Subsurface Exploration and
Geotechnical Engineering Evaluation
For the Malone Fire Station
5187 9th Avenue
Malone, Jackson County, Florida

Ardaman & Associates, Inc.

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Geotechnical, Environmental and
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Ardaman File No.113-24-40-1854

David Melvin Engineers
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Attention: Ms. Kimberly M. Holloway, P.E.

Subject: Subsurface Exploration and
Geotechnical Engineering Evaluation
For the Malone Fire Station
5187 9th Avenue
Malone, Jackson County, Florida

Dear Ms. Holloway:

As requested and authorized, we have completed a subsurface exploration and geotechnical engineering evaluation for the subject project. The purposes of performing this exploration were to evaluate the general subsurface conditions within the building and parking/drive areas and to provide recommendations for site preparation, foundation support, and pavement design. This report documents our findings and presents our engineering recommendations.

SITE LOCATION

The site for the proposed fire station is located at the existing fire station on the southwest corner of the intersection of 9th Avenue and 11th Street in Malone, Florida.

PROPOSED CONSTRUCTION AND GRADING

It is our understanding that the proposed development includes the demolition and reconstruction of a single-story with mezzanine fire station approximately 120 feet by 60 feet in "footprint" plan dimensions. The proposed building will consist of load bearing walls and interior columns with slab-on-grade floors. For the purposes of our analysis, we have assumed the maximum loading conditions for the structure to be on the order of 3 to 5 kips per linear foot for wall foundations, 100 kips for individual column foundations, and 100 pounds per square foot (psf) for slab-on-grade floors. We anticipate the finished floor elevation to be similar to the existing structures. If actual building loads or fill height exceed our assumptions, then the recommendations in this report may not be valid.

REVIEW OF SOIL SURVEY MAPS

Based on information obtained online from the Web Soil Survey as operated by the U.S. Department of Agriculture Natural Resources Conservation Services, the site is located in an area mapped as the “Bonifay sand, 0 to 5 percent slopes” soil series.

The “Bonifay sand, 0 to 5 percent slopes” soil series consists of well drained, moderately slowly permeable soils on ridges and side slopes in the Southern Coastal Plan. According to the Soil Survey, the seasonal high water table is a perched water table about 5 feet below natural ground surface.

FIELD EXPLORATION PROGRAM

SPT Borings

As requested and authorized, the field exploration program included performing four (4) Standard Penetration Test (SPT) borings near the corners of the existing fire station. The SPT borings were advanced to 20 feet below the existing ground surface generally using the methodology outlined in ASTM D-1586. A summary of this field procedure is included in the Appendix.

Soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory in sealed sample jars.

The groundwater level at each of the boring locations was estimated during drilling. The borings were backfilled with soil cuttings upon completion.

Test Locations

The approximate locations of the borings are schematically illustrated on a site plan shown on Figure 1. These locations were determined in the field by tape measuring/estimating distances from existing site features and should be considered accurate only to the degree implied by the method of measurement used. Boring locations should be considered accurate only to the degree implied by the method of locating used.

LABORATORY PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our laboratory for further visual examination and classification. The soil samples were classified using visual-manual procedures in general accordance with the Unified Soil Classification System (ASTM D-2488). The resulting soil descriptions are shown on the soil boring profiles presented on Figure 2.

GENERAL SUBSURFACE CONDITIONS

General Soil Profile

The results of the field exploration and laboratory programs are graphically summarized on the soil boring profiles presented on Figure 2. The stratification of the boring profiles represents our interpretation of the field boring logs and the results of laboratory examinations of the recovered samples. The stratification lines represent the approximate boundary between soil types. The actual transitions may be more gradual than implied.

