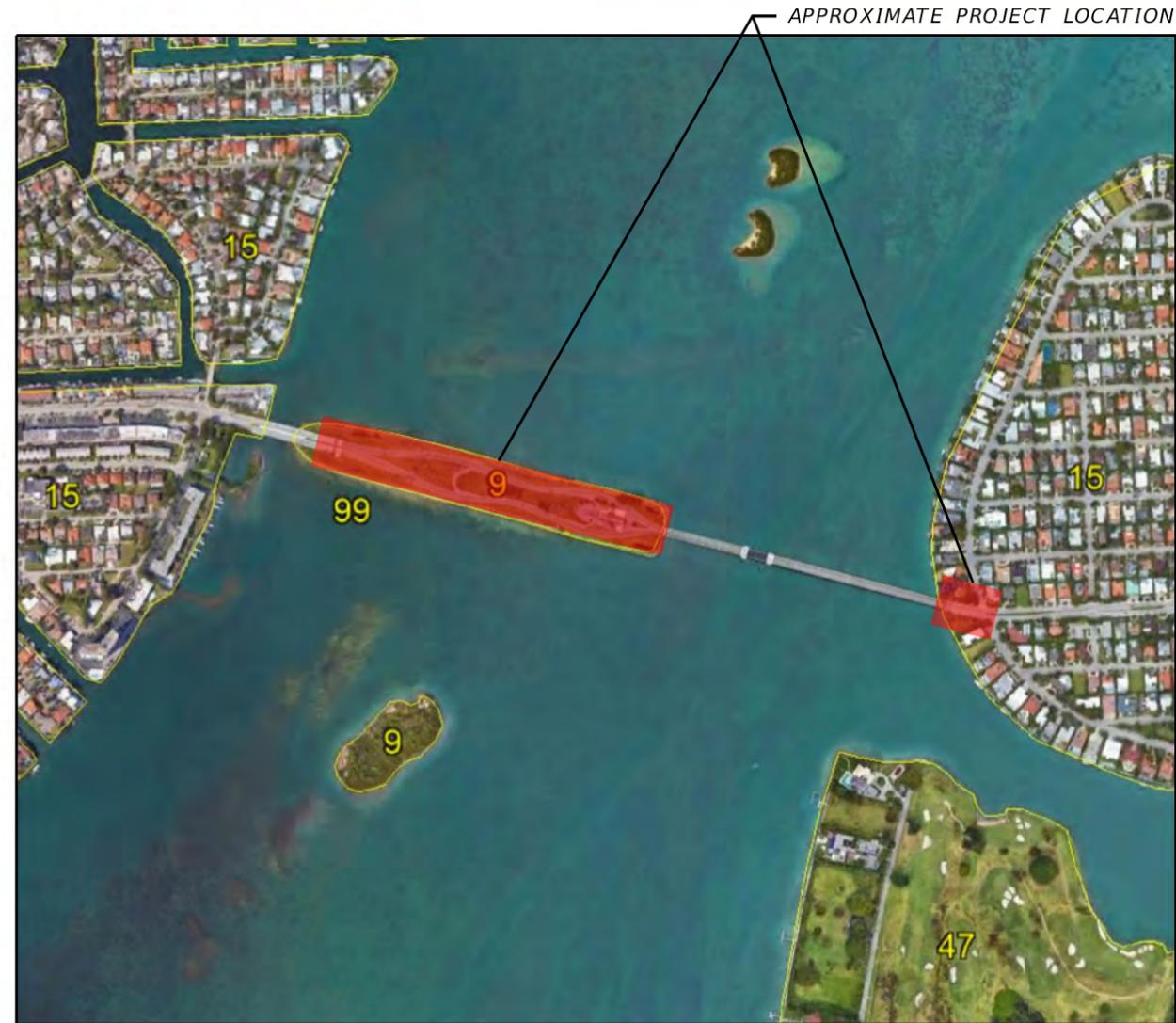
Report of Core Borings

Exfiltration/ Percolation Test Results

Exfiltration/ Percolation Test Data Sheet

USDA SOIL SURVEY MAP

USGS TOPOGRAPHIC MAP

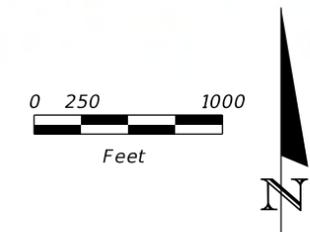
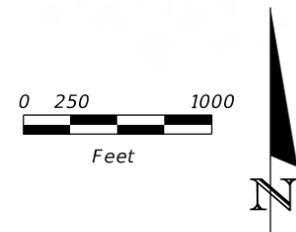


REFERENCE: USDA SOIL SURVEY OF MIAMI-DADE COUNTY, FLORIDA

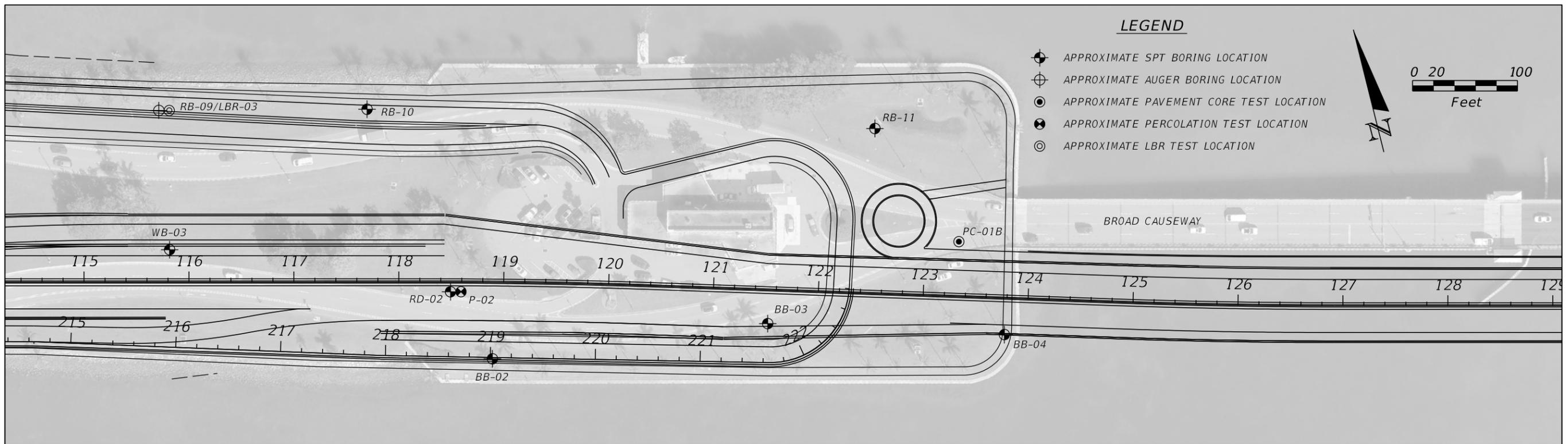
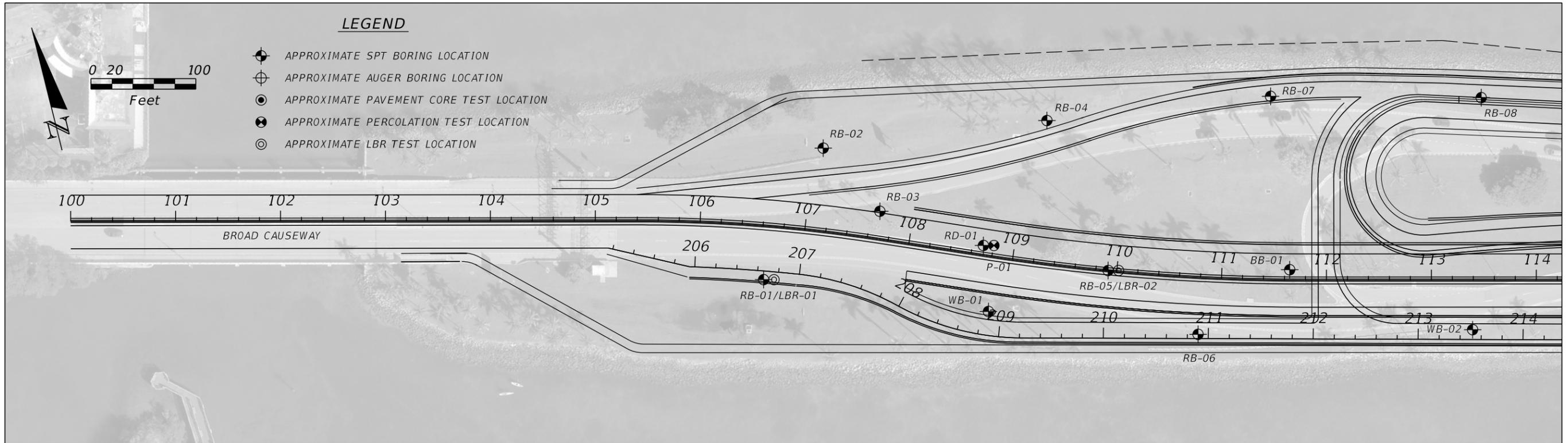
TOWNSHIP: 42 S
 RANGE: 43 E
 SECTION: 4, 9

REFERENCE: "NORTH MIAMI, FLORIDA" USGS QUADRANGLE MAP

TOWNSHIP: 52 S
 RANGE: 42 E
 SECTION: 27, 28



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DATE	DESCRIPTION	DATE	DESCRIPTION		ROAD NO.	COUNTY	PROJECT ID		
					922	MIAMI-DADE	BC-160		



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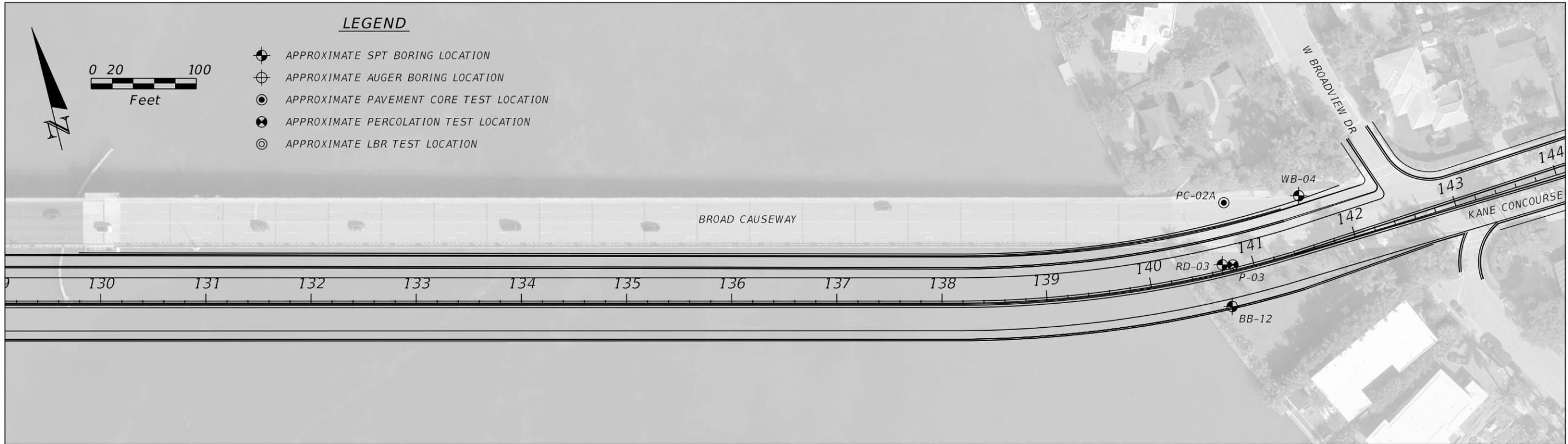
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ANGELA L. ALBA, P.E.
LICENSE NUMBER: 58538
AREHNA ENGINEERING, INC.
12296 WILES ROAD
CORAL SPRINGS, FL 33076

TOWN OF BAY HARBOR ISLANDS		
ROAD NO.	COUNTY	PROJECT ID
922	MIAMI-DADE	BC-160

BORING LOCATION PLAN

SHEET NO.

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Bore # RB-01
 Reference CL3
 Station 106+65
 Offset 51
 Latitude 25.8887111
 Longitude -80.149099
 Elevation 2.6'
 Vertical Datum NAVD88
 Date 3/20/2023
 Driller M. SEIBERT
 Hammer Auto
 Rig CME-45

Bore # RB-02
 Reference CL3
 Station 107+09
 Offset -79
 Latitude 25.8890055
 Longitude -80.1488372
 Elevation 2.5'
 Vertical Datum NAVD88
 Date 5/2/2023
 Driller -
 Hammer Auto
 Rig CME-45

Bore # RB-03
 Reference CL3
 Station 107+68
 Offset -26
 Latitude 25.8888087
 Longitude -80.1487235
 Elevation 5.5'
 Vertical Datum NAVD88
 Date 3/22/2023
 Driller M. SEIBERT
 Hammer Auto
 Rig CME-45

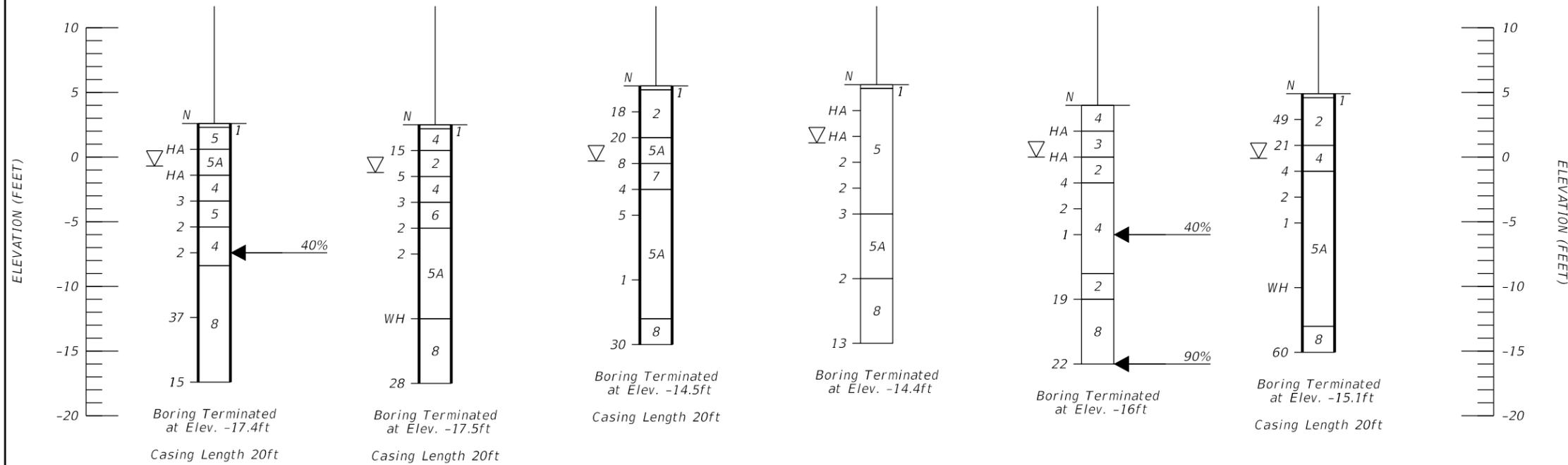
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 Elevation 5.6'
 Vertical Datum NAVD88
 Date 3/22/2023
 Driller M. SEIBERT
 Hammer Auto
 Rig CME-45

Bore # WB-01
 Reference CL3
 Station 108+84
 Offset 52
 Latitude 25.8884841
 Longitude -80.1484906
 Elevation 4'
 Vertical Datum NAVD88
 Date 3/20/2023
 Driller M. SEIBERT
 Hammer Auto
 Rig CME-45

Bore # RB-04
 Reference CL3
 Station 109+15
 Offset -136
 Latitude 25.88893
 Longitude -80.1481893
 Elevation 4.9'
 Vertical Datum NAVD88
 Date 5/2/2023
 Driller -
 Hammer Auto
 Rig CME-45

LEGEND

1. TOPSOIL (A-8)
 2. BROWN SILTY FINE SAND WITH LIMEROCK (A-1-b)
 3. BROWN TO GRAY SAND (A-3)
 4. BROWN TO GRAY FINE SILTY SAND (A-2-4)
 5. GRAY TO DARK GRAY VERY SILTY SAND TO SANDY SILT TO SANDY CLAY (A-4/A-7-6)
 6. GRAY TO DARK GRAY SANDY SILT TO SANDY CLAY (A-7-5/A-7-6)
 7. DARK GRAY ORGANIC SANDY SILT (A-8)
 8. TAN SANDY LIMESTONE
- A WITH SHELL
 B SLIGHTLY ORGANIC
 A-3 AASHTO SOIL CLASSIFICATION GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND/OR LABORATORY TESTING
- ▽ GROUNDWATER TABLE
 N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
 HA HAND AUGER
 WH FELL UNDER WEIGHT OF ROD AND HAMMER
 ← LOSS OF CIRCULATION OF DRILLING FLUID (%)
 | CASING
 AREHNA PROJECT NO. B-22-074



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Roadway Soil Profiles

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Elevation 4.9'
Vertical Datum NAVD88
Date 3/22/2023
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Hammer Auto
Rig CME-45

Bore # RB-06
Reference CL3
Station 110+80
Offset 54
Latitude 25.8882898
Longitude -80.1479183
Elevation 4.9'
Vertical Datum NAVD88
Date 3/20/2023
Driller M. SEIBERT
Hammer Auto
Rig CME-45

Bore # RB-07
Reference CL3
Station 111+64
Offset -174
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Longitude -80.147544
Elevation 4.9'
Vertical Datum NAVD88
Date 5/2/2023
Driller -
Hammer Auto
Rig CME-45

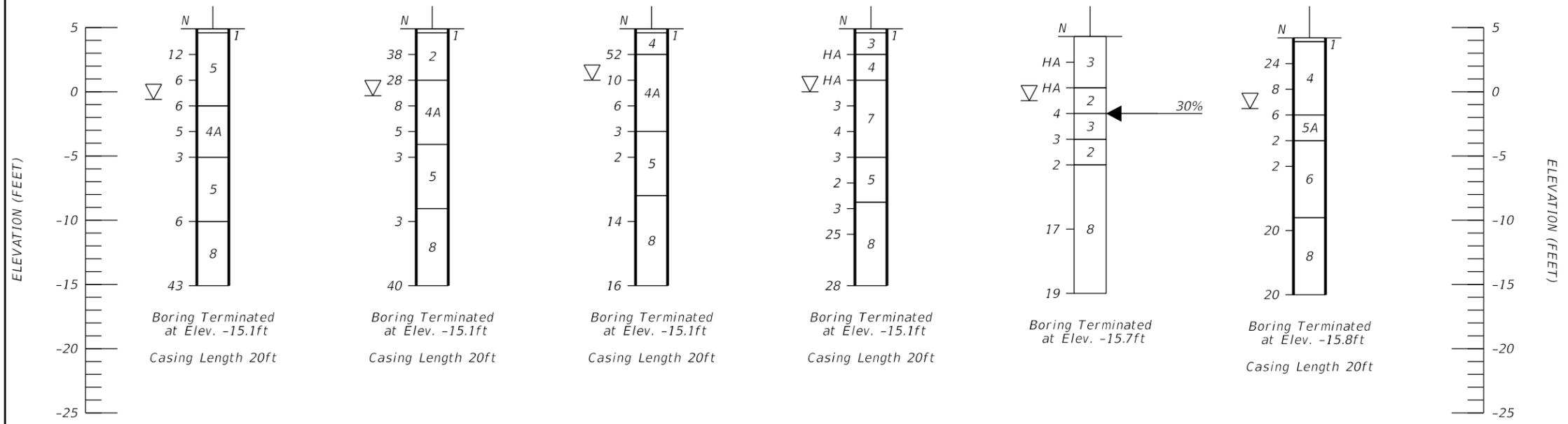
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Reference CL3
Station 111+65
Offset -10
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Longitude -80.1476146
Elevation 4.9'
Vertical Datum NAVD88
Date 3/22/2023
Driller W. CADONO
Hammer Auto
Rig CME-45

Bore # WB-02
Reference CL3
Station 113+39
Offset 47
Latitude 25.8881229
Longitude -80.147144
Elevation 4.3'
Vertical Datum NAVD88
Date 3/21/2023
Driller M. SEIBERT
Hammer Auto
Rig CME-45

Bore # RB-08
Reference CL3
Station 113+48
Offset -173
Latitude 25.8887053
Longitude -80.1469534
Elevation 4.2'
Vertical Datum NAVD88
Date 5/2/2023
Driller -
Hammer Auto
Rig CME-45

LEGEND

1. TOPSOIL (A-8)
 2. BROWN SILTY FINE SAND WITH LIMEROCK (A-1-b)
 3. BROWN TO GRAY SAND (A-3)
 4. BROWN TO GRAY FINE SILTY SAND (A-2-4)
 5. GRAY TO DARK GRAY VERY SILTY SAND TO SANDY SILT TO SANDY CLAY (A-4/A-7-6)
 6. GRAY TO DARK GRAY SANDY SILT TO SANDY CLAY (A-7-5/A-7-6)
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A-3 AASHTO SOIL CLASSIFICATION GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND/OR LABORATORY TESTING
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HA HAND AUGER
WH FELL UNDER WEIGHT OF ROD AND HAMMER
← LOSS OF CIRCULATION OF DRILLING FLUID (%)
| CASING
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Roadway Soil Profiles

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Reference CL3
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Offset -163
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Longitude -80.146302
Elevation 0.9'
Vertical Datum NAVD88
Date 5/2/2023

Bore # WB-03
Reference CL3
Station 115+82
Offset -31
Latitude 25.8881649
Longitude -80.1463717
Elevation 5.2'
Vertical Datum NAVD88
Date 3/21/2023
Driller M. SEIBERT
Hammer Auto
Rig CME-45

Bore # RB-10
Reference CL3
Station 117+70
Offset -164
Latitude 25.8883926
Longitude -80.1457165
Elevation 2.8'
Vertical Datum NAVD88
Date 5/2/2023
Driller -
Hammer Auto
Rig CME-45

