Geotechnical Engineering Services Report

SEWRF Grease Facility Modifications
Manatee County, Florida

Prepared for: **Manatee County Public Works**
1022 26th Avenue East
Bradenton, Florida 33763

Prepared by: **MC Squared, Inc.**
5808-A Breckenridge Parkway
Tampa, Florida 33610

MC² Project No. T042019.074
Date: June 23, 2020

GEOTECHNICAL • ENVIRONMENTAL
MATERIALS TESTING

June 23, 2020

Ms. Anthony Benitez, P.E.
Manatee County Public Works
1022 26th Avenue East
Bradenton, Florida 34208

Subject: Geotechnical Engineering Services Report
Manatee County – SEWRF Grease Facility Modifications
Manatee County, Florida
MC² Project No. T042019.074

Dear Ms. Benitez:

MC Squared, Inc. (MC²) has completed additional geotechnical engineering services for the referenced project. This report outlines the services provided for this project and our evaluations and recommendations.

We trust that this report will assist you with design development and construction of the proposed project. We appreciate the opportunity to be of service on this project. Should you have any questions, please do not hesitate to contact us.

Respectfully submitted,
MC Squared, Inc.

Sergio Gomez, M.Sc.
Staff Engineer

Ethan H. Drew, PE
Project Engineer
Florida PE No. 88622

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Boring Location Plan from MC^2 Report dated October 10, 2013 – Sheet 1
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1 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Authorization to perform the exploration and evaluation for this project was provided through Work Assignment No. 2 dated April 30th, 2020 pursuant to the Manatee County Professional Services for Geotechnical Engineering Agreement No. 18-TA002642AJ. Our services for this project were performed in general accordance with **MC²** Proposal No. T042019.074_G&C dated April 30th, 2020.

1.2 PROJECT BACKGROUND INFORMATION

MC² previously performed a subsurface soil exploration at the subject site for the Southeast Water Reclamation Septage Station in August and September of 2013, the results of which are presented in our report dated October 10, 2013 (MC² Project No. T121211.252).

MC² was requested to review our previous geotechinal engineering report dated October 10, 2013 to determine if the recommendations contained within our previous report remain valid for the proposed modifications and modification locations based on our previous performed subsurface soil exploration. After review, it was determined that additional subsurface soil exploration would be required to obtain sufficient subsurface data to provide recommendations relative to the proposed modifications. The results of the field exploration as documented in our report data October 10, 2013 (MC² Project No. T121211.252) are provided in **Appendix II** and were used in the engineering evaluation presented herein.

1.3 PROJECT DESCRIPTION

New project information was provided by Mike Nixon, P.E. of McKim & Creed through email communications dated April 20, 2020. We understand the planned modifications will include two one-story pre-engineered metal buildings approximately 13 by 24 feet in footprint plan dimensions. The proposed buildings will consist of columns at the corners and will be constructed on a monolithic slab foundation with a spread footings. In addition, we understand the planned modifications include two mixing pumps, various equipment, and a grease screening unit to be constructed on concrete slabs at grade.

If any of this project's description is incorrect or has changed, please inform **MC²** so that we may amend, if appropriate, the information represented in this report.

1.4 SCOPE OF SERVICES

To achieve the project objectives, our scope of work consisted of the following:

1. Reviewed readily available subsurface information from the previous geotechnical study performed by **MC²**.

2. Conducted a site reconnaissance of the proposed modification locations to identify areas with possible access issues for drilling equipment and personnel.

3. Coordinated the clearing of utilities in the vicinity of the proposed boring location through Sunshine 811 and Manatee County personnel.

4. Performed one (1) SPT boring to a depth of 30 feet below the ground surface (bgs) within the footprint of the proposed LFG Dryer Building.

5. Measured and recorded the depth to groundwater.

6. Upon completion of the drilling operation, the borehole was backfilled using bentonite pellets and soil cuttings.

7. Visually examined all recovered soil samples in the laboratory and performed laboratory tests on selected representative samples to characterize the subsurface soil profile. The laboratory classification testing included percent passing the U.S. No. 200 sieve, Atterberg Limits tests, and natural moisture content determination.

MC² presents the following data and recommendations in our report:

1. General assessment of area geology based on published literature, experience and boring information.

2. General location and description of potentially deleterious materials encountered in the boring and previously performed borings, which may interfere with the proposed construction or performance, including existing fills, plastic clays, surficial organics, etc.

3. Critical design and/or construction considerations based on the soil and groundwater conditions developed from the boring and previously performed borings.

4. Groundwater level in the boring and estimate of the seasonal high groundwater table depth.

5. Recommendations for allowable soil bearing capacity and estimate of total settlement

6. Recommendations for bedding, subgrade preparation and backfill compaction, suitability of excavated soils for use as backfill.

The scope of our services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, groundwater, or air, on or below or around the project site. In addition, our scope of services did not include an evaluation of sinkholes or sinkhole activity and none was performed.

2 SITE CONDITIONS

2.1 Site Features

The project site is located at the northeast side of the Southeast Water Reclamation Facility (SEWRF) located at 3331 Lena Road in Bradenton, Manatee County, Florida. The site is currently developed with the existing Septage Station within the SEWRF which includes ground storage tanks, overhead canopies and paved parking/drive areas.

2.2 USGS Topographic Map

Based on our review of the USGS historical topographic quadrangle maps titled "Lorraine Quadrangle" 7.5-Minute Series, the existing site is between contour interval elevations of 30 and 40 feet (NAVD 1988). The project area is relatively flat and has not changed significalty over time. A portion of a **USGS Topographic Quadrangle Map** is provided in **Appendix I** for information and reference.

2.3 Manatee County Soil Survey

The USDA – Soil Conservation Service (SCS) *Soil Survey Manatee County, Florida* was reviewed for general information on the shallow soils approximately within the project limits. The survey area data is Version 16 dated September 17, 2019, with aerial images photographed between December 1, 2018 through January 31, 2019. The USDA SCS Soil Survey outlines approximate areas dominated by a shallow soil type. Small areas of other soils may occur within the mapping unit. The project site is located within one (1) mapping unit:

- EauGallie-EauGallie wet, fine sand, 0 to 2 percent slopes (20)

EauGallie-EauGallie wet, fine sand, 0 to 2 percent slopes has a parent material of sandy and loamy marine deposits with a typical profile of sand from 0 to 55 inches bgs and sandy clay loam from 55 to 80 inches bgs. The material is poorly drained and has a moderately low to moderately high capacity to transmit water. The USDA Soil Conservation Service lists the depth to the groundwater table at about 6 to 18 inches bgs.

The USDA Soil Survey is not necessarily an exact representation of the soils on the site. The mapping is based on interpretation of aerial maps with scattered shallow borings for confirmation. Accordingly, borders between mapping units are approximate and the change may be transitional. Differences may also occur from the typical stratigraphy, and small areas of other similar and dissimilar soils may occur within the soil-mapping unit. As such, there may be differences in the mapped description and the boring descriptions obtained for this report. Development/urbanization can also cause differences in the typical stratigraphy. The survey is, however, a good basis for evaluating the shallow soil conditions of the area. A portion of the **USDA Soil Survey Map** illustrating the soil mapping units for the project area can be found in **Appendix I** for information and reference.

3 ADDITIONAL FIELD EXPLORATION PROGRAM

3.1 GENERAL

The additional field exploration program consisted of performing one (1) Standard Penetration Test boring to a depth of 30-ft. bgs. The additional SPT boring was performed on June 1, 2020 and observed by **MC²** personnel. The field exploration services were overseen by one of **MC²**'s Florida licensed professional geotechnical engineers.