The results of the borings indicate the following general soil profile:

Depth Below Ground Surface (feet)		Description
From	To	
0	5	Brown medium to fine sand (SP-SM to SM)
5	8	Light brown to grayish-brown clayey fine sand (SC)
8	15	Light gray with light reddish-brown seams slightly sandy fat clay to very clayey fine sand (CH to SC)
15	20	Light gray & reddish-brown to light brown to grayish-brown clayey fine sand

The above soil profile is outlined in general terms only. Subsurface soil conditions do vary in the borings performed. Please refer to Figure 2 for soil profile details.

Groundwater Level

The groundwater level was estimated in the boreholes during drilling. As shown on Figure 2, groundwater was encountered at a depth of 4.5 feet below the existing ground surface on the dates indicated. Fluctuation in groundwater levels should be anticipated throughout the year primarily due to seasonal variations in rainfall and other factors that may vary from the time the borings were conducted.

NORMAL SEASONAL HIGH GROUNDWATER LEVEL

The groundwater level is affected by a number of factors. The amount of rainfall and the drainage characteristics of the soils, the land surface elevation, relief points such as drainage ditches, lakes, rivers, swamp areas, etc., and distance to relief points are some of the more important factors influencing the groundwater level.

The normal seasonal high groundwater level each year is the level in the August-September period at the end of the rainy season during a year of normal (average) rainfall. The water table elevations associated with a higher than normal rainfall and in the extreme case, flood, would be higher to much higher than the normal seasonal high groundwater level, and could occur at times outside of the August-September period. The normal high water levels would more approximate the normal seasonal high groundwater levels.

Based on our interpretation of the site conditions using our boring logs, we estimate the normal seasonal high groundwater level at the boring locations to be approximately 1-foot above the groundwater level measured at the time of our field exploration.

ENGINEERING EVALUATION AND RECOMMENDATIONS

General

The results of our exploration indicate that, with proper site preparation as recommended in this report, the existing soils are suitable for supporting the proposed buildings on a "stiffened" shallow foundation system. Spread footings should provide an adequate support system for the structures.

We recommend providing accommodations to the potential differential movement that is anticipated due to the presence of fat clay (fat clay, specifically Stratum 3) which may heave and settle with varying soil moisture contents, which will occur naturally throughout the year. Stiffening the foundation system is a common accommodation and typically includes adding top steel in the strip footings to resist negative moments and adding an additional layer of welded wire mesh in the slab-on-grade.

The following are our recommendations for site preparation and foundation support for the proposed building based on the existing soil conditions encountered during the exploration. The recommendations are made as a guide for the design engineer and/or architect, parts of which should be incorporated into the project's specifications.

Evaluation of Very Loose Conditions Encountered in Boring TH-1

We note that very loose conditions were encountered in the surficial 9 feet at boring TH-1, as indicated by "weight of hammer" conditions, in which the sampler was advanced under the static weight of the hammer and rods. These conditions either indicate that this is previously placed fill and was not sufficiently compacted or potentially a nearby sinkhole condition that has not reached the ground surface yet. Jackson County is subject to sinkhole activity.

These conditions should be further explored, either with additional soil borings or test pits to assess the extent and character of soils and loose conditions. Further assessments will be made during the evaluation of the soils borings or test pits.

Stripping and Grubbing/Root-Raking

The "footprints" of the proposed buildings, the parking/drive areas and other hardscape areas, plus a minimum margin of five feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil or other deleterious materials, as encountered. Buried utilities and other underground structures should be removed or plugged to eliminate conduits into which surrounding soils could erode.

All existing foundations, slabs, asphalt, and any other underground structures should be removed from the proposed construction area. If pipes or any collapsible or leak prone utilities are not removed or completely filled (with grout or concrete), they might serve as conduits for subsurface erosion resulting in excessive settlements. Over-excavated areas resulting from the removal of underground structures and unsuitable materials should be backfilled in accordance with the fill soils section of this report. This excavation must not undermine the existing building foundations. Provide shoring, bracing, and/or underpinning of existing footings as necessary to protect from failure.