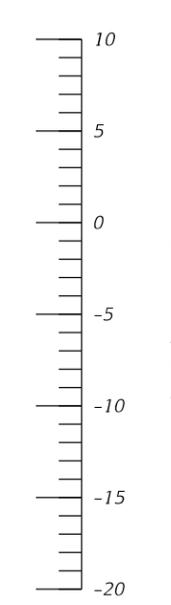
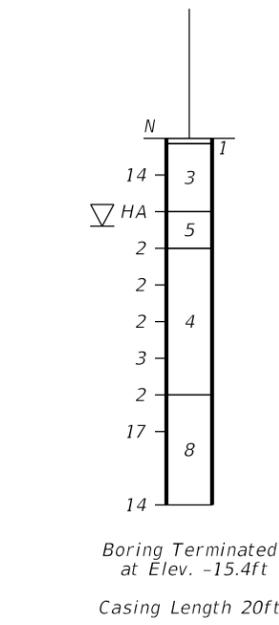
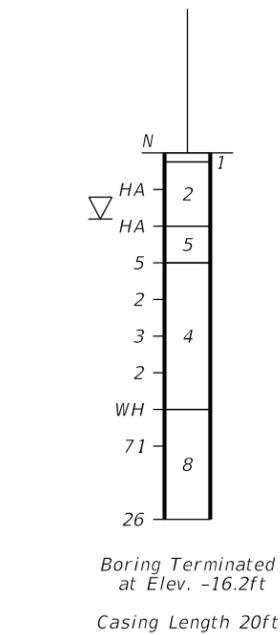
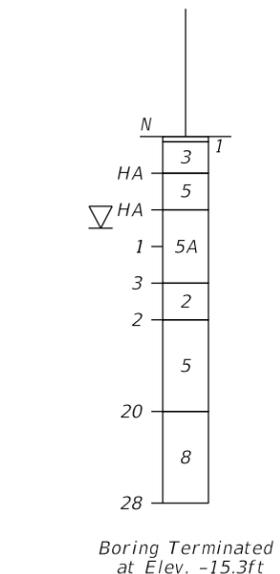
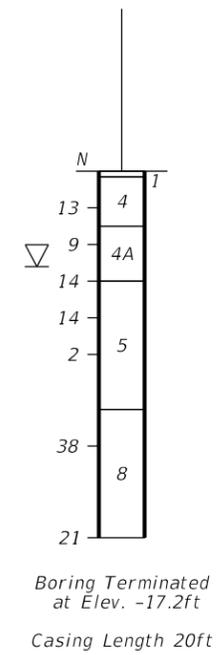
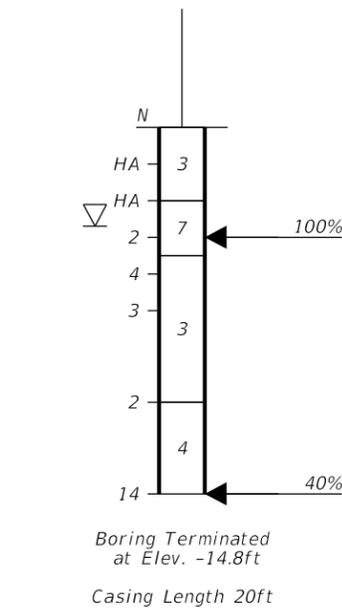
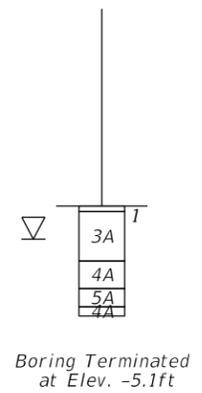
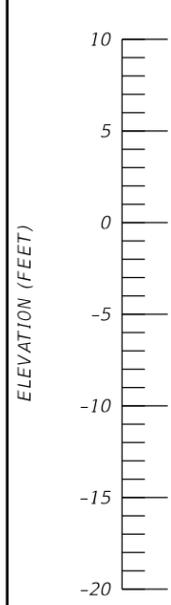
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Vertical Datum NAVD88
Date 3/20/2023
Driller M. SEIBERT
Hammer Auto
Rig CME-45

Bore # BB-02
Reference CL3
Station 118+90
Offset 73
Latitude 25.8876783
Longitude -80.1455436
Elevation 3.8'
Vertical Datum NAVD88
Date 3/21/2023
Driller W. CADONO
Hammer Auto
Rig CME-45

Bore # BB-03
Reference CL3
Station 121+53
Offset 32
Latitude 25.8875884
Longitude -80.1447453
Elevation 4.6'
Vertical Datum NAVD88
Date 3/24/2023
Driller W. CADONO
Hammer Auto
Rig CME-45

LEGEND

1. TOPSOIL (A-8)
 2. BROWN SILTY FINE SAND WITH LIMEROCK (A-1-b)
 3. BROWN TO GRAY SAND (A-3)
 4. BROWN TO GRAY FINE SILTY SAND (A-2-4)
 5. GRAY TO DARK GRAY VERY SILTY SAND TO SANDY SILT TO SANDY CLAY (A-4/A-7-6)
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HA HAND AUGER
WH FELL UNDER WEIGHT OF ROD AND HAMMER
← LOSS OF CIRCULATION OF DRILLING FLUID (%)
| CASING
AREHNA PROJECT NO. B-22-074



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Roadway Soil Profiles

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Bore # RB-11
 Reference CL3
 Station 122+48
 Offset -157
 Latitude 25.8880133
 Longitude -80.1443044
 Elevation 1.9'
 Vertical Datum NAVD88
 Date 5/2/2023
 Driller -
 Hammer Auto
 Rig CME-45

Bore # BB-04
 Reference CL3
 Station 123+79
 Offset 35
 Latitude 25.8874065
 Longitude -80.1440888
 Elevation 2.7'
 Vertical Datum NAVD88
 Date 3/28/2023
 Driller W. CADONO
 Hammer Auto
 Rig CME-45

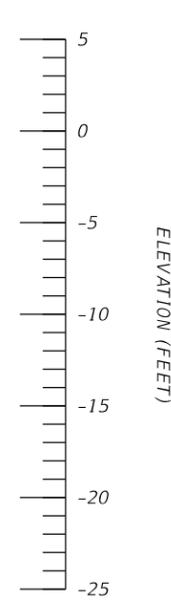
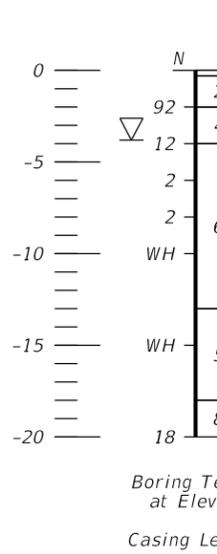
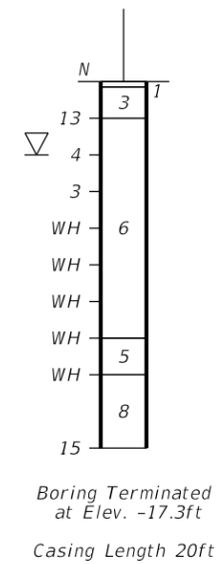
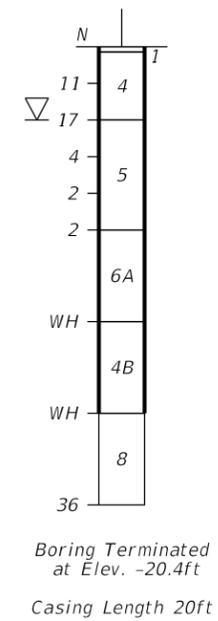
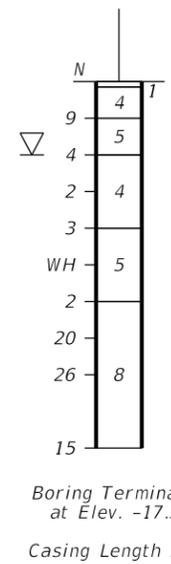
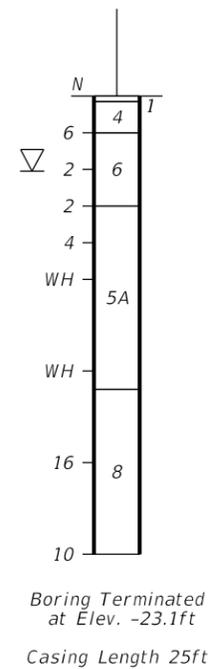
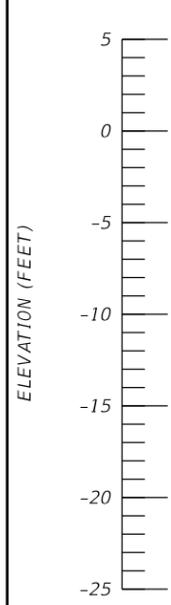
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 Station 140+71
 Offset -8
 Latitude 25.8864256
 Longitude -80.1390633
 Elevation 4.6'
 Vertical Datum NAVD88
 Date 5/2/2023
 Driller -
 Hammer Auto
 Rig CME-45

Bore # BB-12
 Reference CL3
 Station 140+71
 Offset 32
 Latitude 25.8863139
 Longitude -80.1390653
 Elevation 2.7'
 Vertical Datum NAVD88
 Date 3/29/2023
 Driller A. MILAN
 Hammer Auto
 Rig CME-45

Bore # WB-04
 Reference CL3
 Station 141+60
 Offset -52
 Latitude 25.8865506
 Longitude -80.1387998
 Elevation 3.3'
 Vertical Datum NAVD88
 Date 5/1/2023
 Driller C. CHARRI
 Hammer Auto
 Rig CME-45

LEGEND

1. TOPSOIL (A-8)
 2. BROWN SILTY FINE SAND WITH LIMEROCK (A-1-b)
 3. BROWN TO GRAY SAND (A-3)
 4. BROWN TO GRAY FINE SILTY SAND (A-2-4)
 5. GRAY TO DARK GRAY VERY SILTY SAND TO SANDY SILT TO SANDY CLAY (A-4/A-7-6)
 6. GRAY TO DARK GRAY SANDY SILT TO SANDY CLAY (A-7-5/A-7-6)
 7. DARK GRAY ORGANIC SANDY SILT (A-8)
 8. TAN SANDY LIMESTONE
- A WITH SHELL
 B SLIGHTLY ORGANIC
 A-3 AASHTO SOIL CLASSIFICATION GROUP SYMBOL AS DETERMINED BY VISUAL REVIEW AND/OR LABORATORY TESTING
- ▽ GROUNDWATER TABLE
 N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES OF PENETRATION (UNLESS OTHERWISE NOTED).
 HA HAND AUGER
 WH FELL UNDER WEIGHT OF ROD AND HAMMER
 ← LOSS OF CIRCULATION OF DRILLING FLUID (%)
 | CASING
 AREHNA PROJECT NO. B-22-074



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

REVISIONS				ENGINEER OF RECORD		TOWN OF BAY HARBOR ISLANDS			SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	ANGELA L. ALBA, P.E. LICENSE NUMBER: 58538 AREHNA ENGINEERING, INC. 12296 WILES ROAD CORAL SPRINGS, FL 33076		ROAD NO.	COUNTY	PROJECT ID	
						922	MIAMI-DADE	BC-160	

DATE OF SURVEY: MARCH & MAY 2023
 SURVEY MADE BY: AREHNA ENGINEERING, INC.
 SUBMITTED BY: ANGELA L. ALBA, P.E.

TOWN OF BAY HARBOR ISLANDS

DISTRICT: N/A
 ROAD NO.: 922
 COUNTY: MIAMI-DADE

PROJECT ID: BC-160
 PROJECT NAME: BROAD CAUSEWAY BRIDGE REPLACEMENT

CROSS SECTION SOIL SURVEY FOR THE DESIGN OF ROADS
 SURVEY BEGINS STA. : 100+00 SURVEY ENDS STA. : 154+26

REFERENCE: CL3

STRATUM NO.	ORGANIC CONTENT		MOISTURE CONTENT		SIEVE ANALYSIS RESULTS PERCENT PASS (%)					ATTERBERG LIMITS (%)				DESCRIPTION	CORROSION TEST RESULTS					
	NO. OF TESTS	% ORGANIC	NO. OF TESTS	MOISTURE CONTENT	NO. OF TESTS	10 MESH	40 MESH	60 MESH	100 MESH	200 MESH	NO. OF TESTS	LIQUID LIMIT	PLASTIC INDEX		AASHTO GROUP	NO. OF TESTS	RESISTIVITY ohm-cm	CHLORIDES ppm	SULFATES ppm	pH
1	--	--	--	--	--	--	--	--	--	--	--	--	--	A-8	TOPSOIL	--	--	--	--	--
2	--	--	9	10-48	9	42-77	32-49	23-38	14-30	8-20	1	NP	NP	A-1-b	BROWN SILTY FINE SAND WITH LIMEROCK	--	--	--	--	--
3	--	--	1	29	1	99	88	68	35	8	1	NP	NP	A-3	BROWN TO GRAY SAND	--	--	--	--	--
4	3	2-3	7	17-45	7	69-100	57-90	46-72	30-45	11-31	1	NP	NP	A-2-4	BROWN TO GRAY FINE SILTY SAND	--	--	--	--	--
5	1	0	11	44-122	11	83-100	67-96	63-92	57-87	45-81	2	41-NP	21-NP	A-4/A-7-6	GRAY TO DARK GRAY VERY SILTY SAND TO SANDY SILT TO SANDY CLAY	1	690	15	300	7.1
6	--	--	6	41-76	6	92-99	75-95	70-94	64-91	53-84	6	60-97	27-50	A-7-5/ A-7-6	GRAY TO DARK GRAY SANDY SILT TO SANDY CLAY	1	690	15	300	7.1
7	3	10-16	3	87-106	3	98	85-93	78-87	65-75	49-69	--	--	--	A-8	DARK GRAY ORGANIC SANDY SILT	--	--	--	--	--
8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	TAN SANDY LIMESTONE	--	--	--	--	--

EMBANKMENT AND SUBGRADE MATERIAL

STRATA BOUNDARIES ARE APPROXIMATE. MAKE FINAL CHECK AFTER GRADING.

- ▽ GROUNDWATER TABLE
- A WITH SHELL
- B SLIGHTLY ORGANIC

NOTES:

- THE MATERIAL FROM STRATUM 1 IS TOPSOIL (A-8) AND UNSUITABLE AND SHALL BE REMOVED IN ACCORDANCE WITH SECTION 120 OF THE SPECIFICATIONS.
- THE MATERIAL FROM STRATUM 3 (A-3) IS SELECT (S) AND APPEARS SATISFACTORY FOR USE IN THE EMBANKMENT WHEN UTILIZED IN ACCORDANCE WITH STANDARD PLANS, INDEX 120-001.
- THE MATERIAL FROM STRATUM 4 (A-2-4) IS SELECT (S) AND APPEARS SATISFACTORY FOR USE IN THE EMBANKMENT WHEN UTILIZED IN ACCORDANCE WITH STANDARD PLANS, INDEX 120-001. HOWEVER, THIS MATERIAL IS LIKELY TO RETAIN EXCESS MOISTURE AND MAY BE DIFFICULT TO DRY AND COMPACT. IT SHOULD BE USED IN THE EMBANKMENT ABOVE THE WATER LEVEL EXISTING AT THE TIME OF CONSTRUCTION.
- THE MATERIAL FROM STRATUM 5 IS PLASTIC (P) AND SHOULD BE REMOVED PER FDOT STANDARD PLANS INDEX 120-002. HOWEVER, DUE TO THE DEPTHS ENCOUNTERED, EXTENSIVE UTILITIES THROUGHOUT THE ALIGNMENT, AND POTENTIAL ENVIRONMENTAL CONCERNS REMOVAL IS IMPRACTICAL. ADDITIONAL RECOMMENDATIONS FOR GROUND IMPROVEMENTS IN LIEU OF REMOVAL OF PLASTIC MATERIAL WILL BE PROVIDED AFTER ADDITIONAL BORINGS ARE PERFORMED AND DESIGN IS ADVANCED.
- THE MATERIAL FROM STRATUM 6 IS HIGHLY PLASTIC (HP) AND SHOULD BE REMOVED PER FDOT STANDARD PLANS INDEX 120-002 WITHIN THE CONTROL LINE. HOWEVER, DUE TO THE DEPTHS ENCOUNTERED, EXTENSIVE UTILITIES THROUGHOUT THE ALIGNMENT, AND POTENTIAL ENVIRONMENTAL CONCERNS REMOVAL IS IMPRACTICAL. ADDITIONAL RECOMMENDATIONS FOR GROUND IMPROVEMENTS IN LIEU OF REMOVAL OF PLASTIC MATERIAL WILL BE PROVIDED AFTER ADDITIONAL BORINGS ARE PERFORMED AND DESIGN IS ADVANCED.
- THE MATERIAL FROM STRATUM 7 IS ORGANIC SILT (A-8) AND SHOULD BE REMOVED PER FDOT STANDARD PLANS INDEX 120-002. HOWEVER, DUE TO THE DEPTHS ENCOUNTERED, EXTENSIVE UTILITIES THROUGHOUT THE ALIGNMENT, AND POTENTIAL ENVIRONMENTAL CONCERNS REMOVAL IS IMPRACTICAL. ADDITIONAL RECOMMENDATIONS FOR GROUND IMPROVEMENTS IN LIEU OF REMOVAL OF ORGANIC MATERIAL WILL BE PROVIDED AFTER ADDITIONAL BORINGS ARE PERFORMED AND DESIGN IS ADVANCED.
- THE MATERIAL FROM STRATUM 8 CORRESPONDS TO A LIMESTONE FORMATION THAT TYPICALLY OFFERS HIGH RESISTANCE TO EXCAVATION. SPECIAL EQUIPMENT AND BREAKING TOOLS MAY BE REQUIRED TO EXCAVATE IT. IN SHEETPILE WORK THIS MATERIAL WILL TYPICALLY REQUIRE PREDRILLING TO ASSIST IN OBTAINING THE REQUIRED PENETRATION. THIS MATERIAL IS ALSO DIFFICULT TO DEWATER DUE TO ITS HIGH POROSITY AND PERMEABILITY.

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REVISIONS			ENGINEER OF RECORD			TOWN OF BAY HARBOR ISLANDS			SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	DATE	DESCRIPTION	ROAD NO.	COUNTY	PROJECT ID	
						922	MIAMI-DADE	BC-160	

Roadway Soil Survey

TABLE A.1. Summary of Exfiltration Test Results
Usual Open-Hole - FDOT Method
Broad Causeway Bridge Replacement
FLORIDA DEPARTMENT OF TRANSPORTATION - DISTRICT 4
AREHNA Project No. B-22-074

Prepared by/Date: Checked by/Date:

Test No.	Test Date	Station	Offset (ft)	Depth to Water Before Test (ft)	Depth to Water During Test (ft)	HEAD, H ₂ (ft)	Borehole Depth (ft)	Hole Diameter d (inches)	RATE OF FLOW, Q		k, Hydraulic Conductivity (cfs/ft ² -ft. Head)
									gpm	cfs	
P-1 (A)	03/22/23	108+41	-21.0	4.50	0.00	4.50	10.00	2.00	2.25	0.00501	2.7E-04
P-1 (B)	03/22/23	108+41	-21.0	4.50	0.00	4.50	15.00	2.00	3.20	0.00713	6.1E-04
P-1 (C)	09/21/23	108+41	-21.0	5.70	0.00	5.70	20.00	3.00	0.74	0.00165	7.4E-05
P-2 (A)	03/22/23	118+48	2.0	5.00	0.00	5.00	10.00	2.00	2.55	0.00568	2.9E-04
P-2 (B)	03/22/23	118+48	2.0	5.00	0.00	5.00	15.00	2.00	2.95	0.00657	5.0E-04
P-2 (C)	09/21/23	118+48	2.0	5.30	0.00	5.30	20.00	3.00	0.82	0.00183	8.8E-05
P-3 (A)	03/22/23	140+68	-16.0	1.30	0.00	1.30	10.00	2.00	0.07	0.00016	2.5E-05
P-3 (B)	03/22/23	140+68	-16.0	1.30	0.00	1.30	15.00	2.00	0.09	0.00020	5.9E-05
P-3 (C)	09/22/23	140+68	-16.0	4.00	0.00	4.00	20.00	3.00	1.30	0.00290	1.8E-04

In general, K =

for 0 to 10 ft., $K_{10} = Q / [\pi * d * H_2 \{ H_2/2 + D_s \}]$, where $D_s = \text{Hole Depth} - H_2$

for 10 to 15 ft., $K_{15} = Q / [\pi * d * L * H_2]$, where $d = \text{diameter of perforated casing}$, and $L = 5.0 \text{ ft.}$

for 15 to 20 ft., $K_{20} = Q / [\pi * d * L * H_2]$, where $d = \text{diameter of perforated casing}$, and $L = 5.0 \text{ ft.}$

Notes:

1. Due to the subsurface soil conditions (fill, sandy, silty, organic layers), we recommend to use a temporary retaining system to support the French drain excavations and minimize damage to the nearby underground utilities.
2. The above hydraulic conductivity is for a trench drain installed to the same depth as the borehole seepage test.
3. The hydraulic conductivity is expressed as inflow per foot of head per linear foot of trench.
4. The designer should decide on the required factor of safety.

