Final Report of Geotechnical Exploration
For

JEA Eastport Road Force Main

MAE Project No. 0021-0007
September 1, 2020

Prepared for:

ALMOND
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September 1, 2020

Almond Engineering Consulting Civil Engineers
6277 Dupont Station Court E., Unit 1
Jacksonville, Florida 32207

Attention: Ms. Hillary Almond, P.E.

Reference: Final Report of Geotechnical Exploration
JEA Eastport Road Force Main
Jacksonville, Florida
MAE Project No. 0021-0007

Dear Ms. Almond:

Meskel & Associates Engineering, PLLC (MAE) has completed a geotechnical exploration for the subject project. Our work was performed in general accordance with our proposal dated April 24, 2020. The geotechnical exploration was performed to evaluate the general subsurface conditions within the area of the proposed force main alignment, and to provide recommendations for support and design of the pipeline, and site preparation. This report has been updated since our Draft report was submitted July 1, 2020 to update the method of installation of the force main and to include any received comments.

In summary, the borings encountered as surficial pavement section (asphalt/limestone base course), underlain by fine sands to slightly silty fine sands (A-3 soils) within the upper 13.5 feet, and then occasionally followed by intermittent layers of silty fine sands (A-2-4) or clayey fine sands (A-2-6) to the boring termination depths of 20 feet below the existing grade. The relative densities of the encountered soils ranged from loose to medium dense. Groundwater was encountered at all the boring locations between depths of 3 feet 4 inches to 6 feet 7 inches below the existing grade.

Based on the subsurface conditions encountered in our exploration, it is our opinion that the soils are adaptable for installation and support of the planned force main, provided that the recommendations contained in this report are followed.

We appreciate this opportunity to be of service as your geotechnical consultant on this phase of the project. If you have any questions, or if we may be of any further service, please contact us.

Sincerely,
Meskel & Associates Engineering, PLLC
MAE FL Registry No. 28142

P. Rodney Mank, State of Florida, Professional Engineer, License No. 41986. This item has been electronically signed and sealed by P. Rodney Mank, P.E. on 09/01/2020 using a Digital Signature. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

W. Josh Mele, E.I.
Staff Engineer

Philip R Mank
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Distribution: Ms. Hillary Almond, P.E. – Almond Engineering Consulting Civil Engineers 1 pdf

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1.0 PROJECT INFORMATION

1.1 General

Project information was provided to us by Ms. Hillary Almond, P.E., with Almond Engineering Consulting Civil Engineers. Project details were summarized in electronic correspondences (emails) on April 21 and June 16, 2020. In addition, the April email contained a document labeled "Geo Scope of Work" and titled *JEA Eastport FM Scope of Survey* prepared by Almond Engineering Consulting Civil Engineers that detailed the limits of the project along Renne Drive just south of Eastport Road.

Prior to the submittal of this final report, we were provided with the 30 Percent Submittal plans that showed the proposed Force Main.

1.2 Project Description

The site for the subject project begins on Renne Drive near the intersection of Sara Drive and proceeds north, then turns east and terminates at Emuness Road in Jacksonville, Florida. The general site location is shown on Figure 1.

Based on the provided information and our discussions with Ms. Almond, it is our understanding the proposed project includes the construction of approximately 2,800 linear feet of force main. The 30 Percent Submittal plans showed most of the pipeline to consist of 10-inch diameter HDPE pipe to be installed using Horizontal Directional Drilling (HDD) methods. Approximately 388 feet of the pipeline will be installed using open-cut methods beginning just north of Sara Drive near Station 21+00 and ending near Station 24+22, or where the HDD segment begins. Another 95 feet of open-cut installation is planned at Rio Street near an existing gravity sewer pipe. Open-cut installation is also planned at the end of the pipeline beginning near Station 47+00 to its tie-in to an existing line at Emuness Road near Station 48+50, approximately 112 feet of the pipeline. The portions of the pipeline to be installed using open-cut methods will consist of 8-inch diameter PVC pipe.

The pipe embedment installed with open-cut methods will be approximately 3 to 5 feet below existing grade. The portion of the pipeline installed with HDD methods will be generally 7 to 8 feet below existing grade from approximately Station 24+22 to approximately Station 34+80. Following a short 95-foot segment installed by open-cut, the HDD portion will dive under an existing box culvert east of Rio Street to a depth of about 15 feet, and then continue via HDD at a depth of about 4 to 6 feet below existing grade to the termination of the HDD near Emuness Road.

If the final pipeline alignment and construction changes from that shown in the 30 Percent Submittal plans as discussed in this report, then the recommendations in this report may need to be re-evaluated once additional borings are located along the new or changed alignment. Any changes in pipeline construction should also be provided so that the need for re-evaluation of our recommendations can be assessed prior to final design.

2.0 FIELD EXPLORATION

A field exploration was performed on June 6, 2020. An aerial obtained from Google Earth, which shows the approximate boring locations, is included as the *Boring Location Plan*, Figure 2. The boring locations were determined by us and were spaced at approximately 250-foot intervals along the planned force main alignment. GPS coordinates of the boring locations were obtained from Google Earth and our field crew located each boring utilizing a Garmin GPSMAP 78 hand-held receiver. Each location was then marked for reference, and prior to our mobilization, a utility locate request was submitted to the Sunshine State One-Call Center. Once the site utilities were marked or cleared, our field crew mobilized to the site. The boring locations as shown on Figure 2 should be considered accurate only to the degree implied by the method of layout used.

2.1 Standard Penetration Test Borings

To explore the subsurface conditions within the area of the proposed structure, we located and performed 12 Standard Penetration Test (SPT) borings, advanced to depths of approximately 20 feet below the existing ground surface, in general accordance with the methodology outlined in ASTM D 1586. Split-spoon soil samples recovered during performance of the borings were visually described in the field and representative portions of the samples were transported to our laboratory for classification and laboratory testing. A summary of the field procedures is included in Appendix A.

2.2 Bulk Soil Sampling

Two bulk soil samples were obtained along the planned RWM alignment for corrosivity testing. These samples were collected near boring locations B-1 and B-12 at depths between 2 and 4 feet below existing grade. The samples were transported to our laboratory to be classified and tested for soil pH, soil resistivity, chlorides, and sulfates.

3.0 LABORATORY TESTING

Representative soil samples obtained during our field exploration were visually classified by a geotechnical engineer using the AASHTO Soil Classification System in general accordance with ASTM D 3282. A *Key to the Soil Classification System* is included in Appendix A.

3.1 Soil Index Testing

Quantitative laboratory testing was run on selected samples of the soils encountered during the field exploration to better define their composition and to provide data for correlation to their anticipated strength and compressibility characteristics. The laboratory testing determined the natural moisture content and the percent of material passing a U.S. No. 200 sieve (percent fines) of the selected soil samples. The results of the laboratory testing are shown in the *Summary of Laboratory Test Results* table included in Appendix B, on the *Generalized Soil Profiles* sheets (Figures 3 through 5), and on the soil boring logs at the respective depths from which the tested samples were recovered.

3.2 Corrosion Series Tests

As previously stated, two bulk soil samples were selected for corrosion potential testing. The testing included soil pH, resistivity, and chloride and sulfate contents. The test results are discussed in Section 5.4 below, and included in Appendix C.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 General Soil Profile

Graphical presentation of the generalized subsurface conditions is presented on Figures 3 through 5.

Detailed boring records are included in Appendix A. When reviewing these records, it should be understood that the soil conditions will vary between the boring locations. The following table summarizes the soil conditions encountered.

GENERAL SOIL PROFILE: BUILDING AREA, PAVEMENT AREA, ETC			
TYPICAL DEPTH (ft)		**SOIL DESCRIPTION**	**AASHTO[1]**
FROM	**TO**		
0	0.5 to 1	Pavement Section (Asphalt Surface/Limerock Base Course).	---
0.5 to 1	18.5	Loose to medium dense fine sands to fine sands with silt.	A-3
18.5	20	Loose to medium dense fine sands with silt, silty fine sands and clayey fine sands.	A-3, A-2-4, A-2-6
[1] American Association of State Highway and Transportation Officials			

As exceptions, clayey fine sands were encountered at two boring locations beginning at a depth of 13.5 feet below the existing grade boring locations B-4 and B-7. In addition, boring B-5 encountered a silty fine sand layer (A-2-4) between approximate depths of 8 to 13.5 beneath the existing grade.

4.2 Groundwater Level

The groundwater level was encountered at each of the boring locations and recorded at the time of drilling at depths varying from 3 feet 4 inches to 6 feet 7 inches below the existing ground surface. However, it should be anticipated that the groundwater levels will fluctuate seasonally and with changes in climate. As such, we recommend that the water table be remeasured prior to construction. Measured groundwater levels are shown on the boring profiles and boring logs.