It has been our experience that soils surrounding existing buildings sometimes contain pockets of construction debris or other deleterious materials requiring removal and replacement with compacted clean sands. Therefore, we recommend that the stripped surface be inspected by Ardaman & Associates, Inc.

Proof-rolling

We recommend proof-rolling the cleared surface to locate any unforeseen soft areas or unsuitable surface or near-surface soils, to increase the density of the upper soils, and to prepare the existing surface for the addition of the fill soils (as required). Proof-rolling of the building areas should consist of at least 10 passes of a compactor capable of achieving the density requirements described in the next paragraph. Each pass should overlap the preceding pass by 30 percent to achieve complete coverage. If deemed necessary, in areas that continue to "yield", remove all deleterious material and replace with clean, compacted sand backfill. The proof-rolling should occur after cutting and before filling. The number of passes can be reduced to 3 within the proposed parking/drive areas. Proof-rolling should be monitored in the field by an Ardaman representative.

A density equivalent to or greater than 95 percent of the modified Proctor (ASTM D-1557) maximum dry density value for a depth of 2 feet in the building areas and 1 foot in the parking/drive areas must be achieved beneath the stripped and grubbed ground surface. Additional passes and/or overexcavation and recompaction may be required if these minimum density requirements are not achieved. The soil moisture should be adjusted as necessary during compaction.

Care should be exercised to avoid damaging any neighboring structures while the compaction operation is underway. Prior to commencing compaction, occupants of adjacent structures should be notified and the existing condition (i.e., cracks) of the structures documented with photographs and survey (if deemed necessary). Compaction should cease if deemed detrimental to adjacent structures, and Ardaman & Associates should be notified immediately. Heavy vibratory compaction should not be used within 200 feet of existing structures.

Suitable Fill Material and Compaction of Fill Soils

All fill materials should be free of organic materials, such as roots and vegetation. We recommend using fill with less than 12 percent by dry weight of material passing the U.S. Standard No. 200 sieve size. The fine sand and fine sand with silt (Stratum 1 without roots, as shown on Figure 2) are suitable for use as fill materials and, with proper moisture control, should densify using conventional compaction methods. Soils with more than 12 percent passing the No. 200 sieve can be used in some applications, but will be more difficult to compact due to their inherent nature to retain soil moisture.

All structural fill should be placed in level lifts not to exceed 12 inches in uncompacted thickness. Each lift should be compacted to at least 95 percent of the modified Proctor (ASTM D-1557) maximum dry density value. The filling and compaction operations should continue in lifts until the desired elevation(s) is achieved. If hand-held compaction equipment is used, the lift thickness should be reduced to no more than 6 inches.

The use of soils with relatively high fines content (i.e., silty and clayey soils) as fill should be avoided near the ground surface in green-space areas since these relatively low permeability soils promote ponding of water during and following rainfall. Also, in high groundwater areas, silty and clayey soils may cause a rise in the water table elevation due to capillary action. Additionally, these relatively low permeability soils should not be used directly beneath any pavement section as they may trap water within the pavement section leading to premature pavement failure.

Foundation Support by Spread Footings and Foundation Compaction Criteria

Foundations should be excavated to the proposed bottom of footing elevations and, thereafter, the in-place compaction for a depth of 1-foot below the footing bottoms should be verified. If necessary, compact the soils at the bottom of the excavations to at least 95 percent of the modified Proctor maximum dry density (ASTM D-1557) for a depth of 1-foot below the footing bottoms. We note that soils within the building footprint were very clayey and may retain moisture making it difficult to achieve the required compaction when wet. In these instances, either the soft/wet clayey soils need to be dried sufficiently to achieve compaction or will need to be over-excavated and replaced with suitable fill soils, as described above. If over-excavated, the depth of the soils which should be removed and replaced will be determined in the field by an Ardaman engineer since the depth will vary depending on the extent of the soft/wet soil.