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-01A

Date:	3/22/2023	Broad Causeway			
Project No.:	B-22-074	Prepared by/ Date:	AT 5/8/2023		
Driller:	M. Seibert	Checked by/ Date:	ALA 11/8/2023		
Borehole Geometry					
Borehole Diameter:	4.0 (inches)	Solid Casing Depth:	- (feet) to - (feet)		
Casing Diameter:	2.0 (inches)	Perforated Casing Depth:	0.0 (feet) to 10.0 (feet)		
Borehole Depth:	10.0 (feet)	Groundwater Depth:	4.5 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	3.0	19.0
1.0	4.0	4.0	9.0	2.0	21.0
2.0	2.0	6.0	10.0	1.5	22.5
3.0	2.0	8.0			
4.0	2.0	10.0			
5.0	2.0	12.0			
6.0	2.2	14.2			
7.0	1.8	16.0			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	2.0	Gray Silty SAND (SM)		
2	2.0	15.0	Dark Gray Sandy SILT (MH)		
3	15.0	20.0	Light Gray Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-01B

Date:	3/22/2023	Broad Causeway			
Project No.:	B-22-074				
Driller:	M. Seibert	Prepared by/ Date:	AT	5/8/2023	
		Checked by/ Date:	ALA	11/8/2023	
Borehole Geometry					
Borehole Diameter:	4.0 (inches)	Solid Casing Depth:	0.0 (feet) to 10.0 (feet)		
Casing Diameter:	2.0 (inches)	Perforated Casing Depth:	10.0	15.0	10.0 (feet)
Borehole Depth:	15.0 (feet)	Groundwater Depth:	4.5 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	2.6	27.0
1.0	3.6	3.6	9.0	2.5	29.5
2.0	2.9	6.5	10.0	2.5	32.0
3.0	4.9	11.4			
4.0	5.2	16.6			
5.0	2.7	19.3			
6.0	2.5	21.8			
7.0	2.6	24.4			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	2.0	Gray Silty SAND (SM)		
2	2.0	15.0	Dark Gray Sandy SILT (MH)		
3	15.0	20.0	Light Gray Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-01C

Date:	9/21/2023	Broad Causeway			
Project No.:	B-22-074				
Driller:	C. Charri	Prepared by/ Date:	RR	10/6/2023	
		Checked by/ Date:	TC	10/12/2023	
Borehole Geometry					
Borehole Diameter:	6.0 (inches)	Solid Casing Depth:	0.0 (feet) to 15.0 (feet)		
Casing Diameter:	3.0 (inches)	Perforated Casing Depth:	15.0 (feet) to 20.0 (feet)		
Borehole Depth:	20.0 (feet)	Groundwater Depth:	5.7 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	0.6	6.2
1.0	1.5	1.5	9.0	0.6	6.8
2.0	1.0	2.5	10.0	0.6	7.4
3.0	0.8	3.3			
4.0	0.5	3.8			
5.0	0.6	4.4			
6.0	0.8	5.1			
7.0	0.5	5.6			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	2.0	Gray Silty SAND (SM)		
2	2.0	15.0	Dark Gray Sandy SILT (MH)		
3	15.0	20.0	Light Gray Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-02A

Date:	3/22/2023	Broad Causeway			
Project No.:	B-22-074				
Driller:	M. Seibert	Prepared by/ Date:	AT	5/8/2023	
		Checked by/ Date:	ALA	11/8/2023	
Borehole Geometry					
Borehole Diameter:	4.0 (inches)	Solid Casing Depth:	- (feet) to -	(feet)	
Casing Diameter:	2.0 (inches)	Perforated Casing Depth:	0.0 (feet) to 10.0	(feet)	
Borehole Depth:	10.0 (feet)	Groundwater Depth:	5.0 (feet)	(measured from ground surface)	
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet)	(measured from ground surface)	
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	3.0	20.2
1.0	2.0	2.0	9.0	2.5	22.7
2.0	2.0	4.0	10.0	2.7	25.4
3.0	2.1	6.1			
4.0	3.9	10.0			
5.0	2.2	12.2			
6.0	2.6	14.8			
7.0	2.4	17.2			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	0.3	Gray to Dark Gray Fine SAND with trace Limerock (SP)		
2	0.3	2.0	Brown Fine SAND with trace shell fragments (SP)		
3	4.0	6.0	Brown Sandy SILT (MH)		
4	6.0	8.0	Light Brown Shelly Fine SAND (SP)		
5	8.0	10.0	Gray Shelly Sandy SILT (ML)		
6	10.0	15.0	Gray to Dark Gray SILT with Limestone (ML)		
7	15.0	20.0	Light Gray Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-02B

Date:	3/22/2023	Broad Causeway			
Project No.:	B-22-074				
Driller:	M. Seibert	Prepared by/ Date:	AT	5/8/2023	
		Checked by/ Date:	ALA	11/8/2023	
Borehole Geometry					
Borehole Diameter:	4.0 (inches)	Solid Casing Depth:	0.0 (feet) to 10.0 (feet)		
Casing Diameter:	2.0 (inches)	Perforated Casing Depth:	10.0 (feet) to 15.0 (feet)		
Borehole Depth:	10.0 (feet)	Groundwater Depth:	5.0 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	3.0	24.0
1.0	3.8	3.8	9.0	2.5	26.5
2.0	2.7	6.5	10.0	3.0	29.5
3.0	3.0	9.5			
4.0	3.0	12.5			
5.0	3.0	15.5			
6.0	3.0	18.5			
7.0	2.5	21.0			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	0.3	Topsoil		
2	0.3	2.0	Brown Fine SAND with trace shell fragments (SP)		
3	4.0	6.0	Brown Sandy SILT (MH)		
4	6.0	8.0	Light Brown Shelly Fine SAND (SP)		
5	8.0	10.0	Gray Shelly Sandy SILT (ML)		
6	10.0	15.0	Gray to Dark Gray SILT with Limestone (ML)		
7	15.0	20.0	Light Gray Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-02C

Date:	9/21/2023	Broad Causeway			
Project No.:	B-22-074				
Driller:	C. Charri	Prepared by/ Date:	RR	10/6/2023	
		Checked by/ Date:	TC	10/12/2023	
Borehole Geometry					
Borehole Diameter:	6.0 (inches)	Solid Casing Depth:	0.0 (feet) to 15.0 (feet)		
Casing Diameter:	3.0 (inches)	Perforated Casing Depth:	15.0 (feet) to 20.0 (feet)		
Borehole Depth:	20.0 (feet)	Groundwater Depth:	5.3 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	0.8	6.5
1.0	1.0	1.0	9.0	0.9	7.4
2.0	0.9	1.9	10.0	0.8	8.2
3.0	0.6	2.5			
4.0	0.8	3.3			
5.0	0.9	4.2			
6.0	0.8	5.0			
7.0	0.7	5.7			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	0.3	Topsoil		
2	0.3	2.0	Brown Fine SAND with trace shell fragments (SP)		
3	4.0	6.0	Brown Sandy SILT (MH)		
4	6.0	8.0	Light Brown Shelly Fine SAND (SP)		
5	8.0	10.0	Gray Shelly Sandy SILT (ML)		
6	10.0	15.0	Gray to Dark Gray SILT with Limestone (ML)		
7	15.0	20.0	Light Gray Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-03A

Date:	3/22/2023	Broad Causeway			
Project No.:	B-22-074	Prepared by/ Date:	AT 5/8/2023		
Driller:	M. Seibert	Checked by/ Date:	ALA 11/8/2023		
Borehole Geometry					
Borehole Diameter:	4.0 (inches)	Solid Casing Depth:	- (feet) to - (feet)		
Casing Diameter:	2.0 (inches)	Perforated Casing Depth:	0.0 (feet) to 10.0 (feet)		
Borehole Depth:	10.0 (feet)	Groundwater Depth:	1.3 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	6.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	0.10	0.55
1.0	0.10	0.10	9.0	0.05	0.60
2.0	0.10	0.20	10.0	0.05	0.65
3.0	0.05	0.25			
4.0	0.05	0.30			
5.0	0.05	0.35			
6.0	0.05	0.40			
7.0	0.05	0.45			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	4.0	Gray Fine SAND (SP)		
2	4.0	20.0	Gray Sandy SILT (MH)		
3	20.0	25.0	Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-03B

Date:	3/22/2023	Broad Causeway			
Project No.:	B-22-074				
Driller:	M. Seibert	Prepared by/ Date:	AT	5/8/2023	
		Checked by/ Date:	ALA	11/8/2023	
Borehole Geometry					
Borehole Diameter:	4.0 (inches)	Solid Casing Depth:	0.0 (feet) to 10.0 (feet)		
Casing Diameter:	2.0 (inches)	Perforated Casing Depth:	10.0 (feet) to 15.0 (feet)		
Borehole Depth:	10.0 (feet)	Groundwater Depth:	1.3 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	0.15	0.65
1.0	0.05	0.05	9.0	0.10	0.75
2.0	0.05	0.10	10.0	0.15	0.90
3.0	0.05	0.15			
4.0	0.10	0.25			
5.0	0.05	0.30			
6.0	0.10	0.40			
7.0	0.10	0.50			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	4.0	Gray Fine SAND (SP)		
2	4.0	20.0	Gray Sandy SILT (MH)		
3	20.0	25.0	Sandy Limestone		

SFWMD Percolation Test – Constant Head

Percolation Test No.: P-03C

Date:	9/22/2023	Broad Causeway			
Project No.:	B-22-074				
Driller:	C. Charri	Prepared by/ Date:	RR	10/6/2023	
		Checked by/ Date:	TC	10/12/2023	
Borehole Geometry					
Borehole Diameter:	6.0 (inches)	Solid Casing Depth:	0.0 (feet) to 15.0 (feet)		
Casing Diameter:	3.0 (inches)	Perforated Casing Depth:	15.0 (feet) to 20.0 (feet)		
Borehole Depth:	20.0 (feet)	Groundwater Depth:	4.0 (feet) (measured from ground surface)		
Percolation Test Data					
Flushing Period:	10.0 minutes	Groundwater Depth during testing:	0.0 (feet) (measured from ground surface)		
Test Results					
Time	Meter Reading		Time	Meter Reading	
(minutes)	Meter Reading	Gallons (Accumulated)	(minutes)	Meter Reading	Gallons (Accumulated)
Initial Reading	0.0	0.0	8.0	1.20	10.80
1.0	1.60	1.60	9.0	1.20	12.00
2.0	1.60	3.20	10.0	1.10	13.10
3.0	1.40	4.60			
4.0	1.40	6.00			
5.0	1.20	7.20			
6.0	1.20	8.40			
7.0	1.20	9.60			
Boring Information					
Sample No.	Depth (feet)		Soil/Rock Description		
	From	To			
1	0.0	4.0	Gray Fine SAND (SP)		
2	4.0	20.0	Gray Sandy SILT (MH)		
3	20.0	25.0	Sandy Limestone		

APPENDIX B

Summary of USDA Soil Survey – Table 1

Summary of Laboratory Test Results – Table 2

Summary of USDA Soil Survey – Table 2

Summary of Corrosion Test Results – Table 3

Summary of Seasonal High Water Table Estimate – Table 4

Summary of Pavement Core Conditions Table 5

Pavement Core Photographs

Laboratory Test Results

**TABLE 1
SUMMARY OF USDA SOIL SURVEY
BROAD CAUSEWAY ROADWAY PD&E STUDY
TOWN OF BAY HARBOR ISLANDS, FLORIDA
AREHNA Project Number: B-22-074**

Soil Unit Number	USDA Soil Type	Depth (inches)	USDA Soil Description	AASHTO	USCS	Permeability (in/hr)	Seasonal High Groundwater			Risk of Corrosion	
							Depth (feet)	Duration (months)	Kind	Steel	Concrete
9	Udorthents-Water-Urban land complex, 0 to 60 percent slopes	0 - 10	Very gravelly loam	GC, GM	A-1-b, A-2-6, A-6	6 to 10	5.0 - 6.0	May - Dec	Apparent	Moderate	Low
		10 - 80	Extremely gravelly loam	GC-GM, GC, GW	A-1-a, A-2-4, A-6						
15	Urban land, 0 to 2 percent slopes	-	-	-	-	-	-	-	-	-	-

NOTE: Urban land is altered land, which typically contains fill soils. The depth of the water table is dependent on the thickness of fill material at each site.

TABLE 2
SUMMARY OF LABORATORY TEST RESULTS
BROAD CAUSEWAY ROADWAY PD&E STUDY
TOWN OF BAY HARBOR ISLANDS, FLORIDA
AREHNA Project Number: B-22-074

Boring No.	Sample Depth (feet)	AASHTO	Sieve Analysis (% Passing)						Atterberg Limits			Organic Content (%)	Natural Moisture Content (%)
			#4	#10	#40	#60	#100	#200	LL	PL	PI		
Stratum 2: A-1-b													
RB-02	2.0 - 4.0	A-1-b	82	69	36	27	21	14	-	-	-	-	32
WB-01	4.0 - 6.0	A-1-b	84	72	39	30	23	16	-	-	-	-	37
WB-01	13.5 - 15	A-1-b	51	42	33	28	21	14	NP	NP	NP	-	23
RB-04	2.0 - 4.0	A-1-b	72	62	40	27	18	12	-	-	-	-	10
WB-02	4.0 - 6.0	A-1-b	86	76	45	28	14	8	-	-	-	-	26
WB-02	8.0 - 10	A-1-b	73	60	32	23	16	11	-	-	-	-	30
BB-02	2.0 - 4.0	A-1-b	84	74	49	38	24	16	-	-	-	-	19
RD-02	8.0 - 10	A-1-b	82	72	45	38	30	20	-	-	-	-	48
Stratum 3: A-3													
WB-03	13.5 - 15	A-3 / SP-SM	100	99	88	68	35	8	NP	NP	NP		29
Stratum 4: A-2-4													
RB-07	2.0 - 4.0	A-2-4	92	86	67	55	37	24	-	-	-	-	18
BB-02	12.0 - 14.0	A-2-4	100	100	90	72	41	17	-	-	-	2	23
RB-08	2.0 - 4.0	A-2-4	84	80	71	60	35	24	-	-	-	-	17
WB-03	18.5 - 20	A-2-4	76	69	57	46	30	17	NP	NP	NP	-	28
BB-04	4.0 - 6.0	A-2-4	90	82	61	50	39	28	-	-	-	-	45

Boring No.	Sample Depth (feet)	AASHTO	Sieve Analysis (% Passing)						Atterberg Limits			Organic Content (%)	Natural Moisture Content (%)
			#4	#10	#40	#60	#100	#200	LL	PL	PI		
BB-04	6.0 - 8.0	A-2-4	95	88	73	62	45	31	-	-	-	2	43
RD-03	18.5 - 20	A-2-4	-	-	-	-	-	11	-	-	-	3	41
Stratum 5: A-4/A-7-6													
RB-01	2.0 - 4.0	A-4	88	83	67	63	57	51	-	-	-	-	122
RB-01	6.0 - 8.0	A-4	100	98	92	89	83	74	-	-	-	-	82
RB-03	4.0 - 6.0	A-4	100	96	83	74	62	45	-	-	-	-	49
RD-01	2.0 - 4.0	A-4	100	96	86	80	66	50	-	-	-	-	60
RD-01	4.0 - 6.0	A-4	-	100	96	92	85	70	-	-	-	-	49
RB-05	0.0 - 2.0	A-4	100	99	94	89	78	59	-	-	-	-	44
RB-05	4.0 - 6.0	A-4	-	100	94	91	87	81	-	-	-	-	107
BB-01	10 - 12	A-4	98	94	81	74	66	51					67
RB-10	8.0 - 10	A-4	100	99	89	80	67	45	NP	NP	NP	-	48
BB-12	14 - 16	A-4	94	88	73	68	62	50	-	-	-	-	47
WB-04	13.5 - 15	A-7-6	99	96	87	84	80	71	41	20	21	0.4	44
Stratum 6 : A-7-5/A-7-6													
RB-02	6.0 - 8.0	A-7-5	-	-	-	-	-	69	80	42	38	-	74
RB-08	8.0 - 10	A-7-5	-	-	-	-	-	74	97	47	50	-	76
RB-11	4.0 - 6.0	A-7-5	-	-	-	-	-	75	78	45	33	-	68
RD-03	13.5 - 15	A-7-5	-	-	-	-	-	53	78	34	44	-	69

Boring No.	Sample Depth (feet)	AASHTO	Sieve Analysis (% Passing)						Atterberg Limits			Organic Content (%)	Natural Moisture Content (%)
			#4	#10	#40	#60	#100	#200	LL	PL	PI		
BB-12	4.0 - 6.0	A-7-5	98	92	75	70	64	53	75	37	38		41
WB-04	4.0 - 6.0	A-7-6	100	99	95	94	91	84	60	33	27	-	68
Stratum 7 : A-8													
RB-03	6.0 - 8.0	A-8	-	-	-	-	-	69	-	-	-	16	106
BB-01	4.0 - 6.0	A-8	100	98	85	78	65	49	-	-	-	10	87
WB-03	4.0 - 6.0	A-8	100	98	93	87	75	58	-	-	-	11	100

TABLE 3
SUMMARY OF CORROSION TEST RESULTS
BROAD CAUSEWAY ROADWAY PD&E STUDY
TOWN OF BAY HARBOR ISLANDS, FLORIDA
AREHNA Project Number: B-22-074

Boring No.	Sample Type	Sample Depth (feet)	AASHTO Symbol	pH	Resistivity (ohm-cm)	Chlorides (ppm)	Sulfates (ppm)	FDOT Substructure Environmental Classification - Steel	FDOT Substructure Environmental Classification - Concrete
RB-05	Soil	4.0 - 6.0	A-4/A-7-5	7.1	690	15	300	Extremely	Moderately
CS - 1	Water	-	-	7.9	26	49950	330	Extremely	Extremely

TABLE 4
SUMMARY OF SEASONAL HIGH WATER TABLE ESTIMATE
BROAD CAUSEWAY ROADWAY PD&E STUDY
TOWN OF BAY HARBOR ISLANDS, FLORIDA
AREHNA Project Number: B-22-074

Boring Name	State Plane Coordinates Florida East NAD 83 ⁽¹⁾		Ground Elevation ⁽²⁾⁽⁵⁾ (feet)	Boring Depth (Feet)	Measured Groundwater Table			USDA Soil Survey		Estimated Seasonal High Water Table
	Easting	Northing			Date Recorded	Depth ⁽³⁾ (feet)	Approximate Groundwater Elevation (feet)	Map Symbol	Estimated SHGWT ⁽⁴⁾ Depth (feet)	Elevation (feet, NAVD 88)
BB-01	936403.3	566037.2	4.9	20	3/22/2023	4.9	0.0	9	5.0	1.0
BB-02	937085.9	565781.5	3.8	20	3/21/2023	3.6	0.2	9	5.0	1.2
BB-03	937000.0	565750.5	4.6	20	3/24/2023	4.8	-0.2	9	5.0	0.8
BB-04	937564.9	565685.8	2.7	20	3/28/2023	4.0	-1.3	9	5.0	-0.3
BB-12	939219.1	565299.5	2.7	20	3/29/2023	4.0	-1.3	9	5.0	-0.3
RB-01	935914.5	566149.3	2.6	20	3/20/2023	3.3	-0.7	9	5.0	0.3
RB-02	935999.9	566256.9	2.5	20	5/2/2023	3.8	-1.3	9	5.0	-0.3
RB-03	936037.7	566185.6	5.5	6	3/22/2023	GNA	-	9	5.0	0.5
RB-04	936213.1	566230.8	4.9	20	5/2/2023	5.0	-0.1	9	5.0	0.9
RB-05	936235.2	566078.3	4.9	6	3/22/2023	GNA	-	9	5.0	0.0
RB-06	936303.7	565998.7	4.9	6	3/20/2023	5.0	-0.1	9	5.0	0.9
RB-07	936620.0	566151.8	4.9	20	5/2/2023	4.0	0.9	9	5.0	0.9
RB-08	936834.6	566087.6	4.2	20	5/2/2023	5.5	-1.3	9	5.0	-0.3
RB-09	937027.4	566040.8	0.9	6	5/2/2023	1.8	-0.9	9	5.0	0.1
RB-10	937492.5	565905.9	2.8	20	5/2/2023	5.2	-2.4	9	5.0	-1.4
RB-11	937491.6	565910.1	1.9	25	5/2/2023	4.1	-2.2	9	5.0	-1.2
RD-01	936125.6	566130.2	5.6	20	3/22/2023	4.5	1.1	9	5.0	1.1
RD-02	937062.5	565853.1	4.7	20	3/20/2023	5.0	-0.3	9	5.0	0.7

TABLE 4
SUMMARY OF SEASONAL HIGH WATER TABLE ESTIMATE
BROAD CAUSEWAY ROADWAY PD&E STUDY
TOWN OF BAY HARBOR ISLANDS, FLORIDA
AREHNA Project Number: B-22-074

Boring Name	State Plane Coordinates Florida East NAD 83 ⁽¹⁾		Ground Elevation ⁽²⁾⁽⁵⁾ (feet)	Boring Depth (Feet)	Measured Groundwater Table			USDA Soil Survey		Estimated Seasonal High Water Table
	Easting	Northing			Date Recorded	Depth ⁽³⁾ (feet)	Approximate Groundwater Elevation (feet)	Map Symbol	Estimated SHGWT ⁽⁴⁾ Depth (feet)	Elevation (feet, NAVD 88)
RD-03	939219.5	565340.1	4.6	20	5/2/2023	4.0	0.6	9	5.0	0.6
WB-01	936115.1	566068.1	4.0	20	3/20/2023	4.0	0.0	9	5.0	1.0
WB-02	936558.7	565939.7	4.3	20	3/21/2023	5.0	-0.7	9	5.0	0.3
WB-03	936812.5	565956.6	5.2	20	3/21/2023	5.4	-0.2	9	5.0	0.8
WB-04	939305.8	565386.1	3.3	20	5/1/2023	3.8	-0.5	9	5.0	0.5

- (1) Coordinates of the boring locations are based on survey data provided by FR-Aleman on 9/26/23.
(2) Approximate ground elevations provided provided by FR-Aleman on 9/26/23.
(3) Depth below existing grade at time of field work.
(4) Seasonal high water table depth per Miami-Dade County, Florida USDA Soil Survey information.
(5) GNA: Groundwater table not encountered within the first 10 feet of the boring.

TABLE 5
SUMMARY OF PAVEMENT CORE CONDITIONS
 BROAD CAUSEWAY DRAWBRIDGE
 TOWN OF BAY HARBOR ISLANDS, FLORIDA
 AREHNA Project No. B-22-074

Core No.	Date	Lane	Wheel Path (Y/N)	Pavement Layer Thickness			Total Pavement Thickness (in)	Base Thickness (in)	Base Material Type	Crack		Pavement Condition	Rut Depth (in.)	Cross Slope (%)	Comments
				Layer 1 (FC-9.5)	Layer 2 (SP-9.5)	Layer 3 (S)				Depth	Full Depth				
PC-01	10/30/2023	R2	N	1.2	1.4	1.3	3.9	6	LR	-	N	G	-	1.7	SG: A-1-b
PC-02	10/30/2023	L2	N	1.0	0.9	1.4	3.3	8	LR	-	N	G	-	1.1	Could not obtain sample of SG due to amount of Limerock

LR = Limerock Base Material



PAVEMENT CORE	ASPHALT THICKNESS (in)	LIMEROCK BASE THICKNESS (in)
PC-01	3.9	6

Broad Causeway Drawbridge
Town of Bay Harbor Islands, Florida

AREHNA Engineering, Inc.

PAVEMENT CORES

Client: Atkins North America, Inc.
AREHNA Project No.: B-22-074
Date: October 30, 2023

5012 West Lemon Street Tampa, FL 33609
Phone 813.944.3464 ▪ Fax 813.944.4959

Checked By: AT
Drawn By: TC



PAVEMENT CORE	ASPHALT THICKNESS (in)	LIMEROCK BASE THICKNESS (in)
PC-02	3.3	8

Broad Causeway Drawbridge
Town of Bay Harbor Islands, Florida

AREHNA Engineering, Inc.

PAVEMENT CORES

Client: Atkins North America, Inc.
AREHNA Project No.: B-22-074
Date: October 30, 2023

5012 West Lemon Street Tampa, FL 33609
Phone 813.944.3464 ▪ Fax 813.944.4959

Checked By: AT
Drawn By: TC



Before



After

Broad Causeway Drawbridge
Town of Bay Harbor Islands, Florida

AREHNA Engineering, Inc.

PAVEMENT CORES

Client: Atkins North America, Inc.
AREHNA Project No.: B-22-074
Date: October 30, 2023

5012 West Lemon Street Tampa, FL 33609
Phone 813.944.3464 ■ Fax 813.944.4959

Checked By: AT
Drawn By: TC



Before



After

Broad Causeway Drawbridge
Town of Bay Harbor Islands, Florida

AREHNA Engineering, Inc.