3.2 STANDARD PENETRATION TEST BORING

The SPT boring was performed in general accordance with ASTM D-1586 (Standard Test Method for Penetration Test and Split Barrel Sampling of Soils) by a track mounted drill rig using the wet-rotary procedure and a safety hammer. In this method, a 2-inch outer-diameter, split-barrel sampler is driven into the soil by a 140-pound hammer with a free-fall of 30 inches. The number of blows required to drive the sampler through a 12-inch interval, after initial soil penetration of 6 inches, is termed the Standard Penetration Resistance, or "N" value, and is indicated for each sample on the boring log. The "N" value may be taken as an indication of the relative density of cohesionless soils or the consistency of cohesive soils in-situ.

The first four (4) feet in the boring was augered by hand to avoid potentially unmarked utilities and to help aid in the determination of the SHWT. The hand auger boring was performed using a 4-inch diameter bucket auger turned into the soil in 4 to 6-inch increments. Afterwards, the boring was advanced with the drill rig and the soil was sampled continuously in 2-foot incremenets to 10 feet bgs. Below this depth, the soil was sampled every 5 feet in 1.5-foot increments, beginning at 13.5 feet bgs. The boring was backfilled with bentonite chips/pellets upon completion.

Soil samples, recovered during the field exploration program, were placed into air-tight glass jars labeled with the project number, boring number, sample number and date drilled and returned to our Tampa, FL office to confirm field classification and perform laboratory testing, as required. All soil samples collected will be retained in house for 60 days from the date of release of this report and will be subsequently discarded without further notice unless requested otherwise in writing.

4 LABORATORY TESTING

A representative set of soil samples was tested in the laboratory to assist in the classification and determination of engineering characteristics of the soils based on their mechanical and physical behavior. Laboratory testing was accomplished in general accordance with applicable ASTM standards, and consisted of the following:

- Four (4) moisture content determinations (ASTM D2216)
- Four (4) percent passing the No. 200 US standard sieve tests (ASTM D1140)
- One (1) Atterberg limit determination test (ASTM D4318)

- Visual classification descriptions (ASTM D2488)

Results for each of these laboratory tests are summarized in the following table and are also presented on the individual **Soil Profile** log provided in the **Appendix I**.

Table 1: Summary of Laboratory Testing

Boring ID (Depth) (ft)	Moisture Content (%)	Percent Passing No. 200 Sieve (%)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Class.
SPT-01 (0-2)	8.7	2.7	--	--	--	SP
SPT-01 (4-6)	20.4	2.1	--	--	--	SP
SPT-01 (18.5-20)	47.6	89	73	20	53	CH
SPT-01 (28.5-25)	36.7	43.1	-	-	-	SC

5 SUBSURFACE CONDITIONS

5.1 Subsurface Soil Profiles

The soil descriptions presented herein are of generalized nature to highlight the major subsurface stratification features and material characteristics. The soil profile included in **Appendix I** should be reviewed for specific information at the boring location. This profile includes soil description, stratification, penetration resistances (N-values), and laboratory test results. The stratification shown on the boring profile represents the conditions only at the actual boring location. Variations may occur and should be adjacent to the boring location.

The subsurface soil conditions encountered consisted of loose to medium dense fine SAND (SP) from the ground surface to a depth of approximately 12.5 feet bgs, underlain by loose clayey fine SAND (SC) from 12.5 to 17.5 feet bgs and from 22.5 feet to the to the boring termination depth of 30 feet bgs. A firm fat CLAY stratum was encountered from 17.5 to 22.5 feet bgs between the clayey fine SAND stratum.

5.2 Groundwater Information

The groundwater depth was encountered at 4 feet bgs in the SPT boring at the time of drilling. We estimate the SHWT to be approximately 2 feet bgs at the location of the boring. This estimate is based upon our review of available publications, and our review of the soil samples collected in the field.

In general, groundwater levels tend to fluctuate during periods of prolonged drought and extended rainfall and are affected by man-made influences such as drainage conveyance systems. In addition, a seasonal effect will occur in which higher groundwater levels are normally recorded in rainy seasons. Fluctuation of the groundwater levels should be anticipated, and we recommend that the Contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction activites.

6 EVALUATIONS AND CONCLUSIONS

6.1 GENERAL

The following evaluations and conclusions have been developed on the basis of the previously described project characteristics, our review of published data, our site reconnaissance and subsurface conditions encountered during our additional exploration and previous exploration.

1. We compared the USDA Soil Survey information with the shallow subsurface information collected in our test boring. The data provided in the soil survey indicates sand from the surface to a depth of 55 inches bgs underlain by a sandy clay loam from 55 to 80 inches bgs. The soil boring performed encountered fine SAND (SP) within the first 80 inches bgs. Based on this, the information contained within the USDA Soil Survey report appears to be similar to the information gathered for the near-surface soils encountered in our borings, taking plant site development and construction into consideration.

2. Our review of the USGS topographic maps did not indicate any features that appeared out of the ordinary and does not require further clarification at this time.

3. Based on the one (1) SPT boring performed and the borings performed in August and September, 2013 from our previous field exploration (refer to **Appendix II** for boring layot and logs) , the soils encountered are capable of supporting the proposed modifications assuming the recommendations in this report are followed. It is our understanding that a shallow foundation system (monolithic slab foundation with spread footings) is planned for the proposed buildings.

4. We understand the foundation type for the proposed 13-ft by 24-ft building footprints will consist of a monolithic slab foundation with spread footings at the corners for column loads. We estimated the allowable bearing capacity and minimum bearing depth in **Table 2** below based on the provided plans. If the final design differs from the plans provided, **MC²** should be notified to verify that the bearing capacity is still applicable or if it needs to be modified.

Table 2: Summary of Allowable Bearing Capacity

Foundation Type	Minimum/Recommended Depth (ft)	Allowable Bearing Capacity (psf)
Monolithic Slab with Spread Footing (5-ft by 5-ft Spead Footing)	1.5	2,500

5. Based on these loadings, the total estimated settlement of the shallow foundation system was determined to be 1-inch or less. The differential settlement is expected to be approximately ½ or less of the total settlement.

7 RECOMMENDATIONS

7.1 General Site Development Considerations

Based on the findings of our test boring, our understanding of the proposed development, and our geotechnical engineering evaluation, the soils encountered should be suitable for site preparation. If encountered during construction, unsuitable materials, such as organic material and soils, debris, root and clay clods, should be removed and replaced with properly compacted clean sands (SP, SP-SM, SP-SC).

7.2 Selection and Placement of Fill

After excavating materials to design depth, any fill required to bring the site to final grades may be placed in properly compacted lifts. Fill material should be inorganic, non-plastic granular soil (clean to slightly silty or slightly clayey sands, Unified Soil Classification (SP/SP-SM/SP-SC) with less than 12% passing the No. 200 sieve, free of detrimental materials such as organics, clay clods, debris, roots, rocks larger than 1 inch in greatest dimension, etc. The majority of the near surface sandy soils not containing debris, organics or other root laden topsoil will meet this requirement. Careful evaluation should be made of any slightly organic to organic soils and clayey soils prior to use.

Fill should be placed in level lifts not to exceed 12-inch loose thickness. The natural soil exposed once excavating has been completed and any fill placed underneath the building foundation or slab should be compacted to at least 95% of the soil's modified Proctor maximum dry density while within +/-2% of the optimum moisture content as determined by ASTM designation D-1557. In-place density tests should be performed on each lift for the building foundation by an experienced engineering technician working under the direction of a licensed Geotechnical Engineer to verify that the recommended degree of compaction has been achieved. The upper 18 inches beneath the bottom of the foundation or slab should be compacted to at least 95% of the soil's modified Proctor maximum dry density while within +/-2% of the optimum moisture content, as determined by ASTM designation D-1557. Caution should be taken by the contractor to ensure vibrations induced during compacting operations do not adversely affect the existing, nearby structures and utilities.