Based on the existing soil conditions and, assuming the above outlined proof-rolling and compaction criteria are implemented, an allowable soil bearing pressure of 2,000 pounds per square foot (psf) may be used in the foundation design. This bearing pressure should result in foundation settlement within tolerable limits (i.e., 1 inch or less).

Bearing wall foundations should be a minimum of 18 inches wide and column foundations should be a minimum of 24 inches wide. A minimum soil cover of 18 inches should be maintained from the bottom of the foundations to the adjacent finished grades.

As previously noted, differential movement resulting from heave and settlement of the encountered fat clay (Stratum 3) should be anticipated. This differential movement is commonly greatest between the exterior perimeter of the building and extending 8 to 10 feet towards the center of the building. The exterior of the building is subject to greater seasonal variation in moisture than the center of the building. We estimate that about ¼ to ½ -inch of differential movement may occur seasonally within 8 to 10 feet of the building perimeter. Stiffening the foundation system is a common accommodation and typically includes adding top steel in the strip footings to resist negative moments and adding an additional layer of welded wire mesh in the slab-on-grade. Design of the reinforcing should be provided by the project structural engineer.

Floor Slab Moisture Reducer and Slab Compaction Requirements

Prior to concrete placement, soil compaction beneath floor slabs should be verified for a depth of 12 inches and meet the 95 percent criteria (modified Proctor, ASTM D-1557).

Precautions should be taken during the slab construction to reduce moisture entry from the underlying subgrade soils. Moisture entry can be reduced by installing a membrane between the subgrade soils and floor slab. Care should be exercised when placing the reinforcing steel (or mesh) and slab concrete such that the membrane is not punctured. We note that the membrane alone does not prevent moisture from occurring beneath or on top of the slab.

If interior columns are isolated from the floor slab, an expansion joint should be provided around the columns and sealed with a water-proof sealant.

Typical Concrete Pavement Section

General

We understand that a rigid Portland cement concrete pavement is planned for the project. The design of a concrete pavement includes selecting dimensions and other details to provide a section that will adequately carry the anticipated traffic, provide the correct types of joints in the proper locations, and promote positive drainage. The pavement thickness recommendations are based on the "Guide for Design and Construction of Concrete Parking Lots" published by the American Concrete Institute (ACI 330R-08).

Site Preparation

Areas to be paved should be prepared as previously outlined. The subgrade soil compaction should be verified for a depth of 12 inches (i.e., compacted to at least 95 percent of the modified Proctor (ASTM D-1557, AASHTO T-180) maximum dry density value). The subgrade within 12 inches of the bottom of pavement should consist of well-drained soils with less than 5 percent of the sand passing the U.S. No. 200 sieve (Unified Classification SP) (4 inches of No. 57 stone is also appropriate as an alternative to the 12 inches of sand). A minimum clearance of 2 feet must be maintained between the bottom of concrete pavement and the seasonal high water table.

Concrete Pavement

Assuming the pavement will be subjected to Traffic Category C (ADTT=100) levels as described in Table 3.3 of ACI 330R-08, and the subgrade is prepared as outlined above, the concrete pavement should be a minimum of 6.0 inches in thickness and have a minimum compressive strength of 4,000 pounds per square inch.

The above minimum design recommendations can be used for unreinforced, fiber-reinforced or steel-reinforced pavements. Steel reinforcement and joint design should be in accordance with the recommendations presented in ACI 330R-08.

Landscape Drainage

It is the landscape designer's responsibility to specify soil types required in greenspace areas. Typically, low permeability soils should be removed from greenspace areas because low permeability soils inhibit internal drainage and promote standing water and/or saturated ground conditions. These water conditions can be harmful to plant survival and can cause deterioration of adjacent pavements and water intrusion into adjacent buildings.