PAVEMENT CORES

Client: Atkins North America, Inc.
AREHNA Project No.: B-22-074
Date: October 30, 2023

5012 West Lemon Street Tampa, FL 33609
Phone 813.944.3464 ■ Fax 813.944.4959

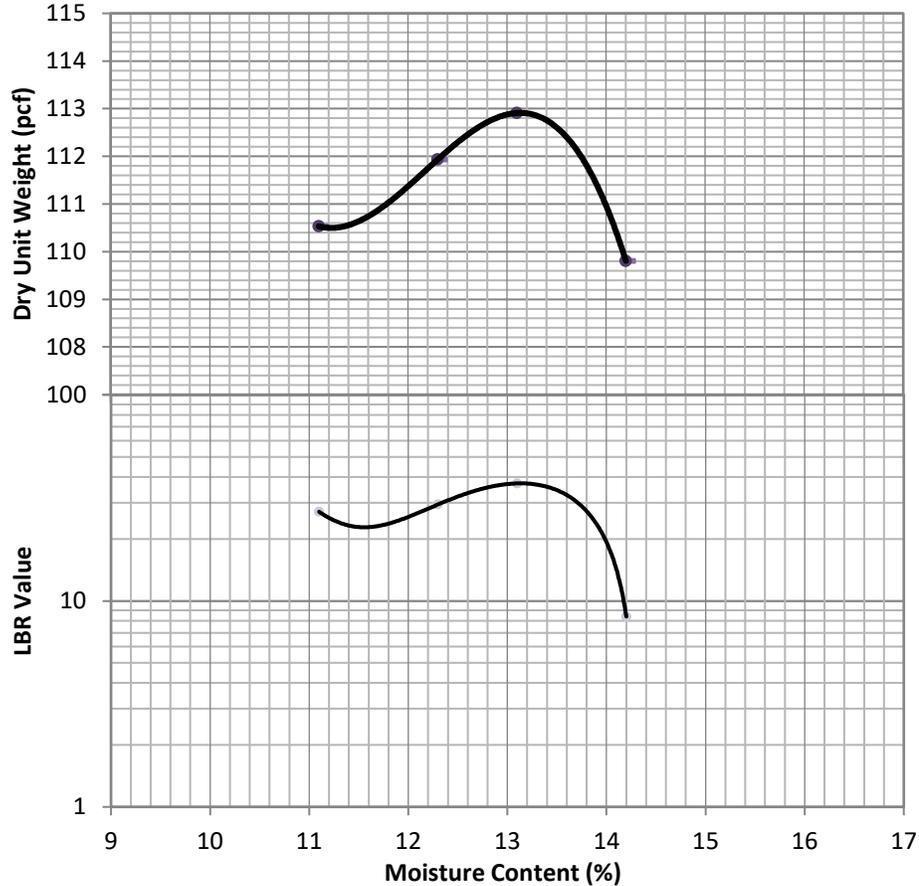
Checked By: AT
Drawn By: TC

Laboratory Test Report

Project Name: Broad Causeway Bridge
 Client: Atkins
 AREHNA Project No.: B-22-074

Sample No.: LBR-01
 Lab No.: AS3665

Limerock Bearing Ratio Test (FDOT FM5-515 D)



Material Information

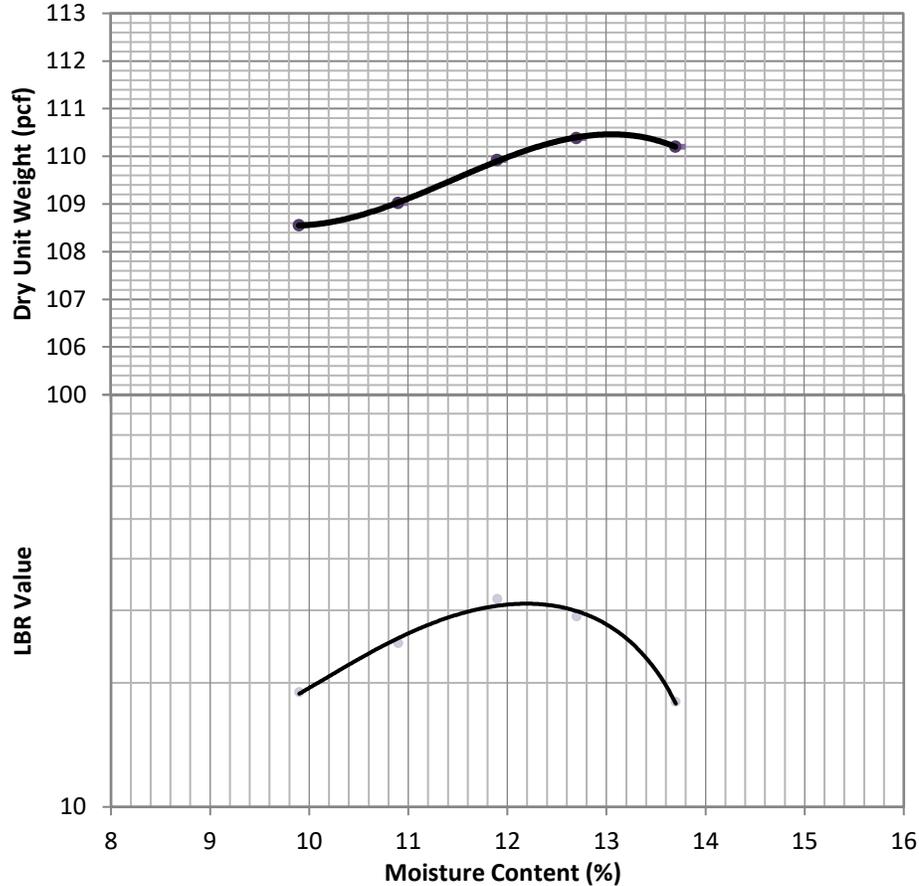
Tested By: Brown, B. % passing #4 Sieve: 74.9
 Max. Dry Density: 112.9 pcf
 Optimum Moisture: 13.1 %
 LBR Value: 37
 Sample Date: 05/24/2023
 Sample Location: Boring No. RB - 01
 Sample Description: Light Brown Sand with Rock

Laboratory Test Report

Project Name: Bay Harbor Broad Causeway Bridge
 Client: Atkins
 AREHNA Project No.: B-22-074

Sample No.: LBR-02
 Lab No.: AS3667

Limerock Bearing Ratio Test (FDOT FM5-515 D)



Material Information

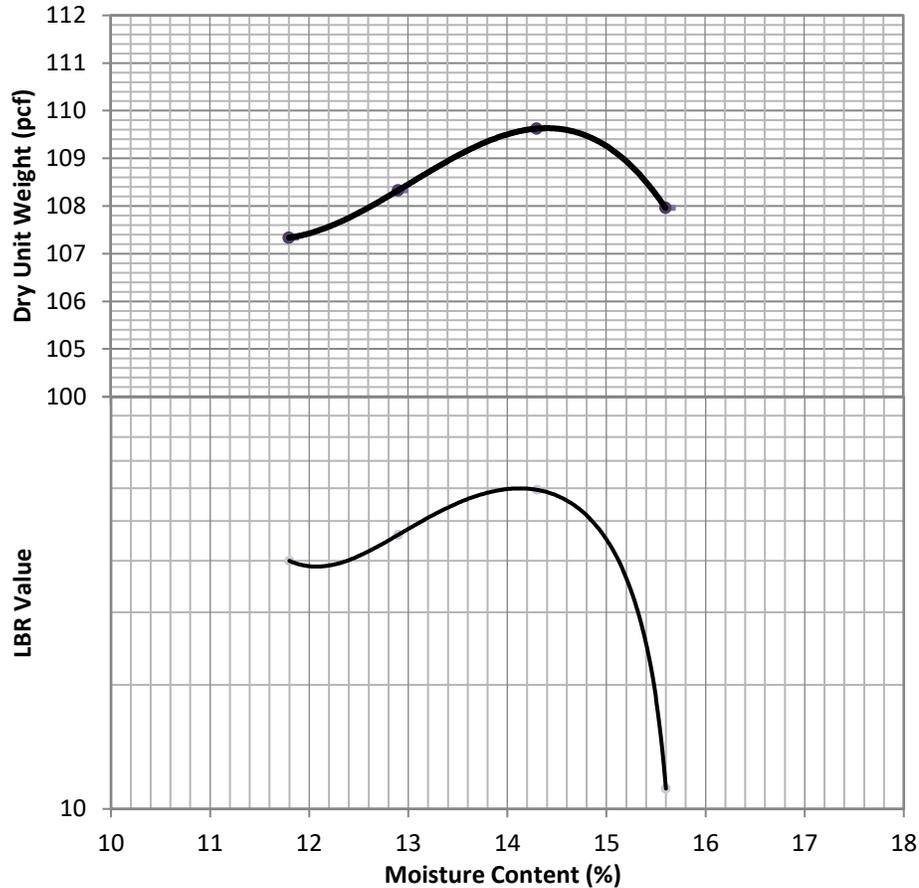
Tested By: Brown, B.	% passing 3.5" Sieve: 100
Max. Dry Density: 110.5 pcf	% passing #4 Sieve: 73.9
Optimum Moisture: 13.1 %	
LBR Value: 31	
Sample Date: 05/24/2023	
Sample Location: Boring No. RB - 05	
Sample Description: Light Brown Sand with Rock	

Laboratory Test Report

Project Name: Broad Causeway Bridge
 Client: Atkins
 AREHNA Project No.: B-22-074

Sample No.: LBR-03
 Lab No.: AS3668

Limerock Bearing Ratio Test (FDOT FM5-515 D)



Material Information

Tested By: Brown, B.	% passing 3.5" Sieve: 100
Max. Dry Density: 109.6 pcf Optimum	% passing #4 Sieve: 77.5
Moisture: 14.4 %	
LBR Value: 60	
Sample Date: 05/24/2023	
Sample Location: Boring No. RB - 09	
Sample Description: Light Brown Sand with limerock	

AREHNA Engineering, Inc.

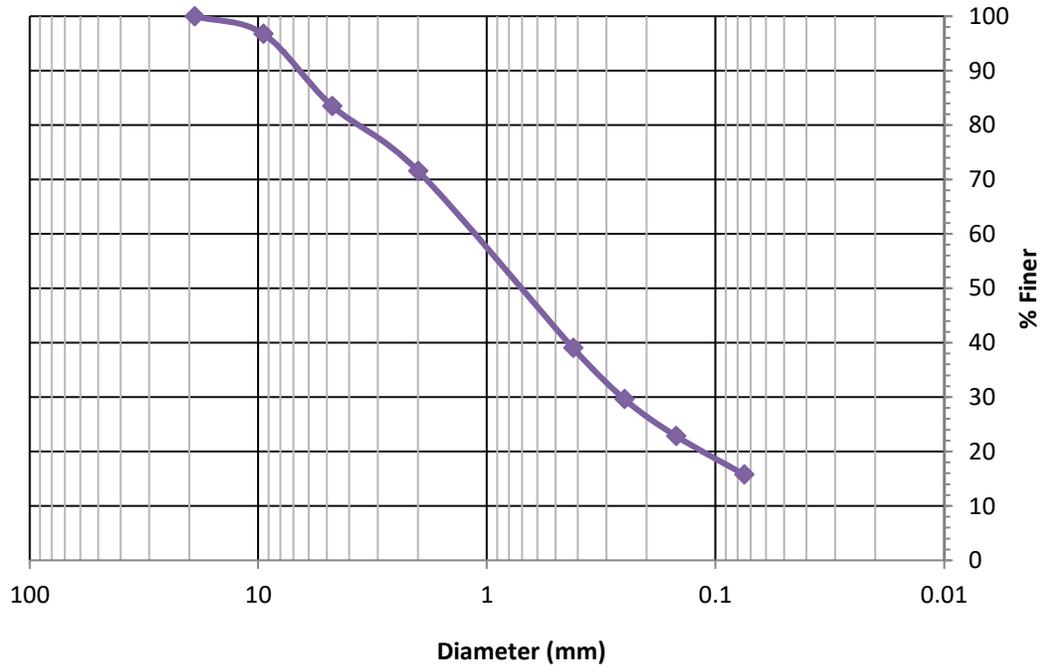
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	96.8
#4	4.76	83.5
#10	2.0	71.6
#40	0.42	39.1
#60	0.25	29.6
#100	0.149	22.9
#200	0.075	15.8

Material Information

Soil Classification: D50: 0.952 mm
AASHTO: A-1-b
Unified: SM
Natural Moisture: 37.4

Boring No.: WB-01
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Brown Silty Sand Some Shells

AREHNA Engineering, Inc.

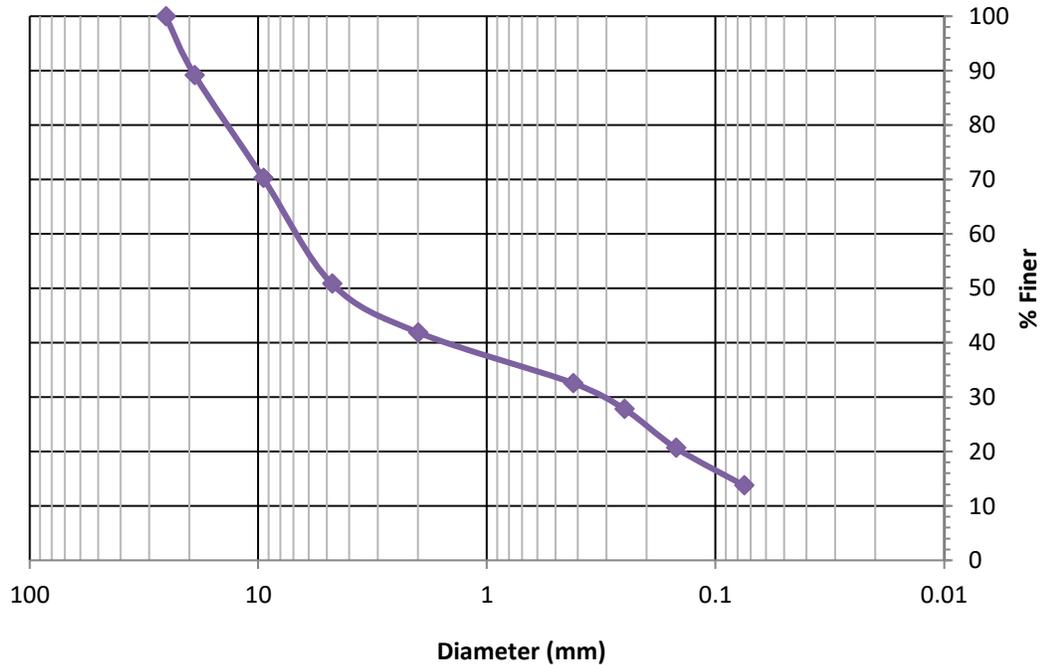
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
1"	25.4	100.0
3/4"	19.0	89.2
3/8"	9.51	70.3
#4	4.76	50.9
#10	2.0	41.9
#40	0.42	32.6
#60	0.25	27.8
#100	0.149	20.7
#200	0.075	13.8

Material Information

Soil Classification:
AASHTO: A-1-b
Unified: SM
Natural Moisture: 22.8

D50: 4.678 mm

Liquid Limit: NP
Plastic Limit: NP
Plasticity Index: NP

Boring No.: WB-01
Sample No.:
Depth: 13.5 - 15
Soil Description: Brown Silty Sand With Few Limestone Fragments

AREHNA Engineering, Inc.

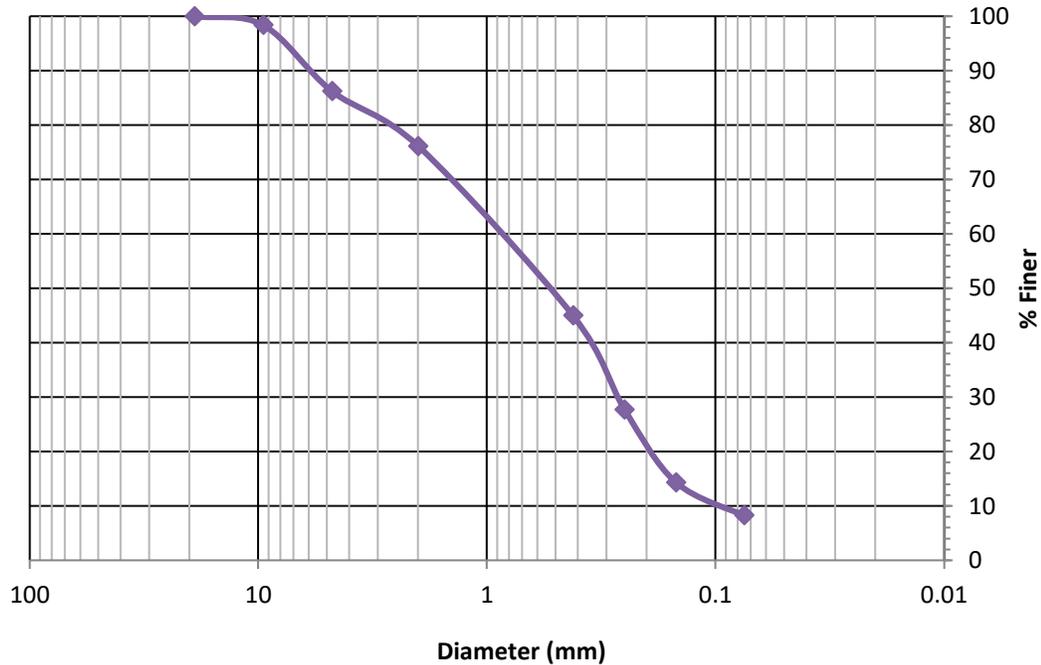
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	98.4
#4	4.76	86.2
#10	2.0	76.1
#40	0.42	45.0
#60	0.25	27.7
#100	0.149	14.3
#200	0.075	8.3

Material Information

Soil Classification: D50: 0.674 mm
AASHTO: A-1-b Cc: 0.656 mm
Unified: SP-SM Cu: 12.324 mm
Natural Moisture: 25.7

Boring No.: WB-02
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Brown Slightly Silty Fine Sand

AREHNA Engineering, Inc.

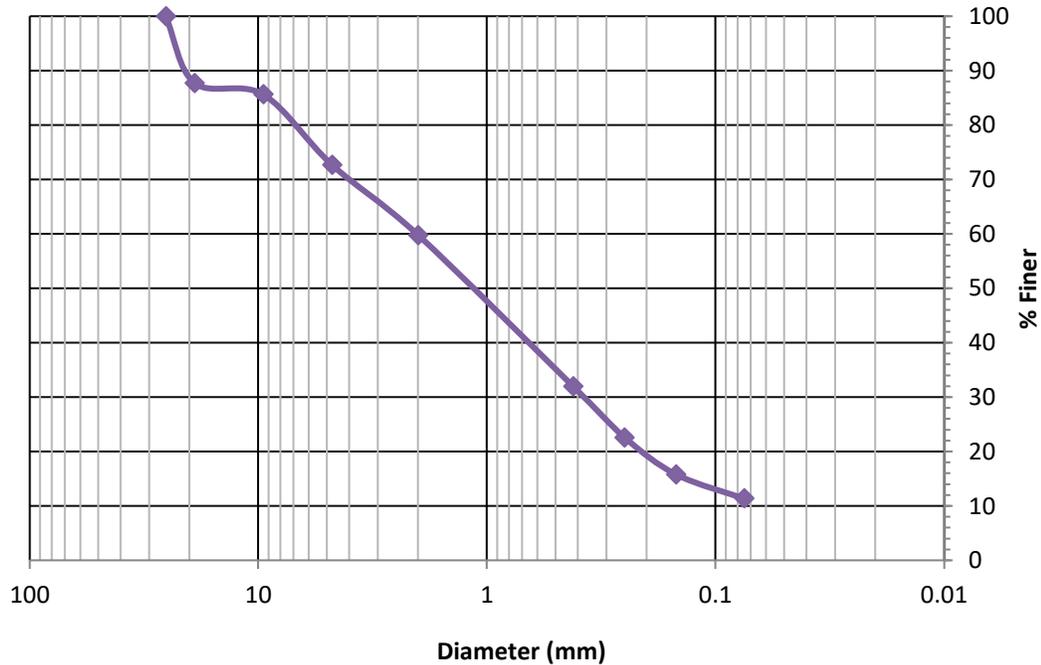
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
1"	25.4	100.0
3/4"	19.0	87.7
3/8"	9.51	85.7
#4	4.76	72.7
#10	2.0	59.8
#40	0.42	32.0
#60	0.25	22.6
#100	0.149	15.8
#200	0.075	11.4

Material Information

Soil Classification: D50: 1.443 mm
AASHTO: A-1-b
Unified: SP-SM
Natural Moisture: 30

Boring No.: WB-02
Sample No.:
Depth: 8.0 - 10
Soil Description: Brown Slightly Silty Sand With Some Shells

AREHNA Engineering, Inc.

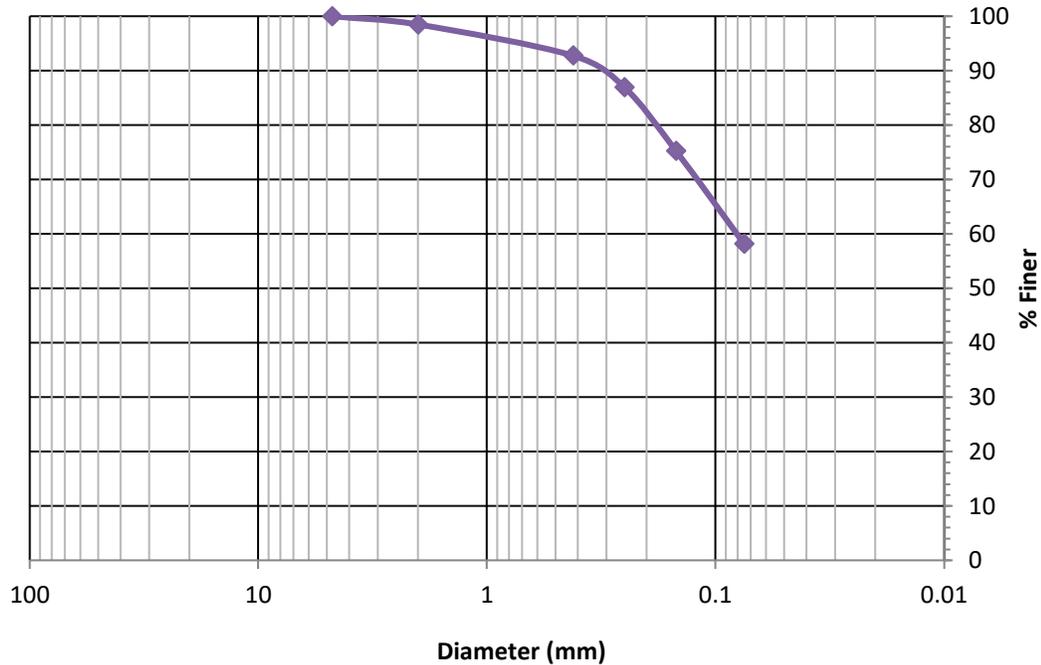
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	98.5
#40	0.42	92.8
#60	0.25	86.9
#100	0.149	75.3
#200	0.075	58.2

Material Information

Soil Classification:
AASHTO: A-8
Unified: OL
Natural Moisture: 100.3

Avg. Organic Content: 11.2%

Boring No.: WB-03
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Dark Brown Organic Silt (OL)

AREHNA Engineering, Inc.