4.3 Review of the USDA Web Soil Survey Map

The results of a review of the USDA Soil Survey Conservation Service (SSCS) Web Soil Survey of Duval County are shown in the table below. There are two predominant soil map units at the project site. The soil drainage class, hydrological group, and estimated seasonal high groundwater levels reported in the Soil Survey are as follows:

Map Unit Symbol	Map Unit Name	Drainage Class	Hydrologic Group	Depth to the Water Table[1] (inches)
71	Urban land[2]-Leon-Boulogne complex[3], 0 to 2 percent slopes	Poorly Drained	A/D, C/D	6 to 18
75	Urban land[2]-hurricane-Albany complex[3], 0 to 5 percent slopes	Somewhat Poorly Drained	A, A/D	12 to 42

[1] The "Water table" above refers to a saturated zone in the soil which occurs during specified months, typically the summer wet season. Estimates of the upper limit shown in the Web Soil Survey are based mainly on observations

of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

(2) The Urban land classification does not have an associated soil type, drainage class, hydrologic group, and estimated seasonal high groundwater levels typically reported in the Soil Survey.

(3) The term "complex", as defined by the USDA, refers to a map unit consisting of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the map.

4.4 Seasonal High Groundwater Level

In estimating seasonal high groundwater level, a number of factors are taken into consideration including antecedent rainfall, soil redoximorphic features (i.e., soil mottling), stratigraphy (including presence of hydraulically restrictive layers), vegetative indicators, effects of development, and relief points such as drainage ditches, low-lying areas, etc.

Based on our interpretation of the current site conditions, including the boring logs and review of published data, we estimate the seasonal high groundwater levels at the soil boring locations to be generally 18 to 24 inches below existing grade as encountered at the time of our field work.

It is possible that higher groundwater levels may exceed the estimated seasonal high groundwater level as a result of significant or prolonged rains. Therefore, we recommend that design drawings and specifications account for the possibility of groundwater level variations, and construction planning should be based on the assumption that such variations will occur.

5.0 DESIGN RECOMMENDATIONS

5.1 General

The following geotechnical engineering evaluation and recommendations are based on the results of the field and laboratory testing performed, our experience with similar soil conditions, and our understanding of the provided project information. If the project information presented in this report is incorrect, or if the project details change prior to final design, then MAE should be contacted so that these recommendations can be reviewed. Also, the discovery of any site or subsurface conditions during construction that deviate from the data presented herein should be reported to us for evaluation. We recommend that we be provided the opportunity to review the plans and earthwork specifications before construction to verify that our recommendations have been properly interpreted and implemented.

5.2 Horizontal Directional Drilling (HDD) Recommendations

Based on review of the provided 30 Percent Submittal plans, we understand that the depth of the HDD bore will be generally 7 to 8 feet below existing grade between approximately Station 24+22 to approximately Station 34+80, approximately 15 feet under an existing box culvert east of Rio Road, and approximately 4 to 6 feet below existing grade to the termination of the HDD near Emuness Road. The soil borings generally encountered loose to medium dense fine sands and fine sands with silt (A-3, A-2-4) within the planned depths of the HDD.

Clayey sands (A-2-6) were encountered at boring B-7 beginning at a depth of about 14 feet below existing grade and continued to the terminating depth of 20 feet. Though these sands were not encountered at boring B-8, these soils may be encountered within the deep HDD segment below the existing box culvert east of Rio Road.

The in-situ friction angle within the sand soils (A-3, A-2-4, A-2-6), based on the measured N-Value from the SPT test, is estimated to range from 30° (loose sands) to 32° (medium dense sands).

No limestone stratum or hard or dense soil layers were encountered in the borings. Therefore, hard drilling is not anticipated within the depths of the borings. In addition, no fluid losses were observed by the field crew at any of the boring locations.

We recommend the general subsurface conditions as described above and in Section 4.0 be provided to the HDD contractor for use in design of the HDD bore.

5.3 Open-Cut Pipeline Support Recommendations

Where open-cut installation of the pipeline will occur, we understand that the planned force main will have an invert elevation that is between 3 and 5 feet below the existing ground surface. Based on the results of the subsurface exploration and laboratory testing as discussed in this report, we consider the subsurface conditions encountered in the borings to be adaptable for supporting this portion of the proposed pipeline when constructed by open-cut methods upon properly prepared subgrade soils.

As discussed earlier in the report, the borings encountered a surficial pavement section underlain by fine sands and fine sands with silt (A-3) throughout most of the boring profiles. These soils are suitable as pipe bedding and are suitable for use as pipe backfill soil. These soils should be placed and compacted as discussed in Section 6.0 below.

Silty fine sands (A-2-4) were encountered at boring B-5 beginning at a depth of about 8.5 feet below existing grade. Though they were not encountered within the planned open-cut portions of the alignment, they may be encountered at or near the pipe invert elevation in unexplored areas of the pipeline route. The A-2-4 soils are not recommended for use as pipe bedding or backfill due to their affinity for moisture, which makes them difficult to place and compact. However, they could be blended with the A-3 soils as long as the blended soil meets the structural backfill recommendations provided in Section 6.0 below.

Clayey fine sands (A-2-6) were encountered at boring locations B-3, B-4, and B-7 beginning at depths of about 13.5 and 18.5 feet below existing grade. Given the expected pipe embedment depth and depths where these soils were encountered, it is not expected that these A-2-6 soils will be encountered during excavation. If A-2-6 soils are encountered, they are not considered suitable for pipe bedding and should be excavated to a depth of at least 24 inches below the pipe invert elevation and replaced with compacted structural fill soil as described in Section 6.4. The purpose of this is to provide more uniform bearing conditions, and to reduce the potential for post construction settlements of the pipeline.

A-2-6 soils should be stockpiled separately from the A-3 soils, and from the A-2-4 soils if they are to be reused, for disposal, and should be replaced with suitable structural backfill soil as described in Section 6.0 below.

Alternatively, a graded aggregate conforming to ASTM No. 67 stone as noted in the JEA *Water & Wastewater Standards Manual*, latest edition, may be used as pipe bedding. If the graded aggregate is used as the pipe bedding material, then the A-2-6/A-2-4 soils need only be excavated to a depth of 12 inches below the pipe invert elevation. Where the bottom of the ASTM No. 67 stone will be on top of the clayey and or silty (A-2-6/A-2-4) soils, a non-woven geotextile should be placed at the gravel/clayey and/or silty soil interface to function as a separation layer. This fabric will help reduce the potential for infiltration of the clay and/or silt fines into the gravel material. The stone should be placed in equal lifts of 6 inches or less, with each lift compacted to form a stable working surface.

Assuming the project information as understood at the beginning of this report is correct and provided the site preparation and earthwork construction recommendations outlined in Section 6.0 of this report are performed, the following parameters may be used for design.

5.3.1 Lateral Pressure Design Parameters

Walls for any underground structures that are backfilled on one side and restrained against rotation at the top, should be designed to resist lateral pressures from soil and groundwater based on the following equivalent fluid unit weights:

Above Water Table - Equivalent Fluid Density	60 lb/ft^3
Below Water Table - Equivalent Fluid Density	90 lb/ft^3

For the design of lateral loads on underground walls, we recommend that the groundwater level be assumed to be at the ground surface. Lateral pressure distributions in accordance with the above do not take into account forces from construction equipment, wheel loads or other surcharge loads. To account for this loading, a pressure equal to 0.5 times the anticipated surface surcharge should be applied over the full height of all walls.

5.3.2 Resisting Lateral Forces

Horizontal forces that act on pipeline structures such as thrust and anchor blocks can be resisted to some extent by the earth pressures that develop in contact with the buried perpendicular face of the block structure, and by shearing resistance mobilized along the block structures base and subgrade interface. Allowable passive earth pressure resistance may be determined using the following equivalent fluid densities:

Above Water Table - Equivalent Fluid Density	100 lb/ft^3
Below Water Table - Equivalent Fluid Density	60 lb/ft^3

A factor of safety of 3 was used for the above values. It is assumed the block structures are surrounded by well compacted structural backfill, as described in Section 6.4 below, extending at least 5 feet horizontally beyond the vertical bearing face. In addition, it is presumed that the block structures can withstand horizontal movements on the order of 0.5-inch before mobilizing full passive resistance.

The allowable sliding shearing resistance mobilized along the base of the block structure may be determined by the following formula:

$$P = {}^{1}/_{3}V \tan ({}^{2}/_{3}\,\Phi)$$

Where:
P = Allowable shearing resistance force
V = Net vertical force (total weight of block and soil overlying the structure minus hydrostatic uplift forces)
Φ = Angle of internal friction = 30°

The following unit weights can be used to calculate the weight of the overburden soil:

Compacted Moist Soil	110 lb/ft^3
Saturated Soil	120 lb/ft^3

5.3.3 Hydrostatic Uplift Resistance

It is anticipated that the buried structures will exert little or no net downward pressure on the soils; rather, the structures may be subject to hydrostatic uplift pressure when empty. Underground structures should be designed to resist hydrostatic uplift pressures appropriate for their depth below final grade and the seasonal high groundwater table. Hydrostatic uplift forces can be resisted in several ways including:

- Addition of dead weight to the structure.
- Mobilizing the dead weight of the soil surrounding the structure through extension of footings outside the perimeter of the structure.

A moist compacted soil unit weight of 110 lb/ft^3 may be used in designing structures to resist buoyancy.

5.3.4 Thrust Block Soil Bearing Pressure

The maximum allowable net soil bearing pressure for use in design of thrust blocks should not exceed 2,000 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of the natural overburden pressure at that level. The structure should be designed based on the maximum load that could be imposed by all loading conditions.

The structures should bear in either compacted suitable natural soils or compacted structural fill. The bearing level soils, after compaction, should exhibit densities equivalent to 95 percent of the modified Proctor maximum dry density (AASHTO T-180), to a depth of at least one foot below the bearing level.

5.4 Environmental Classification

Two bulk soil samples were obtained from borings performed within the planned pipeline alignment. The purpose of these samples was to run soil corrosion potential tests to determine the environmental classification of the soils for ductile iron valve and fitting instillation. The samples were to be classified in accordance with FDOT procedures contained in Chapter 1.3.2.1 of the January 2020 edition of the FDOT *Structures Design Guidelines*. Based on the results of these tests, the encountered soils were classified as Slightly Aggressive for both steel and concrete substructures. Sample locations and test results are shown on the *Summary of Corrosion Series Test Results* in Appendix C.

6.0 SITE PREPARATION AND EARTHWORK RECOMMENDATIONS

Site preparation as outlined in this section should be performed to provide more uniform foundation bearing conditions and to reduce the potential for post-construction settlements of the planned pipeline.

6.1 Clearing

Prior to construction, the location of existing underground utility lines within the construction area should be established. Provisions should then be made to relocate interfering utilities to appropriate locations. It should be noted that if underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which may subsequently lead to excessive settlement of overlying structures.

During the excavation process, pavement section materials such as asphalt and limerock should be stockpiled a safe distance from the construction areas to be removed from the site. We do not recommend use of any of the pavement materials as pipe bedding or backfill within the pipeline excavations.

Outside of the roadway section, it should be anticipated that 6 to 12 inches of topsoil and soils containing significant amounts of organic materials may be encountered along the planned pipeline route. The actual depths of topsoil and surficial organic soils should be determined by MAE using visual observation and judgment during earthwork operations. The topsoil and surficial organic soils should not be reused as backfill material within the pipeline excavations. However, they may be stockpiled and used subsequently in areas to be grassed.

6.2 Temporary Groundwater & Surface Water Control

The groundwater level was encountered at the boring locations at depths varying from 3 feet 4 inches to 6 feet 7 inches below the existing ground surface at the time of our exploration. Because of the need for excavation to the pipeline invert elevations, followed by compaction of the bedding and backfill soils, it may be necessary to install temporary groundwater control measures to dewater the area to facilitate the excavation and compaction processes.

Groundwater control measures should be determined by the contractor but can consist of sumps or wellpoints (or a combination of these or other methods) capable of lowering the groundwater level to at least 2 feet below the required depth of excavation. The dewatering system should not be decommissioned until excavation, compaction, and fill placement is complete, and sufficient deadweight exists on the structures to prevent uplift. It should be anticipated that well point installation into the dense to very dense soils encountered at several of the borings may be difficult, and additional efforts may be necessary to adequately dewater excavations in these soils. During excavation of the pipe trenches, surface water during rainfall events should be diverted or captured and re-routed to avoid impacts to the excavation.

6.3 Preparation of Pipe Bedding Soils

The borings primarily encountered loose to medium dense fine sands and fine sands with silt (A-3) along the planned force main alignment. These soils are suitable for reuse as pipe bedding and backfill material. Silty fine sands (A-2-4) were encountered at boring B-5 beginning at a depth of about 8.5 feet below existing grade. Though they were not encountered within the planned pipe excavation, they may be encountered at or near the pipe invert elevation in unexplored areas of the pipeline route. The A-2-4 soils are not recommended for use as pipe bedding or backfill due to their affinity for moisture, which makes them difficult to place and compact. However, they could be blended with the A-3 soils as long as the blended soil meets the structural backfill recommendations provided in Section 6.4 below.

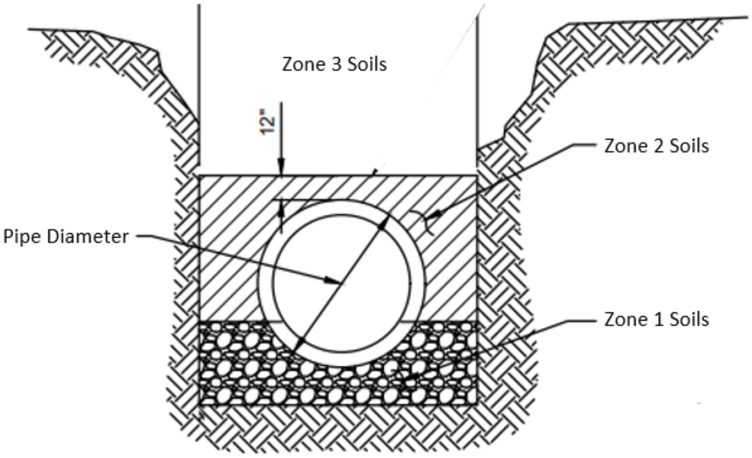
Clayey fine sands (A-2-6) were encountered at boring locations B-3, B-4, and B-7 beginning at depths of about 13.5 and 18.5 feet below existing grade. Given the expected pipe embedment depth and depths where these soils were encountered, it is not expected that these A-2-6 soils will be encountered during excavation. If A-2-6 soils are encountered, they should be removed to a depth of at least 24 inches below the pipe invert elevation and replaced with compacted structural fill soil as described in Section 6.4 below.

Where the pipeline will bear in sand soils (A-3), these soils should be excavated to the proposed bearing elevation and the exposed excavation surface should be compacted as outlined in Section 6.4 below.

An alternative bedding material for the pipe is a graded aggregate conforming to ASTM No. 67 stone as noted in the JEA *Water & Wastewater Standards Manual*, latest edition. If the graded aggregate is used, then the A-2-6 and/or A-2-4 soils need only be excavated to a depth of 12 inches below the pipe invert elevation. Where the bottom of the ASTM No. 67 stone will be on top of the clayey (A-2-6) and/or silty (A-2-4) soils, a non-woven geotextile should be placed at the gravel/clayey and/or silty soil interface to function as a separation layer. This fabric will help reduce the potential for infiltration of the clay and/or silt fines into the gravel material. The stone should be placed in equal lifts of 6 inches or less, with each lift compacted to form a stable working surface. Once the pipe is installed, the excavation should be backfilled with compacted structural backfill to final grades.

6.4 Compaction of Pipe Backfill

After installing the temporary groundwater control measures, achieving the required depth of excavation, and removing any unsuitable soil as described in Section 6.3, the exposed sand soil surface (Zone 1 soils) should be evaluated by the Contractor to ensure the undisturbed soil is A-3 material. In areas where existing silty (A-2-4) or clayey (A-2-6) soils are over-excavated, suitable backfill (A-3 soils) or aggregate (ASTM No. 67 Stone) should meet the compaction criteria shown in the table below.



Open Cut Trench Detail

Zone 1 consists of undisturbed soils or suitable backfill below the pipe.

Zone 2 consists of backfill soils from below the pipe to 1 foot above the top of pipe.

Zone 3 consists of backfill soils from 1 foot above the top of pipe to the ground surface or bottom of stabilized subgrade for a pavement section.

Typically, the backfill soils should exhibit moisture contents within ±2 percent of the Proctor optimum moisture content during the compaction operations. Compaction criteria should meet the requirements shown in the table below.

Location	**Material Type**	**Minimum Compaction Requirement**		**Maximum Lift Thickness**
		Test Type	**Requirement**	
CITY OF JACKSONVILLE EASEMENTS (NOT UNDER PAVEMENT)				
Zone 1: Below Pipe	Undisturbed Soil (A-3)	* (1)	* (1)	* (1)
	Backfill Soil (A-3)	ASTM D 1557	95% Max. Dry Density	6 inches
	ASTM No. 67 Stone (2)	N/A	N/A	N/A
	Flowable Fill (3)	N/A	N/A	N/A
Zone 2: Up to 1-Foot Over Top of Pipe	Backfill Soil (A-3)	ASTM D 1557	98% Max. Dry Density	6 inches

Location	**Material Type**	**Minimum Compaction Requirement**		**Maximum Lift Thickness**
		Test Type	**Requirement**	
Zone 3: Over 1-Foot From Top of Pipe to Grade	Backfill Soil (A-3)	ASTM D 1557	95% Max. Dry Density	12 inches
CITY OF JACKSONVILLE EASEMENTS (UNDER PAVEMENT - CITY/COUNTY ROAD) (4)				
Zone 1: Below Pipe	See Requirement above for COJ Easements (Not Under Pavement)			
Zone 2: Up to 1-Foot Over Top of Pipe	Backfill Soil (A-3)	ASTM D 1557	98% Max. Dry Density	6 inches
Zone 3: Over 1-Foot From Top of Pipe to Bottom of Pavement Section	Backfill Soil (A-3)	ASTM D 1557	95% Max. Dry Density	12 inches

(1) Undisturbed Soil below the pipe must not consist of unsuitable soil as described in Section 6.3. If unsuitable soil is present, this material should be over-excavated and replaced as described in Section 6.3.