Seepage from landscaped areas, under and over curbs, can result in aesthetic problems, pedestrian safety issues, and in extreme cases, premature pavement failures. Such seepage can be reduced by the use of relatively free draining sands in berms, reducing the height of berms, controlling the frequency and amount of irrigation, the use of full-depth curbs, and/or the use of edge/strip drains or underdrains behind curbs. An often successfully used method of enhancing landscape drainage is to slope the greenspace areas downward away from curbs, buildings, etc., and incorporate catch basins with positive outflow to prevent excess water buildup in the greenspace areas.

QUALITY ASSURANCE

We recommend establishing a comprehensive quality assurance program to verify that all site preparation and foundation and pavement construction is conducted in accordance with the appropriate plans and specifications. Materials testing and inspection services should be provided by Ardaman & Associates.

As a minimum, an on-site engineering technician should monitor all stripping and grubbing to verify that deleterious materials have been removed and should observe the final proof-rolling operation to verify that the soils are sufficiently stiff/dense for subgrade support. In-situ density tests should be conducted during earthwork activities and below all structural areas including footings, floor slabs, pavement and other hardscape areas to verify that the required densities have been achieved. In-situ density values should be compared to laboratory Proctor moisture-density results for each of the different natural and fill soils encountered.

Finally, we recommend inspecting and testing the construction materials for the foundations, other structural components, and pavement.

IN-PLACE DENSITY TESTING FREQUENCY

Earthwork testing is typically performed on an on-call basis when the contractor has completed a portion of the work. The test result from a specific location is only representative of a larger area if the contractor has used consistent means and methods and the soils are practically uniform throughout. The frequency of testing can be increased and full-time construction inspection can be provided to account for variations. We recommend that the following minimum testing frequencies be utilized.

In proposed building areas, a minimum frequency of one in-place density test for each 2,500 square feet of area should be used. In-place density testing should be performed at this minimum frequency for a depth of 2 feet below natural ground and for every 1-foot lift of fill placed in the structural area. In addition, density tests should be performed in each column footing for a depth of 2 feet below the bearing surface. For continuous or wall footings, density tests should be performed at a minimum frequency of one test for every 50 linear feet of footing, and for a depth of 2 feet below the bearing surface.

In proposed pavement and other hardscape areas, a minimum frequency of one in-place density test for each 5,000 square feet of area should be used. The existing, natural ground should be tested to a depth of 12 inches at the prescribed frequency. Each 12-inch lift of fill should be tested at this frequency. Utility backfill should be tested at a minimum frequency of one in-place density test for each 12-inch lift for each 200 linear feet of pipe. Additional tests should be performed in backfill for manholes, inlets, etc.

Representative samples of the various natural ground and fill soils should be obtained and transported to our laboratory for Proctor compaction tests. These tests will determine the maximum dry density and optimum moisture content for the materials tested and will be used in conjunction with the results of the in-place density tests to determine the degree of compaction achieved.

CLOSURE

The analyses and recommendations submitted herein are based on the data obtained from the soil borings presented on Figure 2 and the assumed loading conditions. This report does not reflect any variations which may occur adjacent to or between the borings. The nature and extent of the variations between the borings may not become evident until during construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented in this report after performing on-site observations during the construction period and noting the characteristics of the variations.

In the event any changes occur in the design, nature, or location of the proposed facility, we should review the applicability of conclusions and recommendations in this report. We recommend a general review of final design and specifications by our office to verify that earthwork and foundation recommendations are properly interpreted and implemented in the design specifications. Ardaman & Associates should attend the pre-bid and preconstruction meetings to verify that the bidders/contractor understand the recommendations contained in this report.

Because of Ardaman & Associates' familiarity with this site and the proposed development gained through performing the subsurface soil exploration and geotechnical engineering evaluation as presented in this report, Ardaman & Associates is best suited to provide monitoring and testing services during earthwork, and to provide continued evaluation and guidance during construction should variations in the soil conditions be encountered.