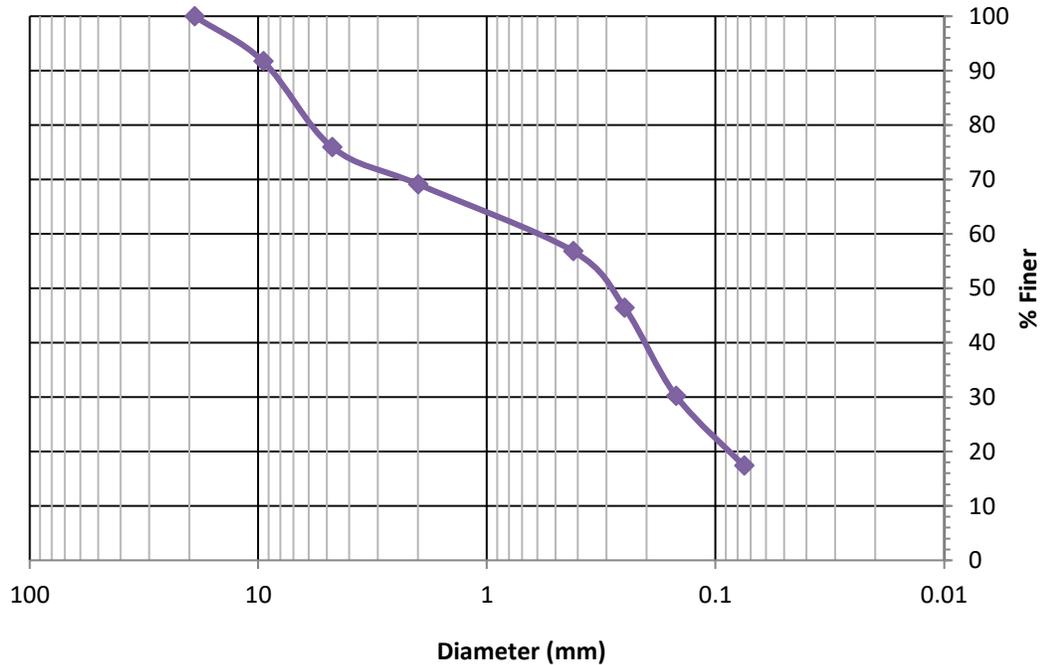
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	91.7
#4	4.76	76.0
#10	2.0	69.1
#40	0.42	56.8
#60	0.25	46.4
#100	0.149	30.3
#200	0.075	17.4

Material Information

Soil Classification:
AASHTO: A-2-4
Unified: SM
Natural Moisture: 27.9

D50: 0.308 mm

Liquid Limit: NP
Plastic Limit: NP
Plasticity Index: NP

Boring No.: WB-03
Sample No.:
Depth: 18.5 - 20
Soil Description: Gray silty sand with limestone

AREHNA Engineering, Inc.

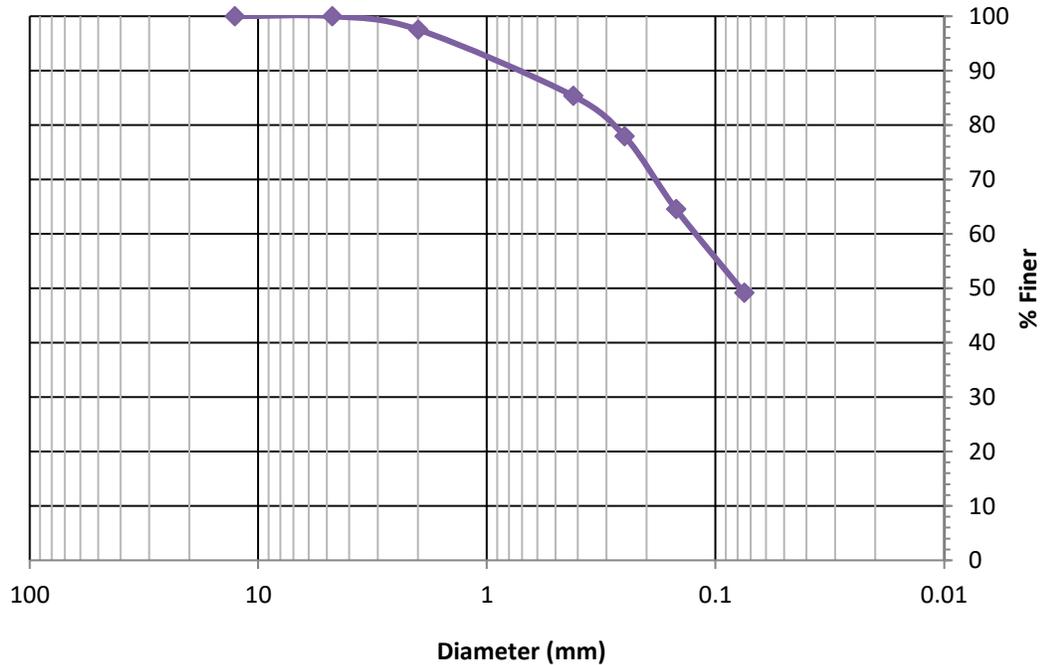
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
1/2"	12.7	100.0
#4	4.76	100.0
#10	2.0	97.5
#40	0.42	85.4
#60	0.25	78.0
#100	0.149	64.6
#200	0.075	49.2

Material Information

Soil Classification:
AASHTO: A-8
Unified: OL
Natural Moisture: 86.8

D50: 0.079 mm

Avg. Organic Content: 10%

Boring No.: BB-01
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Dark Brown Organic Silty Sand

AREHNA Engineering, Inc.

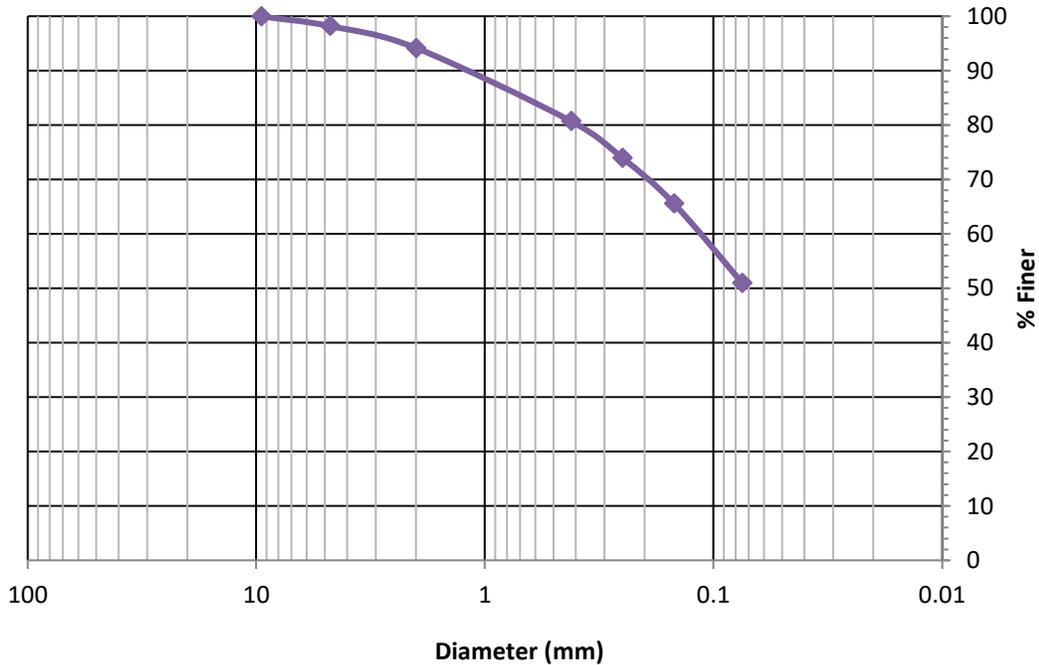
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	98.2
#10	2.0	94.2
#40	0.42	80.7
#60	0.25	74.0
#100	0.149	65.6
#200	0.075	51.0

Material Information

Soil Classification:
AASHTO: A-4
Unified: MH
Natural Moisture: 66.7

Boring No.: BB-01
Sample No.:
Depth: 10 - 12
Soil Description: Gray shelly silt

AREHNA Engineering, Inc.

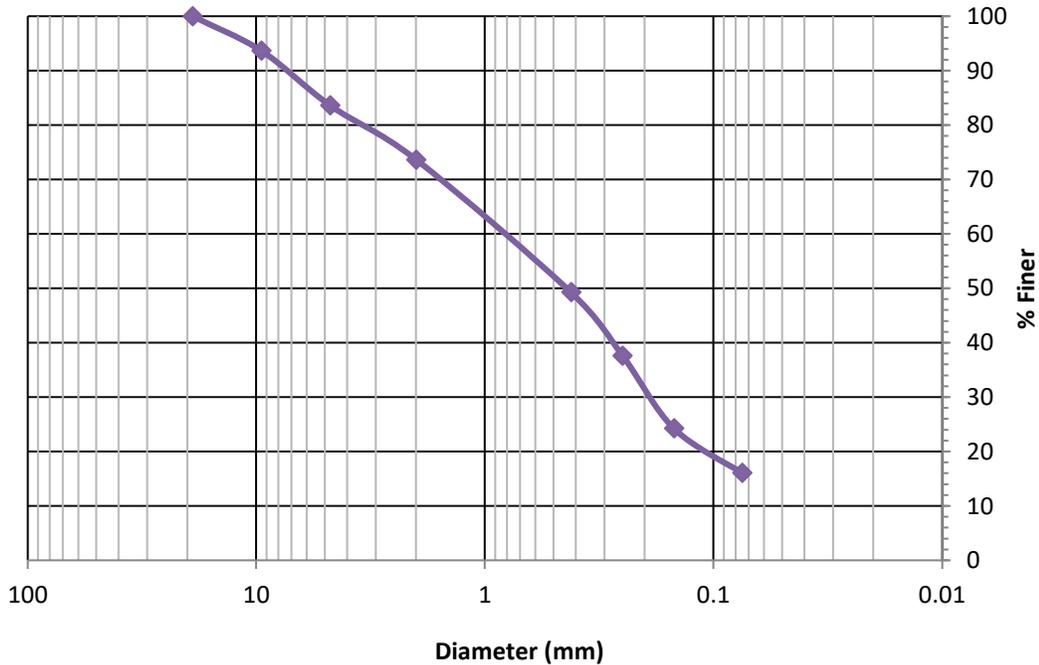
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	93.7
#4	4.76	83.6
#10	2.0	73.6
#40	0.42	49.3
#60	0.25	37.6
#100	0.149	24.3
#200	0.075	16.1

Material Information

Soil Classification: D50: 0.467 mm
AASHTO: A-1-b
Unified: SM
Natural Moisture: 19.3

Boring No.: BB-02
Sample No.:
Depth: 2.0 - 4.0
Soil Description: Light Brown Silty Sand With few shells

AREHNA Engineering, Inc.

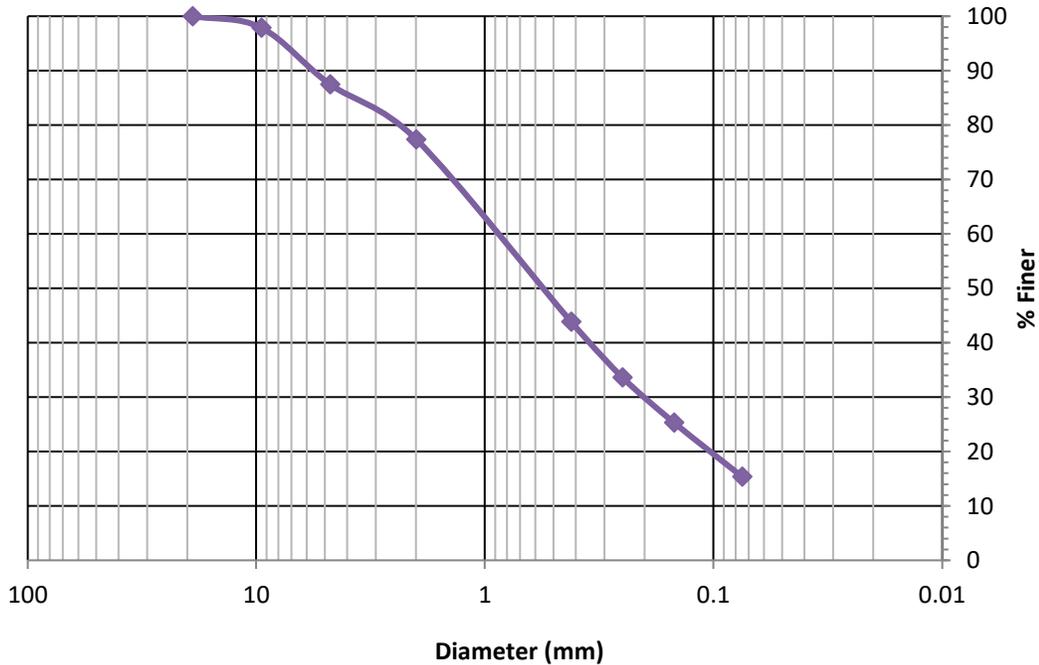
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	97.9
#4	4.76	87.5
#10	2.0	77.4
#40	0.42	43.9
#60	0.25	33.6
#100	0.149	25.4
#200	0.075	15.4

Material Information

Soil Classification: D50: 0.709 mm
AASHTO: A-1-b
Unified: SM
Natural Moisture: 41.2

Boring No.: BB-02
Sample No.:
Depth: 8.0 - 10
Soil Description: Gray Silty shelly Sand

AREHNA Engineering, Inc.

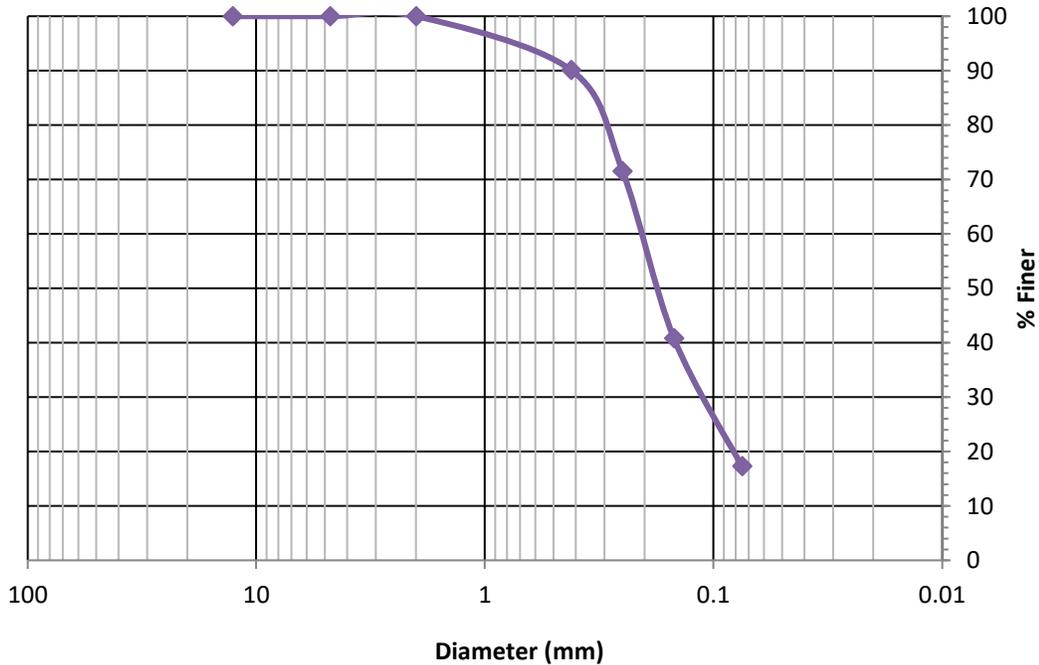
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
1/2"	12.7	100.0
#4	4.76	100.0
#10	2.0	100.0
#40	0.42	90.1
#60	0.25	71.5
#100	0.149	40.8
#200	0.075	17.3

Material Information

Soil Classification:
AASHTO: A-2-4
Unified: SM
Natural Moisture: 23.4

D50: 0.179 mm

Avg. Organic Content: 2.3%

Boring No.: BB-02
Sample No.:
Depth: 12.0 - 14.0
Soil Description: Dark gray organic stained silty sand

AREHNA Engineering, Inc.

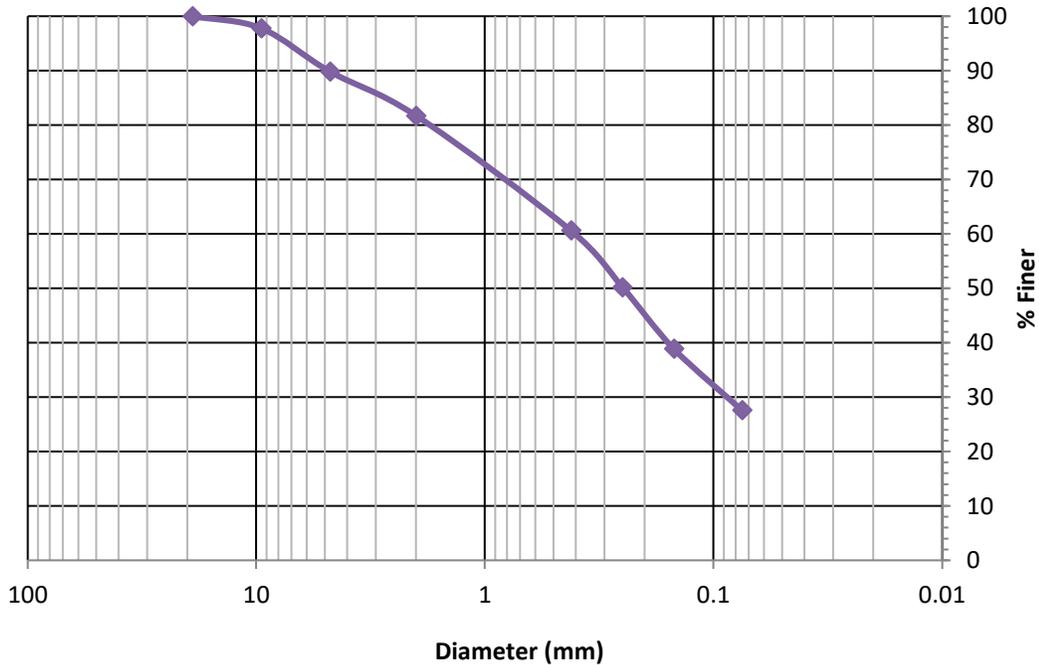
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	97.8
#4	4.76	89.8
#10	2.0	81.7
#40	0.42	60.6
#60	0.25	50.2
#100	0.149	38.9
#200	0.075	27.6

Material Information

Soil Classification: D50: 0.249 mm
AASHTO: A-2-4
Unified: SM
Natural Moisture: 44.7

Boring No.: BB-04
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Brown Silty Sand With Some Shells

AREHNA Engineering, Inc.

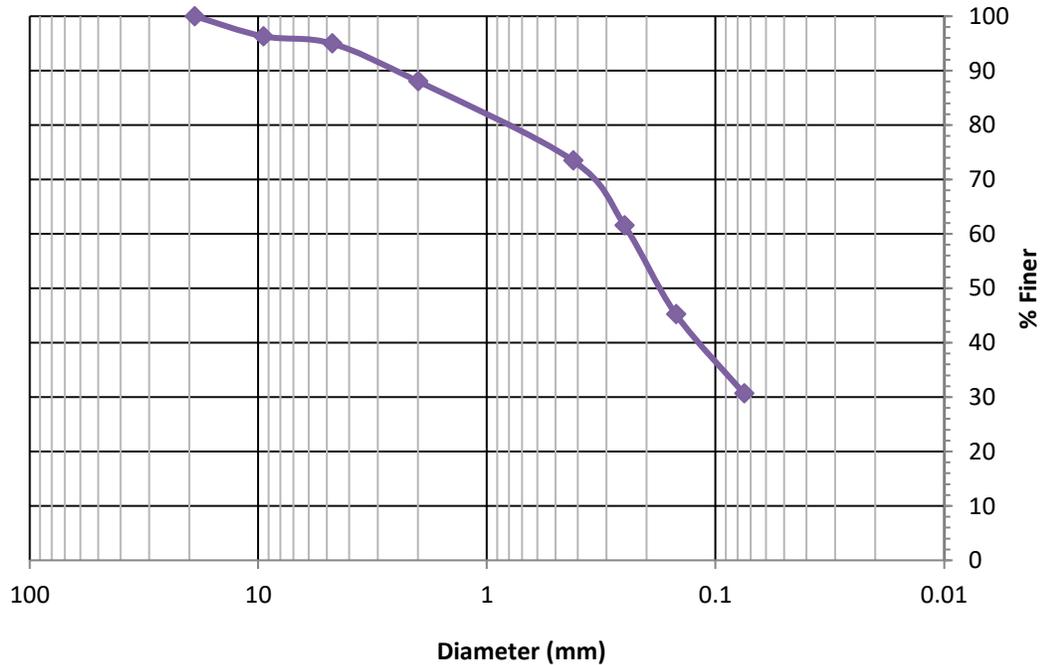
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	96.3
#4	4.76	95.0
#10	2.0	88.0
#40	0.42	73.5
#60	0.25	61.6
#100	0.149	45.3
#200	0.075	30.7

Material Information

Soil Classification:
AASHTO: A-2-4
Unified: SM
Natural Moisture: 42.6

D50: 0.178 mm

Avg. Organic Content: 2.3%

Boring No.: BB-04
Sample No.:
Depth: 6.0 - 8.0
Soil Description: Gray Organic Stained Silty Sand

AREHNA Engineering, Inc.