7.3 Reuse of Excavated Soils as Structural Fill

On site soils classified as SP, SP-SM or SP-SC that may be excavated during construction, should in our opinion, be suitable for reuse as structural fill materials provided they are free of debris, organics and other detrimental material. Routine adjustment of moisture content will generally be necessary to allow compaction in accordance with project specifications. The planned fill soils should be evaluated to determine that they meet the recommended material properties.

If soft yielding soils are encountered at the bottom of the structure excavations, the unsuitable materials should be removed, and the proposed foundation elevation re-established by backfilling after the undesirable material has been removed. This backfilling may also be done with a very lean concrete or with a well-compacted, suitable fill such as clean sand, gravel, or crushed #57 or #67 stone. Sand backfill should be compacted to a dry density of at least 95% of the modified Proctor maximum dry density (ASTM D-1557, +/-2% of the optimum moisture content).

7.4 Drainage and Groundwater Considerations

Groundwater may be a concern during construction, depending on final grades and depths of excavations and the time of year construction is performed. We recommend that the Contractor measure the groundwater level prior to construction, to determine the need for dewatering. For limited, relatively shallow excavations below the groundwater level, pumping from the excavation or sumps should be sufficient to control groundwater seepage. If deeper and larger excavations are necessary, more extensive dewatering measures, such as well points or cut-off walls may be required. We recommend that the area be dewatered to a minimum depth of 12-in. below the excavated grade to provide a stable foundation base, but may need to be deepened further if adequate compaction proves difficult to attain. Recharge of groundwater a short distance from the dewatering location is recommended to avoid significant drawdowns, which may trigger undue subsidence/settlement of existing structures in the vicinity.

8 REPORT LIMITATIONS

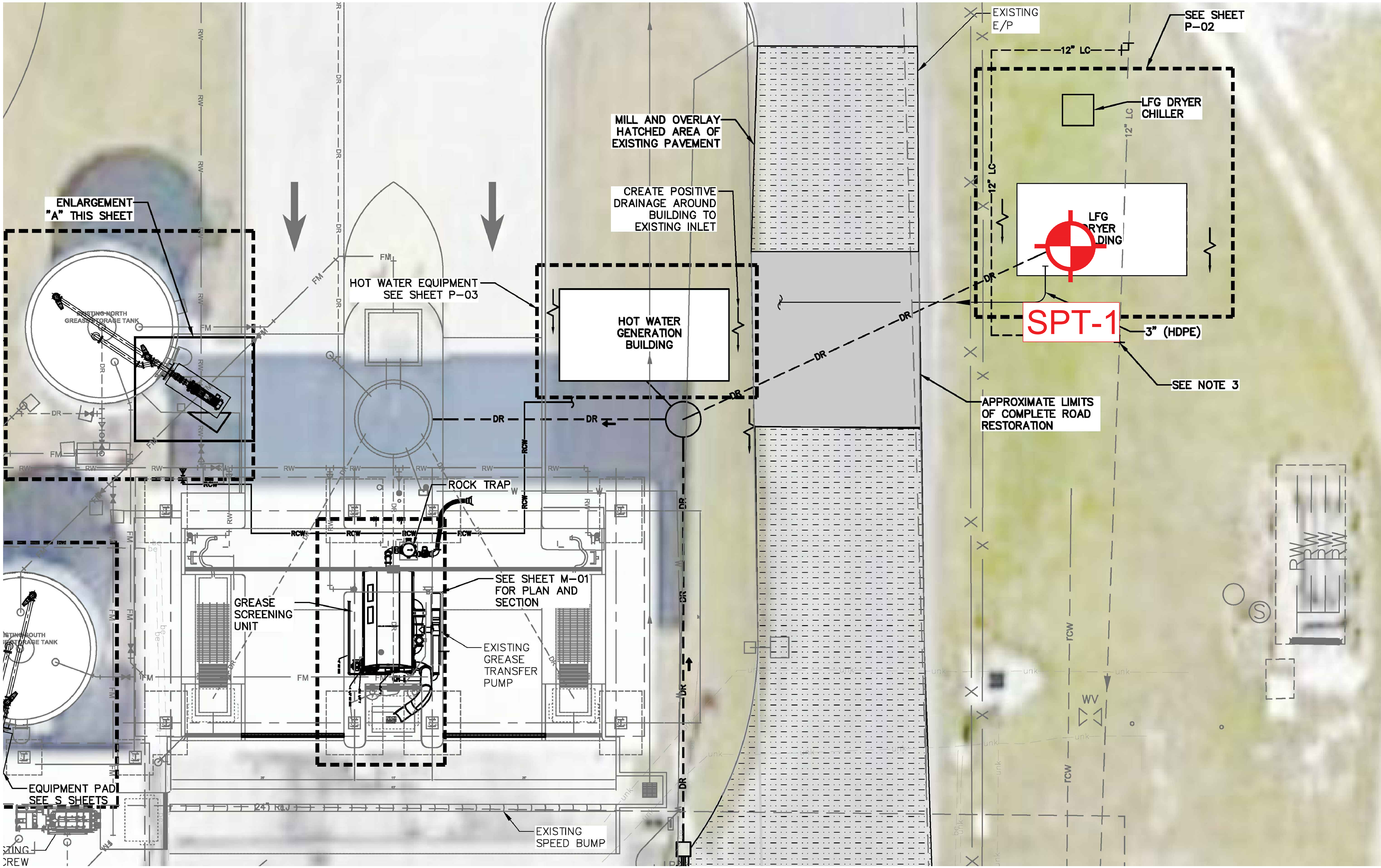
The recommendations submitted are based on the available soil information obtained by **MC²** and design details furnished by **Manatee County** for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **MC²** should be notified immediately to determine if changes in the foundation, or other, recommendations are required. If **MC²** is not retained to perform these functions, **MC²** cannot be responsible for the impact of those conditions on the performance of the project.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the foundation loads, plans and specifications are more complete, the geotechnical engineer should be provided the opportunity to review them to assess that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of **Manatee County** for the specific application to the proposed SEWRF Grease Facility Modifications in Manatee County, Florida.

APPENDIX I

Boring Location Plan – Sheet 1
USDA Soil Survey/USGS Topographic Map – Sheet 2
Subsurface Boring Profile – Sheet 3
Legend – Sheet 4
Individual Soil Profile – (1 Page)
Test Procedures



DATE	NAME	REVISION	APPROVED BY:

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Geotechnical • Environmental Materials Testing

FLORIDA ENGINEERING CERTIFICATE OF AUTHORIZATION No. 9191
Ethan Drew, P.E.
FLORIDA LICENSE No. 88622

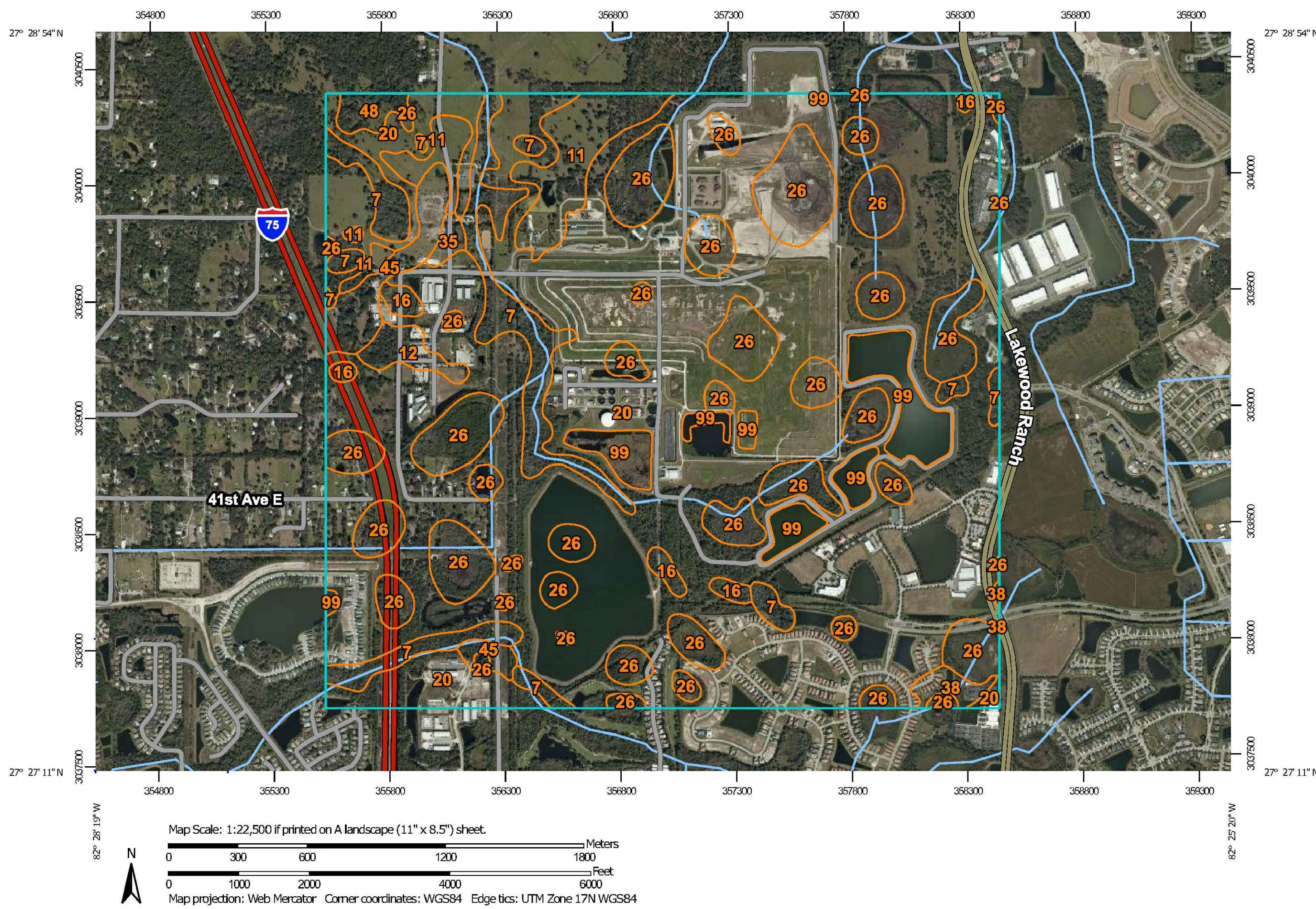
	NAME	DATE
DESIGNED BY:	HM	6/10/2020
DRAWN BY:	HM	6/10/2020
CHECKED BY:	SG	6/11/2020
SUPERVISED BY:	ED	

Boring Location Plan

Manatee County – SEWRF Grease Facility Modifications
Manatee County, Florida

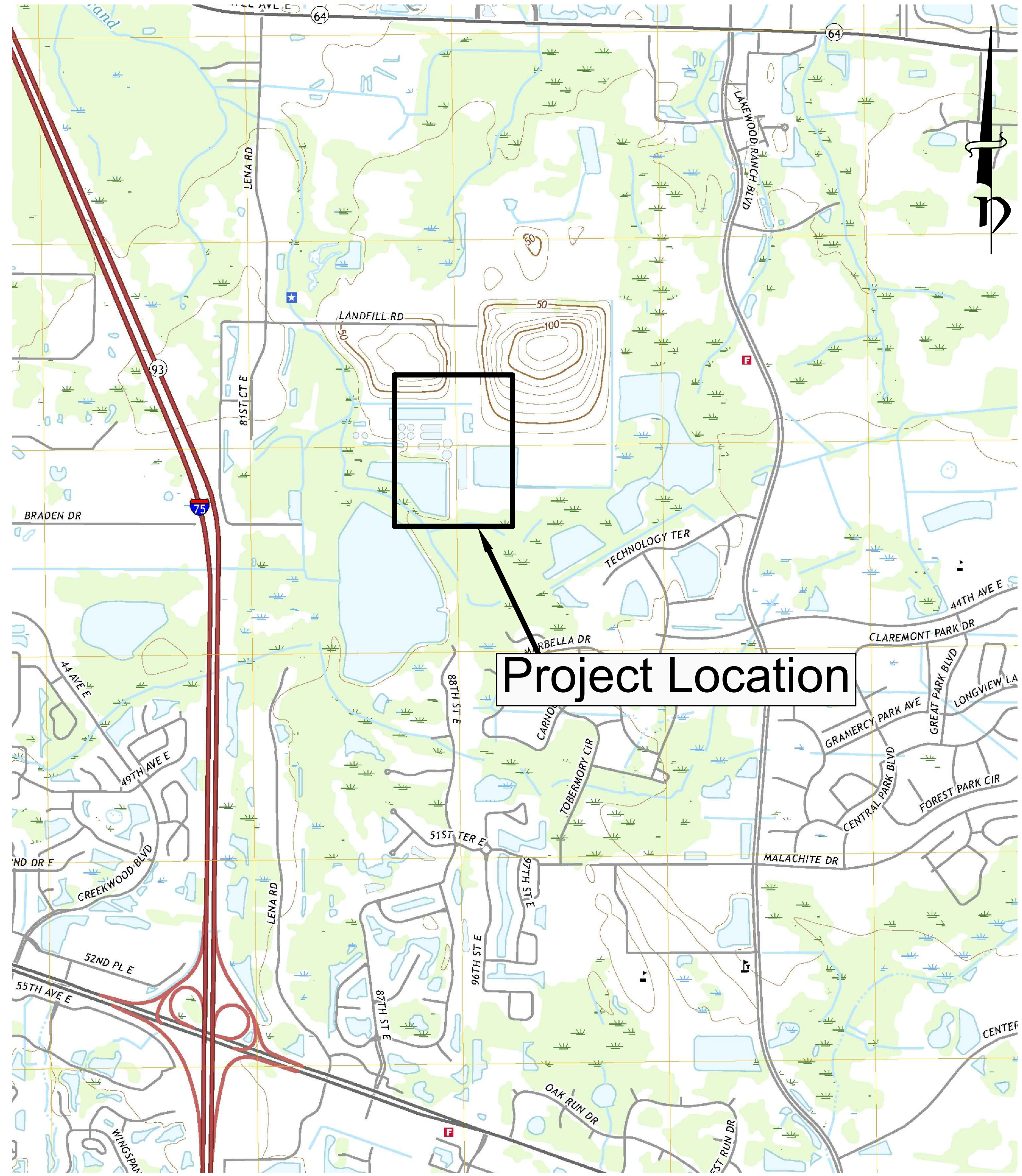
MC² PROJ. NO.	SHEET NO.
T042019.074	1

Soil Map



Pasco County, Florida			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
7	Canova, Anclote, and Okeelanta soils	105.1	5.5%
11	Cassia fine sand, 0 to 2 percent slopes	65.7	3.4%
12	Cassia fine sand, moderately well drained	14.2	0.7%
16	Delray complex	15.8	0.8%
20	EauGallie-EauGallie wet, fine sand, 0 to 2 percent slopes	1260.4	66.0%
26	Floridana-Immokalee-Okeelanta association	318.5	16.7%
35	Ona fine sand, orstein substratum	5.3	0.3%
38	Palmetto sand	9.5	0.5%
45	Tavares fine sand, 0 to 5 percent slopes	36.4	1.9%
48	Wabasso-Wabasso, wet, fine sand, 0 to 2 percent slopes	10.3	0.5%
99	Water	69.1	3.6%
Totals for Area of Interest (AOI)		**1,910.4**	**100.0%**

Source: Natural Resources Conservation Service
The survey data is Version 16 dated Sep 17, 2019,
with aerial images taken Dec 1, 2018 - Jan 31, 2019.



LORRAINE QUADRANGLE
FLORIDA-HILLSBOROUGH CO.
7.5 MINUTE SERIES TOPOGRAPHIC
NAVD: 1988 - DATE: 2018

DATE	NAME	REVISION	APPROVED BY:

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SUPERVISED BY:	ED	

USDA Soil Survey and USGS Topographic Maps

Manatee County – SEWRF Grease Facility Modifications
Manatee County, Florida

MC^2 PROJ. NO.	SHEET NO.
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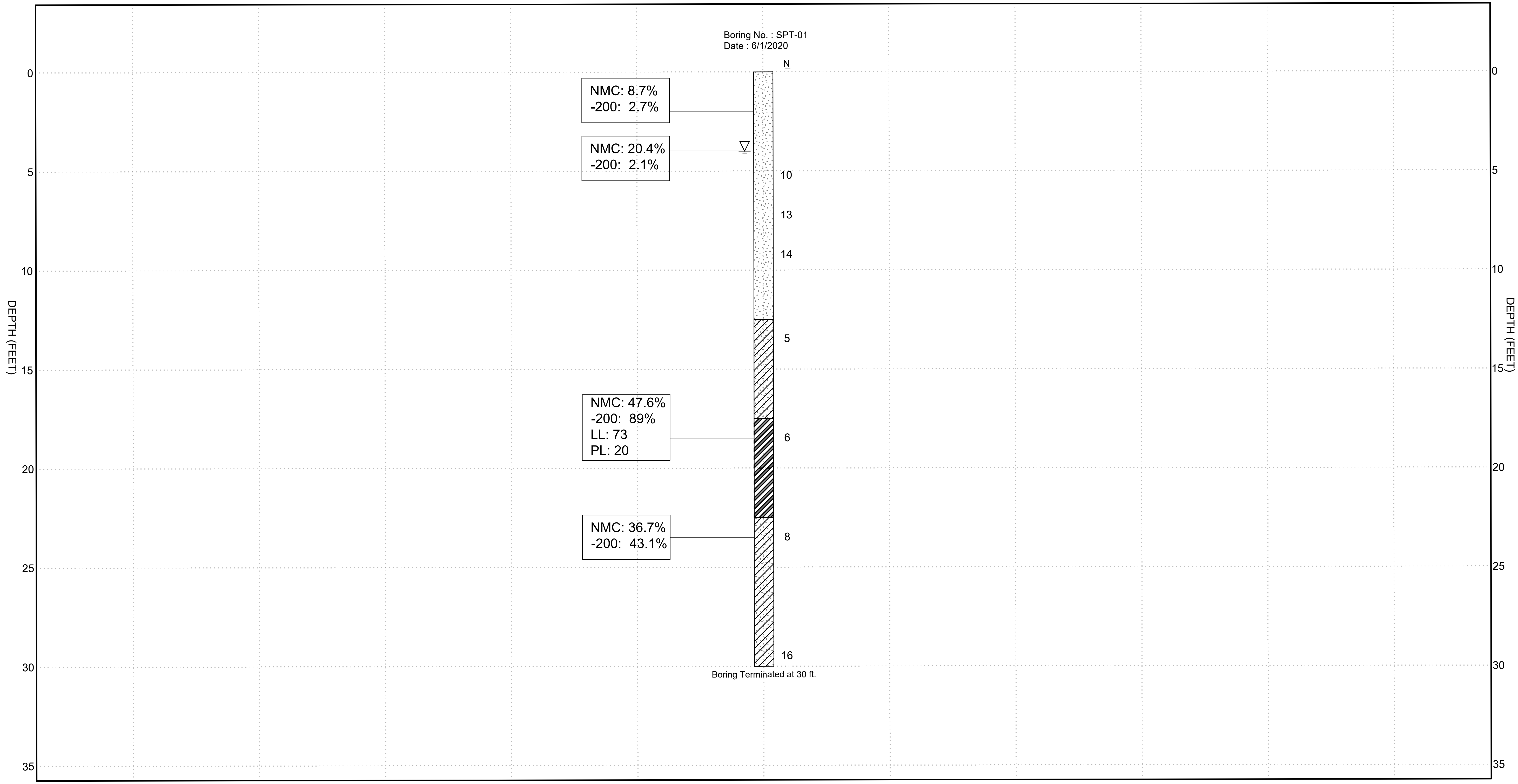

*N Values Drawn At Top Of Interval

DATE	NAME	REVISION	APPROVED BY:

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Subsurface Boring Profiles

Manatee County – SEWRF Grease Facility Modifications
Manatee County, Florida

MC² PROJ. NO.	SHEET NO.
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LEGEND

- Top Soil
- Asphalt
- Concrete
- (GAB) Graded Aggregate Base
- Limerock Base
- No. 57 Stone
- Soil Cement
- (SP) Poorly Graded Sand
- (SP-SM) Poorly Graded Sand With Silt
- (SP-SC) Poorly Graded Sand With Clay
- (SM) Silty Sand
- (SC) Clayey Sand
- (MH) Elastic Silt
- (ML) Silt
- (CL-ML) Silty Clay
- (CH) Fat Clay
- (CL) Lean Clay
- (OH) Organic Clay
- (OL) Organic Silt
- Peat
- Fill
- Bedrock
- Limestone
- (WLS) Weathered Limestone
- (PWR) Partially Weathered Rock
- Granite
- Gneiss
- Schist

NOTES:

▽	Water Table At Time Of Drilling
▼	Water Table After 24 Hours
GNE	Groundwater Not Encountered
GNA	Groundwater Not Apparent
GNM	Groundwater Not Measured
CL	Center Line
RT	Right Of Center Line
LT	Left of Center Line
BGS	Below Ground Surface
HA	Hand Auger
PA	Power Auger
NMC	Natural Moisture Content (%)
-200	Fines Passing A No. 200 Sieve (%)
PI	Plasticity Index
NP	Non Plastic
LL	Liquid Limit
OC	Organic Content (%)
N	SPT N-Value
WOH	Weight-Of-Hammer
WOR	Weight-Of-Rod
CPT	Cone Penetrometer Test
SPT	Standard Penetration Test
DT	Dilatometer Test
LOC	Loss Of Circulation
ROC	Regain Of Circulation
REC	Rock Core Recovery(%)
RQD	Rock Quality Designation
ST	Shelby Tube Sample
q_u	Unconfined Compressive Strength From Pocket Penetrometer In tsf
T	Casing
A	Phosphate Fragments

GRANULAR MATERIALS- RELATIVE DENSITY	SPT (BLOWS/FT)
VERY LOOSE	≤ 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50
SILTS AND CLAYS CONSISTENCY	**SPT (BLOWS/FT)**
VERY SOFT	≤ 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	30-50
VERY HARD	GREATER THAN 50
SPT Spoon Inside Diameter 1 3/8" SPT Spoon Outside Diameter 2"	ASTM Standard Drop Safety Hammer Average Hammer Drop Height 30" Hammer Weight 140 lbs

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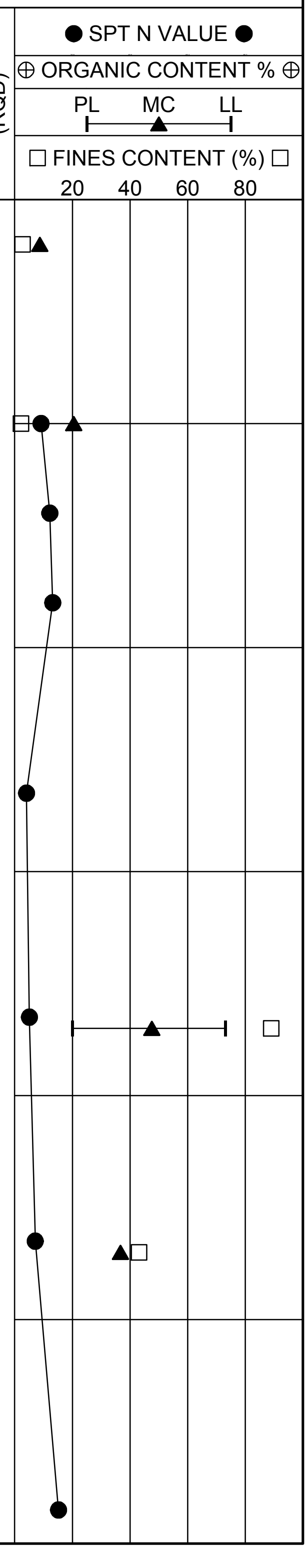
Legend	MC² PROJ. NO.	SHEET NO.
Manatee County – SEWRF Grease Facility Modifications Manatee County, Florida	T042019.074	4

Soil Profile

BORING ID: SPT-01

CLIENT Manatee County Public Works
PROJECT NAME Manatee County – SEWRF Grease Facility Modifications
PROJECT NUMBER T042019.074
PROJECT LOCATION Manatee County, Florida
DATE STARTED 6/1/20 **COMPLETED** 6/1/20
GROUND ELEVATION **HOLE SIZE**
DRILLING CONTRACTOR GHD
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary - Safety Hammer
AT TIME OF DRILLING 4.0 ft
LOGGED BY SG **CHECKED BY** ED
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	USCS Group Symbol	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY % (RQD)
0–12.5	SP	Medium dense, grayish brown, pale brown to brown, poorly-graded fine SAND	HA 1		
			SS 2	3-3-7-7 (10)	
			SS 3	6-6-7-8 (13)	
			SS 4	6-7-7-9 (14)	
12.5–17.5	SC	Loose, gray, clayey fine SAND with phosphate fragments	SS 5	1-2-3 (5)	
17.5–22.5	CH	Firm, light greenish gray, fat CLAY	SS 6	2-3-3 (6)	
22.5–30	SC	Loose to medium dense, gray, clayey fine SAND	SS 7	3-3-5 (8)	
			SS 8	5-8-8 (16)	



Bottom of hole at 30.0 feet.

TEST PROCEDURES

The general field procedures employed by MC Squared, Inc. (**MC²**) are summarized in the American Society for Testing and Materials (ASTM) Standard D420 which is entitled "Investigating and Sampling Soil and Rock". This recommended practice lists recognized methods for determining soil and rock distribution and groundwater conditions. These methods include geophysical and in-situ methods as well as boring.

Standard Drilling Techniques
To obtain subsurface samples, boring are drilled using one of several alternate techniques depending upon the subsurface conditions. Some of these techniques are:

In Soils:

a) Continuous hollow stem augers.
b) Rotary boring using roller cone bits or drag bits, and water or drilling mud to flush the hole.
c) "Hand" augers.

In Rock:

a) Core drilling with diamond-faced, double or triple tube core barrels.
b) Core boring with roller cone bits.

<u>Hollow Stem Augering:</u> A hollow stem auger consists of a hollow steel tube with a continuous exterior spiral flange termed a flight. The auger is turned into the ground, returning the cuttings along the flights. The hollow center permits a variety of sampling and testing tools to be used without removing the auger.

<u>Mud Rotary:</u> In situations where unconsolidated materials are anticipated, the direct-rotary or “mud” rotary method may be used as a more effective method for obtaining soil samples. The fluid used, which is typically stored in an aluminum tub (also known as a “mudtub”), is a mix of water and bentonite, also known as a bentonite slurry or “mud”. This fluid circulates into the borehole and then returns to the mudtub using a pump system. A loss of circulation, partially or otherwise, may signify a void at that sample depth. The key advantage of using this drilling method is that it stabilizes the borehole wall while drilling in unconsolidated formations, due to the buildup of a filter cake on the wall.

<u>Core Drilling</u>: Soil drilling methods are not normally capable of penetrating through hard cemented soil, weathered rock, coarse gravel or boulders, thin rock seams, or the upper surface of sound, continuous rock. Material which cannot be penetrated by auger or rotary soil-drilling methods at a reasonable rate is designated as “refusal material”. Core drilling procedures are required to penetrate and sample refusal materials.

Prior to coring, casing may be set in the drilled hole through the overburden soils, to keep the hole from caving and to prevent excessive water loss. The refusal materials are then cored according to ASTM D-2113 using a diamond-studded bit fastened to the end of a hollow, double or triple tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each drill run, the core barrel is brought to the surface, the core recovery is measured, and the core is placed, in sequence, in boxes for storage and transported to our laboratory.

Sampling and Testing in Boreholes
Several techniques are used to obtain samples and data in soils in the field; however the most common methods in this area are:

a) Standard Penetrating Testing
b) Undisturbed Sampling
c) Dynamic Cone Penetrometer Testing
d) Water Level Readings

The procedures utilized for this project are presented below.

Standard Penetration Testing: At regular intervals, the drilling tools are removed and soil samples obtained with a standard 2-inch diameter split tube sampler connected to an A or N-size rod. The sampler is first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140-pound safety hammer falling 30 inches. Generally, the number of hammer blows required to drive the sampler the final 12 inches is designated the "penetration resistance" or "N" value, in blows per foot (bpf). The split barrel sampler is designed to retain the soil penetrated, so that it may be returned to the surface for observation. Representative portions of the soil samples obtained from each split barrel sample are placed in jars, sealed and transported to our laboratory.

The standard penetration test, when properly evaluated, provides an indication of the soil strength and compressibility. The tests are conducted according to ASTM Standard D1586. The depths and N-values of standard penetration tests are shown on the Boring Logs. Split barrel samples are suitable for visual observation and classification tests but are not sufficiently intact for quantitative laboratory testing.

Water Level Readings: Water level readings are normally taken in the boring and are recorded on the Boring Records. In sandy soils, these readings indicate the approximate location of the hydrostatic water level at the time of our field exploration. In clayey soils, the rate of water seepage into the boring is low and it is generally not possible to establish the location of the hydrostatic water level through short-term water level readings. Also, fluctuation in the water level should be expected with variations in precipitation, surface run-off, evaporation, and other factors. For long-term monitoring of water levels, it is necessary to install piezometers.

The water levels reported on the Boring Logs are determined by field crews immediately after the drilling tools are removed, and several hours after the boring are completed, if possible. The time lag is intended to permit stabilization of the groundwater level that may have been disrupted by the drilling operation.

Occasionally the boring will cave-in, preventing water level readings from being obtained or trapping drilling water above the cave-in zone.

BORING LOGS

The subsurface conditions encountered during drilling are reported on a field boring log prepared by the Driller. The log contains information concerning the boring method, samples attempted and recovered, indications of the presence of coarse gravel, cobbles, etc., and observations of groundwater. It also contains the driller's interpretation of the soil conditions between samples. Therefore, these boring records contain both factual and interpretive information. The field boring records are kept on file in our office.

After the drilling is completed a geotechnical professional classifies the soil samples and prepares the final Boring Logs, which are the basis for our evaluations and recommendations.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our investigations, samples obtained during drilling operations are examined in our laboratory and visually classified by an engineer. The soils are classified according to consistency (based on number of blows from standard penetration tests), color and texture. These classification descriptions are included on our Boring Logs.

The classification system discussed above is primarily qualitative and for detailed soil classification two laboratory tests are necessary; grain size tests and plasticity tests. Using these test results the soil can be classified according to the AASHTO or Unified Classification Systems (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties are presented in this report.

The following table presents criteria that are typically utilized in the classification and description of soil and rock samples for preparation of the Boring Logs.

Relative Density of Cohesionless Soils From Standard Penetration Test

Very Loose	$\leq$ 4 bpf
Loose	5 - 10 bpf
Medium Dense	11 - 30 bpf
Dense	31 - 50 bpf
Very Dense	> 50 bpf

(bpf = blows per foot, ASTM D 1586)

Consistency of Cohesive Soils

Very Soft	$\leq$ 2 bpf
Soft	3 - 4 bpf
Firm	5 - 8 bpf
Stiff	9 - 15 bpf
Very Stiff	16 - 30 bpf
Hard	30 – 50 bpf
Very Hard	> 50 bpf

Relative Hardness of Rock

Very Soft	Very soft rock disintegrates or easily compresses to touch; can be hard to very hard soil.
Soft	May be broken with fingers.
Moderately Soft	May be scratched with a nail, corners and edges may be broken with fingers.
Moderately Hard	Light blow of hammer required to break samples.
Hard	Hard blow of hammer required to break sample.

Particle Size Identification

Boulders	Larger than 12"
Cobbles	3" - 12"
Gravel	
Coarse	3/4" - 3"
Fine	4.76mm - 3/4"
Sand	
Coarse	2.0 - 4.76 mm
Medium	0.42 - 2.00 mm
Fine	0.42 - 0.074 mm
Fines (Silt or Clay)	Smaller than 0.074 mm

Rock Continuity

$$\textbf{RECOVERY} = \frac{\text{Total Length of Core}}{\text{Length of Core Run}} \times 100\ \%$$

Description	Core Recovery %
Incompetent	Less than 40
Competent	40 - 70
Fairly Continuous	71 - 90
Continuous	91 - 100

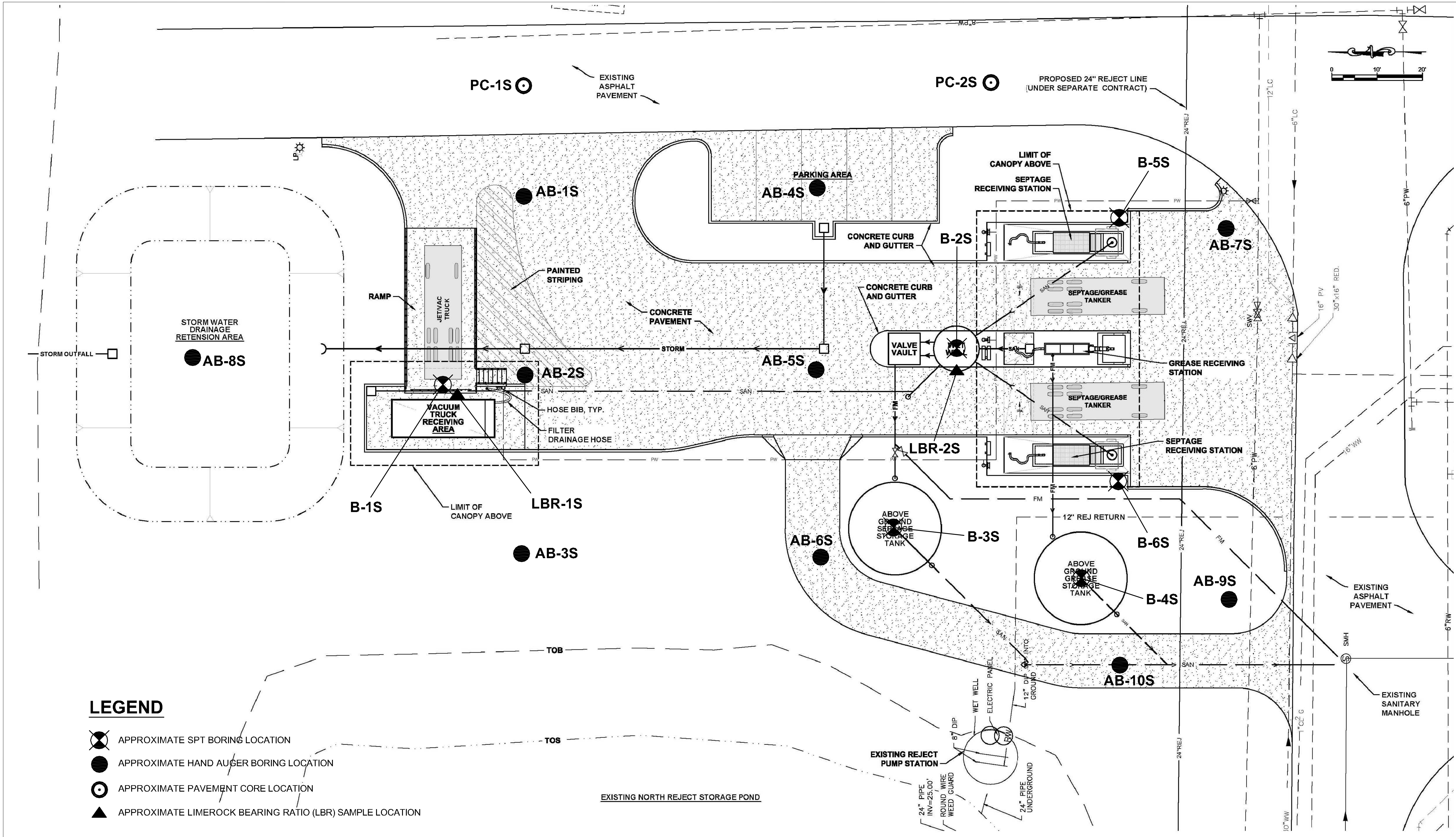
Relative Quality of Rocks

$$\textbf{RQD} = \frac{\text{Total core, counting only pieces > 4" long}}{\text{Length of Core Run}} \times 100\ \%$$

Description	RQD %
Very Poor	0 - 25 %
Poor	25 - 50 %
Fair	50 - 75 %
Good	75 - 90 %
Excellent	90 - 100 %

APPENDIX II

Boring Location Plan from MC^2 Report dated October 10, 2013 – Sheet 1
Report of Core Borings from MC^2 Report dated October 10, 2013 – Sheets 2 and 3



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GEOTECHNICAL • ENVIRONMENTAL MATERIALS TESTING

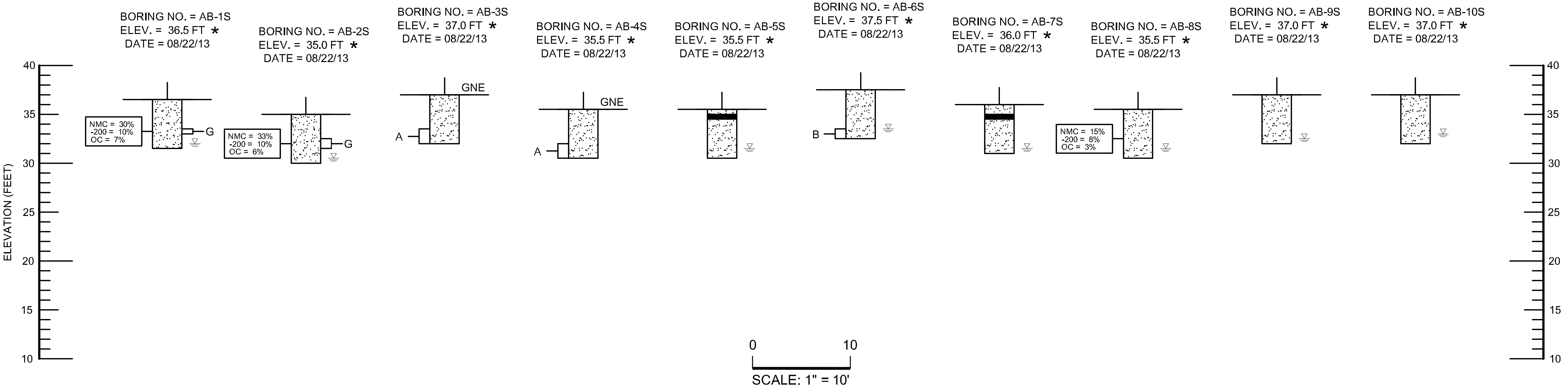
FLORIDA ENGINEERING CERTIFICATE OF AUTHORIZATION No. 9191
Kermit Schmidt, P.E.
FLORIDA LICENSE No. 45603

	NAME	DATE
DESIGNED BY:	IR	09/13
DRAWN BY:	IR	09/13
CHECKED BY:	KS	09/13
SUPERVISED BY:		

BORING LOCATION PLAN

Southeast Water Reclamation Facility
Septage Station
Manatee County, Florida

PROJECT NO.	SHEET NO.
T121211.252	1



LEGEND

(SP/SP-SM/SP-SC) BROWN, LIGHT BROWN, TO DARK BROWN FINE SAND, SLIGHTLY SILTY FINE SAND, TO SLIGHTLY CLAYEY FINE SAND.

SHELL BASE MATERIAL.

(SC) PALE BROWN TO GRAY CLAYEY FINE SAND.

(CL/CH) BROWN TO GRAY SANDY CLAY TO CLAY.

A WITH ROOT FRAGMENTS
B WITH CLAY CLODS
C WITH TRACES TO SOME SHELL
D WITH TRACES TO SOME PHOSPHATE
E WITH CEMENTED CLAY FRAGMENTS
F WITH LARGE PHOSPHATE FRAGEMENTS
G SLIGHTLY ORGANIC

* ELEVATIONS WERE OBTAINED FROM PLANS PROVIDED BY CARDNO TBE AND ARE APPROXIMATE.

NOTES:

WATER TABLE
HA HAND AUGER
GNE GROUNDWATER NOT ENCOUNTERED
WH WEIGHT OF HAMMER
N SPT N-VALUE
100 LOSS OF CIRCULATION (%)
NMC NATURAL MOISTURE CONTENT (%)
-200 FINES PASSING A NO. 200 SIEVE (%)

GRANULAR MATERIALS- RELATIVE DENSITY	SPT (BLOWS/FT)
VERY LOOSE	LESS THAN 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50
SILTS AND CLAYS CONSISTENCY	**SPT (BLOWS/FT)**
VERY SOFT	LESS THAN 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	30-50
VERY HARD	GREATER THAN 50

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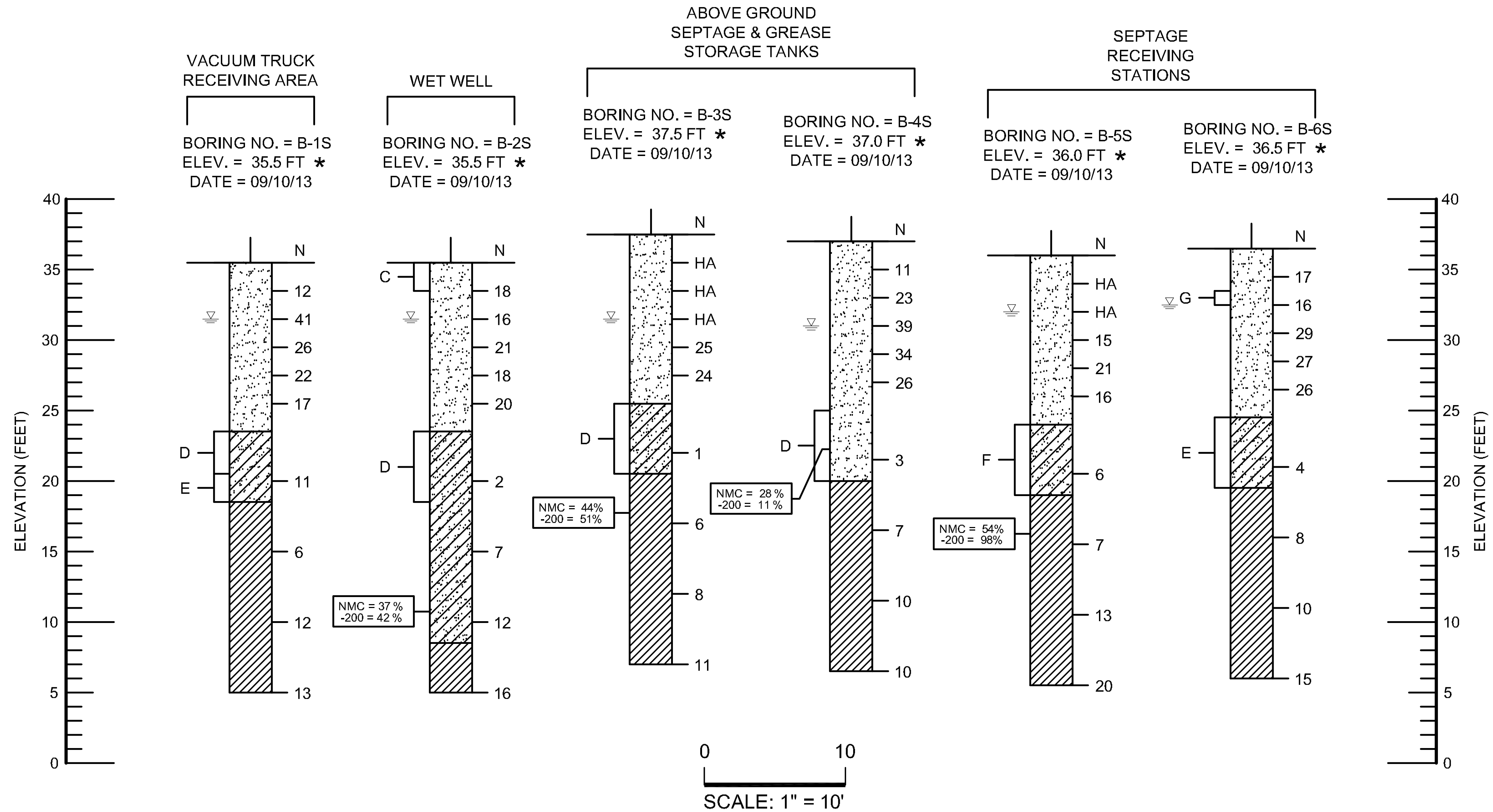
	NAME	DATE
DESIGNED BY:	IR	09/13
DRAWN BY:	IR	09/13
CHECKED BY:	KS	09/13
SUPERVISED BY:		

REPORT OF CORE BORINGS
Southeast Water Reclamation Facility
Septage Station
Manatee County, Florida

PROJECT NO. T121211.252

SHEET NO. 2



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REPORT OF CORE BORINGS

Southeast Water Reclamation Facility
Septage Station
Manatee County, Florida

PROJECT NO.	SHEET NO.
T121211.252	3