This study is based on a relatively shallow exploration and is not intended to be an evaluation for sinkhole potential. This study does not include an evaluation of the environmental (ecological or hazardous/toxic material related) condition of the site and subsurface.

This report has been prepared for the exclusive use of David Melvin Engineers in accordance with generally accepted geotechnical engineering practices for the purpose of the proposed Malone Fire Station. No other warranty, expressed or implied, is made.

We are pleased to be of assistance to you on this phase of the project. When we may be of further service to you or should you have any questions, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.
Florida Registry 5950

Jeremy M Clark

Digitally signed by: Jeremy M Clark
DN: CN = Jeremy M Clark C = US O = ARDAMAN AND ASSOCIATES
Date: 2024.02.08 16:51:44 -05'00'

Michael S. Wilson, P.E.
Tallahassee Branch Manager
FL License No.: 46088

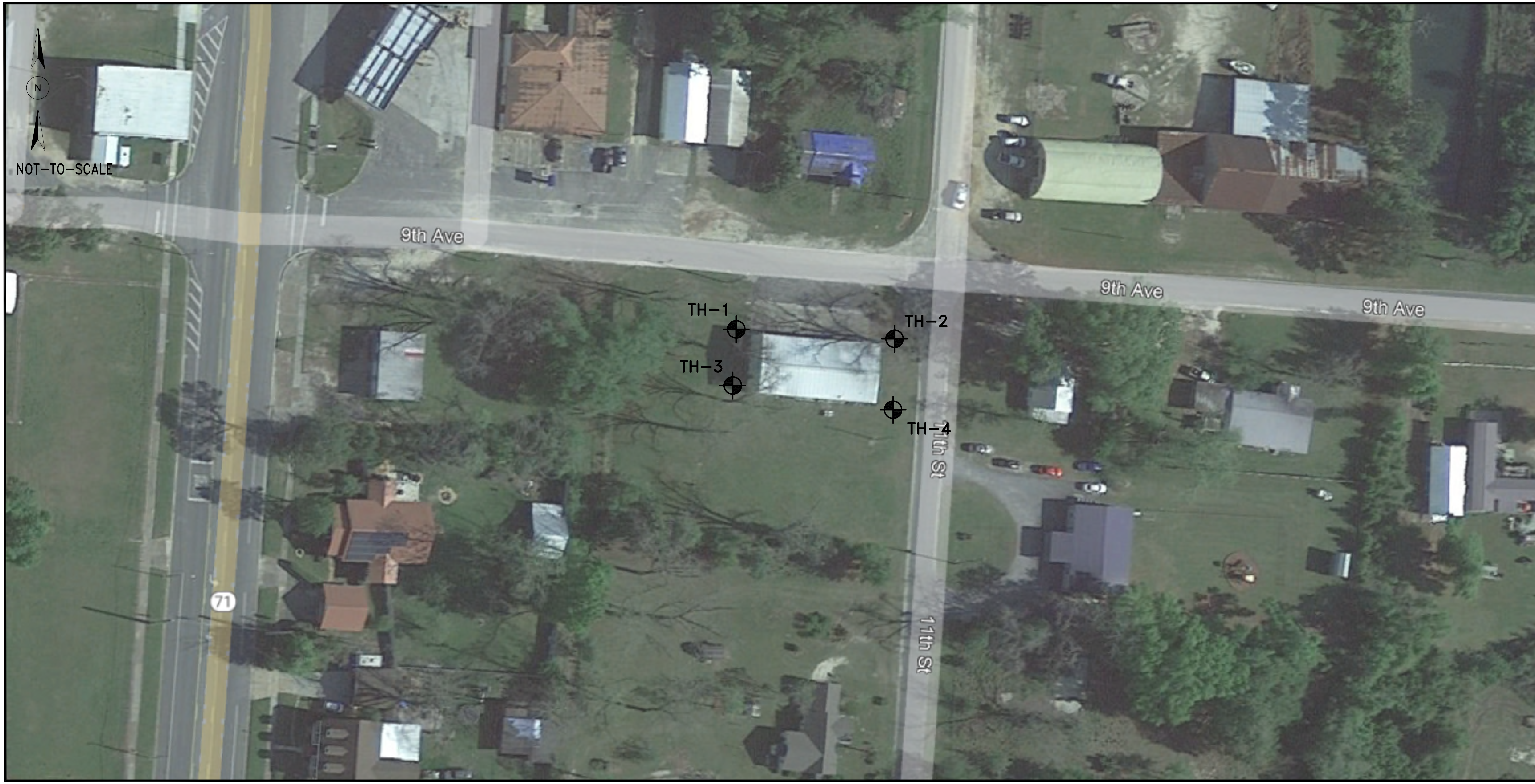
Jeremy M. Clark, P.E.
Senior Engineer
FL License No.: 77660