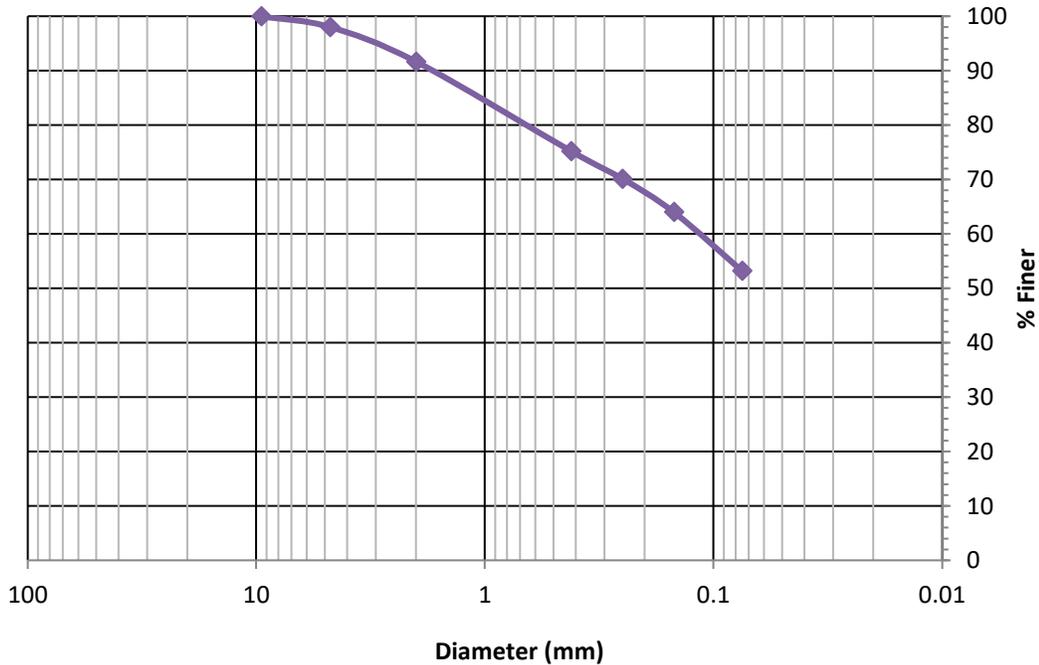
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	98.0
#10	2.0	91.7
#40	0.42	75.2
#60	0.25	70.1
#100	0.149	64.0
#200	0.075	53.2

Material Information

Soil Classification:
AASHTO: A-7-5
Unified: MH
Natural Moisture: 41

Liquid Limit: 75
Plastic Limit: 37
Plasticity Index: 38

Boring No.: BB-12
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Dark Gray sandy silt with trace of shells

AREHNA Engineering, Inc.

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Laboratory Test Report

Project Name: Broad Causeway

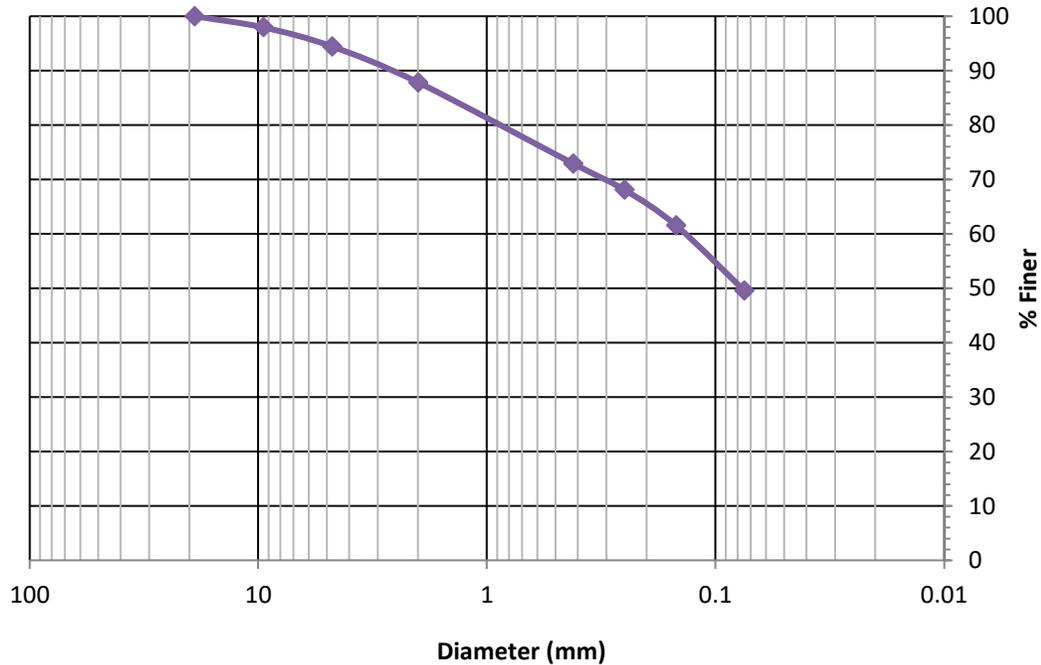
Client: Atkins

AREHNA Project No.: B-22-074

Report Date: 4/11/2023

Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	98.0
#4	4.76	94.5
#10	2.0	87.8
#40	0.42	72.9
#60	0.25	68.1
#100	0.149	61.6
#200	0.075	49.6

Material Information

Soil Classification: D50: 0.077 mm

AASHTO: A-4

Unified: SM

Natural Moisture: 47.4

Boring No.: BB-12

Sample No.:

Depth: 14 - 16

Soil Description: Gray Silty Sand With trace of Shells

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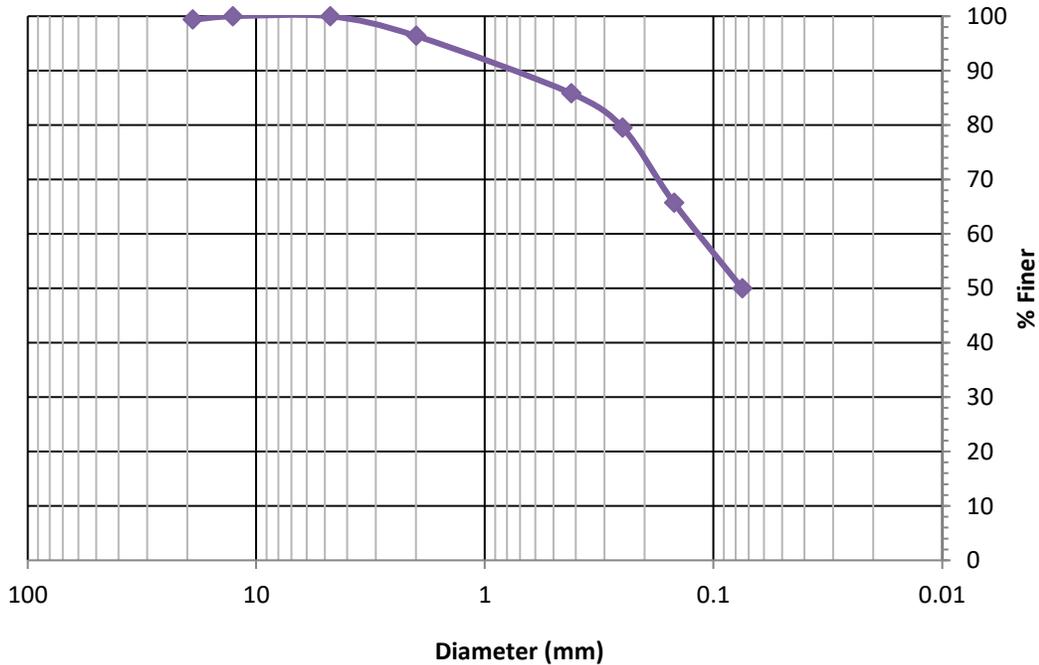
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	99.4
1/2"	12.7	100.0
#4	4.76	100.0
#10	2.0	96.4
#40	0.42	85.9
#60	0.25	79.5
#100	0.149	65.7
#200	0.075	50.0

Material Information

Soil Classification:
AASHTO: A-8
Unified: OL
Natural Moisture: 60

D50: 0.075 mm

Avg. Organic Content: 7.4%

Boring No.: RD-01
Sample No.:
Depth: 2.0 - 4.0
Soil Description: Dark brown organic silt

AREHNA Engineering, Inc.

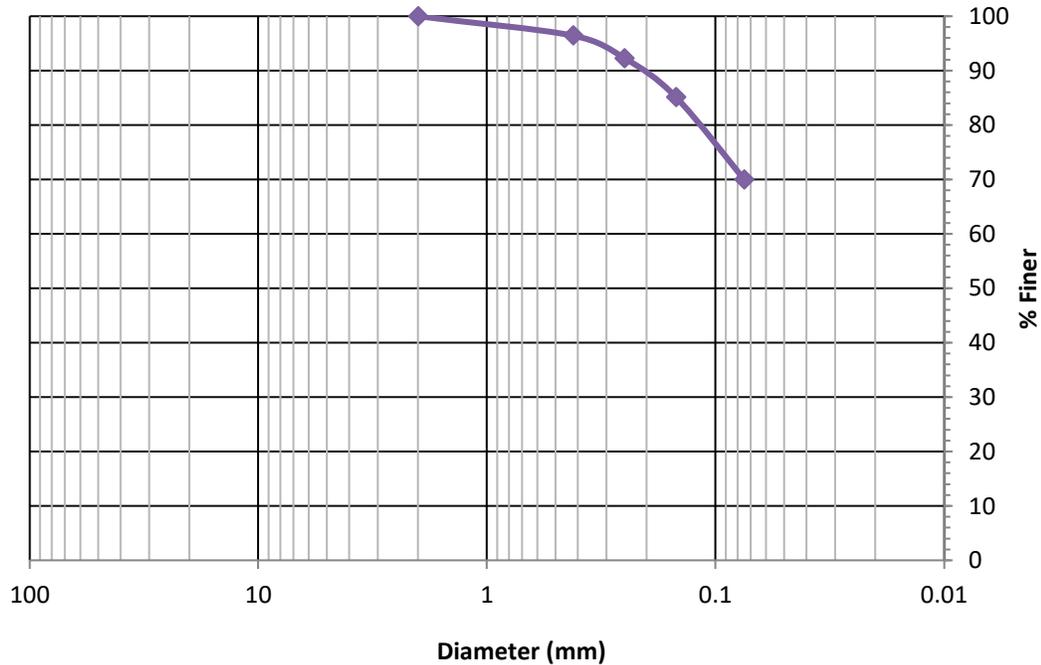
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
#10	2.0	100.0
#40	0.42	96.5
#60	0.25	92.3
#100	0.149	85.2
#200	0.075	70.0

Material Information

Soil Classification:
AASHTO: A-4
Unified: MH
Natural Moisture: 49

Boring No.: RD-01
Sample No.:
Depth: 4.0 - 6.0
Soil Description: dark gray silt

AREHNA Engineering, Inc.

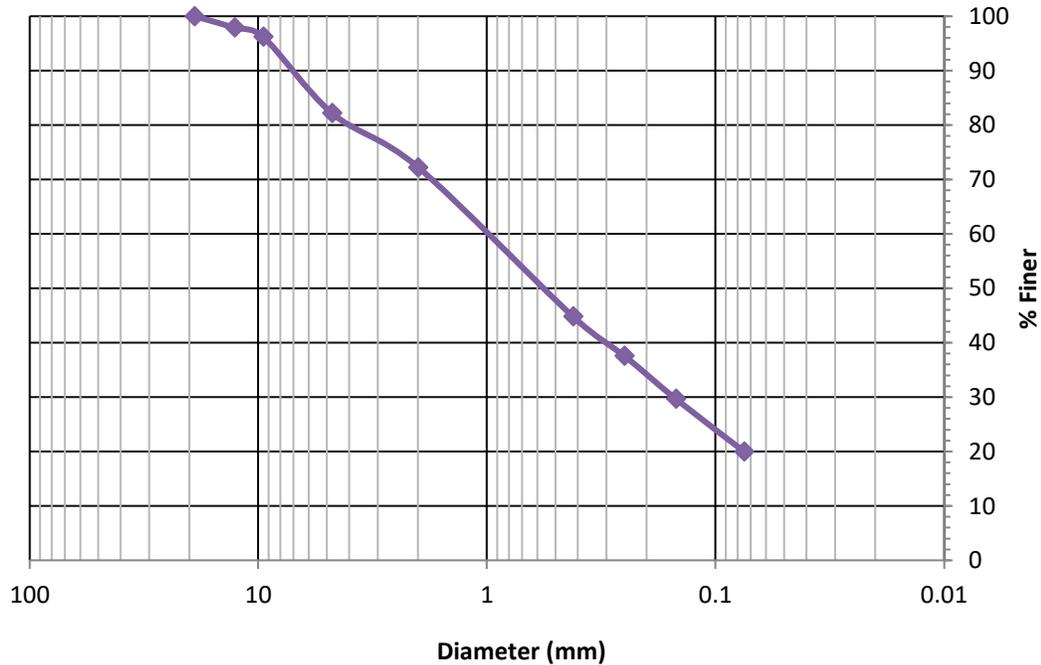
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/1/23
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
1/2"	12.7	97.9
3/8"	9.51	96.2
#4	4.76	82.2
#10	2.0	72.2
#40	0.42	44.8
#60	0.25	37.6
#100	0.149	29.7
#200	0.075	20.0

Material Information

Soil Classification:
AASHTO: A-1-b
Unified: SM
Natural Moisture: 47.6

D50: 0.718 mm

Avg. Organic Content: 2.9%

Boring No.: RD-02

Sample No.:

Depth: 8.0 - 10

Soil Description: Brown organic stained silty sand with some shells

AREHNA Engineering, Inc.

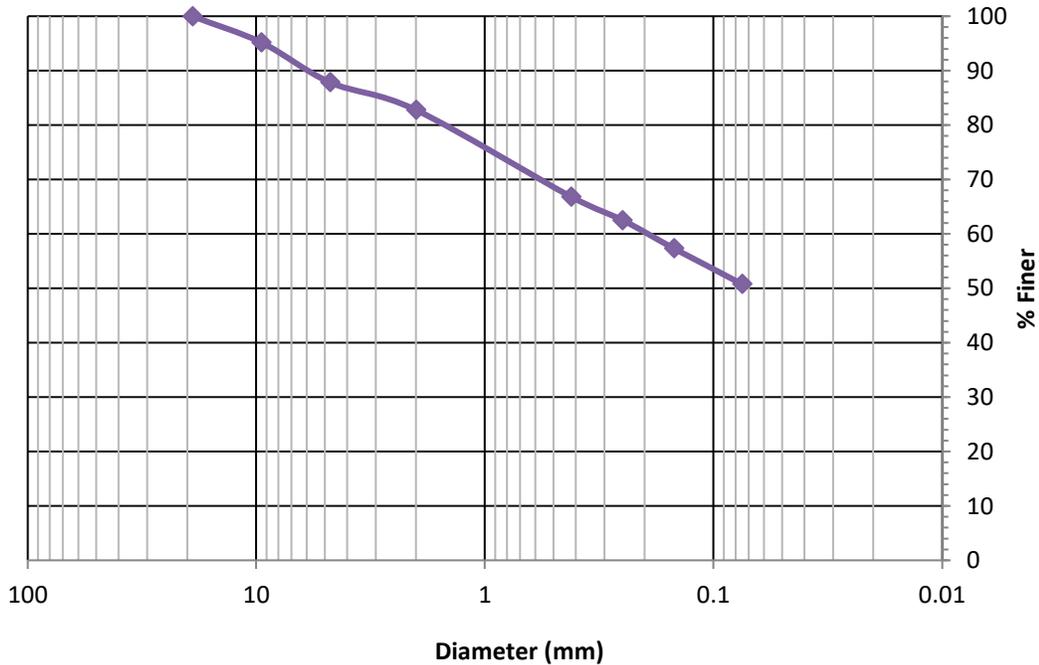
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	95.2
#4	4.76	87.9
#10	2.0	82.8
#40	0.42	66.8
#60	0.25	62.5
#100	0.149	57.3
#200	0.075	50.8

Material Information

Soil Classification:
AASHTO: A-4
Unified: ML
Natural Moisture: 122.3

Boring No.: RB-01
Sample No.:
Depth: 2.0 - 4.0
Soil Description: Dk Brown Very Sandy Silt With Shells

AREHNA Engineering, Inc.

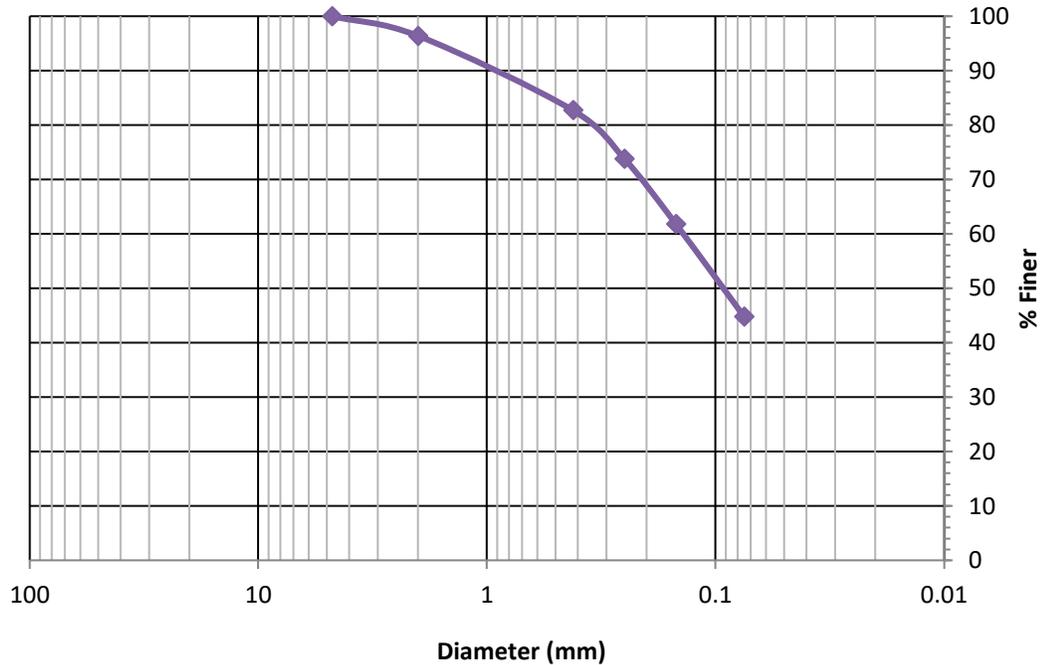
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	96.4
#40	0.42	82.7
#60	0.25	73.8
#100	0.149	61.8
#200	0.075	44.8

Material Information

Soil Classification:
AASHTO: A-4
Unified: SM
Natural Moisture: 48.6

Boring No.: RB-03
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Gray Very Silty Sand W Trace Of shells

AREHNA Engineering, Inc.

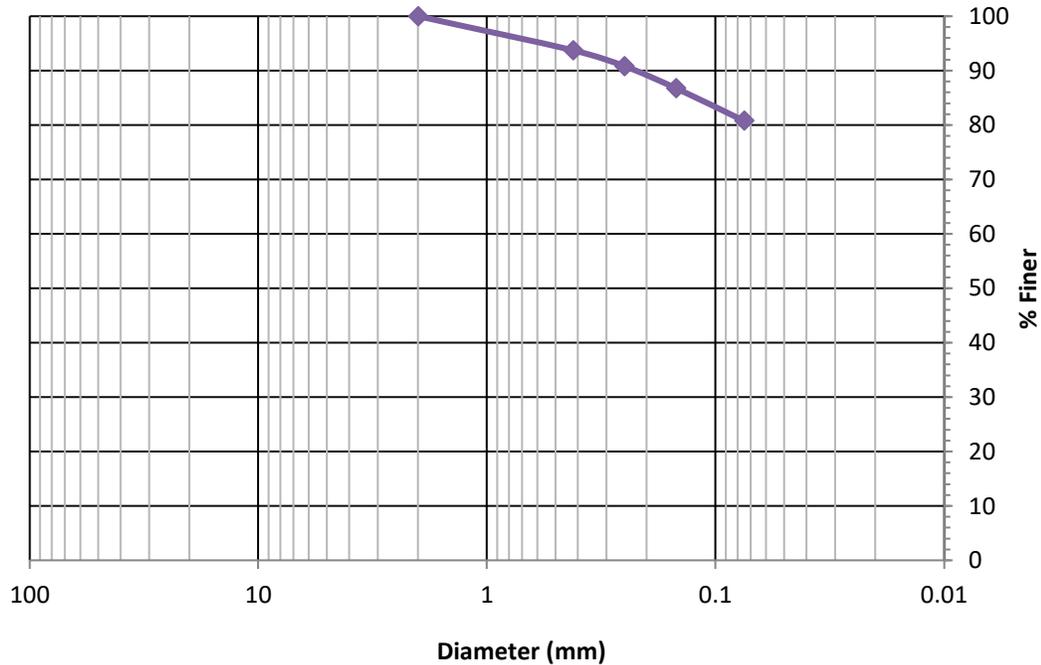
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 4/11/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
#10	2.0	100.0
#40	0.42	93.8
#60	0.25	90.8
#100	0.149	86.8
#200	0.075	80.8

Material Information

Soil Classification:
AASHTO: A-4
Unified: MH
Natural Moisture: 106.7

Avg. Organic Content: 15.9%

Boring No.: RB-05
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Dk Gray Organic Silt

AREHNA Engineering, Inc.

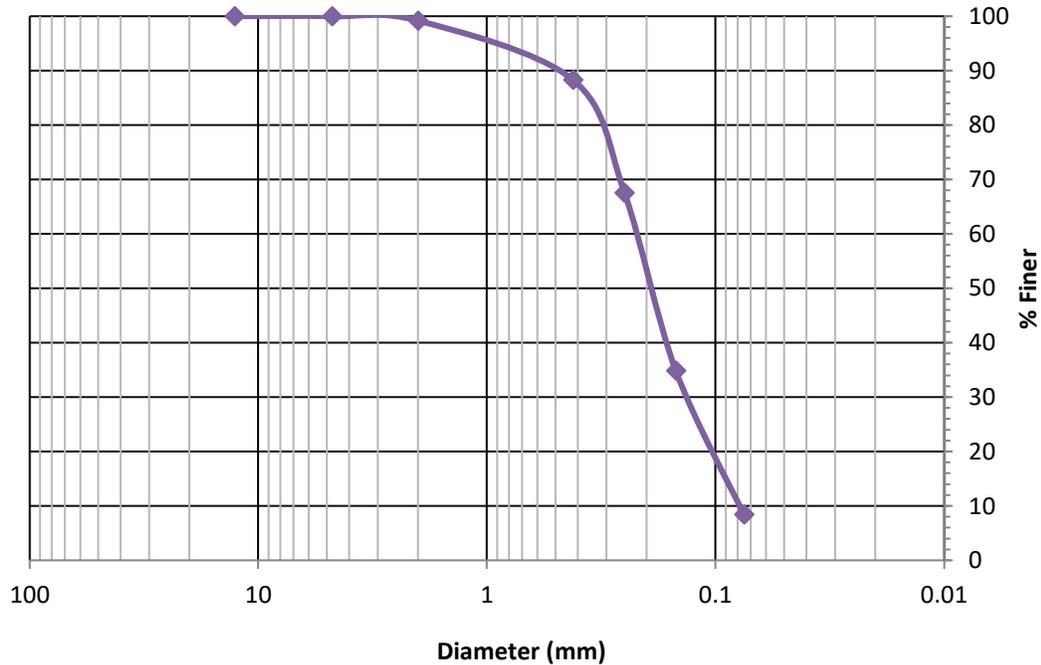
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/17/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
1/2"	12.7	100.0
#4	4.76	100.0
#10	2.0	99.2
#40	0.42	88.3
#60	0.25	67.5
#100	0.149	34.8
#200	0.075	8.4

Material Information

Soil Classification:
AASHTO: A-3
Unified: SP-SM
Natural Moisture: 28.8

D50: 0.196 mm
Cc: 1.018 mm
Cu: 2.853 mm

Liquid Limit: NP
Plastic Limit: NP
Plasticity Index: NP

Boring No.: WB-03
Sample No.:
Depth: 13.5 - 15
Soil Description: Gray Slightly Silty Sand

AREHNA Engineering, Inc.

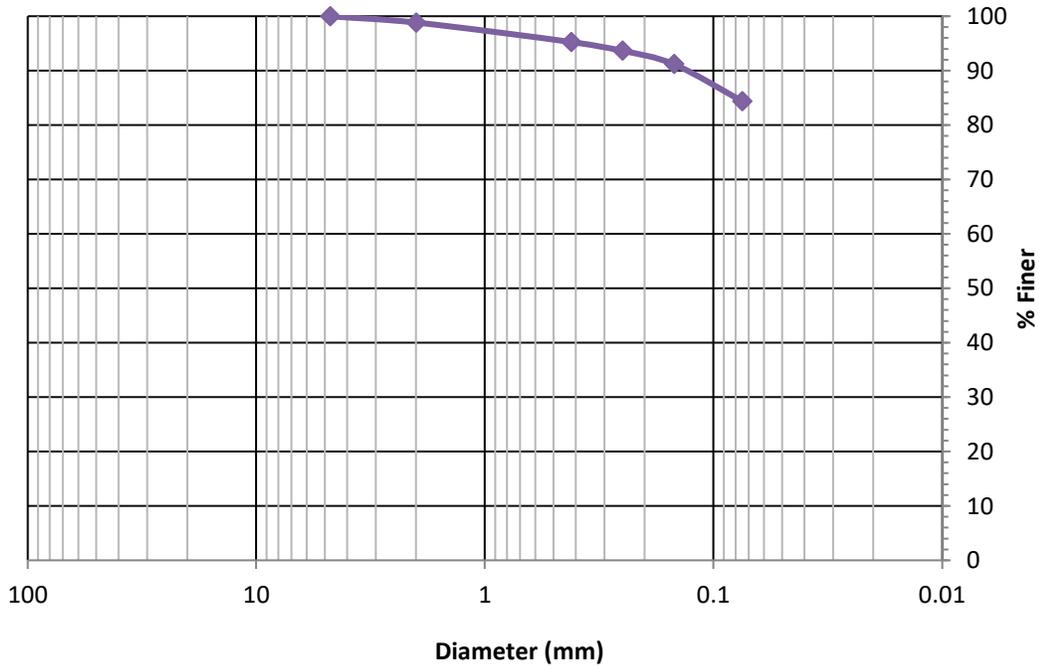
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/17/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	98.9
#40	0.42	95.3
#60	0.25	93.7
#100	0.149	91.2
#200	0.075	84.4

Material Information

Soil Classification:
AASHTO: A-7-5
Unified: MH
Natural Moisture: 68

Liquid Limit: 60
Plastic Limit: 33
Plasticity Index: 27

Boring No.: WB-04
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Gray sandy silt

AREHNA Engineering, Inc.

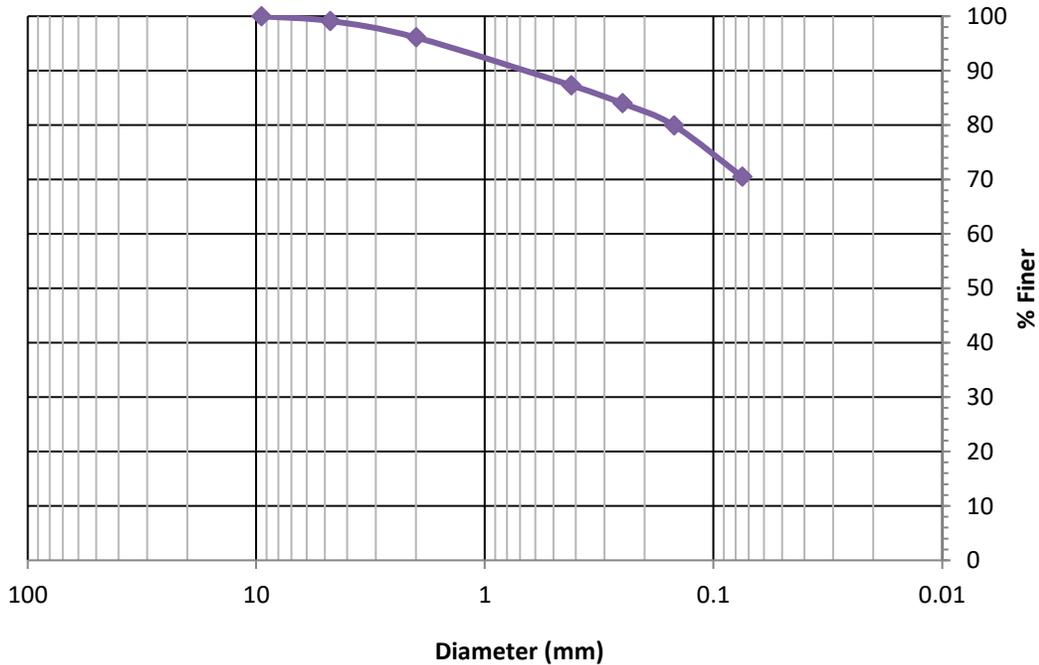
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/17/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	99.1
#10	2.0	96.1
#40	0.42	87.3
#60	0.25	84.0
#100	0.149	79.9
#200	0.075	70.5

Material Information

Soil Classification:
AASHTO: A-7-6
Unified: CL
Natural Moisture: 43.7

Avg. Organic Content: 0.4%
Liquid Limit: 41
Plastic Limit: 20
Plasticity Index: 21

Boring No.: WB-04
Sample No.:
Depth: 13.5 - 15
Soil Description: Gray sandy clay

AREHNA Engineering, Inc.

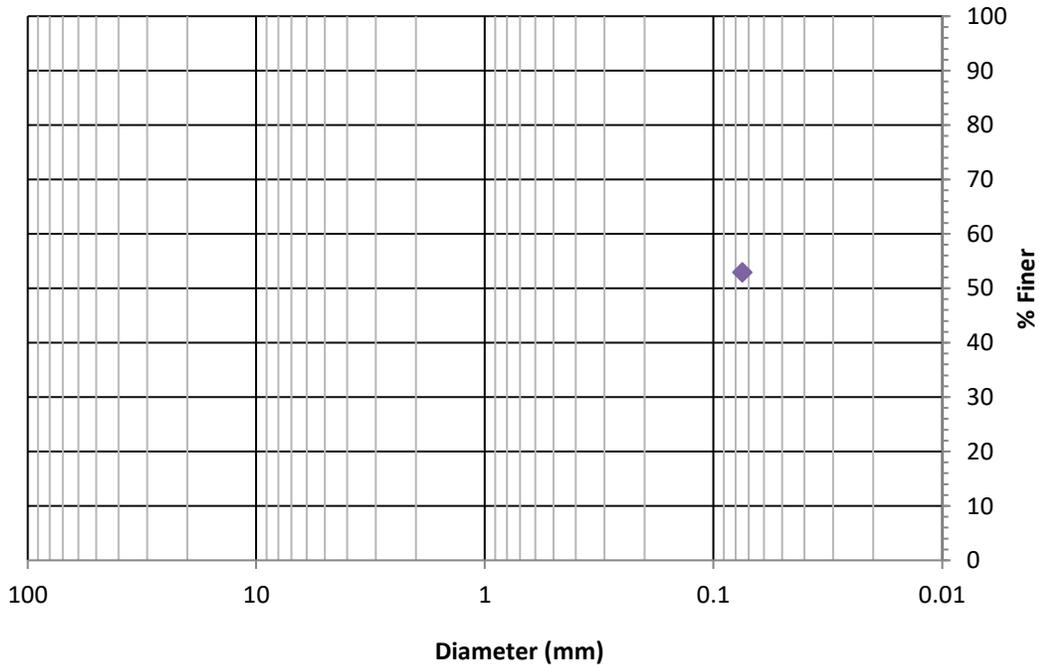
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
#200	0.075	52.9

Material Information

Soil Classification:
AASHTO: A-7-5
Unified: CH
Natural Moisture: 68.6

Liquid Limit: 78
Plastic Limit: 34
Plasticity Index: 44

Boring No.: RD-03
Sample No.:
Depth: 13.5 - 15
Soil Description: Gray sandy clay with traces of shells

AREHNA Engineering, Inc.

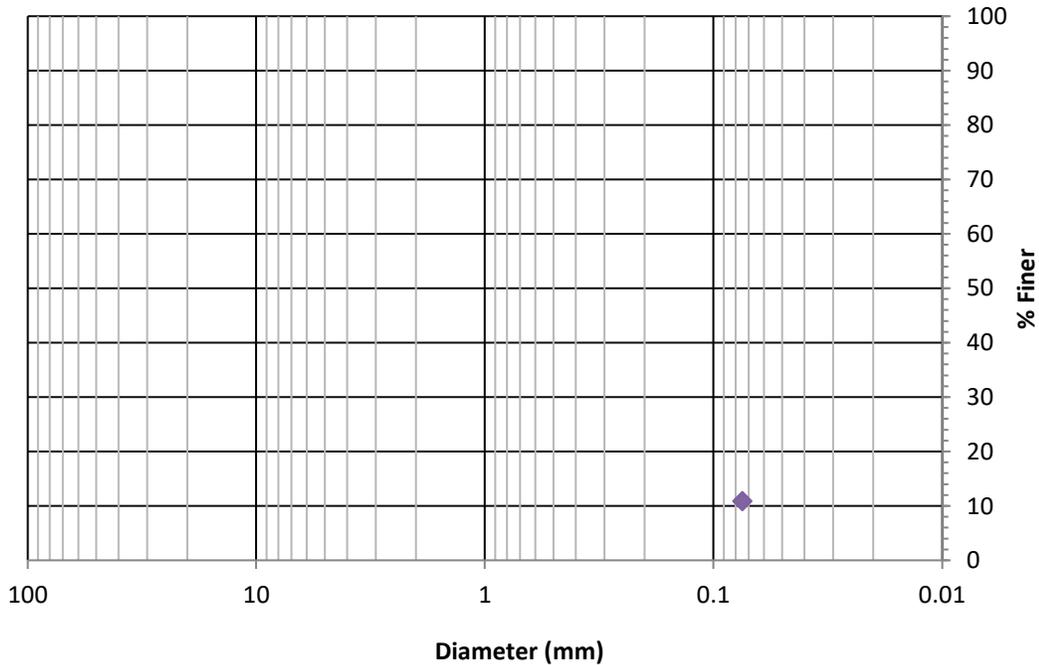
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: PV

Particle-Size Analysis of Soils (ASTM D6913)



Sieve Analysis		
Sieve	Dia.	% Finer
#200	0.075	10.9

Material Information

Soil Classification:
AASHTO: A-2-4
Unified: SP-SC
Natural Moisture: 41.3

Avg. Organic Content: 3.2%

Boring No.: RD-03
Sample No.:
Depth: 18.5 - 20
Soil Description: Dark Brown slightly clayey sand with organics

AREHNA Engineering, Inc.

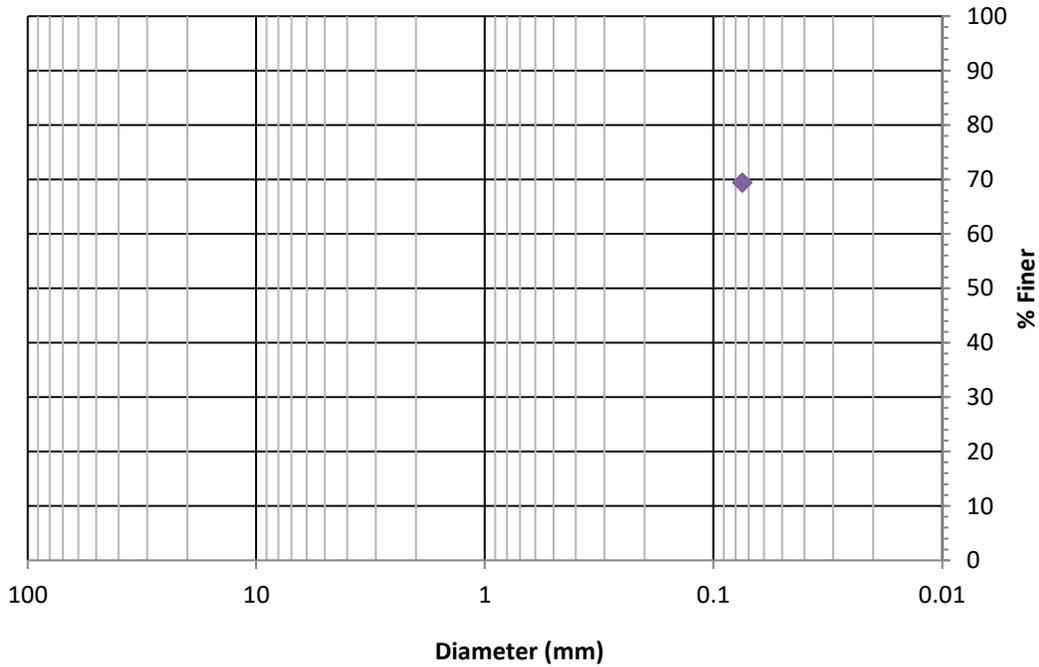
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
#200	0.075	69.4

Material Information

Soil Classification:
AASHTO: A-4
Unified: MH
Natural Moisture: 106.4

Avg. Organic Content: 15.6%

Boring No.: RB-03
Sample No.:
Depth: 6.0 - 8.0
Soil Description: Dark Brown Organic Silt

AREHNA Engineering, Inc.

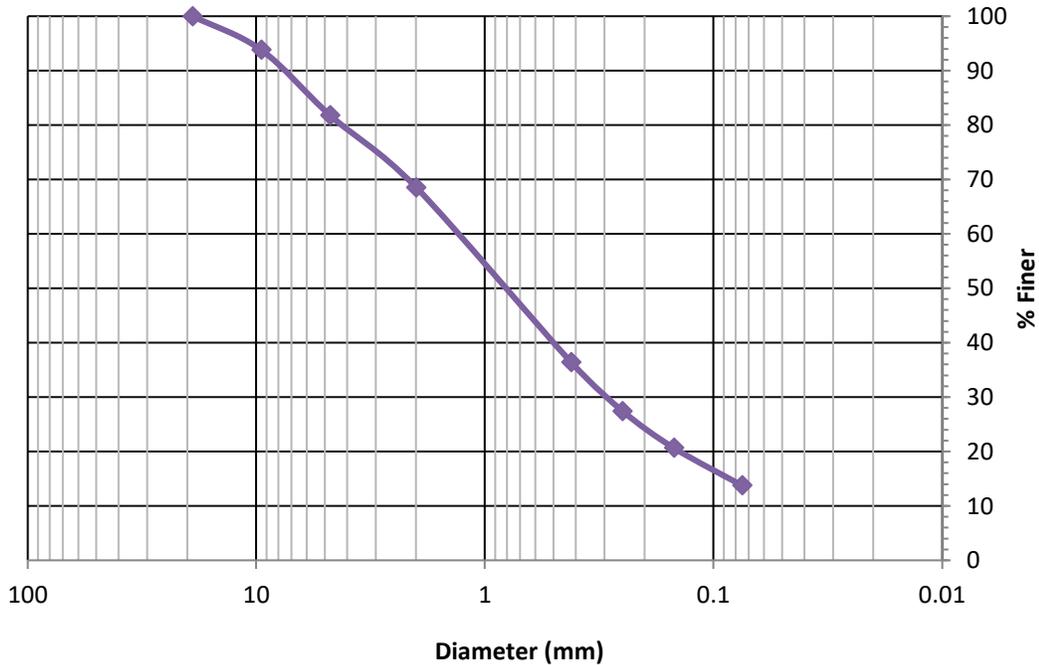
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	93.9
#4	4.76	81.8
#10	2.0	68.5
#40	0.42	36.5
#60	0.25	27.5
#100	0.149	20.7
#200	0.075	13.8

Material Information

Soil Classification: D50: 1.087 mm
AASHTO: A-1-b
Unified: SM
Natural Moisture: 32.2

Boring No.: RB-02
Sample No.:
Depth: 2.0 - 4.0
Soil Description: Brown Silty Sand With some of shells

AREHNA Engineering, Inc.

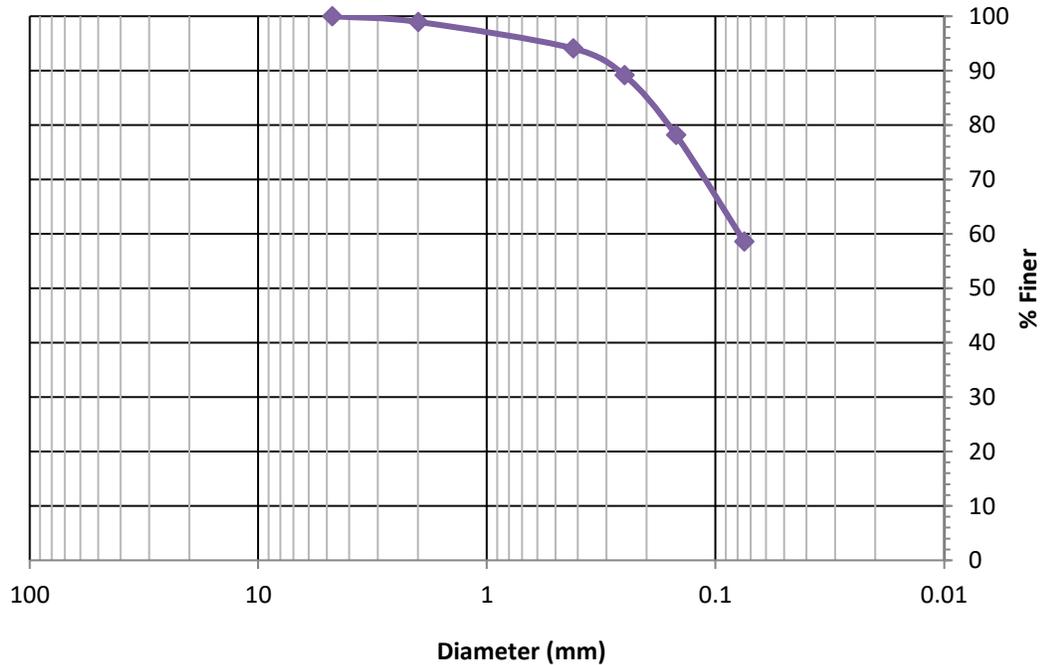
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	99.0
#40	0.42	94.1
#60	0.25	89.2
#100	0.149	78.2
#200	0.075	58.6

Material Information

Soil Classification:
AASHTO: A-4
Unified: MH
Natural Moisture: 43.7

Boring No.: RB-05
Sample No.:
Depth: 0.0 - 2.0
Soil Description: Brown Sandy Silt

AREHNA Engineering, Inc.

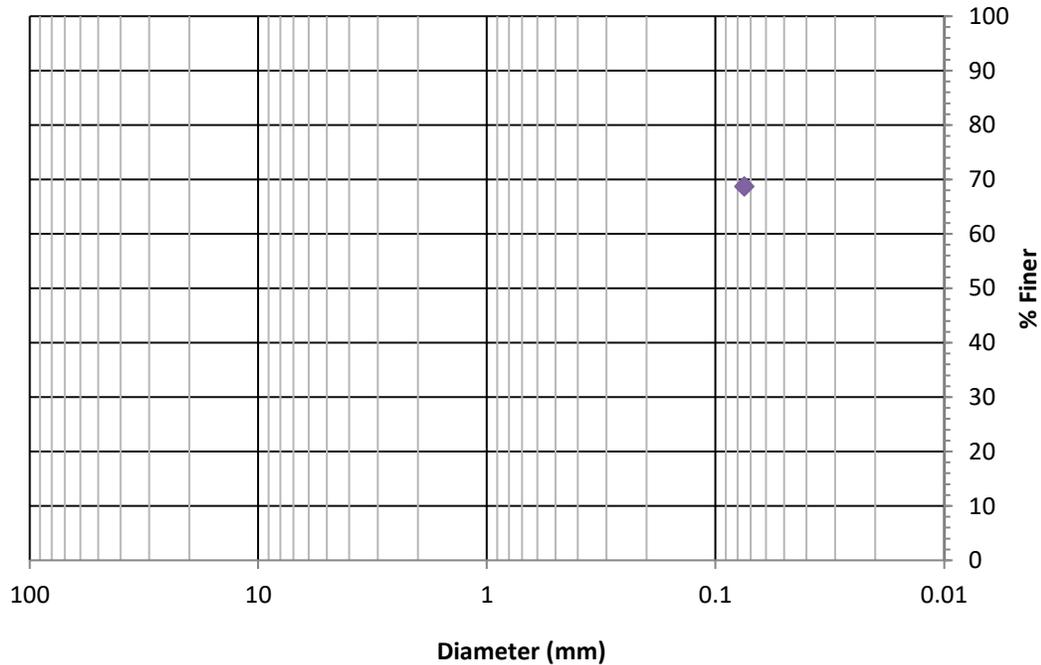
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
#200	0.075	68.7

Material Information

Soil Classification:
AASHTO: A-7-5
Unified: MH
Natural Moisture: 73.7

Liquid Limit: 80
Plastic Limit: 42
Plasticity Index: 38

Boring No.: RB-02
Sample No.:
Depth: 6.0 - 8.0
Soil Description: Dark Gray Silt

AREHNA Engineering, Inc.

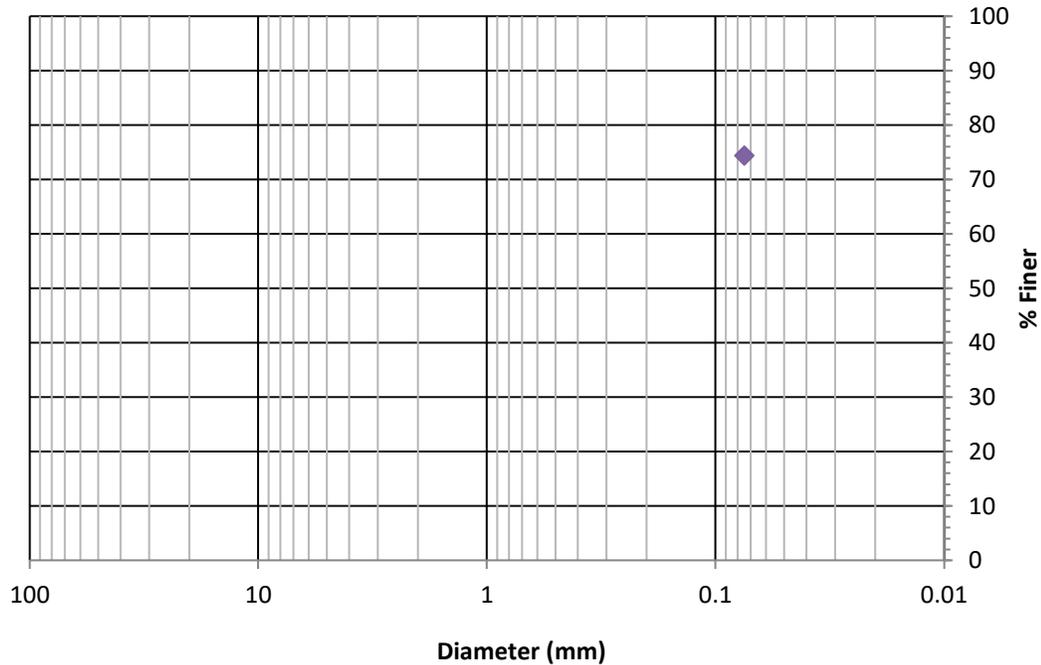
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
#200	0.075	74.4

Material Information

Soil Classification:
AASHTO: A-7-5
Unified: MH
Natural Moisture: 75.9

Liquid Limit: 97
Plastic Limit: 47
Plasticity Index: 50

Boring No.: RB-08
Sample No.:
Depth: 8.0 - 10
Soil Description: Gray Silt

AREHNA Engineering, Inc.

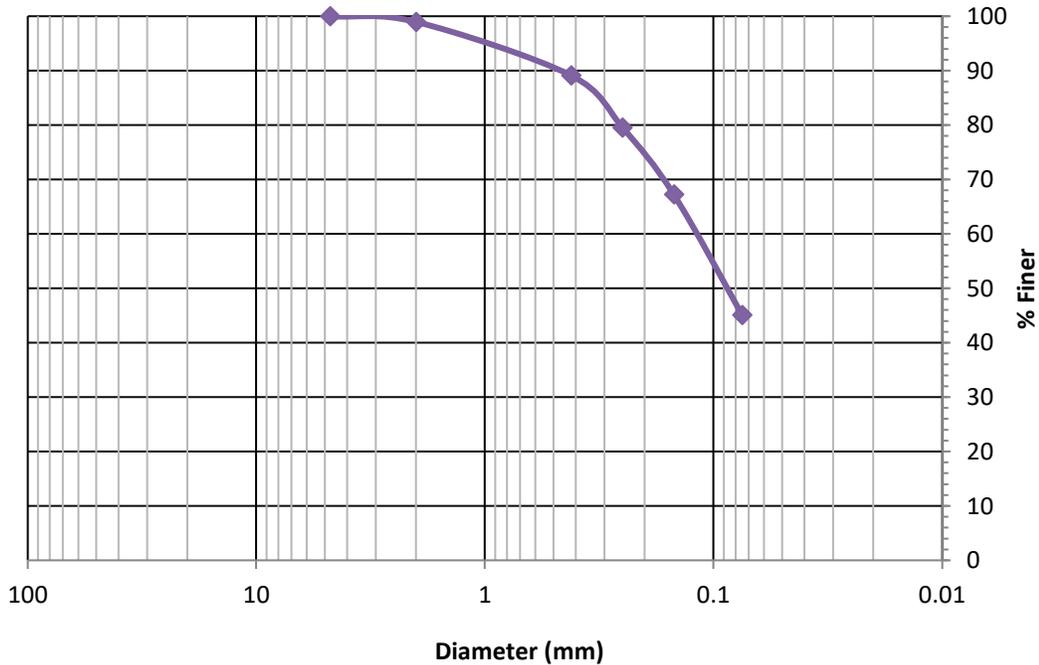
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
#4	4.76	100.0
#10	2.0	99.0
#40	0.42	89.1
#60	0.25	79.5
#100	0.149	67.2
#200	0.075	45.1

Material Information

Soil Classification:
AASHTO: A-4
Unified: SM
Natural Moisture: 48.1

Liquid Limit: NP
Plastic Limit: NP
Plasticity Index: NP

Boring No.: RB-10
Sample No.:
Depth: 8.0 - 10
Soil Description: Gray Very Silty sand

AREHNA Engineering, Inc.

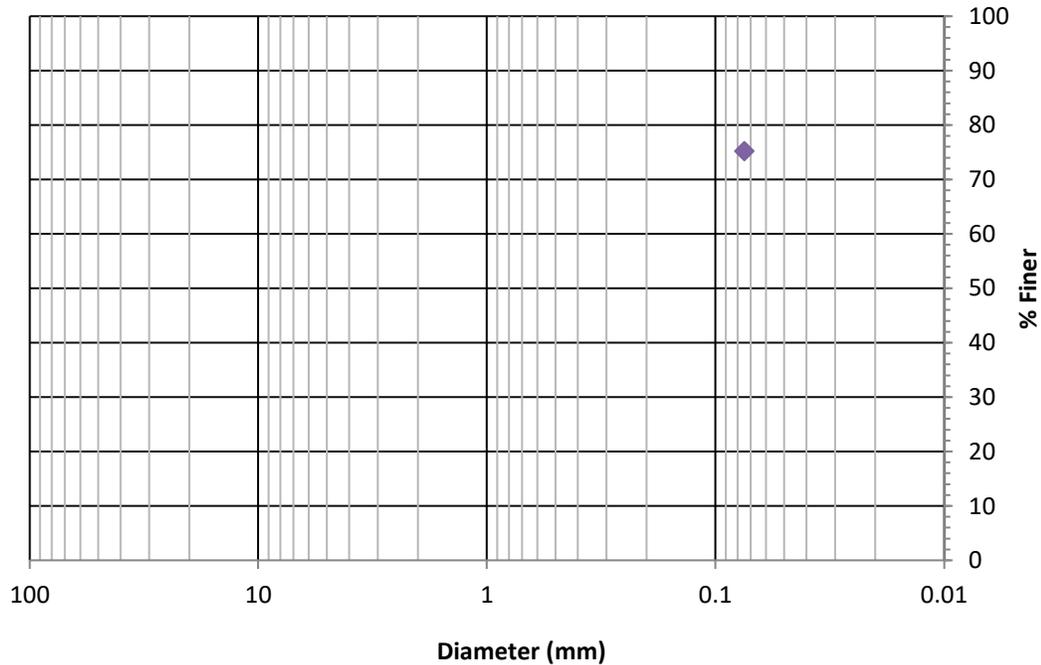
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 5/18/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
#200	0.075	75.2

Material Information

Soil Classification:
AASHTO: A-7-5
Unified: MH
Natural Moisture: 68.1

Liquid Limit: 78
Plastic Limit: 45
Plasticity Index: 33

Boring No.: RB-11
Sample No.:
Depth: 4.0 - 6.0
Soil Description: Brown Silt With Trace shells

AREHNA Engineering, Inc.

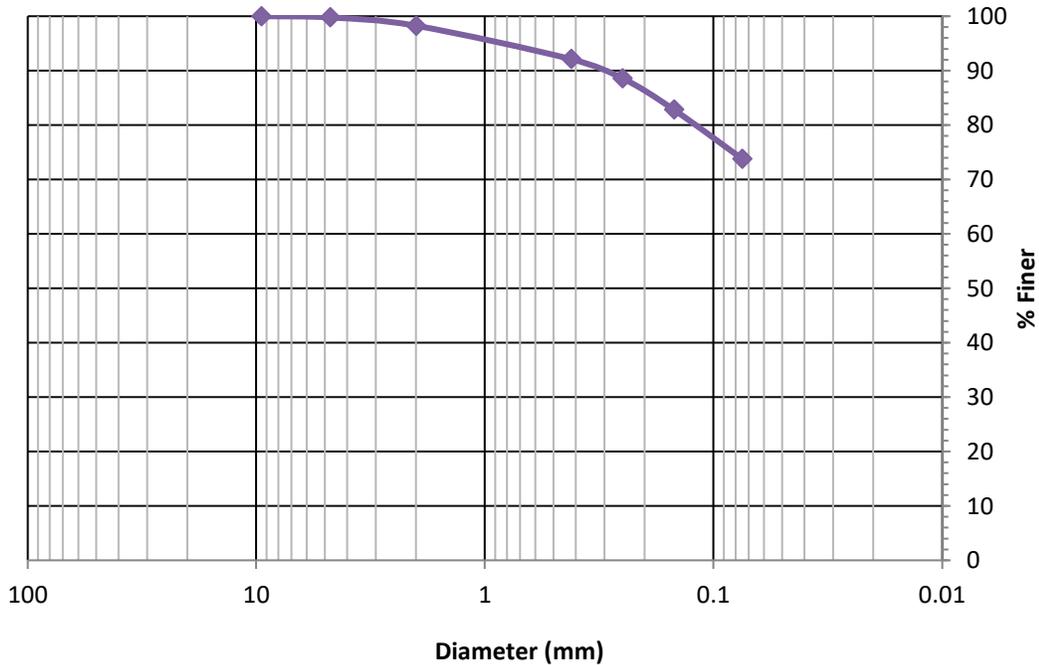
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 10/27/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
3/8"	9.51	100.0
#4	4.76	99.8
#10	2.0	98.3
#40	0.42	92.1
#60	0.25	88.6
#100	0.149	82.9
#200	0.075	73.8

Material Information

Soil Classification:
AASHTO: A-4
Unified: MH
Natural Moisture: 81.9

Boring No.: RB-01
Sample No.:
Depth: 6.0 - 8.0
Soil Description: Brown Sandy Silt

AREHNA Engineering, Inc.

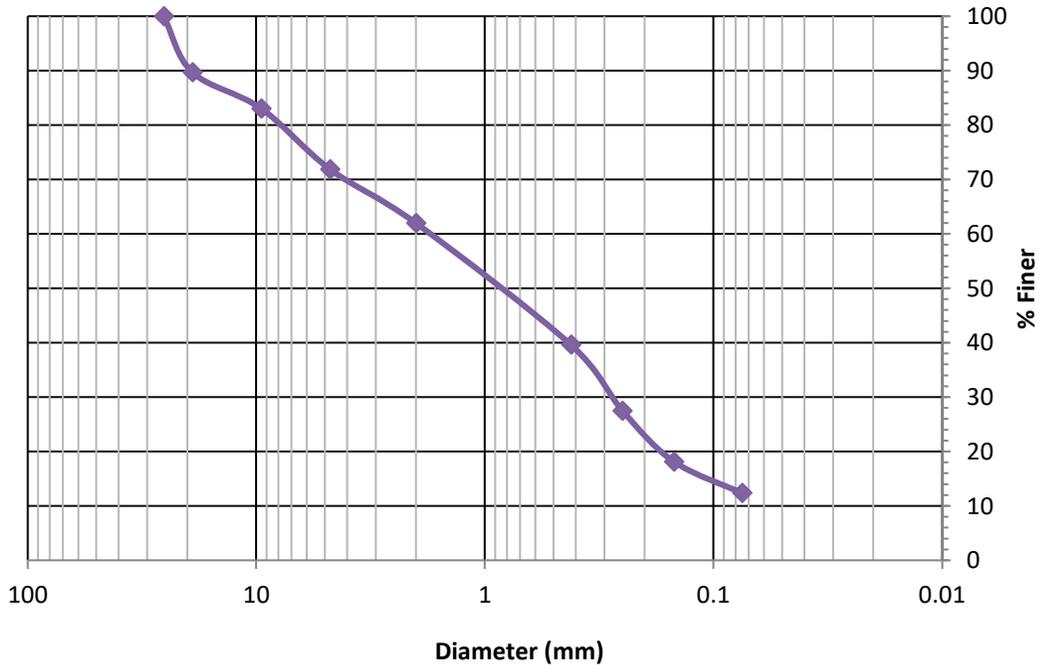
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 10/27/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
1"	25.4	100.0
3/4"	19.0	89.7
3/8"	9.51	83.1
#4	4.76	71.9
#10	2.0	62.0
#40	0.42	39.6
#60	0.25	27.5
#100	0.149	18.1
#200	0.075	12.4

Material Information

Soil Classification: D50: 1.153 mm
AASHTO: A-1-b
Unified: GM
Natural Moisture: 9.8

Boring No.: RB-04
Sample No.:
Depth: 2.0 - 4.0
Soil Description: Brown Silty Sand with some Limerock

AREHNA Engineering, Inc.

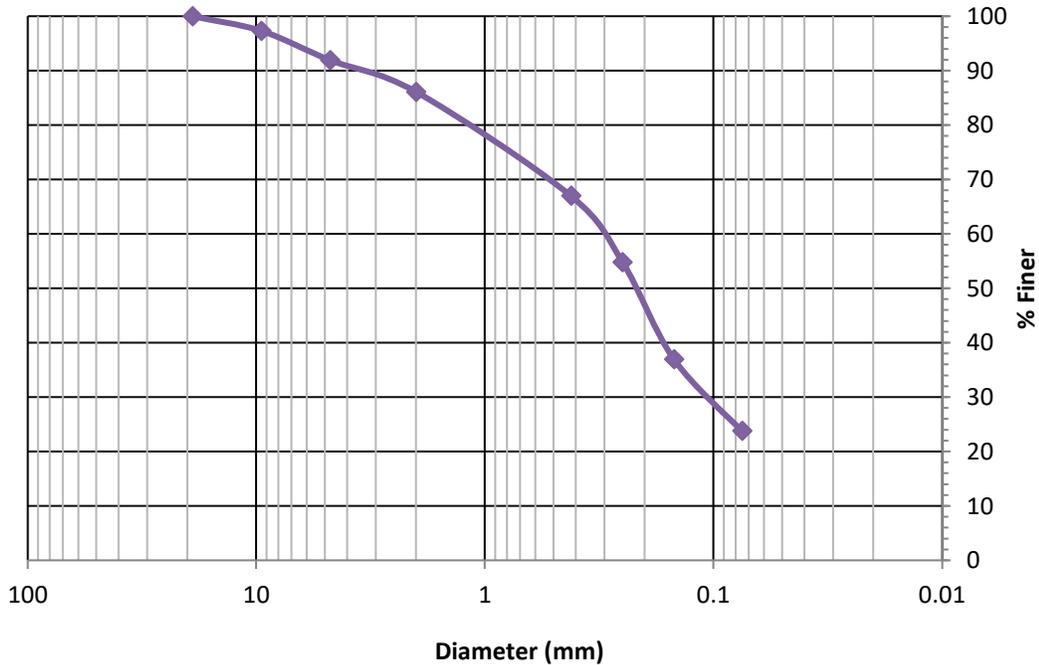
5012 W Lemon Street, Tampa, FL 33609 | 12296 Wiles Road, Coral Springs, FL 33076

Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 10/27/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	97.3
#4	4.76	91.9
#10	2.0	86.1
#40	0.42	67.0
#60	0.25	54.8
#100	0.149	37.0
#200	0.075	23.8

Material Information

Soil Classification: D50: 0.223 mm
AASHTO: A-2-4
Unified: SM
Natural Moisture: 17.5

Boring No.: RB-07
Sample No.:
Depth: 2.0 - 4.0
Soil Description: Brown Silty Sand

AREHNA Engineering, Inc.

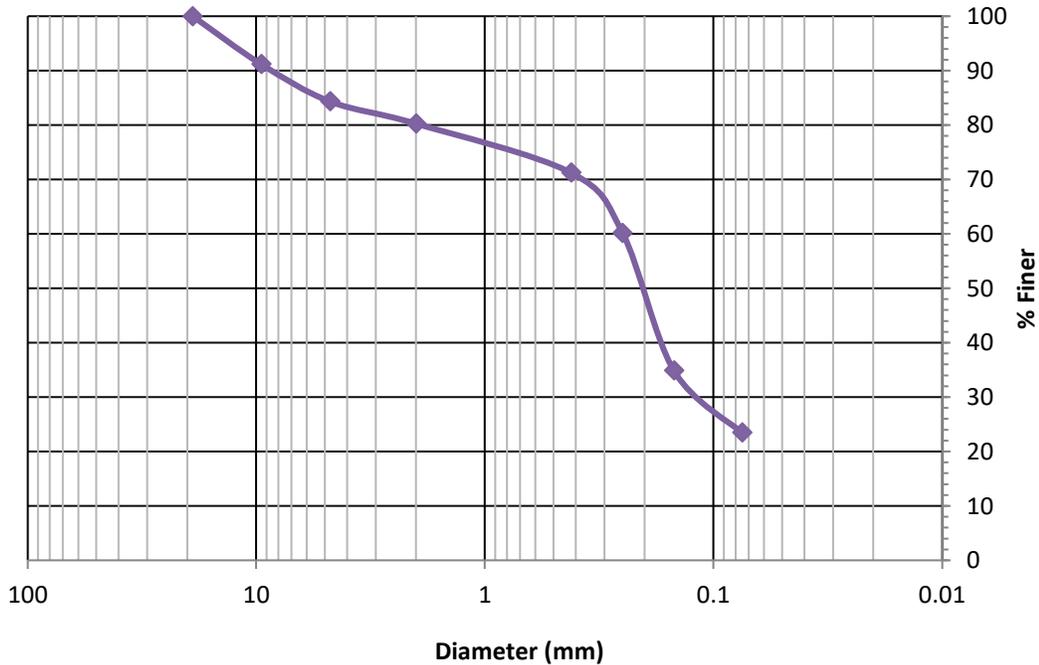
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Laboratory Test Report

Project Name: Broad Causeway
Client: Atkins
AREHNA Project No.: B-22-074

Report Date: 10/27/2023
Reviewed By: A. Tao

Particle-Size Analysis of Soils ()



Sieve Analysis		
Sieve	Dia.	% Finer
3/4"	19.0	100.0
3/8"	9.51	91.2
#4	4.76	84.4
#10	2.0	80.3
#40	0.42	71.3
#60	0.25	60.2
#100	0.149	34.9
#200	0.075	23.5

Material Information

Soil Classification: D50: 0.209 mm
AASHTO: A-2-4
Unified: SM
Natural Moisture: 17

Boring No.: RB-08
Sample No.:
Depth: 2.0 - 4.0
Soil Description: Brown Silty Sand

Project Name: Broad Causeway
 Project Number: B-22-074
 Boring: RB-05
 Sample Depth 4 - 6'

Auto Classification:

AASHTO	A-4/A-7-5
Unified	

Corrosion Classification

Steel	Extremely
Concrete	Moderately

Sample Type

Soil or Water	Soil
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pH (FM 5-550)

pH Reading	7.10
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Chlorides

(FM 5-552)

	Drops Required	Multiplier	No. Dilutions	Reading
0-100 ppm	2	5	3	15
100-400 ppm		20	3	
500-10,000 ppm		500	3	
5,000-100,000ppm		5000	30	
			Final Reading	15

Sulfates (FM 5-553)

	Meter Reading	No. Dilutions	Reading
Low Range (2 to 70 ppm)		3	
High Range (70+ ppm)	10	30	300
		Final Reading	300

Resistivity (FM 5-551)

	Ohms
	83000
	16000
	4100
	1300
	960
	890
	850
	840
	730
	690
Final Reading	690

APPENDIX C

FHWA CHECKLIST (SECTION A)

TABLE OF CONTENTS

"GEOTECHNICAL REPORT REVIEW CHECKLISTS"

The following checklists cover the major information and recommendations which should be addressed in project geotechnical reports.

Section A covers site investigation information which will be common to all geotechnical reports for any type of geotechnical feature.

Sections B through I cover the basic information and recommendations which should be presented in geotechnical reports for specific geotechnical features: centerline cuts and embankments, embankments over soft ground, landslides, retaining walls, structure foundations and material sites.

<u>Subject</u>	<u>Page</u>
SECTION A, Site Investigation Information.....	1
SECTION B, Centerline Cuts and Embankments	3
SECTION C, Embankments Over Soft Ground	5
SECTION D, Landslide Corrections.....	7
SECTION E, Retaining Walls.....	9
SECTION F, Structure Foundations - Spread Footings.....	10
SECTION G, Structure Foundations - Piles	11
SECTION H, Structure Foundations - Drilled Shafts.....	14
SECTION I, Material Sites	15

In most sections and subsections the user has been provided supplemental page references to the Soils and Foundations Workshop Manual. These page numbers appear in parentheses () immediately adjacent to the section or subsection topic. Generalist engineers are particularly encouraged to read these references. Additional reference information on these topics is available in the Geotechnical Notebook, a copy of which is kept in all Division Offices by either the Bridge Engineer or the engineer with the soils responsibility.

Certain checklist items are of vital importance to have been included in the geotechnical report. These checklist items have been marked with an asterisk (*). A negative response to any of these asterisked items is cause to contact the geotechnical engineer for clarification of this omission.

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

"GTR REVIEW CHECKLIST" (SITE INVESTIGATION)

A. Site Investigation Information

Since the most important step in the geotechnical design process is the conduct of an adequate site investigation, presentation of the subsurface information in the geotechnical report and on the plans deserves careful attention.

<u>Geotechnical Report Text (Introduction) (Pages 322-325)</u>		<u>Yes</u>	<u>No</u>	<u>Unknown or N/A</u>
1.	Is the general location of the investigation described an/or a vicinity map included?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Is scope and purpose of the investigation summarized?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Is concise description given of geologic setting and topography of area?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Are the field explorations and laboratory tests on which the report is based listed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Is general description of subsurface soil, rock, and groundwater conditions given?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*6.	Is the following information included with the geotechnical report (typically included in report appendices):			
a.	Test hole logs? (Pages 25-33)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b.	Field test data?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c.	Laboratory test data? (Pages 74-75)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d.	Photographs (if pertinent)?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Plan and Subsurface Profile (Pages 24, 47-49, 335)

*7.	Is a plan and subsurface profile of the investigation site provided?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
-----	--	-------------------------------------	--------------------------	--------------------------

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.

A. <u>Site Investigation Information (Cont.)</u>	<u>Yes</u>	<u>No</u>	<u>Unknown or N/A</u>
8. Are the field explorations located on the plan view?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*9. Does the conducted site investigation meet minimum criteria outlined in Table 2?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Are the explorations plotted and correctly numbered on the profile at their true elevation and location?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Does the subsurface profile contain a word description and/or graphic depiction of soil and rock types?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Are groundwater levels and date measured shown on the subsurface profile?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Subsurface Profile or Field Boring Log (Pages 16-17, 25-29)

13. Are sample types and depths noted?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
*14. Are SPT blow counts, percent core recovery, and RQD values shown?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. If cone penetration tests were made, are plots of cone resistance and friction ratio shown with depth?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Laboratory Test Data (Pages 60, 74-75)

*16. Were lab soil classification tests such as natural moisture content, gradation, Atterberg limits, performed on selected representative samples to verify field visual soil identifications?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Are laboratory test results such as shear strength (Page 62), consolidation (Page 68), etc., included and/or summarized?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

*A response other than (yes) or (N/A) for any of these checklist questions is cause to contact the appropriate geotechnical engineer for a clarification and/or to discuss the project.



Town of Bay Harbor Islands

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