(2) In lieu of the A-3 soil material for backfill and bedding, granular backfill shall consisting of well-graded crushed stone or crushed gravel meeting the requirements of ASTM Designation C33, Gradation 67 (3/4 inch to No. 4) may be used.

(3) Flowable fill may be used in accordance with Section IX.4 of the JEA Water & Wastewater Standards.

(4) Renne Drive and Emuness Road are considered City roadways.

Should the bearing level soils experience pumping and soil strength loss during the compaction operations, compaction work should be immediately terminated and (1) the disturbed soils removed and backfilled with dry structural fill soils that are then compacted, or (2) the excess moisture content within the disturbed soils allowed to dissipate before recompacting.

Structural backfill placed within the pipeline excavation, and in areas in which over-excavation of unsuitable soils is required below the pipeline elevation, should be placed in loose lifts not exceeding the lift thicknesses shown in the table above and compacted using hand or mechanically-operated compaction equipment.

Structural backfill placed around structures should be placed in 6-inch lifts and compacted with hand-operated compaction equipment. Heavy compaction equipment should not be used within 5 feet of structures to prevent overstressing of the structure walls.

Structural backfill is defined as a non-plastic, granular soil having less than 10 percent material passing the No. 200 mesh sieve and containing less than 4 percent organic material. The sand soils (A-3) meeting the properties given above, as encountered in the borings, may be used as backfill. The A-2-4 soils as encountered in the borings can be blended with the A-3 soils as long as the blended soil meets the structural backfill recommendations given above.

The backfill soils should exhibit moisture contents within ±2 percent of the Proctor optimum moisture content during the compaction operations. Compaction should continue until density requirements in the table above have been achieved within each lift of compacted structural backfill.

We recommend that soil excavated from the pipeline trenches that will be reused as backfill be stockpiled a safe distance from the excavations and in such a manner that promotes runoff away from the open trenches and limits saturation of the excavated soil.

Care should be exercised to avoid damaging any nearby structures while the compaction operations are underway. Compaction should cease if deemed detrimental to adjacent structures.

6.5 Excavation Protection

Excavation work for the water main construction will be required to meet OSHA Excavation Standard Subpart P regulations for Type C Soils. The use of excavation support systems for trenches that are 5 feet in depth or deeper will be necessary where there is not sufficient space to allow the side slopes of the excavation to be laidback to at least 1.5H:1V (1.5 horizontal to 1 vertical) to provide a safe and stable working area and to facilitate adequate compaction along the sides of the excavation. Trenches that are less than 5 feet deep may have unsupported, vertical walls if a competent person as defined by OSHA determines that a protective system is not required. In addition, it should be anticipated that an excavation support system may be necessary to protect adjacent existing structures, pavement and/or utilities that are located along the proposed pipeline alignment.

The method of excavation support should be determined by the contractor but can consist of a trench box, drilled-in soldier piles with lagging, interlocking steel sheeting or other methods. The support structure should be designed according to OSHA sheeting and bracing requirements by a Florida licensed Professional Engineer. Where pipeline excavations and the construction of excavation support systems are within 50 feet of existing structures, the existing structures should be monitored for adverse reactions to construction vibrations and dewatering activities.

7.0 QUALITY CONTROL TESTING

A representative number of field in-place density tests should be made in the upper 2 feet of compacted natural soils, in each lift of compacted backfill and fill, and in the upper 12 to 24 inches below the bearing levels in the pipeline excavations if the existing bedding soils are removed and replaced with suitable backfill soil. The density tests are considered necessary to verify that satisfactory compaction operations have been performed. We recommend density testing be performed at a minimum of one location for every 150 feet of pipeline in open-cut trenches within City-Owned Right-of-Ways.

8.0 REPORT LIMITATIONS

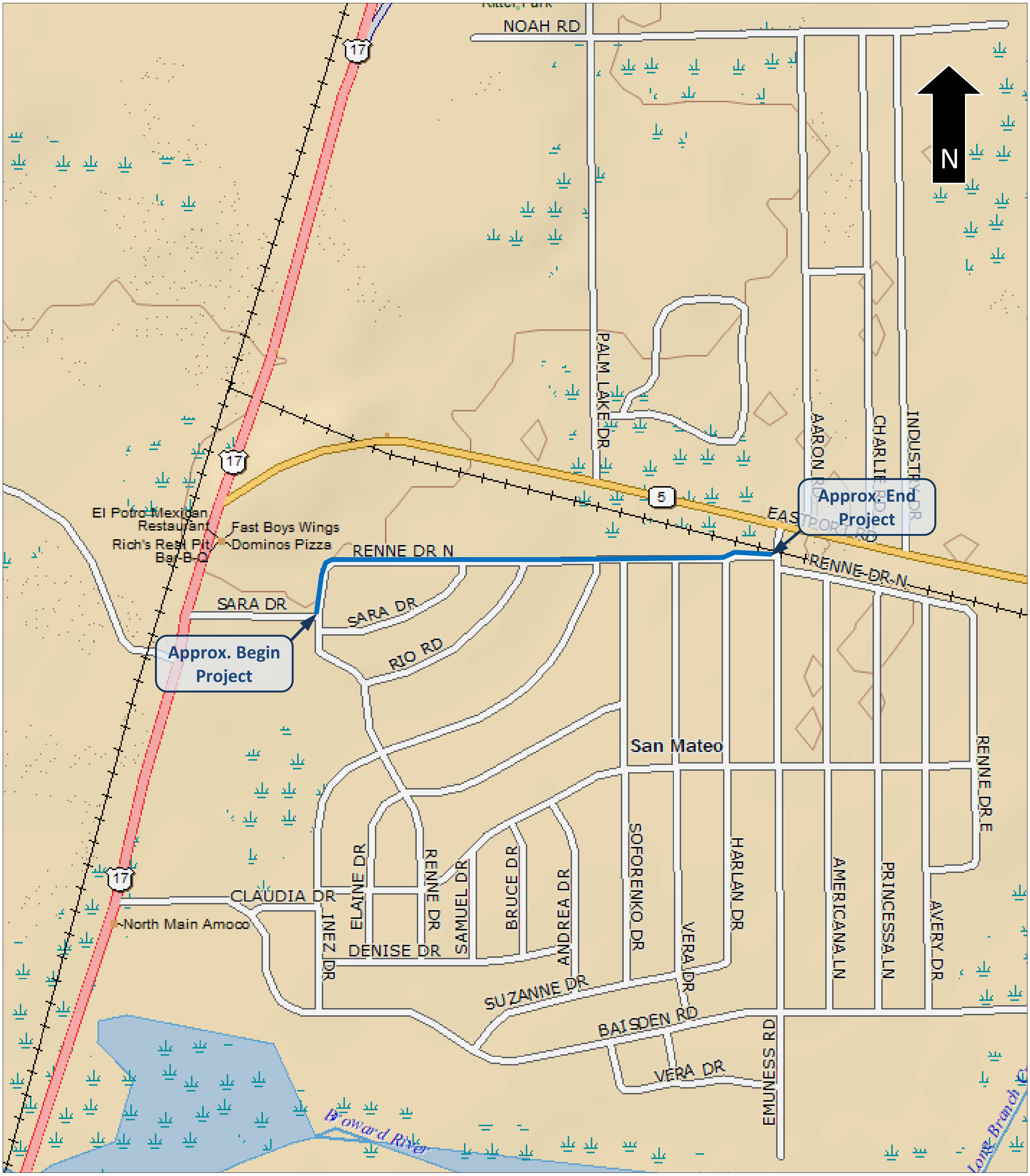
This report has been prepared for the exclusive use of Almond Engineering Consulting Civil Engineers and JEA for specific application to the design and construction of the *JEA Eastport Force Main* project. An electronically signed and sealed version, and a version of our report that is signed and sealed in blue ink, may be considered an original of the report. Copies of an original should not be relied on unless specifically allowed by MAE in writing. Our work for this project was performed in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from this project. This testing indicates subsurface conditions only at the specific locations and times, and only to the depths explored. These results do not reflect subsurface variations that may exist away from the boring locations and/or at depths below the boring termination depths. Subsurface conditions and water levels at other locations may differ from conditions occurring at the tested locations. In addition, it should be understood that the passage of time may result in a change in the conditions at the tested locations. If variations in subsurface conditions from those described in this report are observed during construction, the recommendations in this report must be re-evaluated.

The scope of our services did not include any environmental assessment or testing for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the subject site. Any statements made in this report, and/or notations made on the generalized soil profiles or boring logs, regarding odors or other potential environmental concerns are based on observations made during execution of our scope of services and as such are strictly for the information of our client. No opinion of any environmental concern of such observations is made or implied. Unless complete environmental information regarding the site is already available, an environmental assessment is recommended.

If changes in the alignment of the force main occur, the conclusions and recommendations contained in this report may need to be modified. We recommend that these changes be provided to us for our consideration. MAE is not responsible for conclusions, interpretations, opinions, or recommendations made by others based on the data contained in this report.

Figures



Site Location Map

PREPARED BY	PROJECT NAME
Meskel & Associates Engineering	**JEA Eastport Road Force Main Jacksonville, Florida**
	REFERERENCE: Delorme XMap 7.0
	SCALE: NTS
PREPARED FOR	MAE PROJECT NO.: 0021-0007
Almond Engineering Consulting Civil Engineers	**FIGURE NO.**: 1

Project Manager:	BHH	Project No.	0021-0007
Drawn by:	BHH	Scale:	AS SHOWN
Checked by:	BHH	File Name:	0021-0007.BLP
Approved by:	BHH	Date:	7/1/2020

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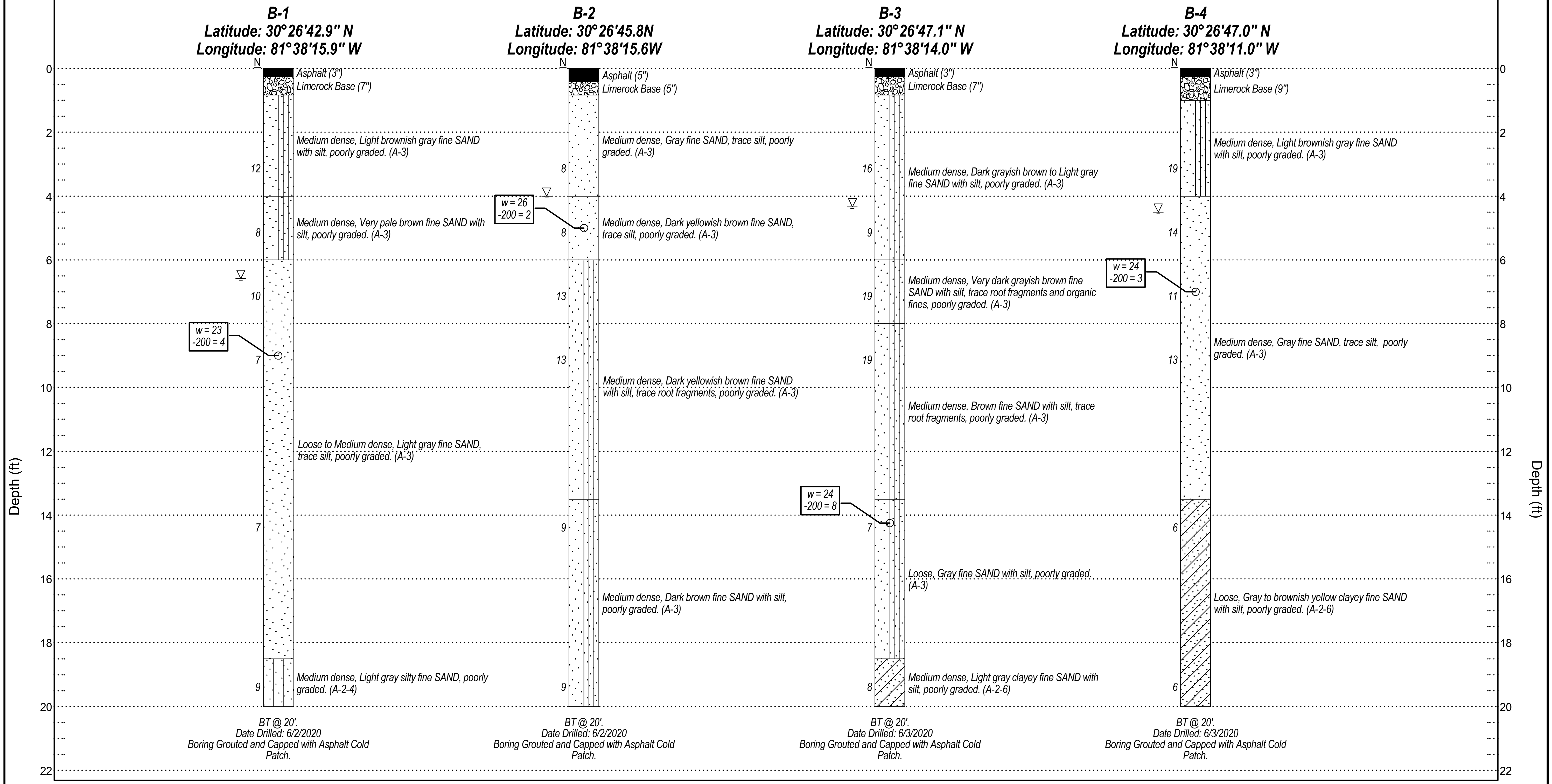
Meskel & Associates Engineering

3728 PHILIPS HIGHWAY – SUITE 208 • JACKSONVILLE, FLORIDA 32207
PH. (904) 519-6990 • FAX (904) 519-6992 • www.MeskelEngineering.com

BORING LOCATION PLAN

JEA EASTPORT ROAD FORCE MAIN
JACKSONVILLE, FLORIDA

FIG NO.
2



Legend

■ Asphalt
⁙ Fine Sand
▩ Limerock Base
▥ Silty Fine Sand
▥ Fine Sand with Silt
▨ Clayey Fine Sand

N	Standard Penetration Resistance, Blows/Foot	(A-3)	AASHTO Soil Classification System	w	Natural Moisture Content (%)
BT	Boring Terminated at Depth Below Existing Grade	∇	Depth to Groundwater at Time of Drilling	-200	% Passing No. 200 U.S. Standard Sieve

Note: Each boring advanced by drilling through pavement layers and driving split-spoon sampler to the first SPT interval of 2 feet below grade.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986
MAE
Meskel & Associates Engineering
FL. Registry No. 28142
3728 Philips Highway, Suite 208, Jacksonville, FL 32207

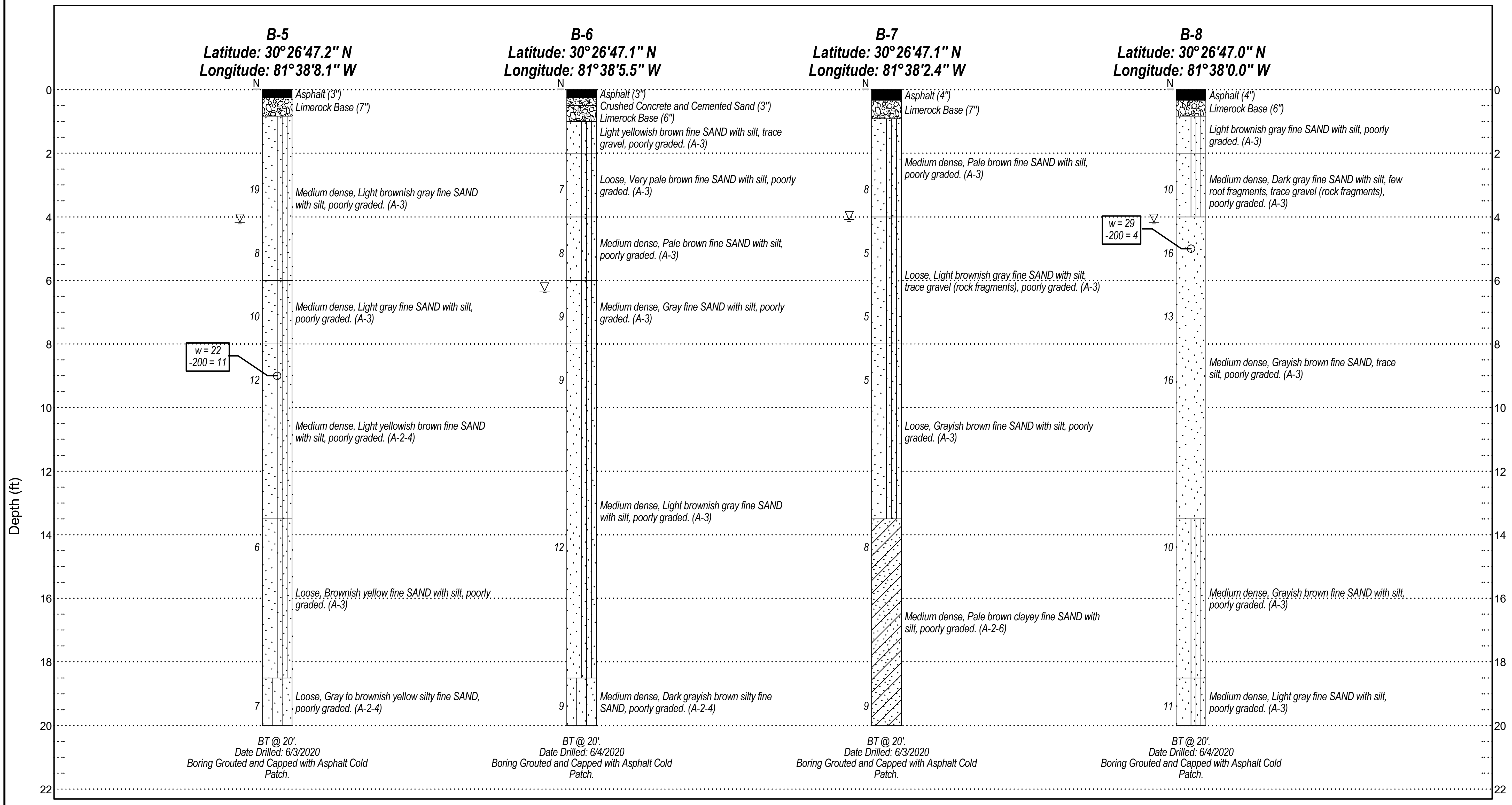
Almond Engineering Consulting Civil Engineers

DATE:	MAE PROJECT NO.
9/1/2020	0021-0007

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: JEA Eastport Road Force Main
Jacksonville, FL

FIGURE NO.
3



Legend

■ Asphalt	▨ Limerock Base	▥ Fine Sand with Silt
▥ Silty Fine Sand	▨ Crushed Concrete	▨ Clayey Fine Sand
⁘ Fine Sand		

N Standard Penetration Resistance, Blows/Foot

BT Boring Terminated at Depth Below Existing Grade

(A-3) AASHTO Soil Classification System

∇ Depth to Groundwater at Time of Drilling

w Natural Moisture Content (%)

-200 % Passing No. 200 U.S. Standard Sieve

Note: Each boring advanced by drilling through pavement layers and driving split-spoon sampler to the first SPT interval of 2 feet below grade.

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

P. RODNEY MANK, P.E. P.E. NO.: 41986

MAE
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FL. Registry No. 28142
3728 Philips Highway, Suite 208, Jacksonville, FL 32207

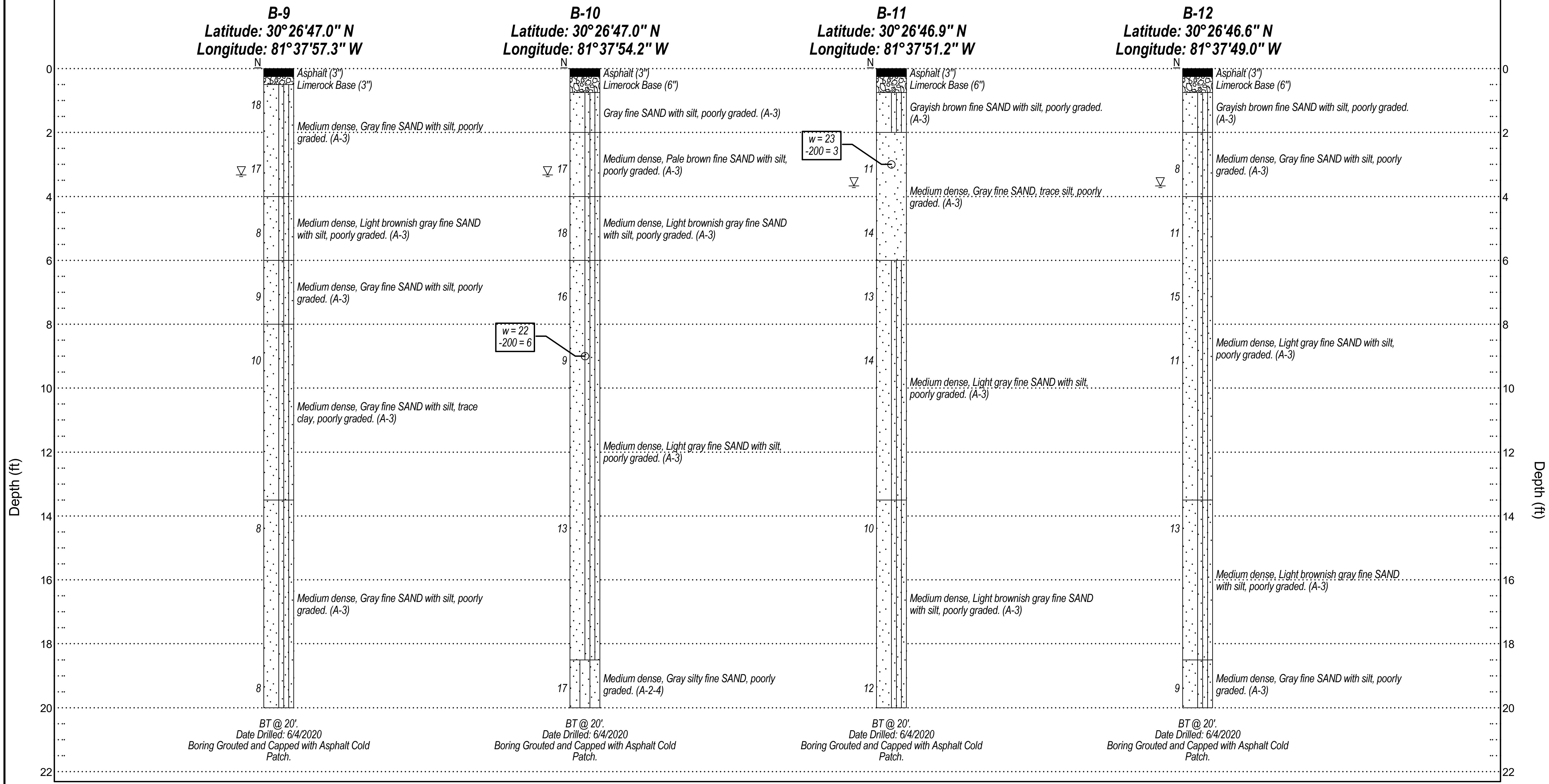
Almond Engineering Consulting Civil Engineers

DATE:	MAE PROJECT NO.
9/1/2020	0021-0007

SHEET TITLE:
Generalized Soil Profiles

PROJECT NAME:
JEA Eastport Road Force Main
Jacksonville, FL

FIGURE NO.
4



Legend

■ Asphalt

▨ Limerock Base

▥ Fine Sand with Silt

▥ Silty Fine Sand

⁘ Fine Sand

N Standard Penetration Resistance, Blows/Foot

BT Boring Terminated at Depth Below Existing Grade

(A-3) AASHTO Soil Classification System

▽ Depth to Groundwater at Time of Drilling

w Natural Moisture Content (%)

-200 % Passing No. 200 U.S. Standard Sieve

Note: Borings B-10, B-11 & B-12 advanced by drilling through pavement layers and driving split-spoon sampler to the first SPT interval of 2 feet below grade.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

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Almond Engineering Consulting Civil Engineers

DATE:	MAE PROJECT NO.
9/1/2020	0021-0007

SHEET TITLE: Generalized Soil Profiles

PROJECT NAME: JEA Eastport Road Force Main
Jacksonville, FL

FIGURE NO. 5

Appendix A

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Meskel & Associates Engineering

BORING B-1

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main
PROJECT LOCATION Jacksonville, FL
CLIENT Almond Engineering Consulting Civil Engineers
DATE STARTED 6/2/2020 **COMPLETED** 6/2/2020
LATITUDE 30°26'42.9" N **LONGITUDE** 81°38'15.9" W
DRILLING CONTRACTOR MAE, PLLC
DRILLING METHOD Standard Penetration Test
LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele
GROUND ELEVATION —
HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3")												
		Limerock Base (7")												
	1	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		9 10									
	2				6 8 4 4	12								
5	3	Medium dense, Very pale brown fine SAND with silt, poorly graded.	A-3		5 4 4 5	8								
	4	∇ Loose to Medium dense, Light gray fine SAND, trace silt, poorly graded.	A-3		6 5 5 3	10								
10	5				3 4 3 4	7	23	4						
15	6				3 4 3	7								
20	7	Medium dense, Light gray silty fine SAND, poorly graded.	A-2-4		5 5 4	9								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

∇ **AT TIME OF DRILLING** 6 ft 7 in *∇ **END OF DAY** ---

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BORING B-2

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

DATE STARTED 6/2/2020 **COMPLETED** 6/2/2020

LATITUDE 30°26'45.8N **LONGITUDE** 81°38'15.6W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele

GROUND ELEVATION —

HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (5")												
		Limerock Base (5")												
	1	Medium dense, Gray fine SAND, trace silt, poorly graded.	A-3		3 2									
	2				3 4 4 6	8								
5	3	Medium dense, Dark yellowish brown fine SAND, trace silt, poorly graded.	A-3		3 4 4 4	8	26	2						
	4	Medium dense, Dark yellowish brown fine SAND with silt, trace root fragments, poorly graded.	A-3		6 6 7 9	13								
10	5				8 7 6 9	13								
15	6	Medium dense, Dark brown fine SAND with silt, poorly graded.	A-3		3 4 5	9								
20	7				5 4 5	9								

▽ (at 4 ft)

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 0 in

*▽ **END OF DAY** ---

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BORING B-3

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL **CLIENT** Almond Engineering Consulting Civil Engineers

DATE STARTED 6/3/2020 **COMPLETED** 6/3/2020 **LATITUDE** 30°26'47.1" N **LONGITUDE** 81°38'14.0" W

DRILLING CONTRACTOR MAE, PLLC **DRILLING METHOD** Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele **GROUND ELEVATION** — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3") Limerock Base (7")												
	1				8 8									
	2	Medium dense, Dark grayish brown to Light gray fine SAND with silt, poorly graded.	A-3		6 8 8 8	16								
5	3	∇			3 4 5 6	9								
	4	Medium dense, Very dark grayish brown fine SAND with silt, trace root fragments and organic fines, poorly graded.	A-3		6 8 11 12	19								
10	5				9 9 10 13	19								
		Medium dense, Brown fine SAND with silt, trace root fragments, poorly graded.	A-3											
15	6				6 3 4	7	24	8						
		Loose, Gray fine SAND with silt, poorly graded.	A-3											
20	7	Medium dense, Light gray clayey fine SAND with silt, poorly graded.	A-2-6		3 4 4	8								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

∇ **AT TIME OF DRILLING** 4 ft 4 in *∇ **END OF DAY** ---

NEW MAE LOG AASTHO LAT_LONG_G3 - NEW TEMPLATE 7-30-12.GDT - 6/16/20 09:00 - F:\GINT\GINT FILES\PROJECTS\0021-0007\JEA EASTPORT FORCE MAIN.GPJ

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BORING B-4

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main
PROJECT LOCATION Jacksonville, FL
CLIENT Almond Engineering Consulting Civil Engineers
DATE STARTED 6/3/2020 **COMPLETED** 6/3/2020
LATITUDE 30°26'47.0" N **LONGITUDE** 81°38'11.0" W
DRILLING CONTRACTOR MAE, PLLC
DRILLING METHOD Standard Penetration Test
LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele
GROUND ELEVATION —
HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3")												
	1	Limerock Base (9")			9 13									
	2	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		11 11 8 13	19								
5	3	▽ Medium dense, Gray fine SAND, trace silt, poorly graded.	A-3		6 8 6 5	14								
	4				5 6 5 4	11	24	3						
10	5				6 6 7 7	13								
15	6	Loose, Gray to brownish yellow clayey fine SAND with silt, poorly graded.	A-2-6		2 3 3	6								
20	7				2 3 3	6								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 6 in *▽ **END OF DAY** ---

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PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

DATE STARTED 6/3/2020 **COMPLETED** 6/3/2020

LATITUDE 30°26'47.2" N **LONGITUDE** 81°38'8.1" W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele

GROUND ELEVATION —

HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3")												
		Limerock Base (7")												
	1	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		9 9									
	2	∇			7 9 10 9	19								
5	3				3 4 4 5	8								
	4	Medium dense, Light gray fine SAND with silt, poorly graded.	A-3		3 4 6 6	10								
10	5	Medium dense, Light yellowish brown fine SAND with silt, poorly graded.	A-2-4		4 6 6 6	12	22	11						
15	6	Loose, Brownish yellow fine SAND with silt, poorly graded.	A-3		6 3 3	6								
20	7	Loose, Gray to brownish yellow silty fine SAND, poorly graded.	A-2-4		4 3 4	7								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

∇ **AT TIME OF DRILLING** 4 ft 2 in *∇ **END OF DAY** ---

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BORING B-6

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

DATE STARTED 6/4/2020 **COMPLETED** 6/4/2020

LATITUDE 30°26'47.1" N **LONGITUDE** 81°38'5.5" W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele

GROUND ELEVATION — **HAMMER TYPE** Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0	1	Asphalt (3") Crushed Concrete and Cemented Sand (3") Limerock Base (6") Light yellowish brown fine SAND with silt, trace gravel, poorly graded.	A-3		3 4									
	2	Loose, Very pale brown fine SAND with silt, poorly graded.	A-3		3 4 3 4	7								
5	3	Medium dense, Pale brown fine SAND with silt, poorly graded.	A-3		3 4 4 4	8								
	4	⊻ Medium dense, Gray fine SAND with silt, poorly graded.	A-3		4 4 5 6	9								
10	5	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		3 4 5 4	9								
15	6				4 6 6	12								
20	7	Medium dense, Dark grayish brown silty fine SAND, poorly graded.	A-2-4		3 4 5	9								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

⊻ **AT TIME OF DRILLING** 6 ft 4 in *⊻ **END OF DAY** ---

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BORING B-7

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main
PROJECT LOCATION Jacksonville, FL
CLIENT Almond Engineering Consulting Civil Engineers
DATE STARTED 6/3/2020 **COMPLETED** 6/3/2020
LATITUDE 30°26'47.1" N **LONGITUDE** 81°38'2.4" W
DRILLING CONTRACTOR MAE, PLLC
DRILLING METHOD Standard Penetration Test
LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele
GROUND ELEVATION —
HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (4")												
		Limerock Base (7")												
	1	Medium dense, Pale brown fine SAND with silt, poorly graded.	A-3		8 7									
	2				3 4 4 3	8								
		∇												
5	3	Loose, Light brownish gray fine SAND with silt, trace gravel (rock fragments), poorly graded.	A-3		3 3 2 2	5								
	4				2 2 3 2	5								
	5	Loose, Grayish brown fine SAND with silt, poorly graded.	A-3		3 2 3 4	5								
10														
	6	Medium dense, Pale brown clayey fine SAND with silt, poorly graded.	A-2-6		3 4 4	8								
15														
	7				4 5 4	9								
20														

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

∇ **AT TIME OF DRILLING** 4 ft 1 in *∇ **END OF DAY** ---

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BORING B-8

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

DATE STARTED 6/4/2020 **COMPLETED** 6/4/2020

LATITUDE 30°26'47.0" N **LONGITUDE** 81°38'0.0" W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele

GROUND ELEVATION —

HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (4")												
		Limerock Base (6")												
	1	Light brownish gray fine SAND with silt, poorly graded.	A-3		10 11									
	2	Medium dense, Dark gray fine SAND with silt, few root fragments, trace gravel (rock fragments), poorly graded.	A-3		12 5 5 8	10								
5	3	▽ Medium dense, Grayish brown fine SAND, trace silt, poorly graded.	A-3		8 7 9 12	16	29	4						
	4				8 6 7 7	13								
10	5				6 7 9 9	16								
15	6	Medium dense, Grayish brown fine SAND with silt, poorly graded.	A-3		4 5 5	10								
20	7	Medium dense, Light gray fine SAND with silt, poorly graded.	A-3		6 5 6	11								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 4 ft 2 in *▽ **END OF DAY** ---

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BORING B-9

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

DATE STARTED 6/4/2020 **COMPLETED** 6/4/2020

LATITUDE 30°26'47.0" N **LONGITUDE** 81°37'57.3" W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele

GROUND ELEVATION —

HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3")												
		Limerock Base (3")												
	1	Medium dense, Gray fine SAND with silt, poorly graded.	A-3		8 9 9	18								
	2	▽			8 9 8 8	17								
5	3	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		4 4 4 5	8								
	4	Medium dense, Gray fine SAND with silt, poorly graded.	A-3		3 4 5 4	9								
10	5	Medium dense, Gray fine SAND with silt, trace clay, poorly graded.	A-3		5 4 6 6	10								
15	6	Medium dense, Gray fine SAND with silt, poorly graded.	A-3		6 4 4	8								
20	7				3 3 5	8								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 4 in *▽ **END OF DAY** ---

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BORING B-10

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

DATE STARTED 6/4/2020 **COMPLETED** 6/4/2020

LATITUDE 30°26'47.0" N **LONGITUDE** 81°37'54.2" W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele

GROUND ELEVATION —

HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3")												
		Limerock Base (6")												
	1	Gray fine SAND with silt, poorly graded.	A-3		12 7									
	2	▽ Medium dense, Pale brown fine SAND with silt, poorly graded.	A-3		7 8 9 9	17								
5	3	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		6 8 10 6	18								
	4	Medium dense, Light gray fine SAND with silt, poorly graded.	A-3		6 7 9 6	16								
10	5				3 4 5 5	9	22	6						
15	6				7 7 6	13								
20	7	Medium dense, Gray silty fine SAND, poorly graded.	A-2-4		9 8 9	17								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

▽ **AT TIME OF DRILLING** 3 ft 4 in

*▽ **END OF DAY** ---

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BORING B-11

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main
PROJECT LOCATION Jacksonville, FL
CLIENT Almond Engineering Consulting Civil Engineers
DATE STARTED 6/4/2020 **COMPLETED** 6/4/2020
LATITUDE 30°26'46.9" N **LONGITUDE** 81°37'51.2" W
DRILLING CONTRACTOR MAE, PLLC
DRILLING METHOD Standard Penetration Test
LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele
GROUND ELEVATION —
HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3")												
		Limerock Base (6")												
	1	Grayish brown fine SAND with silt, poorly graded.	A-3		7 6									
	2	∇ Medium dense, Gray fine SAND, trace silt, poorly graded.	A-3		4 6 5 6	11	23	4						
5	3				7 8 6 6	14								
	4	Medium dense, Light gray fine SAND with silt, poorly graded.	A-3		4 6 7 7	13								
10	5				9 8 6 6	14								
15	6	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		4 4 6	10								
20	7				6 6 6	12								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

∇ **AT TIME OF DRILLING** 3 ft 8 in *∇ **END OF DAY** ---

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BORING B-12

PAGE 1 OF 1

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

DATE STARTED 6/4/2020 **COMPLETED** 6/4/2020

LATITUDE 30°26'46.6" N **LONGITUDE** 81°37'49.0" W

DRILLING CONTRACTOR MAE, PLLC

DRILLING METHOD Standard Penetration Test

LOGGED BY D.Mclellan **CHECKED BY** W. Josh Mele

GROUND ELEVATION —

HAMMER TYPE Automatic

DEPTH (ft)	SAMPLE DEPTH NUMBER	MATERIAL DESCRIPTION	AASHTO	GRAPHIC LOG	BLOW COUNTS	N-VALUE	MOISTURE CONTENT (%)	FINES CONTENT (%)	ORGANIC CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	POCKET PEN. (tsf)	RECOVERY % (RQD)	REMARKS
0		Asphalt (3")												
		Limerock Base (6")												
	1	Grayish brown fine SAND with silt, poorly graded.	A-3		10 4									
	2	Medium dense, Gray fine SAND with silt, poorly graded. ∇	A-3		3 4 4 6	8								
5	3	Medium dense, Light gray fine SAND with silt, poorly graded.	A-3		5 6 5 5	11								
	4				6 7 8 9	15								
10	5				4 5 6 6	11								
15	6	Medium dense, Light brownish gray fine SAND with silt, poorly graded.	A-3		6 6 7	13								
20	7	Medium dense, Gray fine SAND with silt, poorly graded.	A-3		4 5 4	9								

Bottom of borehole at 20 feet.

NOTES Boring Grouted and Capped with Asphalt Cold Patch.

GROUND WATER LEVELS

∇ **AT TIME OF DRILLING** 3 ft 8 in

*∇ **END OF DAY** ---

NEW MAE LOG AASHTO LAT_LONG_G3 - NEW TEMPLATE 7-30-12.GDT - 6/16/20 09:00 - F:\GINT\GINT FILES\PROJECTS\0021-0007\JEA EASTPORT FORCE MAIN.GPJ

FIELD EXPLORATION PROCEDURES

Standard Penetration Test (SPT) Borings

The Standard Penetration Test (SPT) boring(s) are performed in general accordance with the latest revision of ASTM D1586, “Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.” In some cases, the borings are advanced manually from the ground surface using a hand-held bucket auger to a depth of approximately 5 feet if there are possible shallow utility conflicts. Otherwise, the borings are advanced using rotary drilling techniques. A split-barrel sampler is inserted to the bottom of the borehole at each sampling interval. The sampler is driven 18 to 24 inches into the soil using a 140-pound hammer falling an average height of 30 inches per hammer blow. The number of hammer blows for the final 12 inches of penetration (18” sample) or for the sum of the middle 12 inches of penetration (24” sample) is termed the “penetration resistance, blow count, or N-value.” This value is an index to several in-situ geotechnical properties of the material tested, such as relative density and Young’s Modulus.

After driving the sampler, it was retrieved from the borehole and representative samples of the material within the split-barrel were containerized and sealed. After completing the drilling operations, the samples for each boring were transported to the laboratory where they were examined by our engineer in order to verify the field descriptions.

Once the boring is complete and the groundwater level is measured, the borehole is backfilled with soil, or it is backfilled from bottom to top with a lean cementitious grout.

KEY TO BORING LOGS – AASHTO

Soil Classification

Soil classification of samples obtained at the boring locations is based on the American Association of State Highway and Transportation Officials (AASHTO) Classification System. Coarse grained soils have more than 50% of their dry weight retained on a #200 sieve. Their principal descriptors are: sand, cobbles and boulders. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve. They are principally described as clays if they are plastic and silts if they are slightly to non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

BORING LOG LEGEND

Symbol	Description
N	Standard Penetration Resistance, the number of blows required to advance a standard spoon sampler 12" when driven by a 140-lb hammer dropping 30".
WOR	Split Spoon sampler advanced under the weight of the drill rods
WOH	Split Spoon sampler advanced under the weight of the SPT hammer
50/2”	Indicates 50 hammer blows drove the split spoon 2 inches; 50 Hammer blows for less than 6-inches of split spoon driving is considered “Refusal”.
(SP)	Unified Soil Classification System
-200	Fines content, % Passing No. 200 U.S. Standard Sieve
w	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit
PI	Plasticity Index
NP	Non-Plastic
PP	Pocket Penetrometer in tons per square foot (tsf)

MODIFIERS

SECONDARY CONSTITUENTS
(Sand, Silt or Clay)

Trace	Less than 5%
With	5% to 12%
Sandy, Silty or Clayey	12% to 35%
Very Sandy, Very Silty or Very Clayey	35% to 50%

ORGANIC CONTENT

Trace	2% or less
With	3% to 5%
Organic Soils	5% to 20%
Highly Organic Soils (Muck)	20% to 75%
PEAT	Greater than 75%

MINOR COMPONENTS
(Shell, Rock, Debris, Roots, etc.)

Trace	Less than 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%

RELATIVE DENSITY (Coarse-Grained Soils)

Relative Density	N-Value *
Very Loose	Less than 3
Loose	3 to 8
Medium Dense	8 to 24
Dense	24 to 40
Very Dense	Greater than 40

CONSISTENCY (Fine-Grained Soils)

Consistency	N-Value *
Very Soft	Less than 1
Soft	1 to 3
Firm	3 to 6
Stiff	6 to 12
Very Stiff	12 to 24
Hard	Greater than 24

RELATIVE HARDNESS (Limestone)

Relative Hardness	N-Value *
Soft	Less than 50
Hard	Greater than 50

* Using Automatic Hammer

AASHTO Soil Classification System
(from AASHTO M 145 or ASTM D 3282)

General Classification	***Granular Materials*** *(35% or less passing the 0.075 mm sieve)*							***Silt-Clay Materials*** *(>35% passing the 0.075 mm sieve)*			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5* A-7-6*
Sieve Analysis, % passing:											
2.00 mm (No. 10)	50 max	…	…	…	…	…	…	…	…	…	…
0.425 (No. 40)	30 max	50 max	51 min	…	…	…	…	…	…	…	…
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40):											
Liquid Limit	…		…	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General ***local***** rating as a subgrade	excellent to good			fair to poor							

* Plasticity index of A-7-5 subgroup is equal to or less than the LL - 30. Plasticity index of A-7-6 subgroup is greater than LL – 30

** *Northeast Florida*

Appendix B

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SUMMARY OF LABORATORY TEST RESULTS

PROJECT NO. 0021-0007

PROJECT NAME JEA Eastport Road Force Main

DATE. 7/1/2020

PROJECT LOCATION Jacksonville, FL

CLIENT Almond Engineering Consulting Civil Engineers

Borehole	Sample No.	Approx. Depth (ft)	%<#200 Sieve	Water Content (%)	Organic Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	AASHTO Classification	Comments
B-1	5	9	4	23	---	---	---	---	A-3	
B-2	3	5	2	26	---	---	---	---	A-3	
B-3	6	14	8	24	---	---	---	---	A-3	
B-4	4	7	3	24	---	---	---	---	A-3	
B-5	5	9	11	22	---	---	---	---	A-2-4	
B-8	3	5	4	29	---	---	---	---	A-3	
B-10	5	9	6	22	---	---	---	---	A-3	
B-11	2	3	3	23	---	---	---	---	A-3	

Note: "---" Untested Parameter

LABORATORY TEST PROCEDURES

Percent Fines Content

The percent fines or material passing the No. 200 mesh sieve of the sample tested was determined in general accordance with the latest revision of ASTM D 1140. The percent fines are the soil particles in the silt and clay size range.

Natural Moisture Content

The water content of the tested sample was determined in general accordance with the latest revision of ASTM D 2216. The water content is defined as the ratio of "pore" or "free" water in a given mass of material to the mass of solid material particles.

Appendix C

Summary of Corrosion Series Test Results
JEA Eastport Road Force Main
MAE Project No.: 0021-0007

Boring No.	GPS Coordinates		Approximate Test Depth(1) (ft)	AASHTO Soil Classifications	pH	Resistivity (ohm-cm)	Chlorides (ppm)	Sulfates (ppm)	Environmental Classification	
	Latitude	Longitude							Steel Substructure	Concrete Substructure
B-1	30°26'42.9'' N	81°38'15.9'' W	2-4	A-3	7.36	8,000	0	6.0	Slightly Aggressive	Slightly Aggressive
B-12	30°26'46.6'' N	81°37'49.0'' W	2- 4	A-3	7.30	36,000	5	27	Slightly Aggressive	Slightly Aggressive

(1) Feet below existing ground surface.