JMC/MSW

This item has been digitally signed and sealed by Jeremy M. Clark, P.E. on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

GENERAL TEST BORING LOCATION PLAN
(Image Source: Google Earth)



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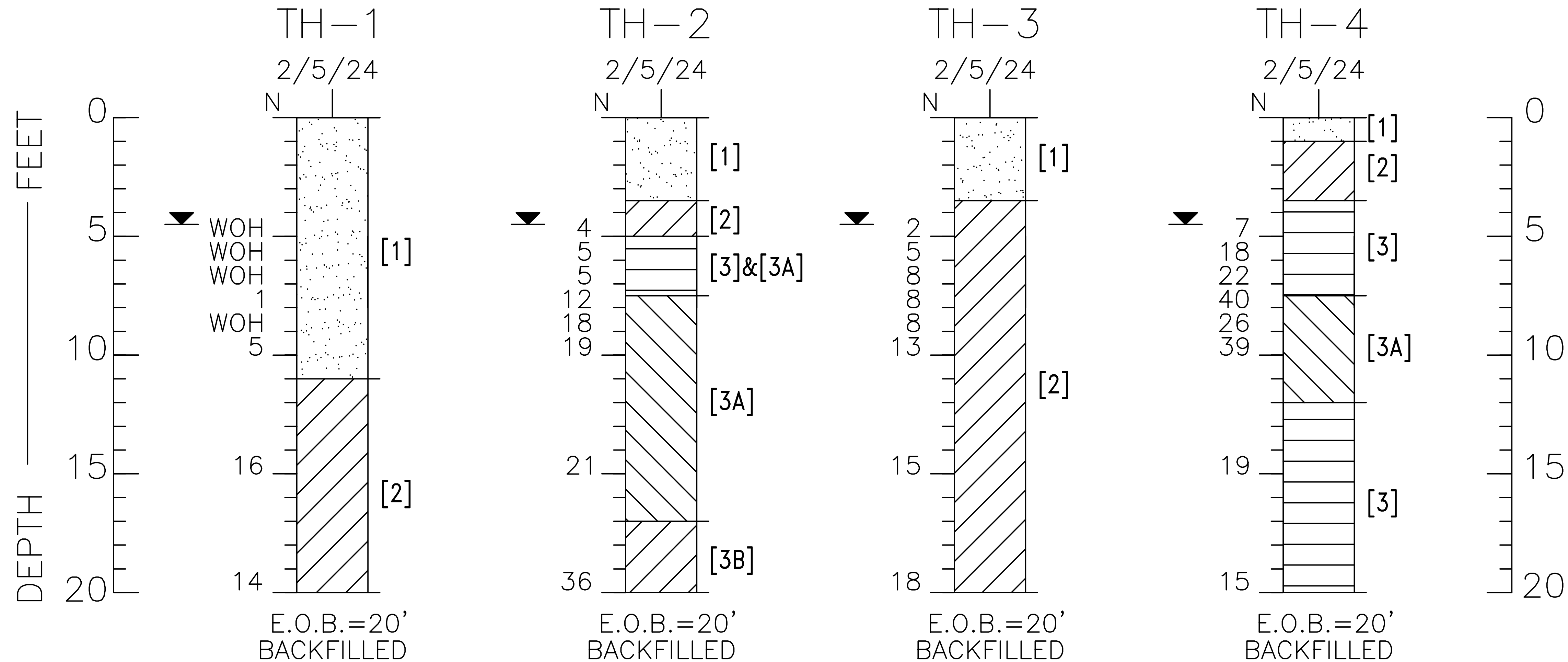
SHEET TITLE:
BORING LOCATION PLAN
5187 9th AVENUE
MALONE FIRE STATION
MALONE, JACKSON COUNTY, FLORIDA

DRAWN BY: JMC	CHECKED BY: MSW	DATE: 2/6/24
FILE NO. 113-24-40-1854	APPROVED BY: M.S. WILSON, P.E.	FIGURE 1

BORING PROFILES



ENGINEERING CLASSIFICATION

I COHESIONLESS SOILS

DESCRIPTION	BLOW COUNT "N"
VERY LOOSE	0 TO 4
LOOSE	4 TO 10
MEDIUM DENSE	10 TO 30
DENSE	30 TO 50
VERY DENSE	>50

II COHESIVE SOILS

DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH, QU, TSF	BLOW COUNT "N"
VERY SOFT	<1/4	0 TO 2
SOFT	1/4 TO 1/2	2 TO 4
MEDIUM STIFF	1/2 TO 1	4 TO 8
STIFF	1 TO 2	8 TO 15
VERY STIFF	2 TO 4	15 TO 30
HARD	>4	>30

LEGEND

TH	LOCATION OF SPT TEST HOLE
N	STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT (ASTM D-1586)
WOH	SAMPLER ADVANCED BY STATIC WEIGHT OF HAMMER AND RODS
EOB	END OF BORING
▼	GROUNDWATER DEPTH MEASURED ON DATE DRILLED
SP-SM,SM,SC	UNIFIED SOIL CLASSIFICATION SYSTEM
A-3,A-2-4	AASHTO SOIL CLASSIFICATION SYSTEM
DRILLERS:	IDI, RP

SOIL LEGEND

[1] BROWN MEDIUM TO FINE SAND W/SILT (SP-SM TO SM; A-3 TO A-2-4)

[2] LIGHT BROWN TO GRAYISH-BROWN CLAYEY FINE SAND (SC; A-2-6)

[3] LIGHT GRAY W/LIGHT REDDISH-BROWN SEAMS SLIGHTLY SANDY FAT CLAY (CH; A-7)

[3A] LIGHT GRAY & REDDISH-BROWN VERY CLAYEY FINE SAND (SC; A-6)

[3B] LIGHT GRAY & REDDISH-BROWN CLAYEY FINE SAND (SC; A-2-6)

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR. ABSENCE OF WATER SURFACE DATA ON CERTAIN BORINGS IMPLIES THAT NO GROUNDWATER DATA IS AVAILABLE, BUT DOES NOT NECESSARILY MEAN THAT GROUNDWATER WILL NOT BE ENCOUNTERED AT THESE LOCATIONS OR WITHIN THE VERTICAL REACHES OF THESE BORINGS IN THE FUTURE.

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DRAWN BY: JMC | CHECKED BY: MSW | DATE: 2/6/24

FILE NO. 113-24-40-1854 | APPROVED BY: M.S. WILSON, P.E. | FIGURE 2

APPENDIX

Standard Penetration Test

STANDARD PENETRATION TEST

The standard penetration test is a widely accepted test method of *in situ* testing of soils (ASTM D 1586), and Ardaman & Associates generally follows this test method. A 2-foot long, 2-inch O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 or 24 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties.

The tests are usually performed at 5-foot intervals. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid.

Representative split-spoon samples from the soils are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary.