CHATHAM COUNTY PURCHASING & CONTRACTING DEPARTMENT

ADDENDUM NO. 1 TO 22-0037-4

FOR: Architectural & Engineering Design Services for the New Heavy Bay Fleet Facility on Varnedoe Drive

PLEASE SEE THE FOLLOWING FOR ADDITIONS, CLARIFICATIONS AND/OR CHANGES:

1. See the attached sheet for Responses to Questions received. (1 page)

2. See attached 2014 Geotechnical Report for reference purposes. (57 pages)

3. See attached As-Builts for the Chatham County Fuel Station for reference purposes. (7 plan sheets)

PROPOSALS REMAIN DUE: 5PM, TUESDAY, MAY 3, 2021

THE PROPOSER IS RESPONSIBLE FOR MAKING THE NECESSARY CHANGES AND MUST ACKNOWLEDGE RECEIPT OF ADDENDUM.

4/26/22
DATE

ROBERT E. MARSHALL
SENIOR PROCUREMENT SPECIALIST
CHATHAM COUNTY

Questions Received:

1. Q) Please elaborate on the scope of work for the existing fueling station.

   A) The design just needs to incorporate the existing fueling station into the design. We are not looking to make any changes to the fueling station. As-builts for the fuel station site are attached.

2. Q) Page 23 mentions site lighting under civil design, will the design professional provide the site lighting or will that be provided by Georgia Power?

   A) Design professional to provide lighting design.

3. Q) Page 23, item J. states Geotechnical Services recommendations, do you want the design professional to provide geotechnical design services?

   A) Design professional to provide geotechnical services, as needed. A copy of the previously completed Geotechnical Report from 2014 is attached.

4. Q) Page 23, item P. states Environmental Site Assessment, do you want the design professional to complete a Phase 1 ESA?

   A) Design professional to provide ESA.

5. Q) Can the 25-page count include front & back?

   A) Yes.

6. Q) Is there any additional information on the oil management/water oil management system that you could provide?

   A) No additional information on the oil management/water oil management system.

Geotechnical Engineering Investigation

Chatham County Fueling Station
Savannah, Georgia

October 17, 2014
Terracon Project No. ES145143

Prepared for:
Thomas & Hutton
Savannah, Georgia

Prepared by:
Terracon Consultants, Inc.
Savannah, Georgia

October 17, 2014

Thomas & Hutton
50 Park of Commerce Way
Savannah, Georgia 31402

Attn: Mr. John Giordano
P: (912) 721 4054
E: giordano.j@thomasandhutton.com

Re: Geotechnical Engineering Investigation
Chatham County Fueling Station
Savannah, Georgia
Terracon Project No: ES145143

Dear Mr. Giordano:

Terracon Consultants, Inc. (Terracon) has completed the Geotechnical Engineering Investigation for the above-referenced project. The services were performed in general accordance with our proposal No. PES140273 dated June 6, 2014. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements.

We appreciate the opportunity to be of service to you. Should you have any questions concerning this report or if we may be of further service, please contact us at your convenience.

Sincerely,
Terracon Consultants, Inc.

GUOMING LIN

Biraj Gautam, M.S., E.I.T.
Staff Geotechnical Engineer

Guoming Lin, Ph.D., P.E.
Senior Principal

cc: 1 – Client (PDF)
1 – File

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This report presents the results of our Geotechnical Engineering Investigation for the proposed Chatham County Fueling Station to be located east of Varnedoe Drive in Savannah, Georgia. The investigation included a field exploration program and engineering evaluation of the subsurface conditions and foundation recommendations. Based on the results of the subsurface exploration and analyses, we conclude the site is suitable for the proposed development. The following geotechnical considerations were identified:

- The subsurface conditions are relatively uniform across the site. The top 0.5 to 1 foot at the site is silty sands with grass roots. Below the topsoil to a depth of about 5 to 7 feet below ground surface (BGS) are loose to medium dense silty sands, followed by dense to very dense silty sands (hardpan) to a depth of about 10 to 12 feet BGS. The soils below hardpan are loose to medium dense sands with silt to silty sands to a depth of about 27 feet BGS, which are underlain by soft to medium stiff sandy clays to a depth of about 32 feet BGS. Below the sandy clays are loose to medium dense silty to clayey sands to the termination of the SPT borings at a depth of about 35 feet BGS.

- Groundwater was encountered at a depth of about 2.0 to 3.5 feet BGS in the SPT borings and about 1.5 to 3.0 feet BGS in the hand auger borings. The groundwater table should be checked prior to construction to assess its effect on site work and other construction activities.

- In general, the onsite soils are suitable for structural fill and subgrade support provided that the debris and other objectionable materials are not present in the soils.

- An effective drainage system is recommended in the proposed fueling station to intercept rain and surface water. Groundwater table is relatively shallow and thus dewatering should be planned during the excavation for the fuel tank construction.

- The information regarding the structural loads and the site grading plan was not available at the time of this report preparation. Settlement analyses were performed using assumed structural loads and the soil parameters derived from the CPT soundings and SPT borings. For settlement analyses, we assumed a maximum column load of 100 kips, a slab load of 200 psf, and a fuel tank floor load of 500 psf for our foundation evaluation. If heavier structural loads are required or if more stringent settlement criteria are required, we should perform additional evaluation to determine if ground improvement measures or another foundation option is required. Based on the results of our settlement analyses, the maximum settlements were estimated to be less than 1 inch at all the CPT sounding and SPT boring locations. With the subgrade improvements using undercut and backfill or densification and proofrolling as discussed in **Section 4.2**, the proposed fueling station may be supported on shallow foundation systems.

- Deeper undercutting and backfilling may be required in isolated loose/soft areas under the footings to achieve stable subgrade. The extent and depth of undercut should be based on the subsurface conditions encountered during construction.

- A net allowable bearing capacity of 2,000 pounds per square foot (psf) is recommended for foundation design. The allowable bearing capacity may be increased by 1/3 for transient wind load and seismic load conditions. All footings should bear at least 2 feet below finished grade. Continuous wall footings and isolated column footings should be at least 24 inches wide.

- For seismic design purposes, the subject site shall be classified as Site Class D in accordance with the International Building Code (IBC) 2012 and ASCE 7-10 Section 11.4.2.

- For seismic evaluation, we estimated liquefaction induced settlements from geometric mean maximum considered earthquake (MCE_G) to be around 4.0 inches with differential settlements approaching 50% to 100% of the total. Actual liquefaction settlements at the site would be highly dependent on magnitude and distance from the source during the design earthquake event. In the event of an earthquake, the structure may sustain some damage that should be repairable. We recommend the structural engineer to design the structures to avoid total collapse. As such, it would not be necessary to use special ground improvement measures to mitigate the risk of liquefaction.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items and recommendations contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report’s limitations.

GEOTECHNICAL ENGINEERING INVESTIGATION

Chatham County Fueling Station
Savannah, Georgia
Terracon Project No. ES145143
October 17, 2014

1.0 INTRODUCTION

Terracon has completed the Geotechnical Engineering Investigation for the proposed Chatham County Fueling Station to be located east of Varnedoe Drive in Savannah, Georgia. The investigation included a field exploration program and engineering evaluation of the subsurface conditions and foundation recommendations. The subsurface conditions within the project site were explored with a total of five (5) cone penetration test (CPT) soundings, three (3) standard penetration test (SPT) borings, seven (7) hand auger borings and four (4) double ring infiltrometer tests. The CPT soundings at the site were pushed to refusal at depths of about 6 to 9 feet below ground surface (BGS). To determine the existing subsurface conditions below 9 feet BGS, SPT borings were conducted to a depth of about 35 feet BGS. The hand auger borings were performed to a depth of about 5 feet BGS, and the infiltration tests were performed close to the ground surface at a depth of about 12 inches BGS. A detailed presentation of the subsurface soils encountered at each borehole and sounding location during site exploration can be found in the CPT, SPT and hand auger boring logs included in **Appendix A** of this report, along with a site location map and exploration location plan. The results obtained from the double ring infiltrometer test are also included in **Appendix A.**

The purpose of our investigation was to explore and evaluate the existing subsurface conditions at the project site and develop conclusions and geotechnical recommendations for the proposed development. The following study was conducted in accordance with our scope of services outlined in our proposal (Proposal No. PES140273) dated June 6, 2014:

- subsurface soil conditions
- site preparation
- pavement recommendations
- groundwater conditions
- foundation design and construction
- seismic considerations

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Proposed Improvements	The proposed development will include the construction of fueling station, canopy, and parking and drive aisles.

Item	Description
Finished floor elevation	Not provided but assumed to be close to the existing grades.
Maximum loads	Not provided. The following loading conditions were assumed for the settlement analyses. **Column Load**: 100 kips (assumed) **Building Slab Load**: 200 psf (assumed) **Fuel Tank Floor Load**: 500 psf (assumed)
Maximum allowable settlement	Total settlement: 1 inch (assumed). Differential settlement: ¾ inches over 40 feet or between columns.
Grading	It is anticipated that the site work will involve cut and fill.

2.2 Site Location and Description

Item	Description
Location	The site is located at east of Varnedoe Drive in Savannah, Georgia. Latitude: 31.9913°, Longitude:-81.0796°.
Existing improvements	Undeveloped.
Current ground cover	The site was densely wooded at the time of subsurface exploration.
Existing topography	Relatively level.

Should any of the above information or assumptions be inconsistent with the planned construction, Terracon should be informed so that modifications to this report can be made as necessary.

3.0 SUBSURFACE CONDITIONS

The subsurface conditions of the project site were initially explored with a total of five (5) cone penetration test (CPT) soundings. Due to shallow refusal at depths of about 6 to 9 feet BGS in the CPT soundings, SPT soil borings were performed at the site to determine soil conditions below the very dense silty sand layer (hardpan). A total of three (3) SPT soil borings were conducted to a depth of about 35 feet BGS.

3.1 Typical Profile

Based on the results of the field exploration program, we developed a generalized soil profile to represent the soil conditions of the project site. The subsurface conditions at the site are relatively consistent and can be generalized as follows:

From the CPT soundings

Description	**Approximate Depth to Bottom of Stratum** (feet)	**Material Encountered**	**Equivalent SPT N_{60}**
Topsoil	0.5 to 1	Silty sands with grass roots.	--
Stratum 1	5 to 8	Loose to medium dense silty sands.	4 to 12
Stratum 2	9, termination of sounding	Very dense silty sands (hardpan).	50+

From the SPT borings

Description	**Approximate Depth to Bottom of Stratum** (feet)	**Material Encountered**	**SPT N_{60}**
Topsoil	0.5 to 1	Silty sands with grass roots.	--
Stratum 1	5 to 7	Loose to medium dense silty sands.	5 to 18
Stratum 2	10 to 12	Dense to very dense silty sands (hardpan).	30 to 50+
Stratum 3	27	Loose to medium dense sands with silt to silty sands.	4 to 29
Stratum 4	32	Soft to medium stiff silty clays.	4 to 7
Stratum 5	35, termination of boring	Loose to medium dense silty to clayey sands.	7 to 12

Details of subsurface conditions encountered at each sounding and boring location are presented in the individual CPT sounding, SPT boring and hand auger borings logs in **Appendix A** of this report. Stratification boundaries on the logs represent the approximate depth of changes in soil types; the transition between materials may be gradual.

3.2 Groundwater

Groundwater was encountered at a depth of about 2.0 to 3.5 feet BGS in the SPT borings and about 1.5 to 3.0 feet BGS in the hand auger borings. It should be noted that groundwater levels tend to fluctuate with seasonal and climatic variations, as well as with construction activities. As such, the possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project. The groundwater table should be checked prior to construction to assess its effect on site work and other construction activities.

3.3 Double Ring Infiltration Test Results

A total of four (4) Double-Ring Infiltrometer tests (IR1 through IR4) were conducted within the proposed area for determining the infiltration rates of the in-situ soils (Please refer to **Exhibit A-2** for the test locations). These test locations were selected and provided by the civil engineer.

The infiltration tests were conducted in accordance with ASTM D3385. In the test, two open cylinders, one inside the other, were driven into the ground, partially filling the rings with water, and maintaining the water at constant level. The volume of water added to the inner ring to maintain the water level constant is the measure of the volume of water that infiltrates the soil. The volume infiltrated during timed intervals is converted to an incremental infiltration velocity, usually in/hour and plotted versus elapsed time. The average incremental velocity is equivalent to the infiltration rate. Below is the table showing infiltration rates estimated from the double ring infiltrometer test conducted at Test Locations IR1 through IR4.

Double Ring Infiltrometer Test Result

Test Location	**Test Depth**	**Soil Classification**	**Infiltration Rate** (in/hr.)
IR1	12 inch BGS	Poorly graded SAND with silt (SP-SM)	51.1
IR2	12 inch BGS	Silty SAND (SM)	13.8
IR3	12 inch BGS	Silty SAND (SM)	23.2
IR4	12 inch BGS	Silty SAND (SM)	20.0

It should be noted that saturation levels along with other factors such as siltation and vegetation growth may affect the infiltration rates. The actual infiltration rate may vary from the values reported here.

3.4 Laboratory Tests

The laboratory tests included natural moisture content, grain size analyses and Atterberg limits. The test results are provided in **Appendix B** of this report.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The subsurface conditions at this site are considered relatively consistent across the area explored and are adaptable for the proposed development. The generalized soil profile is presented in **Section 3.1**.

The information regarding the structural loads and the site grading plan was not available at the time of this report preparation. Settlement analyses were performed using assumed structural loads and the soil parameters derived from the CPT soundings and SPT borings. We assumed a column load of 100 kips, a slab load of 200 psf, and a fuel tank floor load of 500 psf for our foundation evaluation. If heavier structural loads are required or if more stringent settlement criteria are required, we should perform additional evaluation to determine if ground improvement measures or another foundation option is required.

Based on the results of our settlement analyses, the maximum settlements were estimated to be less than 1 inch at all the CPT sounding and SPT boring locations. With the subgrade improvements using undercut and backfill or densification and proofrolling as discussed in **Section 4.2**, the proposed fueling station may be supported on shallow foundation systems. However, deeper undercutting and backfilling may be required in isolated loose/soft areas under the footings to achieve stable subgrade. The extent and depth of undercut should be based on the subsurface conditions encountered during construction.

The subgrade soils may lose some of their strengths when rain and surface water infiltrates into them. An effective drainage system is recommended in the proposed fueling station to intercept rain and surface water. Groundwater table is relatively shallow and thus dewatering should be planned during the excavation for the fuel tank construction.

We recommend a thorough field quality control program of proofrolling of the subgrade. The bottom of the excavation should be observed for potential unsuitable material. Hand auger boring and dynamic cone penetration (DCP) testing may be performed to evaluate and confirm the subgrade conditions. It is anticipated that some subgrade soil undercutting may be required during subgrade preparation for foundation and slab support.

A net allowable bearing capacity of 2,000 pounds per square foot (psf) is recommended for shallow foundation design. The allowable bearing capacity may be increased by 1/3 for transient wind load and seismic load conditions. Terracon should be retained to confirm and test the subgrade during construction to provide more specific recommendations on subgrade repair based on the conditions at footing subgrade.

No topsoil, organic matter, stumps, existing fill, or other unsuitable materials should be left in place below any footings. All footings should bear on suitable natural soil, or on properly compacted structural fills. Compacted fill below any footings should be placed directly on suitable natural soil. We recommend Terracon be retained to test the footing subgrade during construction so that Terracon can provide additional recommendations to prepare the subgrade based on the conditions uncovered during the footing preparation.

4.2 Earthwork

The site work conditions will be largely dependent on the weather conditions and the contractor’s means and methods in controlling surface drainage and protecting the subgrade. Site preparation should include installation of a site drainage system, subgrade preparation, densification and proofrolling. The following paragraphs present our considerations and recommendations for the site and subgrade preparation.

4.2.1 Site Drainage

Due to the presence of shallow groundwater table, we recommend an effective drainage system be installed prior to site preparation and grading activities to intercept surface water and to improve overall shallow drainage. The drainage system may consist of perimeter ditches supplemented with parallel ditches and swales. Pumping equipment should be prepared if the above ditch system cannot effectively drain water away from the site, especially during the rainy season. The site should be graded to shed water and avoid ponding over the subgrade. The contractor should schedule the work according to the weather conditions and protect the subgrade from water damage.

We anticipate the site work will include deep excavation to a depth of about 10 feet BGS for the fuel tank construction. From the subsurface exploration and groundwater level measurement at the site, the groundwater table is around 1.5 to 3.5 feet BGS. Therefore, the contractor should prepare dewatering during excavation. The site drainage should be installed to direct water away from the excavation.

4.2.2 Densification and Proofrolling

Prior to fill placement on the subgrade, the entire building, fuel tank and associated drive lanes and parking areas should be densified with a heavy-duty vibratory roller to achieve a uniform subgrade. The subgrade should be thoroughly proofrolled after the completion of densification. Proofrolling will help detect any isolated soft or loose areas that "pump", deflect or rut excessively, and also densify the near-surface soils for floor slab support.

A loaded tandem axle dump truck, capable of transferring a load in excess of 20 tons, should be utilized for this operation. Proofrolling should be performed under the Geotechnical Engineer’s observation. Areas where pumping, excessive deflection or rutting is observed after successive passes of the proofrolling equipment should be undercut, backfilled and then properly compacted. It is anticipated that some amount of subgrade undercutting may be required under the footing during subgrade preparation.

4.2.3 Fill Material Consideration

Structural fill should be placed over a stable or stabilized subgrade. The properties of the fill will affect the performance of the footings and the floor slabs. Hence, the soils to be used as structural fill should be free of organics, roots, or other deleterious materials. It should be non-plastic granular material containing less than 25 percent fines passing the No. 200 sieve. If necessary, soils with more than 25 percent fines may be used as fill in less critical areas under close control of moisture and compaction. In general, the onsite soils are suitable for structural fill and subgrade support provided that the debris and other objectionable materials are not present in the soils.

Areas to receive structural fills should be placed in thin (8 to 10 inches loose) lifts and compacted to a minimum of 95% of the soil's Modified Proctor maximum dry density (ASTM D-1557). If import fill is required, the fill should be within 3 percent (wet or dry) of the optimum moisture content and should meet the properties as described above.

Some manipulation of the moisture content (such as wetting, drying) will be required during the filling operation to obtain the required degree of compaction. The manipulation of the moisture content is highly dependent on weather conditions and site drainage conditions. Therefore, the contractor should prepare both dry and wet fill materials to obtain the specified compaction during grading. A sufficient number of density tests should be performed to confirm the required compaction of the fill material.

4.3 Spread Footing Foundations

With the subgrade improvements using undercut and backfill or densification and proofrolling as discussed in **Section 4.2**, the proposed structures can be supported on a shallow, spread footing foundation system provided the structural loads are less than or equal to the assumed loads presented in **Section 2.1** of this report. The following sections present design recommendations and construction considerations for the shallow foundations for the proposed structures and related structural elements.

4.3.1 Spread Footing Design Recommendations

Description	Column	Wall
Net allowable bearing pressure[1]	2,000 psf	2,000 psf
Minimum dimensions	24 inches	12 inches
Minimum embedment below finished grade	18 inches	12 inches
Approximate total settlement[2]	<1 inch	<1 inch
Estimated differential settlement	<1 inch between columns	<1/2 inch over 40 feet
Ultimate Coefficient of sliding friction[3]	0.32	

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. It assumes any unsuitable fill or soft soils, if encountered, will be replaced with compacted structural fill.

2. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Footings should be proportioned to reduce differential settlements. Proportioning on the basis of equal total settlement is recommended; however, proportioning to relative constant dead-load pressure will also reduce differential settlement between adjacent footings.
3. Sliding friction along the base of the footing will not develop where net uplift conditions exist.

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

Footings, foundations, and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the Geotechnical Engineer. If the soil conditions encountered differ significantly from those presented in this report, Terracon should be contacted to provide additional evaluation and supplemental recommendations.

4.3.2 Spread Footing Construction Considerations

The bottom of all foundation excavations should be free of water and loose soil and rock prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Extremely wet or dry material or any loose or disturbed material in the bottom of the footing excavations should be removed before foundation concrete is placed. If the soils at bearing level become excessively dry, disturbed or saturated, the affected soil should be removed prior to placing concrete. A lean concrete mud-mat should be placed over the bearing soils if the excavations must remain open overnight or for an extended period of time.

Regarding construction of footings, we generally anticipate material suitable for the recommended design bearing pressure will be present at the bottom of the footings. However, there is a possibility that isolated zones of soft or loose native soils could be encountered below footing bearing level, even though field density tests are expected to be performed during fill placement operations. Therefore, it is important that the Geotechnical Engineer be retained to observe, test, and evaluate the bearing soil prior to placing reinforcing steel and concrete to determine if additional footing excavation or other subgrade repair is needed for the design loads.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on those soils at the lower level or on lean concrete backfill placed in the excavations. As an alternative, the footings could also bear on properly compacted structural backfill extending down to the suitable soils. Over-excavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation.

Depending on the final grade elevation, the over-excavation could encounter the groundwater level in the footings. Dewatering of the over-excavation should be planned for and #57 stone is recommended if the groundwater is encountered. The over-excavation should then be backfilled up to the footing base elevation with well-graded granular material placed in lifts of 6 inches or less in loose thickness and compacted to at least 95 percent of the material's maximum dry density as determined by the Modified Proctor test (ASTM D-1557). No. 57 stone is recommended in lieu of structural fill when the volume of excavation is relatively small, recompaction of the fill is difficult or the weather conditions or construction schedule becomes a controlling factor.

4.4 Floor Slabs

4.4.1 Floor Slab Design Recommendations

Item	Description
Floor slab support	Compacted structural fill / inspected and tested natural ground[1].
Modulus of subgrade reaction	120 pounds per square inch per in (psi / in) for point loading conditions.
Base course/capillary break[2]	4 inches of free draining granular material.
Vapor barrier	Project Specific[3].
Structural considerations	Floor slabs should be structurally separated from columns and walls to allow relative movements[4].

1. Because the existing ground may have been filled or disturbed previously, we recommend the subgrade be inspected and tested with proofrolling after the topsoil is stripped as outlined in **Section 4.2** of this report.
2. The floor slab design should include a base course comprised of free-draining, compacted, granular material, at least 4 inches thick. The granular subbase may be graded aggregate base (GAB) or sands containing less than 5 percent fines (material passing the #200 sieve). GAB subbase can also help improve workability of the subgrade especially during rain periods.
3. The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor

retarder, the slab designer should refer to ACI 302 and / or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

4. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation. Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates that any differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks that occur beyond the length of the structural dowels. The structural engineer should account for this potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

4.4.2 Floor Slab Construction Considerations

Prior to construction of grade supported slabs, varying levels of remediation may be required to reestablish stable subgrades within slab areas due to construction traffic, rainfall, disturbance, desiccation, etc. As a minimum, the following measures are recommended:

- The interior trench backfill placed beneath slabs should be compacted in accordance with recommendations outlined in **Section 4.2** of this report.
- All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the stone base and concrete.

4.5 Excavation and Earth Support for Fuel Tank Construction

Construction of the fuel tank will require excavations to be performed with proper excavation support and dewatering. To support the excavation and dewatering activities, a temporary sheet pile wall or a similar earth retaining structure should be constructed unless there is space for a sloped excavation. Shoring may be required to support the temporary retaining structure in order to prevent collapse so that the construction can proceed. If sloped open excavation considered, the temporary slope can have an inclination of 1.5 horizontal to 1 vertical or flatter.

At the time of this report preparation, the specific location of the proposed fuel tank pit and the extent of excavation were not available. Based on our experience with similar projects, we assume the depth of excavation for the fuel tank construction will be about 10 feet BGS. From the subsurface exploration at the site, we anticipate that the site excavations will largely encounter near-surface loose to medium dense silty sands followed by very dense silty sands (hardpan layer) at a depth of about 10 feet BGS.

For the construction of fuel tank, a permanent retaining wall is required to provide lateral support. The temporary wall for excavation support and the permanent wall for the fuel tank should be properly designed to resist the lateral earth pressures exerted by the soils behind the wall and the loads adjacent to the wall. If placement of footings in permanent wall backfill is required, the resulting loads and their effects on the wall should be evaluated, and for the analysis, a structural engineer should be consulted. In order to avoid excessive lateral pressures on the walls, heavy compaction should not be operated within a minimum distance out from the wall, which is typically a distance equal to the height of the wall.

The temporary and permanent retaining walls should be designed for earth pressures equal to those provided in the table below. Earth pressures are influenced by the structural design of the wall system, conditions of the wall restraint, construction methods and/or compaction and the strength of the materials being used. The recommended design lateral earth pressures provided in the table below do not include a factor of safety and do not provide hydrostatic pressures on the wall.

Lateral Soil Pressure Coefficient for Temporary Wall Design for Excavation Support

Approximate Depth to Bottom of Stratum (feet)	**Material Type**	**Unit Weight,** (pcf)	**Active Earth Pressure Coefficient (k_a)**	**At-Rest Earth Pressure Coefficient (k_o)**	**Passive Earth Pressure Coefficient (k_p)**
5 to 7	Loose to medium dense silty sand.	120	0.33	0.50	3.00
10 to 12	Dense to very dense silty sand (hardpan).	125	0.29	0.46	3.45
27	Loose to medium dense sand with silt to silty sand	120	0.33	0.50	3.00
32	Soft to medium stiff silty clay.	95	1.00	1.00	1.00
35, termination of exploration	Loose to medium dense silty to clayey sand.	120	0.33	0.50	3.00

Lateral Soil Pressure Coefficient for Permanent Wall Design

Approximate Depth to Bottom of Stratum (feet)	**Material Type**	**Unit Weight,** (pcf)	**Active Earth Pressure Coefficient (k_a)**	**At-Rest Earth Pressure Coefficient (k_o)**	**Passive Earth Pressure Coefficient (k_p)**
10 to 15	Granular backfill soil.	120	0.33	0.50	3.00

Note: The lateral pressure coefficients for the soils below 10 feet below existing grade provided in the table above can be used for the permanent wall design.

The backfill placed against wall structures should consist of granular soils to reduce the hydrostatic pressure that could develop behind the wall. The granular backfill must extend out from the base of the wall at an angle of 45 degrees from the vertical.

Depending on the depth of excavation and long term groundwater conditions, the unbalanced hydrostatic pressure may be considered in the design of the retaining wall. To control infiltrating surface water behind the wall, a perimeter drain should be installed at the foundation level. The drain lines should be sloped to provide for gravity flow leading to a reliable discharge such as a stormwater drain and sump with pump system. The drain lines should be surrounded by a filter material to prevent the intrusion of fines.

4.5.1 Groundwater Control

Control of the groundwater is an important consideration in the design of underground works. The impact from construction on the existing structures should be minimized, particularly from the effect of dewatering and potential vibration. Excess drop of groundwater could result in settlement of adjacent structures. Monitoring wells should be installed outside the wall to monitor the groundwater tables to aid in the assessment of the potential effect to the existing structures. The contractor may need to prepare a contingency plan to address unexpected drop of water levels outside the excavation or localized blowout within the excavation. The groundwater should be discharged into an outlet or drain approved by city officials.

4.5.2 Building Condition Survey and Construction Monitoring

The location where the excavation will be performed for the fuel tank construction is unknown at the time of this report preparation. The proposed fueling station will be constructed in an area surrounded by many existing buildings and roads. We recommend the project should be designed and constructed with minimum effect to the existing structures. The potential effects may be caused by dewatering and vibration. To protect the owners of the existing structures from potential impact and the developer from potential mis-conceived or frivolous claims, we strongly recommend a pre-construction survey for all structures in the vicinity of the project be performed to document the existing conditions of the structures. The survey should include documentation with sketches and photographs of cracks, opening of joints and other defects and deficiencies.

Construction monitoring should be performed during onsite activities such as dewatering, excavation and ground vibration. The monitoring program should include measurements of groundwater table, ground vibration, lateral ground movements outside excavation, and monitoring of existing cracks at selected locations on the neighboring structures. Terracon can develop a more detailed plan for condition survey and monitoring as construction plans are developed.

4.6 Pavements

We understand that the proposed development will include paved drive and parking areas. This section presents thickness recommendations for asphalt concrete and Portland cement concrete pavements and general considerations for pavement construction. Pavement thickness design is dependent upon:

- The anticipated traffic load conditions during the design life of the pavement
- Subgrade and paving material characteristics
- Climatic conditions of the region

Traffic patterns and anticipated loading conditions were not available at the time of this report preparation. However, we anticipate that traffic loads will be produced primarily by automobile traffic, pickup trucks and a limited number of delivery and trash removal trucks. Two pavement section alternatives have been provided. The light duty section is for the areas that receive only car traffic. The heavy duty section assumes car traffic and 10 delivery vehicles per day and 5 trash removal trucks per week. If heavier traffic loading is expected, this office should be provided with the information and allowed to review these pavement sections. A design life of 20 years was assumed to develop the total traffic used in thickness design. However, as typical for pavement, some maintenance repairs are typically required for a period of 7 to 10 years.

A California Bearing Ratio (CBR) value of 8 has been estimated for the proposed fill material. To help obtain this CBR value in the field, the upper 24 inches of pavement subgrades should be granular material with less than 15 percent fines compacted to at least 95 percent of the modified Proctor density at moisture content within 3 percent of its optimum moisture.

Climatic conditions are considered in the design subgrade support value listed above and in the paving material characteristics. Recommended paving material characteristics, taken from the Georgia Department of Transportation's (GDOT) 2001 edition of *Standard Specifications for Construction of Transportation Systems,* are included for the asphalt concrete sections.

4.6.1 Pavement Design Recommendations

Material[1]	**Asphalt Section Thickness (inches)**	
	Light Duty Section[2]	**Heavy Duty[3]**
Asphalt Surface Course	2	1 ½
Asphalt Intermediate Course	0	2
Aggregate Base Course	7	8
Total Pavement Section	**9**	**11.5**

1. Asphalt concrete aggregates and base course materials should conform to the following GDOT material specifications.

- Section 815 for Graded Aggregate
- Section 828 for Hot Mix Asphalt Concrete Mixture. Surface course may use 9.5 mm Superpave for smooth surface in the light-duty section or 12.5 mm Superpave for the heavy-duty section. 19 mm Superpave is recommended for the intermediate course.

2. Light-duty section assumes only car traffic.
3. Heavy-duty section traffic assumes car traffic and 10 delivery vehicles per day and 5 trash removal trucks per week.

For the areas subject to concentrated and repetitive loading conditions such as dumpster pads, truck delivery docks, pavement areas around fuel pumps, and ingress/egress aprons, we recommend using a Portland cement concrete pavement with a thickness of at least 7 inches underlain by at least 4 inches of crushed stone. The concrete should be air entrained and have a minimum compressive strength of 4,000 psi after 28 days of lab curing per ASTM C-31. The above section represents the minimum design thickness and, as such, periodic maintenance should be anticipated. Prior to placement of the crushed stone the areas should be thoroughly proofrolled. For dumpster pads, the concrete pavement area should be large enough to support the container and the tipping axle of the refuse truck.

The above pavement recommendations are based on the assumption that no heavy duty trucks, such as construction dump trucks or similar maintenance vehicles, will use the facility. If the facility will be used by those heavy duty trucks, we recommend the concrete pavement be designed by the structural engineer based on the actual loads anticipated for the trucks and equipment.

Long-term performance of pavements constructed on the site will be dependent upon maintaining stable moisture content of the subgrade soils, and providing for a planned program of preventative maintenance. The performance of all pavements can be enhanced by minimizing excess moisture that can reach the subgrade soils. At a minimum, the following recommendations should be considered:

- Final grade adjacent to parking lots and drives should slope down from pavement edges at a minimum 2%.
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage.
- Pavement subgrade drainage should be installed surrounding the areas anticipated for frequent wetting, such as landscaped islands and along curbs and gutters.
- All landscaped areas in or adjacent to pavements should be sealed to reduce moisture migration to subgrade soils.

4.6.2 Pavement Construction Considerations

Pavement subgrades prepared early in the project should be carefully evaluated as the time for pavement construction approaches. We recommend the pavement areas be rough graded and then thoroughly proofrolled with a loaded tandem-axle dump truck. Particular attention should be paid to high traffic areas that were rutted and disturbed and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fill. After proofrolling and repairing subgrade deficiencies, the entire subgrade should be scarified to a depth of 12 inches, and uniformly compacted to at least 95 percent of the materials' modified Proctor maximum dry density.

4.7 Seismic Considerations

4.7.1 Liquefaction Potential

We performed a liquefaction potential analysis for the site to evaluate the stability of the soils. Ground shaking at the foundation of structures and liquefaction of the soil under the foundation are the principal seismic hazards identified for the design of earthquake-resistant structures. Our estimates of liquefaction induced settlements from the geometric mean maximum considered earthquake (MCE_G) are around 4.0 inches. We estimate differential settlements in the range of 50% to 100% of the total. Actual liquefaction settlements at the site would be highly dependent on magnitude and distance from the source during the design earthquake event. In the event of an earthquake, the structure may sustain some damage that should be repairable. We recommend the structural engineer to design the facility to prevent total collapse. The fueling system should include emergency shutoff in the events of pipe rupture or tank leakage. Since large earthquake is such a rare event, we do not feel justifiable to use special ground improvement measures to mitigate the risk of liquefaction for such a facility.

4.7.2 Seismic Design Parameters

According to the International Building Code (IBC) 2012 and ASCE 7-10, structures should be designed and constructed to withstand the effects of earthquakes and avoid failure during a maximum considered earthquake. The maximum considered earthquake (MCE) is a seismic event that has a 50-year exposure period with a 2% probability of exceedance. The 2500-year earthquake has a Moment Magnitude (Mw) of 7.36 and a Site Class Adjusted Peak Ground Acceleration (PGA_M) of **0.250g**, as determined by data provided by the IBC 2012 and ASCE 7-10 Standards.

Based on the findings from the field exploration and our knowledge of the local geological formation in the project area, the site can be classified as Site Class D in accordance with International Building Code (IBC) 2012 and ASCE 7-10. The seismic design parameters obtained based on IBC2012 and ASCE 7-10 are summarized in the table below. The design response spectrum curve, as presented in **Appendix C**, was developed based on the S_{DS} and S_{D1} values according to IBC2012 and ASCE 7-10.

Summary of Seismic Design Parameters

Site Location (Lat. – Long.)	**Site Classification**	S_s	S_1	F_a	F_v	S_{DS}	S_{D1}
31.9913° -81.0796°	D	0.295g	0.116g	1.564	2.336	0.308	0.181g

- In general accordance with the 2012 International Building Code and ASCE 7-10.
- The 2012 IBC and ASCE 7-10 require a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope does not include 100 foot soil profile determination. Explorations for this project extended to a maximum depth of 35 feet and this seismic site class definition was provided in consideration of the overall soil conditions as well as the general geology of the area.

5.0 GENERAL COMMENTS

Terracon should be consulted to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the project design and specifications. Terracon should also be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analyses and recommendations presented in this report are based upon the data obtained from the explorations performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between exploration locations, across the site, or may be caused due to the modifying effects of construction or weather. Bear in mind that the nature and extent of such variations may not become evident until construction has started or until construction activities have ceased. If variations do appear, Terracon should be notified immediately so that further evaluation and supplemental recommendations can be provided. The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, and bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or hazardous conditions. If the owner is concerned about the potential for such contamination or pollution, please advise so that additional studies may be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project and site discussed, and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes, and then either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

Image Courtesy of
Google Earth™

Project Manager:	BG
Drawn by:	BG
Checked by:	GL
Approved by:	GL

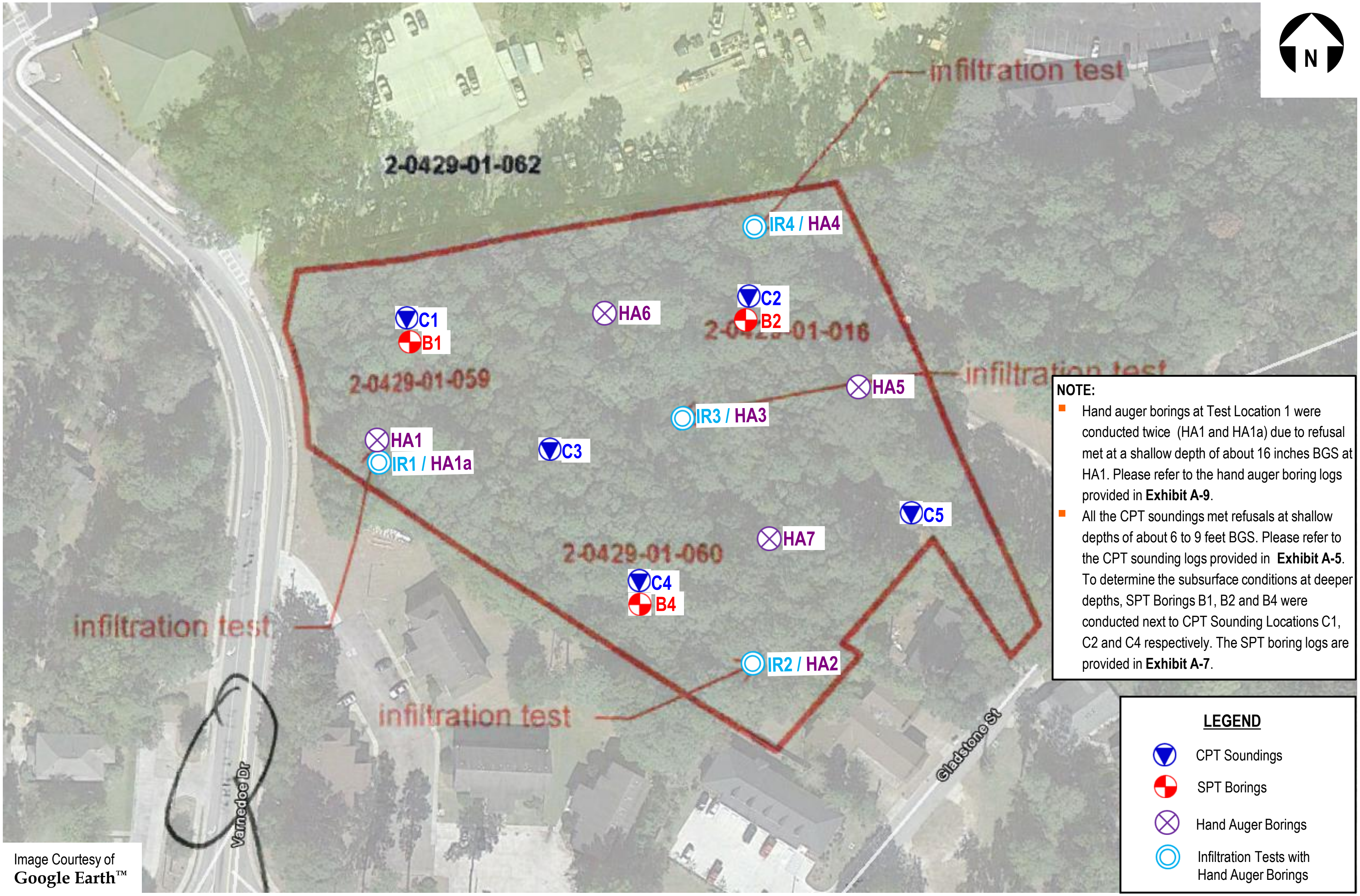
Project No.	ES145143
Scale:	N.T.S.
File Name:	
Date:	10-13-2014

Terracon
Consulting Engineers & Scientists
2201 Rowland Avenue Savannah, Georgia 31404
Phone (912) 629 4000 Fax (912) 629 4001

SITE LOCATION MAP

Chatham County Fueling Station
Savannah
Chatham County, Georgia

Exhibit:
A-1



NOTE:

- Hand auger borings at Test Location 1 were conducted twice (HA1 and HA1a) due to refusal met at a shallow depth of about 16 inches BGS at HA1. Please refer to the hand auger boring logs provided in **Exhibit A-9**.
- All the CPT soundings met refusals at shallow depths of about 6 to 9 feet BGS. Please refer to the CPT sounding logs provided in **Exhibit A-5**. To determine the subsurface conditions at deeper depths, SPT Borings B1, B2 and B4 were conducted next to CPT Sounding Locations C1, C2 and C4 respectively. The SPT boring logs are provided in **Exhibit A-7**.

LEGEND

▼	CPT Soundings
⊕	SPT Borings
⊗	Hand Auger Borings
◎	Infiltration Tests with Hand Auger Borings

NOTE:
ALL THE EXPLORATION LOCATIONS WERE LOCATED IN THE FIELD USING A GPS UNIT, AND THE EXPLORATION LOCATIONS SHOULD BE CONSIDERED APPROXIMATE. DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES. EXPLORATION BORING PLAN BASED ON INFORMATION PROVIDED BY THOMAS & HUTTON.

Project Manager:	BG	Project No.	ES145143
Drawn by:	BG	Scale:	N.T.S.
Checked by:	GL	File Name:	
Approved by:	GL	Date:	10-13-2014

Terracon
Consulting Engineers & Scientists
2201 Rowland Avenue Savannah, Georgia 31404
Phone (912) 629 4000 Fax (912) 629 4001

EXPLORATION LOCATION PLAN

Chatham County Fueling Station
Savannah
Chatham County, Georgia

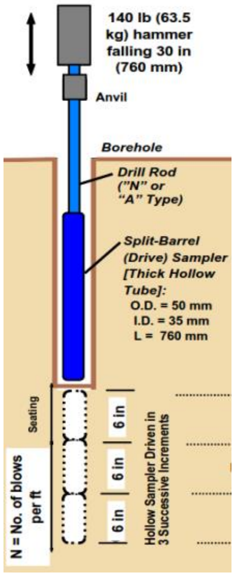
Exhibit:
A-2

FIELD EXPLORATION DESCRIPTION

The locations of Standard Penetration Test (SPT) borings, Cone Penetration Test (CPT) soundings and Hand Auger borings are determined by Terracon based on the proposed development and were located in the field using hand-held GPS units and in reference to existing features. These boring and test locations were reviewed and approved by the civil engineer. These locations are shown in the Exploration Location Plan and should be considered approximate.

Standard Penetration Testing

The SPT borings were performed in accordance with ASTM D1586 with an truck-mounted Acker drilling rig using mud rotatory drilling techniques. Samples of the soil encountered in the borings were obtained using split-barrel sampling procedures. In the split barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in situ relative density of cohesionless soils and consistency of cohesive soils. A rope and cathead hammer was used to advance the split-barrel sampler in the borings performed on this site.



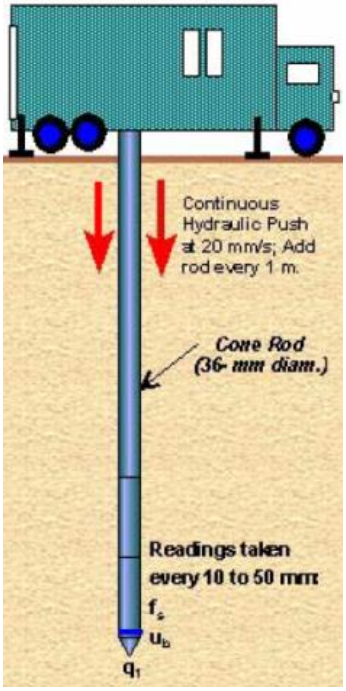
Source: FHWA NHI-06-088

Cone Penetration Testing

The CPT hydraulically pushes an instrumented cone through the soil while nearly continuous readings are recorded to a portable computer. The cone is equipped with electronic load cells to measure tip resistance and sleeve resistance and a pressure transducer to measure the generated ambient pore pressure. The face of the cone has an apex angle of 60° and an area of 10 cm^2. Digital data representing the tip resistance, friction resistance, pore water pressure, and probe inclination angle are recorded about every 2 centimeters while advancing through the ground at a rate between 1½ and 2½ centimeters per second. These measurements are correlated to various soil properties used for geotechnical design. No soil samples are gathered through this subsurface investigation technique.

CPT testing is conducted in general accordance with ASTM D5778 "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils."

Upon completion, the data collected were analyzed and processed by the project engineer.



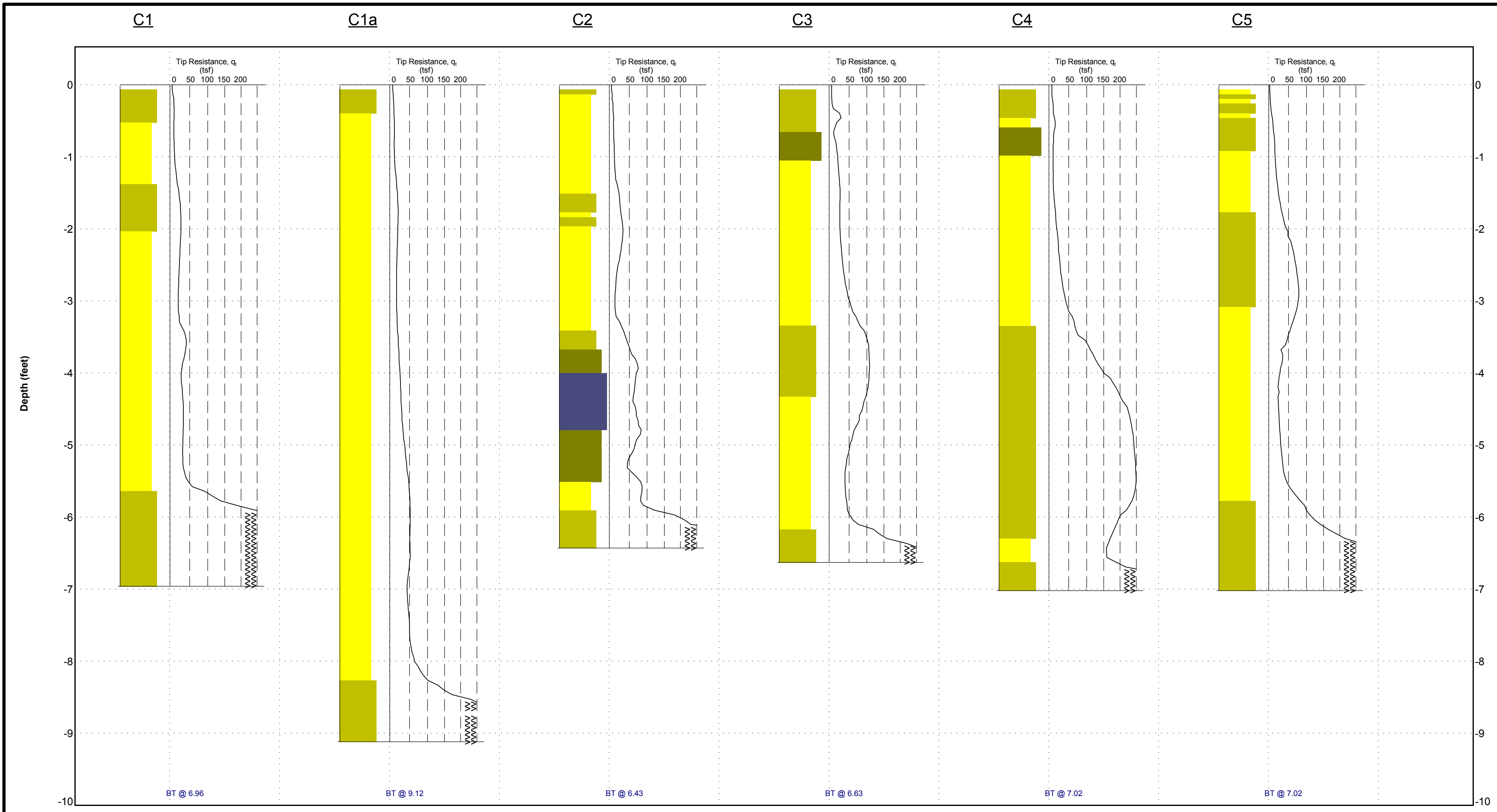
Source: FHWA NHI-06-088

Double Ring Infiltrometer Test

The double ring infiltrometer test was conducted in general accordance with ASTM D3385. The test method consists of driving two open cylinders, one inside the other, into the ground, partially filling the rings with water, and maintaining the liquid at constant level. The volume of water added to the inner ring to maintain the water level constant is the measure of the volume of water that infiltrates the soil. The volume infiltrated during timed intervals is converted to an incremental infiltration velocity, usually in/hr and plotted versus elapsed time. The average incremental velocity is equivalent to the infiltration rate.

Hand Auger Borings

Hand auger borings were conducted in general accordance with ASTM D 1452-80, Standard Practice for Soil Investigation and Sampling by Auger Borings. In this test, hand auger borings are drilled by rotating and advancing a bucket auger to the desired depths while periodically removing the auger from the hole to clear and examine the auger cuttings. The soils were classified in accordance with ASTM D2488.



Explanation

- 🟥 1 Sensitive, fine grained
- 🟧 2 Organic soils - clay
- 🟩 3 Clay - silty clay to clay
- 🟦 4 Silt mixtures - clayey silt to silty clay
- 🟪 5 Sand mixtures - silty sand to sandy silt
- 🟨 6 Sands - clean sand to silty sand
- 🟨 7 Gravelly sand to dense sand
- 🟫 8 Very stiff sand to clayey sand
- ⬛ 9 Very stiff fine grained

NOTES:
See Exhibit for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provide dfor illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager:
Drawn by: BG
Approved by: GL
Date: 10/10/2014

Project No.: ES145143
Scale: N.T.S.
File Name:

Terracon
2201 Rowland Avenue
Savannah, Georgia
PH. 912-629-4000 FAX. 912-629-4001

SUBSURFACE PROFILE

CHATHAM COUNTY FUELING STATION
SAVANNAH, CHATHAM COUNTY, GEORGIA
,

EXHIBIT
A-4

THIS TEST RECORD IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. 11X17 CPT FENCE CPT.GPJ FENCE PROJECT 1-30-13.GPJ 10/10/14

CPT LOG NO. C1

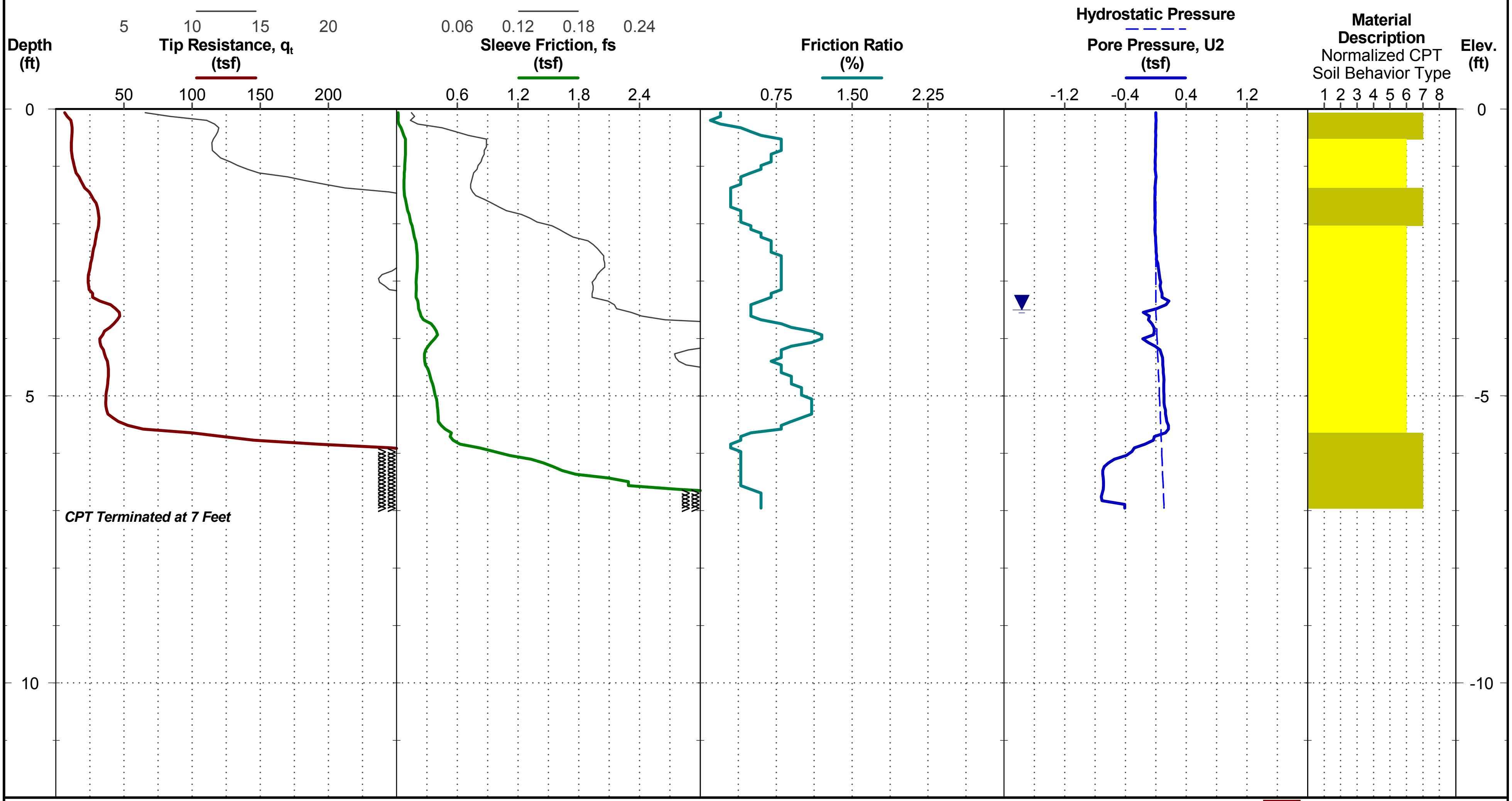
Page 1 of 1

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

TEST LOCATION: See Exhibit A-2

SITE: Savannah, Chatham County, Georgia



CPT Terminated at 7 Feet

See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

- 🟥 1 Sensitive, fine grained
- 🟧 2 Organic soils - clay
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- 🟨 6 Sands - clean sand to silty sand
- 🟨 7 Gravelly sand to dense sand
- 🟫 8 Very stiff sand to clayey sand
- ⬛ 9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 3.5 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 7522 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 8/15/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
2201 Rowland Avenue
Savannah, Georgia

CPT Started: 9/18/2014	CPT Completed: 9/18/2014
Rig: Pagani TG73-200	Operator: BS
Project No.: ES145143	Exhibit: A-5-1

CPT LOG NO. C1a

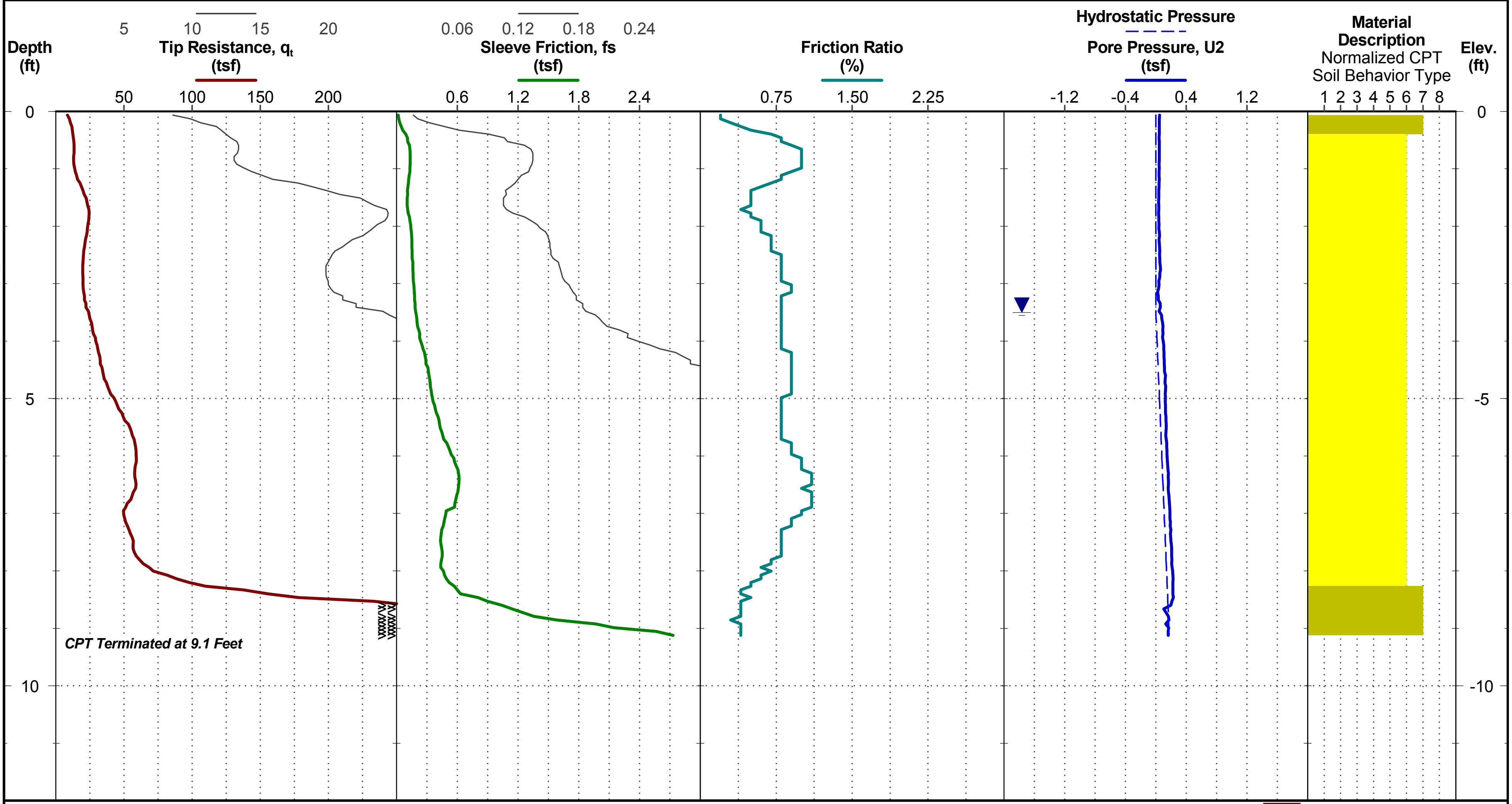
Page 1 of 1

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

TEST LOCATION: See Exhibit A-2

SITE: Savannah, Chatham County, Georgia



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

- 🟥 1 Sensitive, fine grained
- 🟧 2 Organic soils - clay
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- 🟨 6 Sands - clean sand to silty sand
- 🟨 7 Gravelly sand to dense sand
- 🟫 8 Very stiff sand to clayey sand
- ⬛ 9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 3.5 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 7522 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 8/15/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
2201 Rowland Avenue
Savannah, Georgia

CPT Started: 9/18/2014	CPT Completed: 9/18/2014
Rig: Pagani TG73-200	Operator: BS
Project No.: ES145143	Exhibit: A-5-2

THIS TEST RECORD IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT CPT.GPJ TERRACON2012_W INSITU.GDT 10/10/14

CPT LOG NO. C2

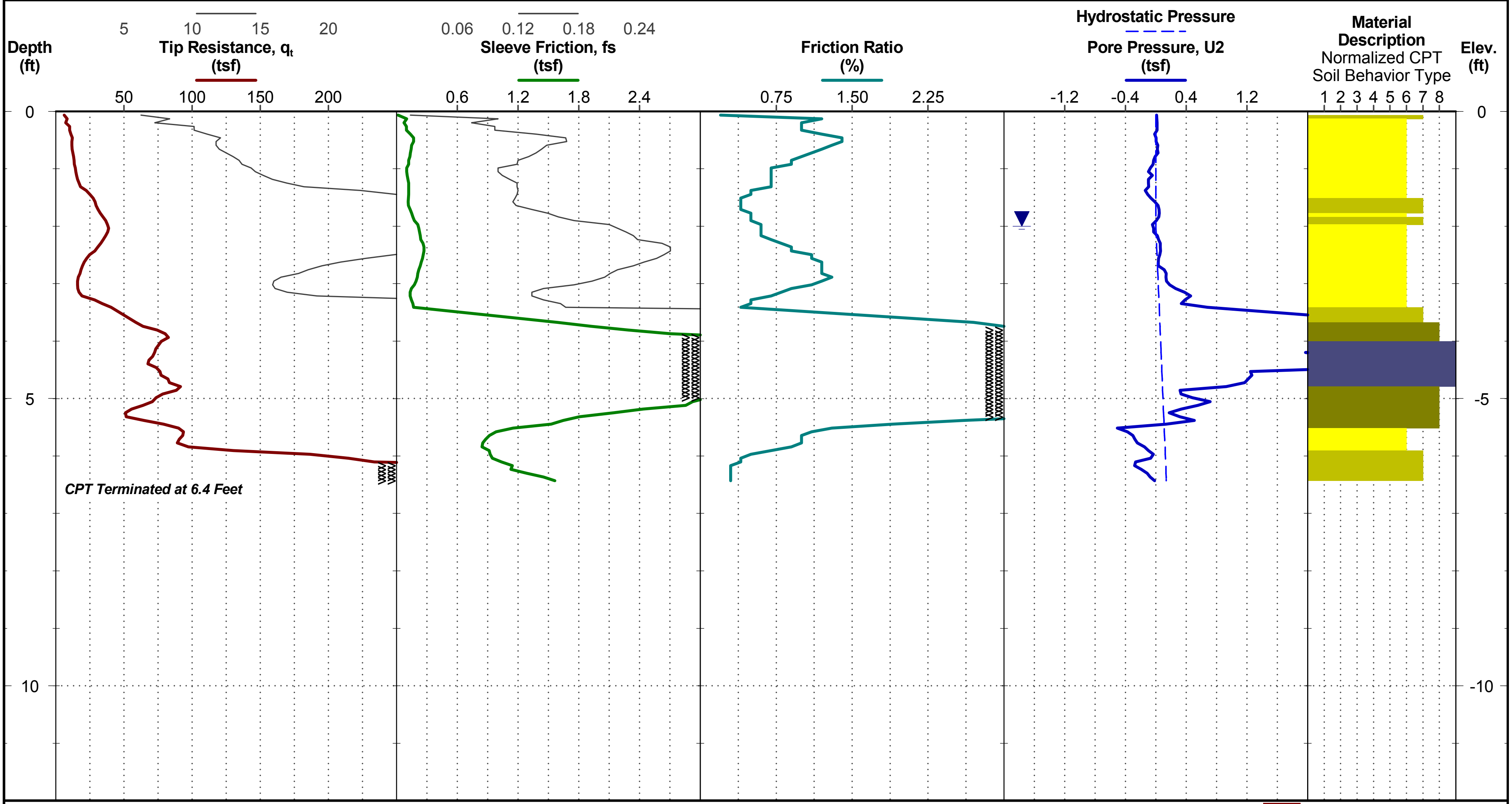
Page 1 of 1

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

TEST LOCATION: See Exhibit A-2

SITE: Savannah, Chatham County, Georgia



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

🟥	1 Sensitive, fine grained
🟧	2 Organic soils - clay
🟩	3 Clay - silty clay to clay
🟦	4 Silt mixtures - clayey silt to silty clay
🟪	5 Sand mixtures - silty sand to sandy silt
🟨	6 Sands - clean sand to silty sand
🟨	7 Gravelly sand to dense sand
🟫	8 Very stiff sand to clayey sand
⬛	9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 2 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 7522 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 8/15/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
2201 Rowland Avenue
Savannah, Georgia

CPT Started: 9/18/2014
Rig: Pagani TG73-200
Project No.: ES145143

CPT Completed: 9/18/2014
Operator: BS
Exhibit: A-5-3

CPT LOG NO. C3

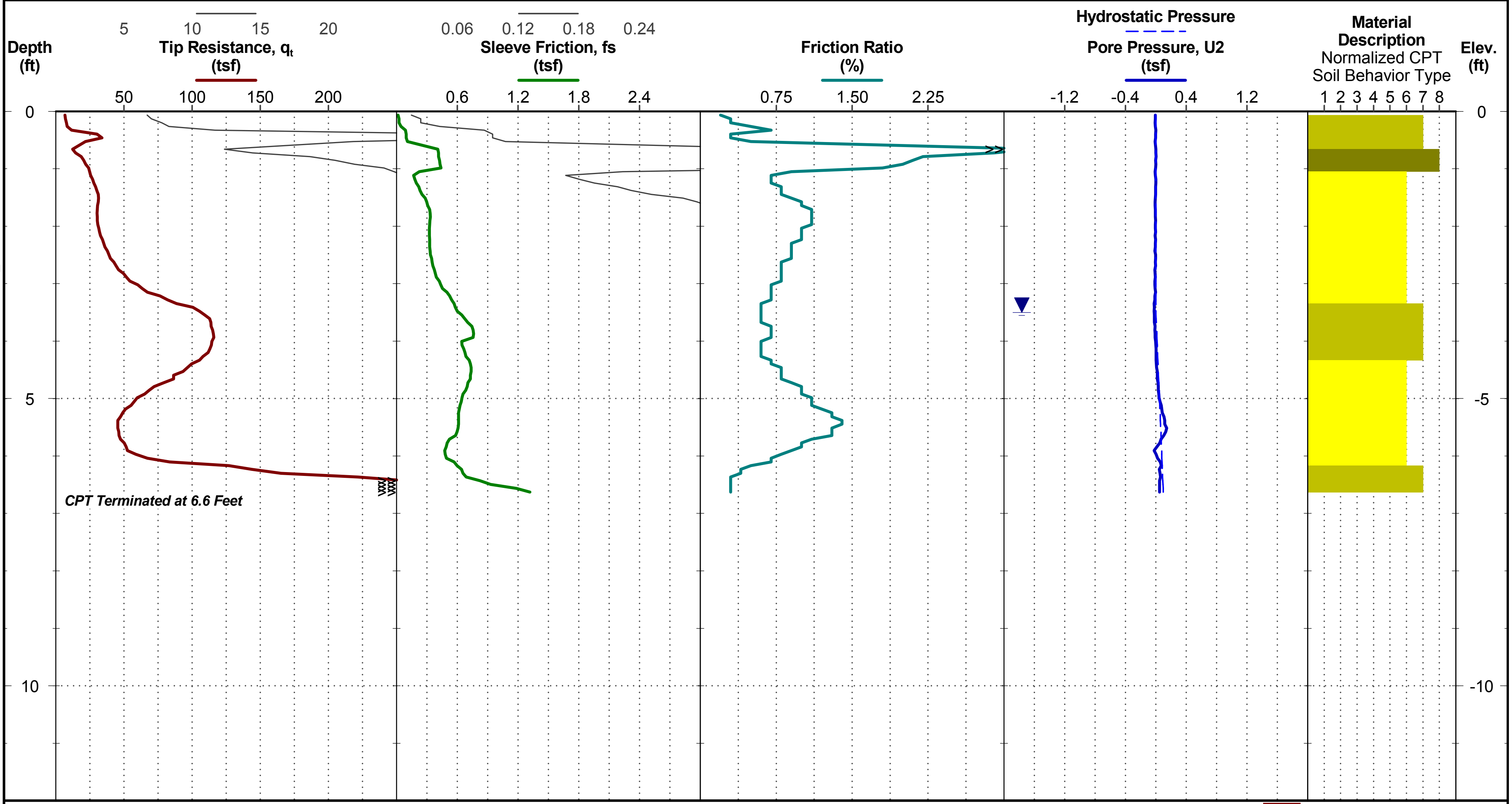
Page 1 of 1

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

TEST LOCATION: See Exhibit A-2

SITE: Savannah, Chatham County, Georgia



See Exhibit A-3 for description of field procedures.

See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

- 🟥 1 Sensitive, fine grained
- 🟧 2 Organic soils - clay
- 🟩 3 Clay - silty clay to clay
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- 🟫 7 Gravelly sand to dense sand
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- ⬛ 9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 3.5 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 7522 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 8/15/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
2201 Rowland Avenue
Savannah, Georgia

CPT Started: 9/18/2014	CPT Completed: 9/18/2014
Rig: Pagani TG73-200	Operator: BS
Project No.: ES145143	Exhibit: A-5-4

CPT LOG NO. C4

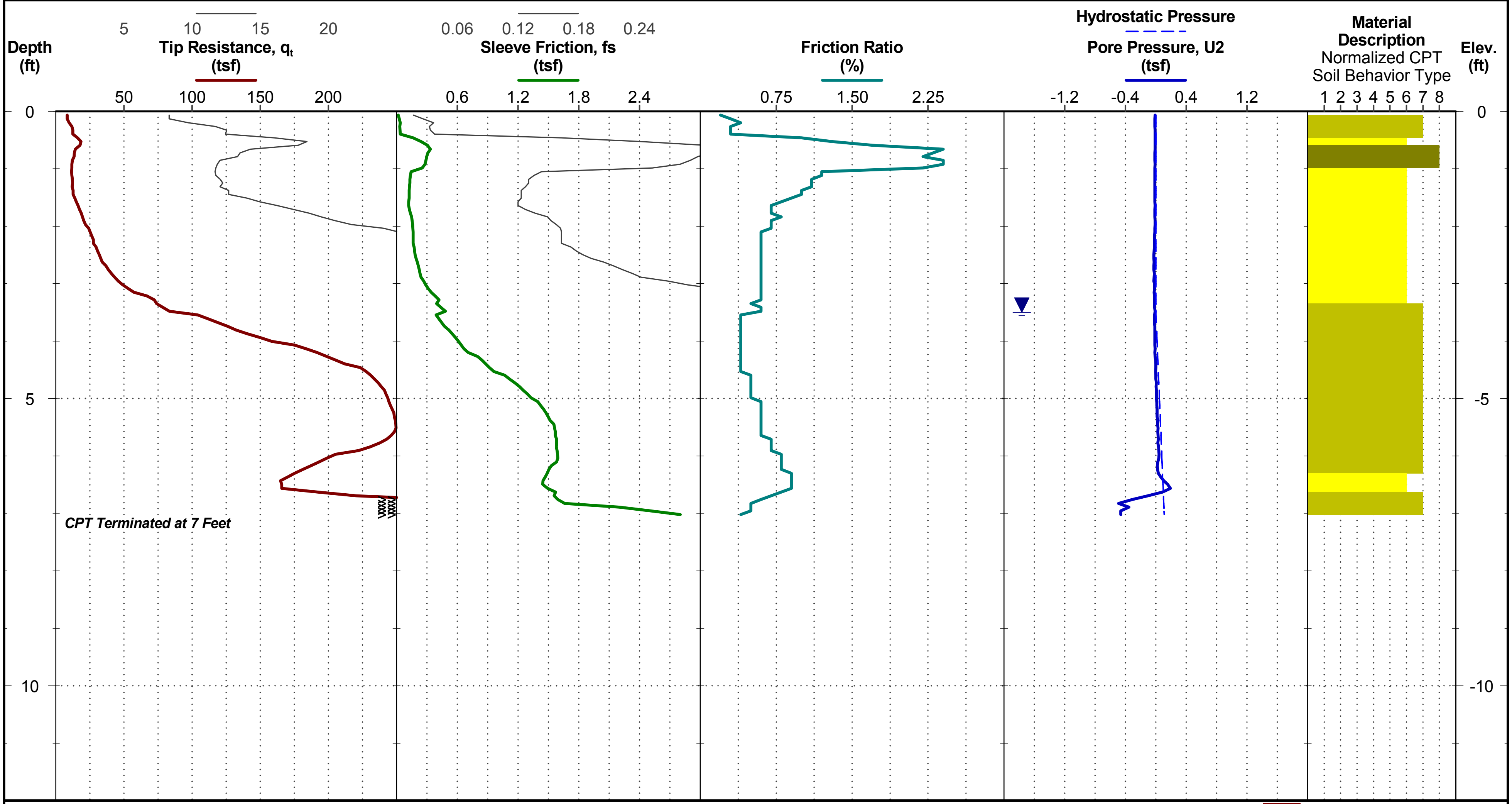
Page 1 of 1

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

TEST LOCATION: See Exhibit A-2

SITE: Savannah, Chatham County, Georgia



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

🟥	1 Sensitive, fine grained
🟧	2 Organic soils - clay
🟩	3 Clay - silty clay to clay
🟦	4 Silt mixtures - clayey silt to silty clay
🟪	5 Sand mixtures - silty sand to sandy silt
🟨	6 Sands - clean sand to silty sand
▨	7 Gravelly sand to dense sand
▨	8 Very stiff sand to clayey sand
▨	9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 3.5 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 7522 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 8/15/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

Terracon
2201 Rowland Avenue
Savannah, Georgia

CPT Started: 9/18/2014
CPT Completed: 9/18/2014
Rig: Pagani TG73-200
Operator: BS
Project No.: ES145143
Exhibit: A-5-5

CPT LOG NO. C5

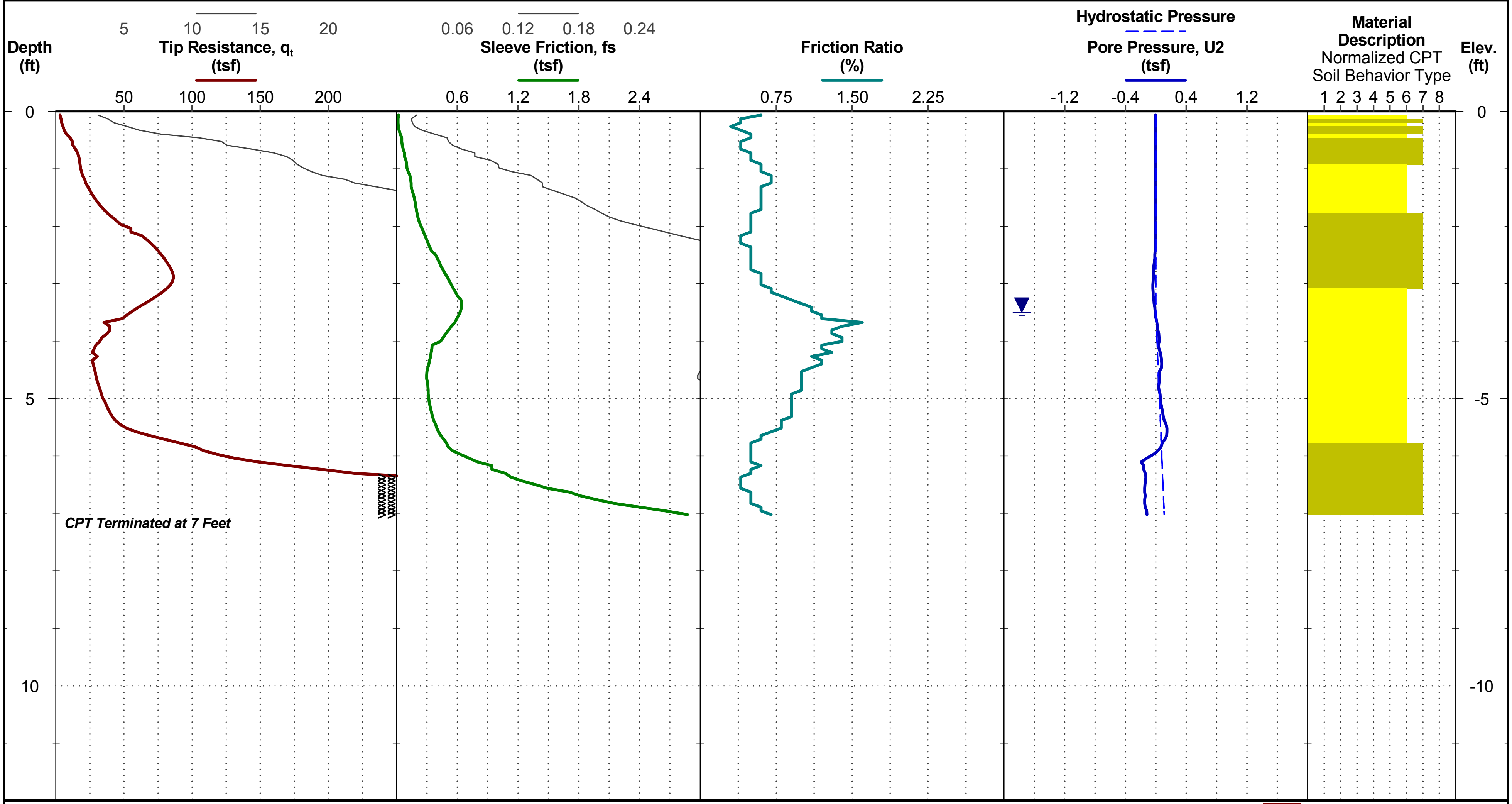
Page 1 of 1

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

TEST LOCATION: See Exhibit A-2

SITE: Savannah, Chatham County, Georgia



See Exhibit A-3 for description of field procedures.
See Appendix C for explanation of symbols and abbreviations.

CPT sensor calibration reports available upon request.

🟥 1 Sensitive, fine grained
🟧 2 Organic soils - clay
🟩 3 Clay - silty clay to clay
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🟫 8 Very stiff sand to clayey sand
⬛ 9 Very stiff fine grained

WATER LEVEL OBSERVATION

▼ 3.5 ft estimated water depth
(used in normalizations and correlations; see Appendix C)

Probe no. 7522 with net area ratio of 0.84
U2 pore pressure transducer location
Manufactured by Geotech A.B.; calibrated 8/15/2014
Tip and sleeve areas of 10 cm^2 and 150 cm^2
Ring friction reducer with O.D. of 1.875 in

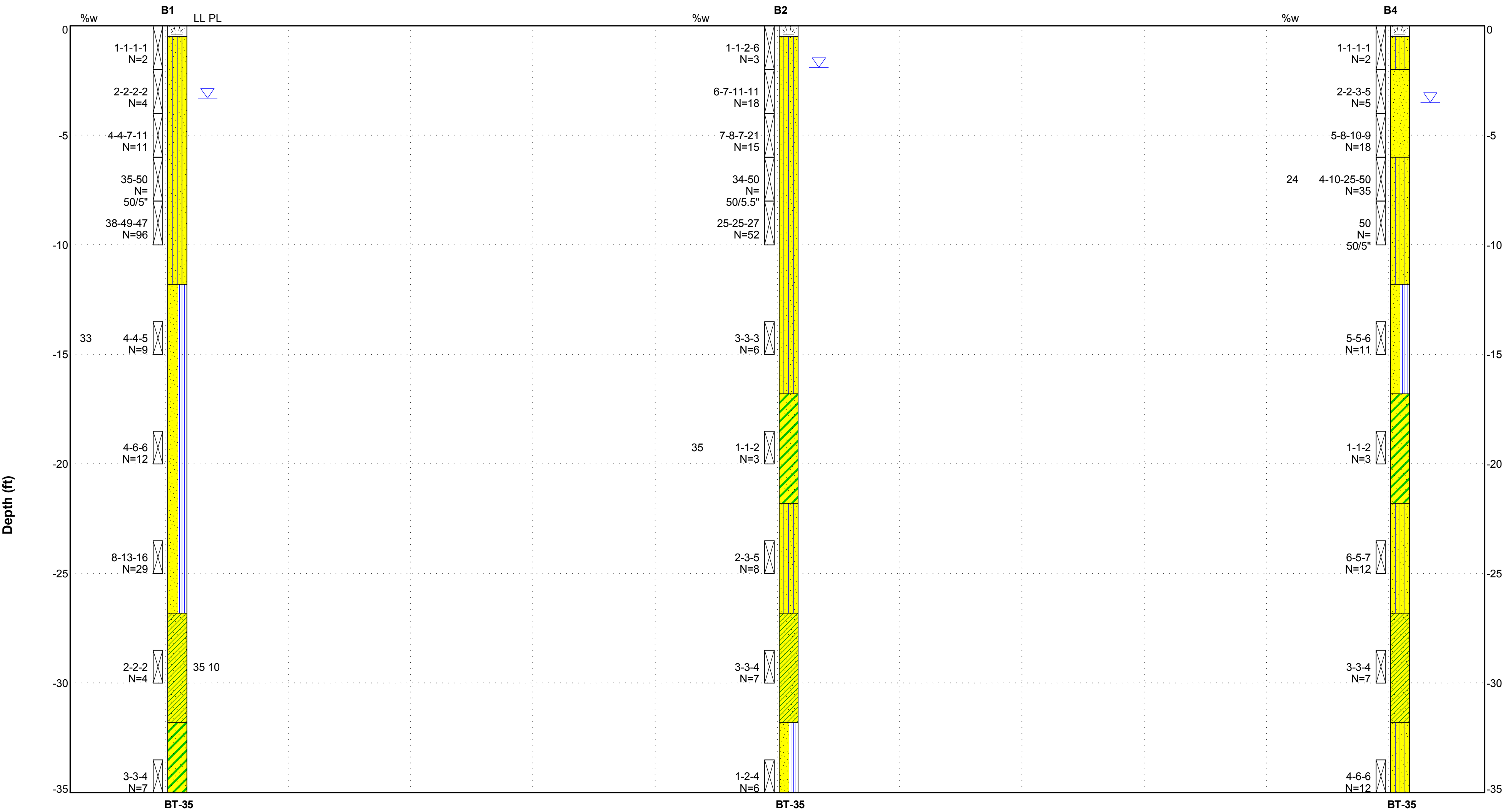
Terracon
2201 Rowland Avenue
Savannah, Georgia

CPT Started: 9/18/2014
Rig: Pagani TG73-200
Project No.: ES145143

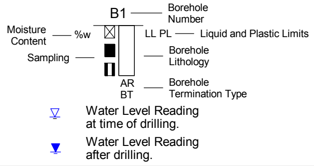
CPT Completed: 9/18/2014
Operator: BS
Exhibit: A-5-6

THIS TEST RECORD IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CPT REPORT CPT.GPJ TERRACON2012_W INSITU.GDT 10/10/14

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. 11X17-W-LABS SPT.GPJ 73111048.GPJ 10/8/14



Explanation



NOTES:
See Exhibit for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager:
Drawn by: YH
Approved by: GL
Date: 10/8/2014

Project No.: ES145143
Scale: N.T.S.
File Name:

Terracon
2201 Rowland Avenue
Savannah, Georgia
PH. 912-629-4000 FAX. 912-629-4001

SUBSURFACE PROFILE

CHATHAM COUNTY FUELING STATION
SAVANNAH, GEORGIA

EXHIBIT
A-6

BORING LOG NO. B1

Page 1 of 1

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

SITE: Savannah, Georgia

LOCATION See Exhibit A-2

DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST TEST TYPE	 COMPRESSIVE STRENGTH (psf)	 STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.5	**TOPSOIL**			☒	1-1-1-1 N=2							
	SILTY SAND (SM), fine grained, dark gray/brown, very loose		▽	☒	2-2-2-2 N=4							
	fine grained, dark brown, very loose to loose	5		☒	4-4-7-11 N=11							
	fine grained, very dense, cemented			☒	35-50 N= 50/5"							
11.8		10		☒	38-49-47 N=96							
	POORLY GRADED SAND WITH SILT (SP-SM), fine grained, brown, loose to medium dense	15		☒	4-4-5 N=9				33			1
	fine grained, gray, medium dense	20		☒	4-6-6 N=12							
26.8		25		☒	8-13-16 N=29							
31.8	**SANDY LEAN CLAY (CL)**, gray, soft to medium-stiff	30		☒	2-2-2 N=4						35-10-25	
35.0	**CLAYEY SAND (SC)**, fine grained, gray, loose	35		☒	3-3-4 N=7							
	Boring Terminated at 35 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *measured during drilling*

Terracon
2201 Rowland Avenue
Savannah, Georgia

Boring Started: 9/26/2014	Boring Completed: 9/26/2014
Drill Rig: Acker AD-I	Driller: Aaron and Josh
Project No.: ES145143	Exhibit: A-7-1

BORING LOG NO. B2

PROJECT: Chatham County Fueling Station

CLIENT: Thomas & Hutton
Savannah, Georgia

SITE: Savannah, Georgia

GRAPHIC LOG	DEPTH	LOCATION See Exhibit A-2	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST TEST TYPE	STRENGTH TEST COMPRESSIVE STRENGTH (psf)	STRENGTH TEST STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
🟨	0.5	**TOPSOIL** **SILTY SAND (SM)**, fine grained, dark brown, loose		▽	☒	1-1-2-6 N=3							
		fine grained, dark brown, medium dense, with organics			☒	6-7-11-11 N=18							
			5		☒	7-8-7-21 N=15							
		fine grained, dark brown, very dense, cemented			☒	34-50 N= 50/5.5"							
		fine grained, brown, very dense	10		☒	25-25-27 N=52							
			15		☒	3-3-3 N=6							
🟩	16.8	**CLAYEY SAND (SC)**, fine grained, brown, very loose											
			20		☒	1-1-2 N=3				35			4
🟨	21.8	**SILTY SAND (SM)**, fine grained, brown/gray, loose											
			25		☒	2-3-5 N=8							
▨	26.8	**SANDY LEAN CLAY (CL)**, brown/gray, medium stiff to stiff											
			30		☒	3-3-4 N=7							
🟨	31.8	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, brown/gray, loose, with broken shell fragment and mica											
	35.0		35		☒	1-2-4 N=6							
		Boring Terminated at 35 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure.

Hammer Type: Rope and Cathead

Advancement Method:
Mud Rotary

Abandonment Method:

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *measured during drilling*

Terracon
2201 Rowland Avenue
Savannah, Georgia

Boring Started: 9/26/2014	Boring Completed: 9/26/2014
Drill Rig: Acker AD-I	Driller: Aaron and Josh
Project No.: ES145143	Exhibit: A-7-2

BORING LOG NO. B4

Page 1 of 1

PROJECT: Chatham County Fueling Station

SITE: Savannah, Georgia

CLIENT: Thomas & Hutton
Savannah, Georgia

GRAPHIC LOG	LOCATION See Exhibit A-2 DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (psf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.5 **TOPSOIL**			☒	1-1-1-1 N=2							
	2.0 **SILTY SAND (SM)**, fine grained, dark brown, very loose, with roots											
	6.0 **POORLY GRADED SAND (SP)**, fine grained, gray, loose to medium dense	5	▽	☒ ☒	2-2-3-5 N=5 5-8-10-9 N=18							
	11.8 **SILTY SAND (SM)**, fine grained, dark brown, dense to very dense, cemented	10		☒ ☒	4-10-25-50 N=35 50 N= 50/5"				24			3
	16.8 **POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, brown, medium dense	15		☒	5-5-6 N=11							
	21.8 **CLAYEY SAND (SC)**, fine grained, brown, very loose	20		☒	1-1-2 N=3							
	26.8 **SILTY SAND (SM)**, fine grained, gray, medium dense	25		☒	6-5-7 N=12							
	31.8 **SANDY LEAN CLAY (CL)**, fine grained, brown/gray, medium stiff to stiff	30		☒	3-3-4 N=7							
	35.0 **SILTY SAND (SM)**, fine grained, gray, medium dense, with broken shell fragment	35		☒	4-6-6 N=12							
	Boring Terminated at 35 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.
The SPT blow counts have not been adjusted for hammer or overburden pressure.

Hammer Type: Rope and Cathead

Advancement Method: Mud Rotary	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any). See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		

WATER LEVEL OBSERVATIONS

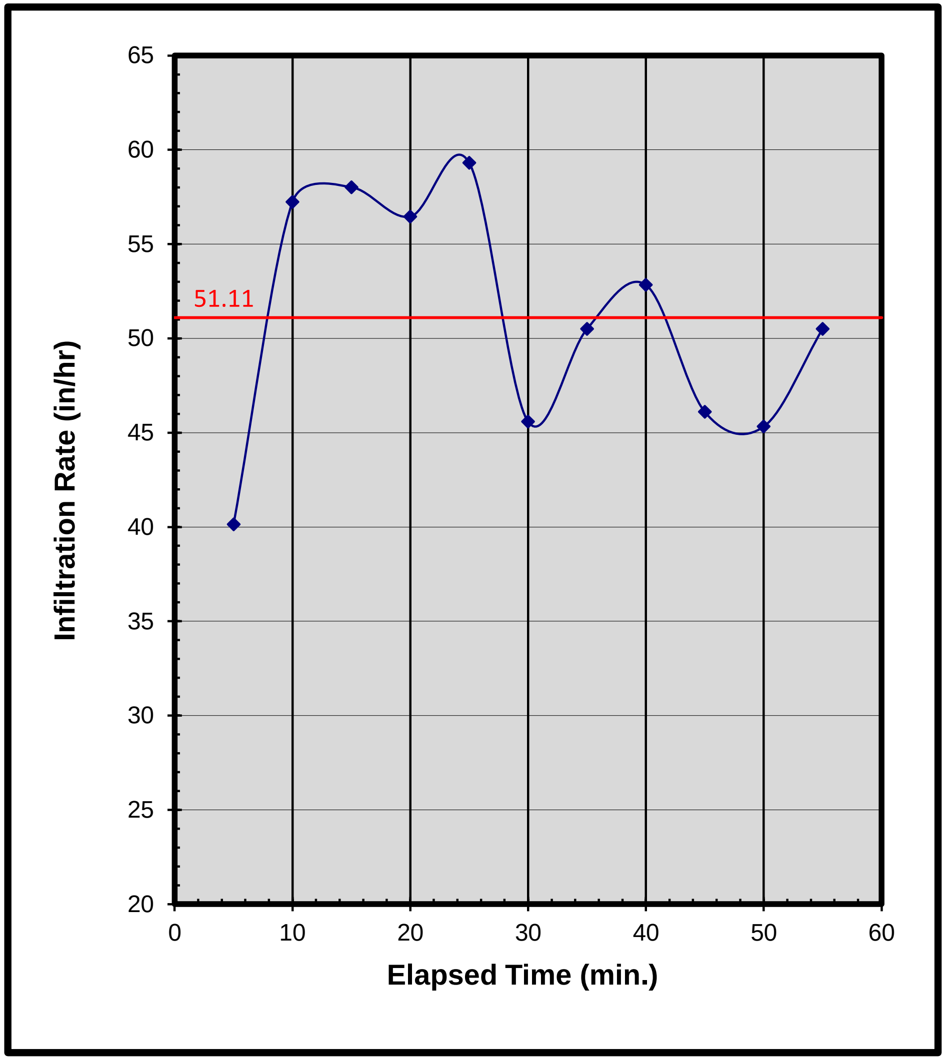
▽ *measured during drilling*

Terracon
2201 Rowland Avenue
Savannah, Georgia

Boring Started: 9/26/2014	Boring Completed: 9/26/2014
Drill Rig: Acker AD-I	Driller: Aaron and Josh
Project No.: ES145143	Exhibit: A-7-3

DOUBLE RING INFILTROMETER TEST RESULT

Elapsed Time (min.)	Quantity of Water (ml)	Infiltration Rate (in/hr)
5	1550	40.14
10	2210	57.24
15	2240	58.01
20	2180	56.46
25	2290	59.31
30	1760	45.58
35	1950	50.50
40	2040	52.83
45	1780	46.10
50	1750	45.32
55	1950	50.50
60	1980	51.28
Average (in/hr)		51.11



Soil Profile	
Depth (inch)	Soil Description
0 to12	Dark brown silty SAND (SM) with roots (Topsoil)
12 to 20	Light brown SAND with silt (SP-SM)
20 to 60	Brown silty SAND (SM)
Boring Terminated @ 60" BGS	
Groundwater @ 32" BGS	
Note: BGS = Below ground surface	

Test Data
Test Location : IR1
Diameter of Inner Ring (Inches): 6
Diameter of Outer Ring (Inches): 12
Test Depth (Inches): 12
Head Maintained Above Test Depth (Inches): 4
Date Performed: September 11, 2014
Performed By: JM
Infiltration Rate (in/hr): 51.11

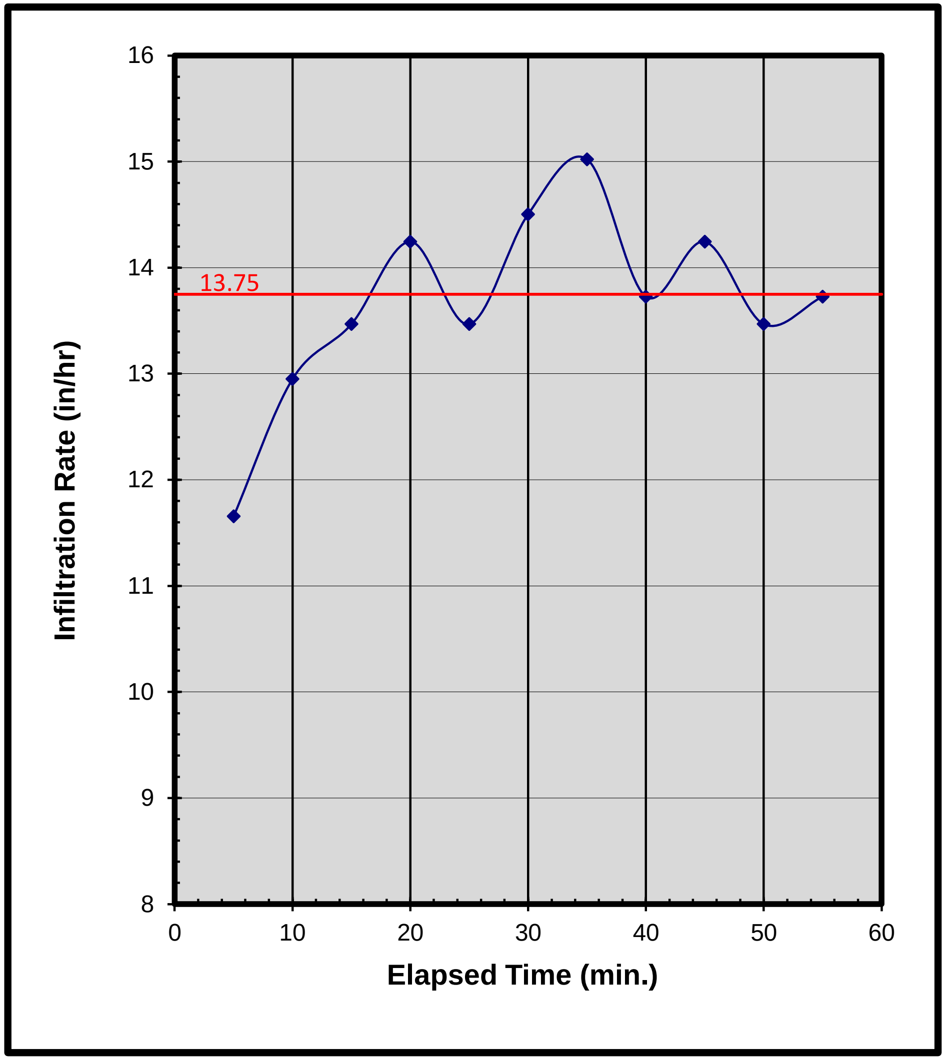
Terracon
Consulting Engineers & Scientists

2201 Rowland Avenue
Savannah, Georgia 31404

Project Name: Chatham County Fueling Station
Project No.: ES145143
Location: Savannah, Chatham County, Georgia

DOUBLE RING INFILTROMETER TEST RESULT

Elapsed Time (min.)	Quantity of Water (ml)	Infiltration Rate (in/hr)
5	450	11.65
10	500	12.95
15	520	13.47
20	550	14.24
25	520	13.47
30	560	14.50
35	580	15.02
40	530	13.73
45	550	14.24
50	520	13.47
55	530	13.73
60	560	14.50
Average (in/hr)		13.75



Soil Profile	
Depth (inch)	Soil Description
0 to 6	Leaves, sticks, organic, debris (Topsoil)
6 to 32	Dark brown silty SAND (SM)
32 to 48	Light brown SAND with silt (SP-SM)
48 to 60	Dark brown silty SAND (SM)

Boring Terminated @ 60" BGS

Groundwater @ 28" BGS

Note:

BGS = Below ground surface

Test Data

Test Location : IR2

Diameter of Inner Ring (Inches): 6

Diameter of Outer Ring (Inches): 12

Test Depth (Inches): 12

Head Maintained Above Test Depth (Inches): 4

Date Performed: September 11, 2014

Performed By: JM

Infiltration Rate (in/hr): 13.75

Terracon
Consulting Engineers & Scientists

2201 Rowland Avenue
Savannah, Georgia 31404

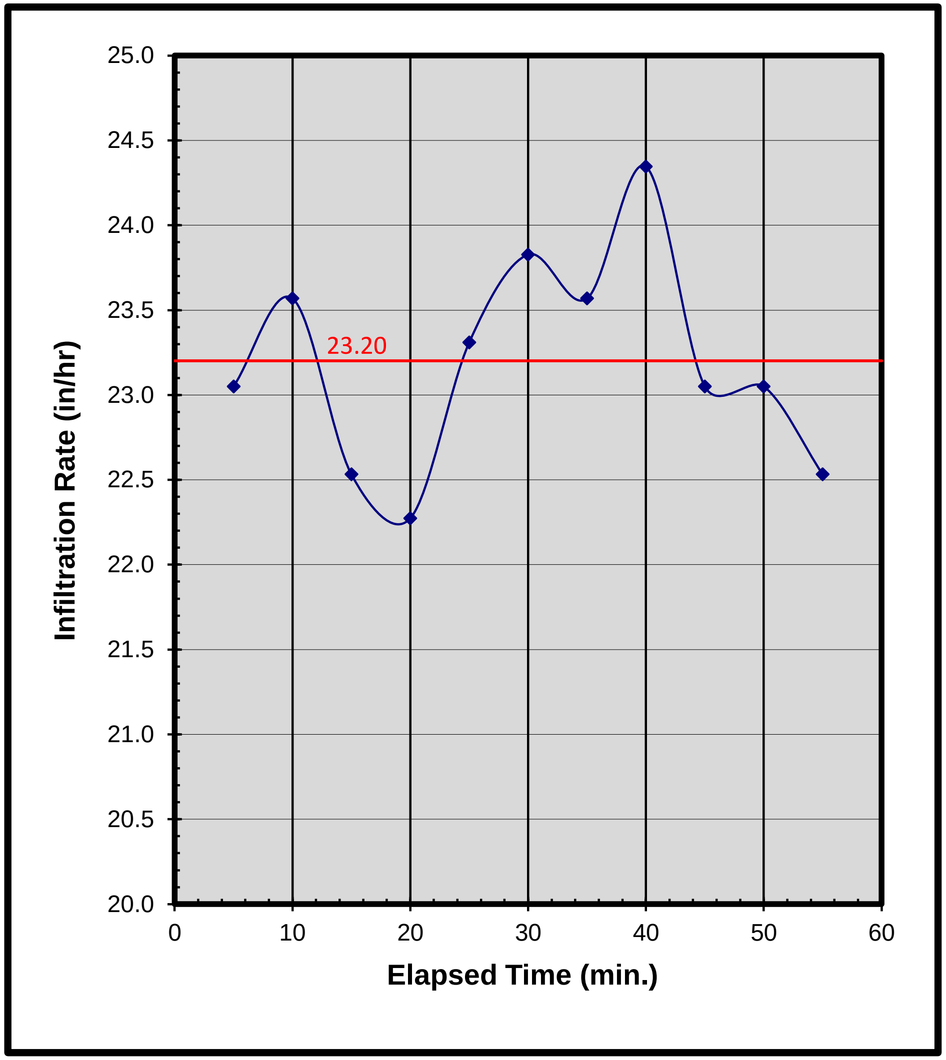
Project Name: Chatham County Fueling Station

Project No.: ES145143

Location: Savannah, Chatham County, Georgia

DOUBLE RING INFILTROMETER TEST RESULT

Elapsed Time (min.)	Quantity of Water (ml)	Infiltration Rate (in/hr)
5	890	23.05
10	910	23.57
15	870	22.53
20	860	22.27
25	900	23.31
30	920	23.83
35	910	23.57
40	940	24.35
45	890	23.05
50	890	23.05
55	870	22.53
60	900	23.31
Average (in/hr)		23.20



Soil Profile	
Depth (inch)	Soil Description
0 to 6	Organics, leaves, debris, sticks (Topsoil)
6 to 28	Dark brown silty SAND (SM)
28 to 60	Brown silty SAND (SM) with interbedded sand with silt (SP-SM) layer

Boring Terminated @ 60" BGS

Groundwater @ 28" BGS

Note:

BGS = Below ground surface

Test Data

Test Location : IR3

Diameter of Inner Ring (Inches): 6

Diameter of Outer Ring (Inches): 12

Test Depth (Inches): 12

Head Maintained Above Test Depth (Inches): 4

Date Performed: September 11, 2014

Performed By: JM

Infiltration Rate (in/hr): 23.20

Terracon
Consulting Engineers & Scientists

2201 Rowland Avenue
Savannah, Georgia 31404

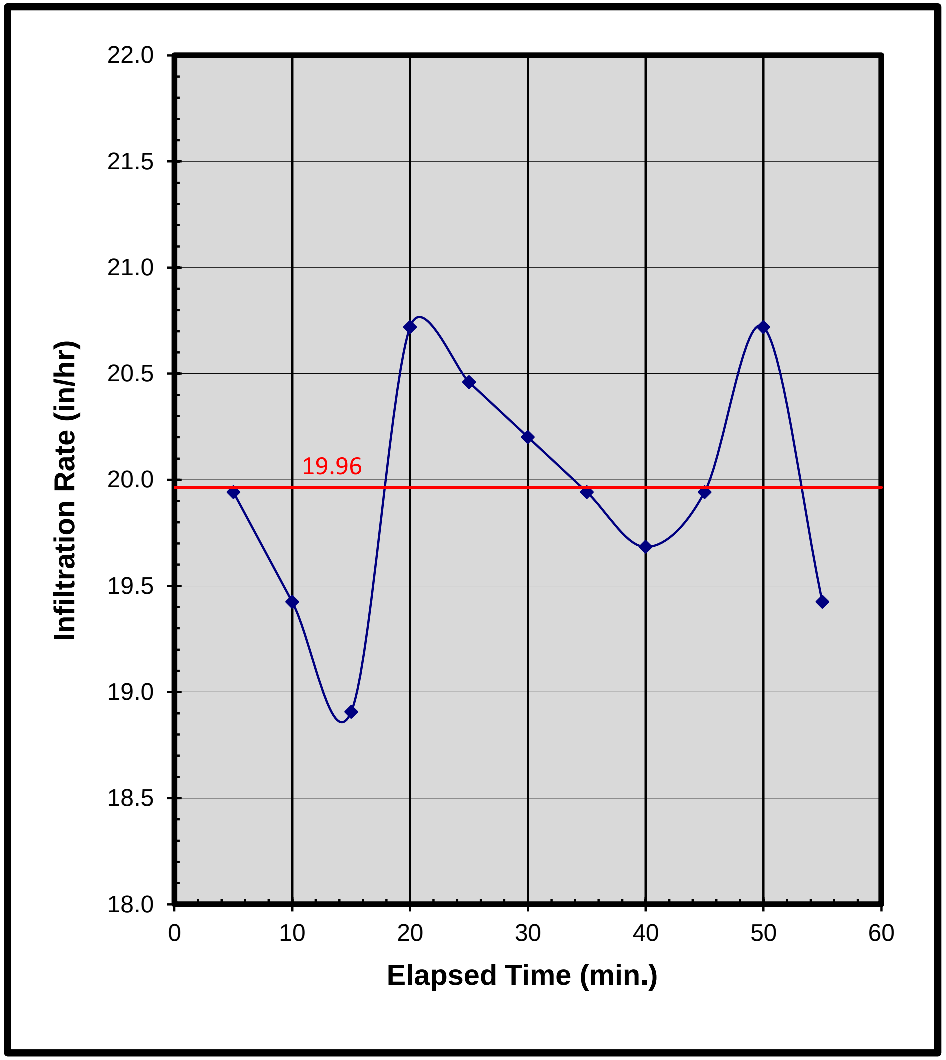
Project Name: Chatham County Fueling Station

Project No.: ES145143

Location: Savannah, Chatham County, Georgia

DOUBLE RING INFILTROMETER TEST RESULT

Elapsed Time (min.)	Quantity of Water (ml)	Infiltration Rate (in/hr)
5	770	19.94
10	750	19.42
15	730	18.91
20	800	20.72
25	790	20.46
30	780	20.20
35	770	19.94
40	760	19.68
45	770	19.94
50	800	20.72
55	750	19.42
60	780	20.20
Average (in/hr)		19.96



Soil Profile	
Depth (inch)	Soil Description
0 to 12	Brown silty SAND (SM) with organics, leaves and woods (Topsoil)
12 to 60	Dark brown silty SAND (SM)
Boring Terminated @ 60" BGS	
Groundwater @ 26" BGS	
Note: BGS = Below ground surface	

Test Data
Test Location : IR4
Diameter of Inner Ring (Inches): 6
Diameter of Outer Ring (Inches): 12
Test Depth (Inches): 12
Head Maintained Above Test Depth (Inches): 4
Date Performed: September 11, 2014
Performed By: JM
Infiltration Rate (in/hr): 19.96

Terracon
Consulting Engineers & Scientists

2201 Rowland Avenue
Savannah, Georgia 31404

Project Name: Chatham County Fueling Station
Project No.: ES145143
Location: Savannah, Chatham County, Georgia

Hand Auger Boring Logs

Project Name:	Chatham County Fueling Station
Project No.:	ES145143
Project Location:	Savannah, Chatham County, Georgia

HA1

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 10	Dark brown silty SAND with grass roots (Topsoil)	SM
10 to 16	Light brown SAND with silt	SP-SM

Refusal @ 16" BGS

No Groundwater encountered **No Mottling Noted**

HA1a

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 12	Dark brown silty SAND with grass roots (Topsoil)	SM
12 to 20	Light brown SAND with silt	SP-SM
20 to 60	Brown silty SAND	SM

Groundwater @ 32" BGS **No Mottling Noted**

HA2

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 6	Leaves, woods and organics (Topsoil)	--
6 to 32	Dark brown silty SAND	SM
32 to 48	Light brown SAND with silt	SP-SM
48 to 60	Dark brown silty SAND	SM

Groundwater @ 28" BGS **No Mottling Noted**

HA3

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 6	Leaves, woods and organics (Topsoil)	--
6 to 28	Dark brown silty SAND	SM
28 to 60	Brown silty SAND with interbeded sand with silt layer	SM

Groundwater @ 28" BGS **No Mottling Noted**

BGS = Below existing Ground Surface

Exhibit A-9-1

Hand Auger Boring Logs

Project Name:	Chatham County Fueling Station
Project No.:	ES145143
Project Location:	Savannah, Chatham County, Georgia

HA4

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 12	Brown silty SAND with organics, leaves and woods (Topsoil)	SM
12 to 60	Dark brown silty SAND	SM
Groundwater @ 26" BGS	**No Mottling Noted**	

HA5

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 8	Dark brown silty SAND with grass roots (Topsoil)	SM
8 to 60	Dark brown silty SAND	SM
Groundwater @ 28" BGS	**No Mottling Noted**	

HA6

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 8	Brown silty SAND with grass roots (Topsoil)	SM
8 to 16	Light brown SAND with silt	SP-SM
16 to 60	Brown silty SAND	SM
Groundwater @ 32" BGS	**No Mottling Noted**	

HA7

Depth Below Ground Surface (inch)	Material Description	USCS CLASSIFICATION
0 to 6	Brown silty SAND with grass roots (Topsoil)	SM
6 to 60	Brown silty SAND	SM
Groundwater @ 18" BGS	**No Mottling Noted**	

BGS = Below existing Ground Surface

Exhibit A-9-2

APPENDIX B
LABORATORY TEST RESULTS

Exhibit B-1	Summary of Soil Laboratory Test Results
Exhibit B-2	Grain Size Distribution
Exhibit B-3	Atterberg Limits

Terracon Project Name: Chatham County Fueling Station
Terracon Project No.: ES145143
Project Location: Savannah, Georgia

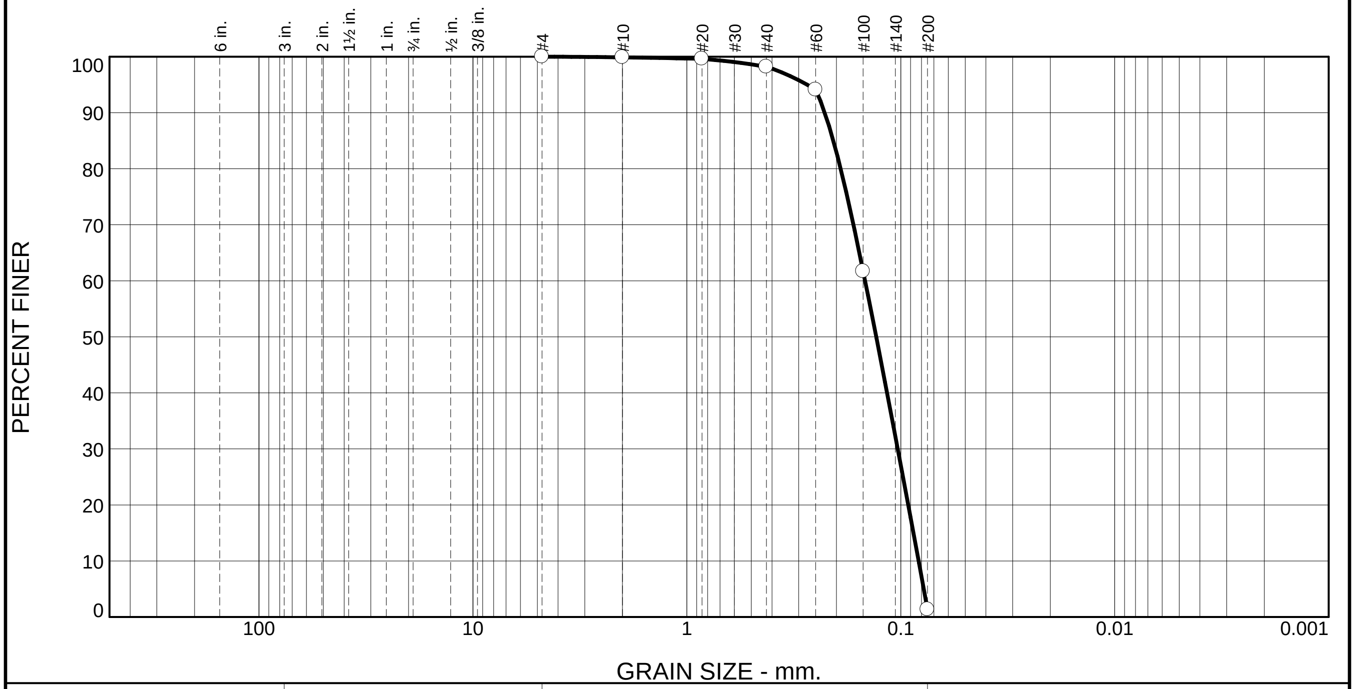
Terracon

Summary of Soil Laboratory Test Results

Sample No.	Sample Depth (ft)	Material Description	USCS	Natural Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Cu	Cc	D90 (mm)	D60 (mm)	D30 (mm)	% Gravel	%Sand	%Fine
B1	13.5 to 15.0	Fine SAND	SP	33.4	--	--	--	1.78	0.88	0.227	0.147	0.103	0.0	98.7	1.3
	28.5 to 30.0	Sandy CLAY	CL	--	35	10	25	--	--	--	--	--	--	--	--
B2	18.5 to 20.0	Fine SAND	SP	34.7	--	--	--	1.83	0.88	0.229	0.147	0.102	0.0	95.8	4.2
B4	6.0 to 8.0	Fine SAND	SP	24.3	--	--	--	1.85	1.08	0.226	0.177	0.135	0.0	97.5	2.5

Exhibit B-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.7	96.9	1.3	

Test Results (D422 & D1140)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.9		
#20	99.6		
#40	98.2		
#60	94.1		
#100	61.7		
#200	1.3		

* (no specification provided)

Material Description

Fine SAND

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=**

Coefficients

D_{90}= 0.2265 D_{85}= 0.2066 D_{60}= 0.1469
D_{50}= 0.1303 D_{30}= 0.1034 D_{15}= 0.0873
D_{10}= 0.0826 C_u= 1.78 C_c= 0.88

Remarks

Date Received: 10-1-14 **Date Tested:** 10-7-14
Tested By: KG
Checked By: GKT
Title: Lab Manager

Sample Number: B1-6 **Depth:** 13.5-15' **Date Sampled:** 10-1-14

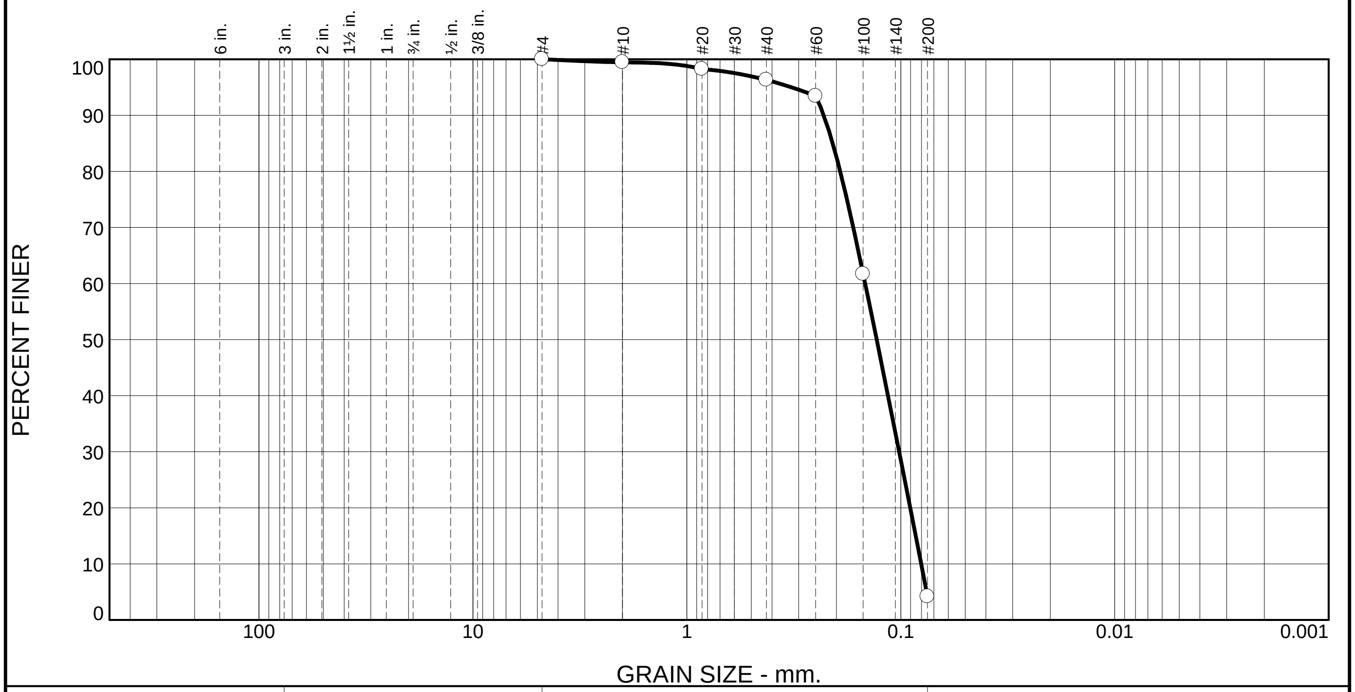
Terracon

Client: Thomas & Hutton
Project: Chatham County Fueling Station

Project No: ES145143 **Figure**

Exhibit B-2-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	3.2	92.1	4.2	

Test Results (D422 & D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	99.5		
#20	98.2		
#40	96.3		
#60	93.4		
#100	61.7		
#200	4.2		

* (no specification provided)

Material Description

Fine SAND

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=**

Coefficients

D_{90}= 0.2290 D_{85}= 0.2080 D_{60}= 0.1468
D_{50}= 0.1297 D_{30}= 0.1018 D_{15}= 0.0852
D_{10}= 0.0803 C_u= 1.83 C_c= 0.88

Remarks

Date Received: 10-1-14 **Date Tested:** 10-7-14
Tested By: KG
Checked By: GKT
Title: Lab Manager

Sample Number: B2-7 **Depth:** 18.5-20' **Date Sampled:** 10-1-14

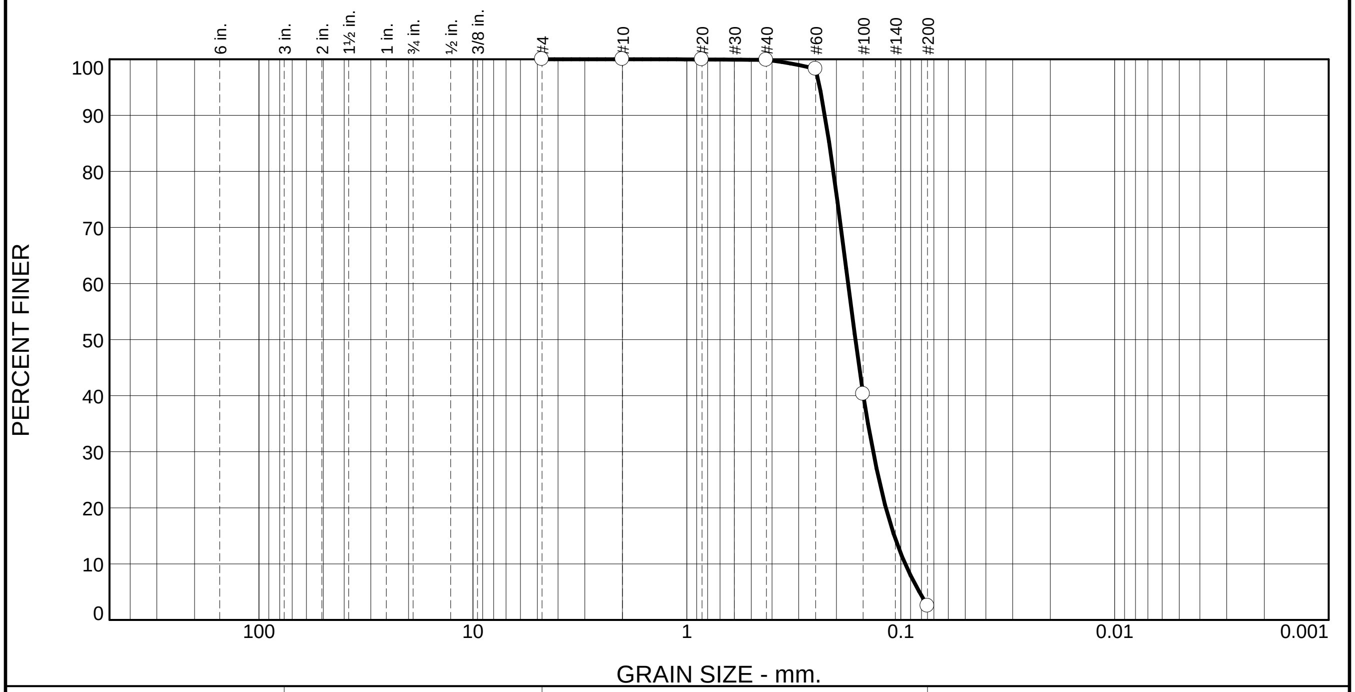
Terracon

Client: Thomas & Hutton
Project: Chatham County Fueling Station

Project No: ES145143 **Figure**

Exhibit B-2-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.1	97.4	2.5	

Test Results (D422 & D1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	100.0		
#10	100.0		
#20	100.0		
#40	99.9		
#60	98.3		
#100	40.3		
#200	2.5		

* (no specification provided)

Material Description

Fine SAND

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= SP **AASHTO (M 145)=**

Coefficients

D_{90}= 0.2264 D_{85}= 0.2159 D_{60}= 0.1765
D_{50}= 0.1631 D_{30}= 0.1348 D_{15}= 0.1072
D_{10}= 0.0955 C_u= 1.85 C_c= 1.08

Remarks

Date Received: 10-1-14 **Date Tested:** 10-7-14
Tested By: KG
Checked By: GKT
Title: Lab Manager

Sample Number: B4-3 **Depth:** 6-8' **Date Sampled:** 10-1-14

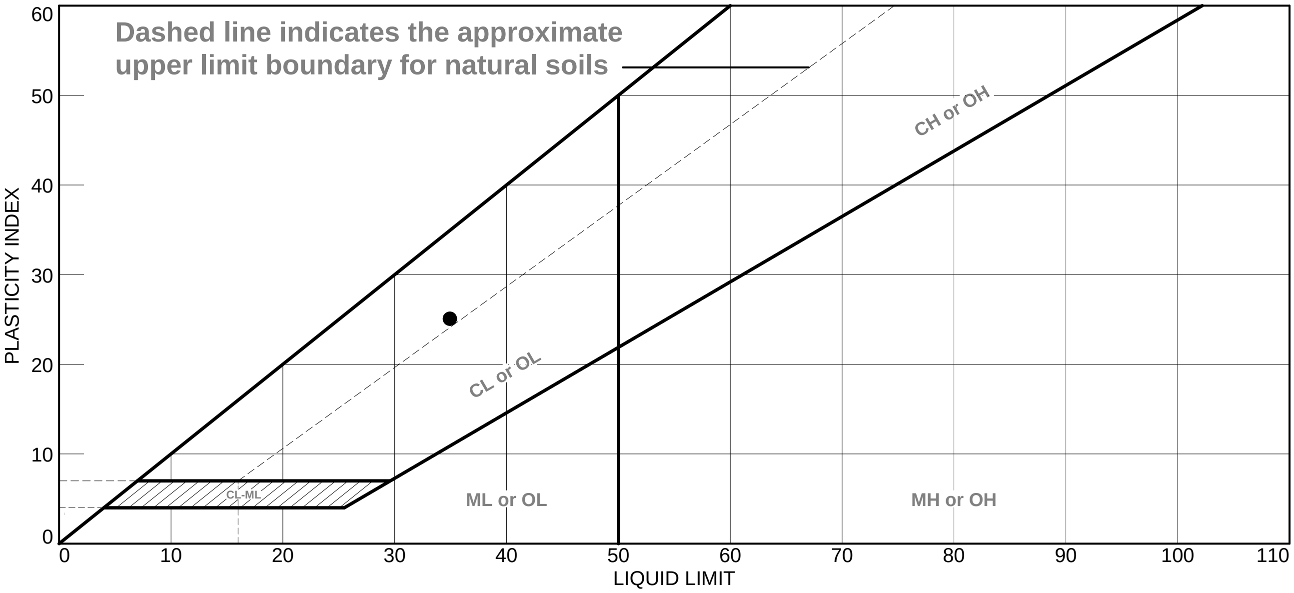
Terracon

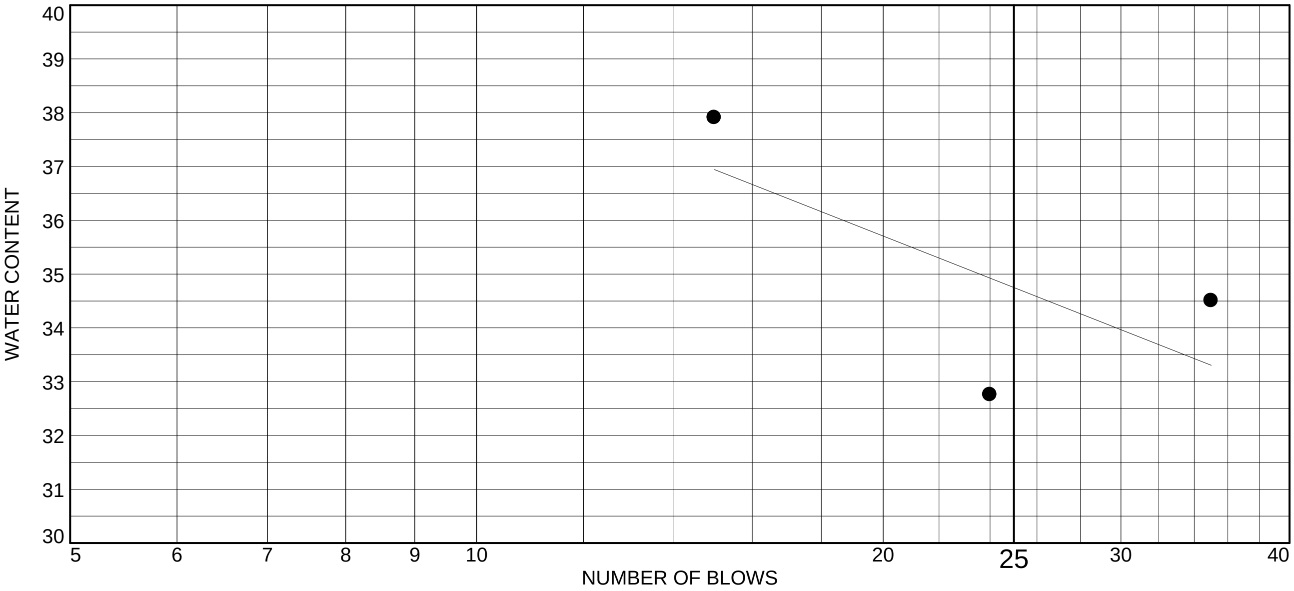
Client: Thomas & Hutton
Project: Chatham County Fueling Station

Project No: ES145143 **Figure**

Exhibit B-2-3

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Sandy CLAY	35	10	25			

Project No. ES145143 **Client:** Thomas & Hutton

Project: Chatham County Fueling Station

Sample Number: B1-9 **Depth:** 28.5-30'

Remarks:

Figure

Exhibit B-3

Tested By: KG **Checked By:** GKT

APPENDIX C
SUPPORTING INFORMATION

Seismic Design Parameters Based on IBC2012 Code and ASCE 7-10 Standard

Terracon Project Name: Chatham County Fueling Station
Terracon Project Number: ES145143

Terracon

Site Location: Savannah, Chatham County, Georgia
Latitude : 31.9913
Longitude : -81.0796

Site Class: D
Design Response Spectrum for the Site Class

S_s	0.295	S_1	0.116
F_a	1.564	F_v	2.336
S_{MS}	0.462	S_{M1}	0.271
S_{DS}	0.308	S_{D1}	0.181

	Period (sec)	Sa (g)
	0.000	0.123
T_0	0.118	0.308
	0.200	0.308
T_S	0.588	0.308
T	0.700	0.259
	0.800	0.226
	0.900	0.201
	1.000	0.181
	1.100	0.165
	1.200	0.151
	1.300	0.139
	1.400	0.129
	1.500	0.121
	1.600	0.113
	1.700	0.106
	1.800	0.101
	1.900	0.095
	2.000	0.091

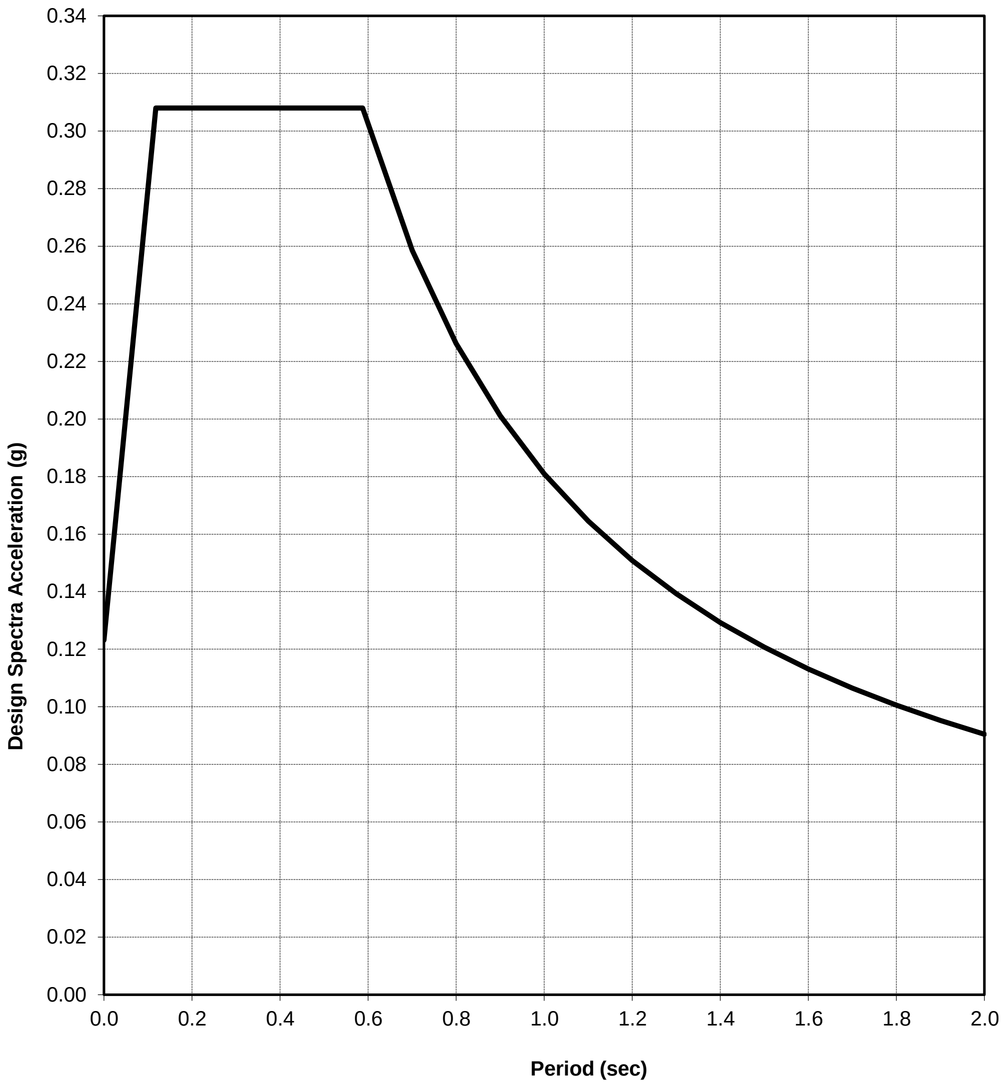


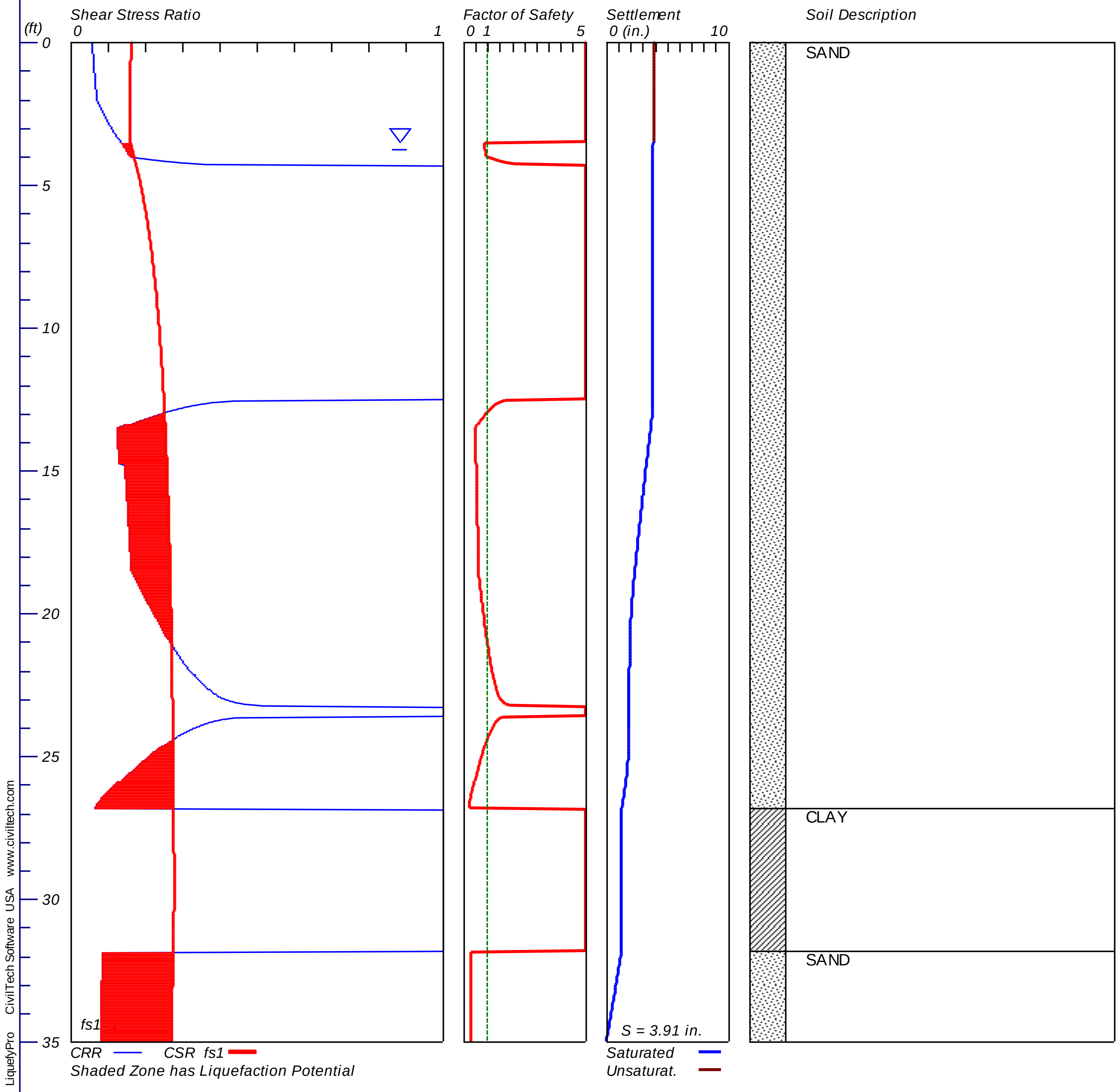
Exhibit C-1

LIQUEFACTION ANALYSIS

Chatham County Fueling Station

Hole No.=B1 Water Depth=3.5 ft Surface Elev.=0

Magnitude=7.36
Acceleration=0.25g



GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

Auger	**Split Spoon**
Shelby Tube	**Macro Core**
No Recovery	**Rock Core**
Ring Sampler	

GROUNDWATER

▽	**Groundwater Initially Encountered**
▽	**Groundwater Level After a Specified Period of Time**
▼	**Static Groundwater Level After a Specified Period of Time**
☒	**No Groundwater Observed**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	**Hand Penetrometer**
(T)	**Torvane**
(b/f)	**Standard Penetration Test (blows per foot)**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. 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 plastic or 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.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Std. Penetration Resistance (blows per foot)**	**Descriptive Term (Consistency)**	**Undrained Shear Strength (kips per square foot)**	**Std. Penetration Resistance (blows per foot)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium-Stiff	0.50 to 1.00	5 - 7
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 14
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	above 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	**Percent of Dry Weight**
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Descriptive Term(s) of other constituents	**Percent of Dry Weight**
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	**Percent of Dry Weight**
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	**Plasticity Index**
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Exhibit C-3

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3[E]	GW	Well-graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines More than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G, H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3[E]	SW	Well-graded sand[I]
			Cu < 6 and/or 1 > Cc > 3[E]	SP	Poorly graded sand[I]
		Sands with Fines More than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines Classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays Liquid limit less than 50	inorganic	PI > 7 and plots on or above “A” line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below “A” line[J]	ML	Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OL	Organic clay[K,L,M,N]
					Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above “A” line	CH	Fat clay[K,L,M]
			PI plots below “A” line	MH	Elastic Silt[K,L,M]
		organic	$\frac{\text{Liquid limit - oven dried}}{\text{Liquid limit - not dried}} < 0.75$	OH	Organic clay[K,L,M,P]
					Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains ≥ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.

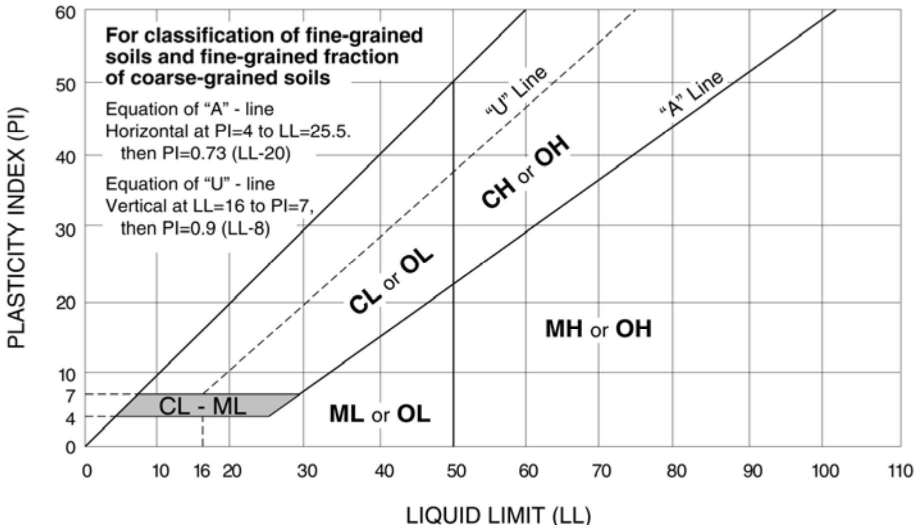
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ≥ 4 and plots on or above “A” line.

[O] PI < 4 or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



Terracon

Exhibit C-4

CPT GENERAL NOTES

DESCRIPTION OF MEASUREMENTS AND CALIBRATIONS

To be reported per ASTM D5778:

Uncorrected Tip Resistance, q_c
Measured force acting on the cone
divided by the cone's projected area

Corrected Tip Resistance, q_t
Cone resistance corrected for porewater
and net area ratio effects
$q_t = q_c + U2(1 - a)$

Where a is the net area ratio,
a lab calibration of the cone typically
between 0.70 and 0.85

Pore Pressure, U1/U2
Pore pressure generated during penetration
U1 - sensor on the face of the cone
U2 - sensor on the shoulder (more common)

Sleeve Friction, fs
Frictional force acting on the sleeve
divided by its surface area

Normalized Friction Ratio, FR
The ratio as a percentage of fs to q_t,
accounting for overburden pressure

To be reported per ASTM D7400, if collected:

Shear Wave Velocity, Vs
Measured in a Seismic CPT and provides
direct measure of soil stiffness

DESCRIPTION OF GEOTECHNICAL CORRELATIONS

Normalized Tip Resistance, Q_t
$Q_t = (q_t - \sigma_{V0})/\sigma'_{V0}$

Over Consolidation Ratio, OCR
$OCR\ (1) = 0.25(Q_t)^{1.25}$
$OCR\ (2) = 0.33(Q_t)$

Undrained Shear Strength, Su
$Su = Q_t \times \sigma'_{V0}/N_{kt}$
N_{kt} is a geographical factor (shown on Su plot)

Sensitivy, St
$St = (q_t - \sigma_{V0}/N_{kt}) \times (1/fs)$

Effective Friction Angle, ϕ'
$\phi'\ (1) = \tan^{-1}(0.373[\log(q_t/\sigma'_{V0}) + 0.29])$
$\phi'\ (2) = 17.6 + 11[\log(Q_t)]$

Unit Weight
$UW = (0.27[\log(FR)]+0.36[\log(q_t/atm)]+1.236) \times UW_{water}$
σ_{V0} is taken as the incremental sum of the unit weights

SPT N_{60}
$N_{60} = (q_t/atm) / 10^{(1.1268 - 0.2817Ic)}$

Soil Behavior Type Index, Ic
$Ic = [(3.47 - \log(Q_t)^2 + (\log(FR) + 1.22)^2]^{0.5}$

Small Strain Modulus, G_0
$G_0 = \rho Vs^2$

Elastic Modulus, Es (assumes $q/q_{ultimate} \sim 0.3$, i.e. FS = 3)
$Es\ (1) = 2.6\psi G_0$
where $\psi = 0.56 - 0.33\log Q_{t,clean\ sand}$
$Es\ (2) = G_0$
$Es\ (3) = 0.015 \times 10^{(0.55Ic + 1.68)}(q_t - \sigma_{V0})$
$Es\ (4) = 2.5q_t$

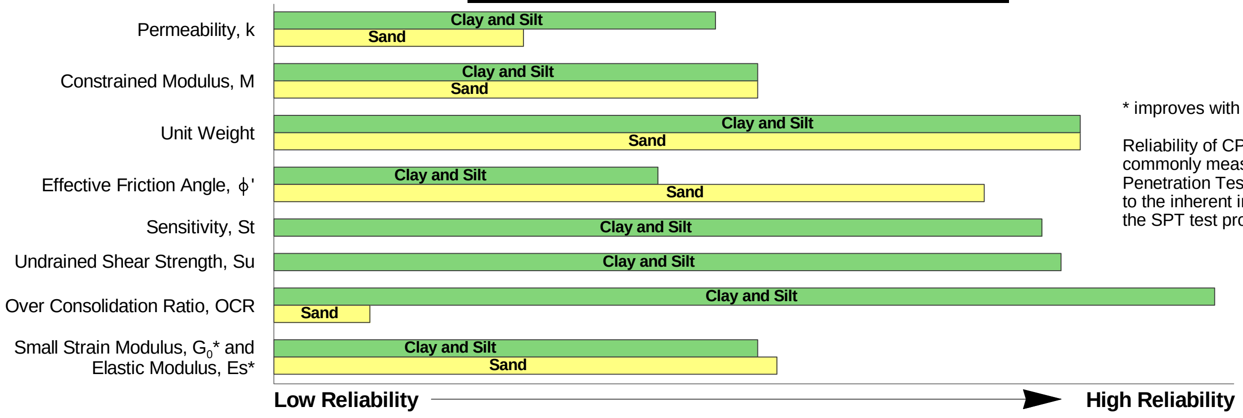
Constrained Modulus, M
$M = \alpha_M(q_t - \sigma_{V0})$
For Ic > 2.2 (fine-grained soils)
$\alpha_M = Q_t$ with maximum of 14
For Ic < 2.2 (coarse-grained soils)
$\alpha_M = 0.0188 \times 10^{(0.55Ic + 1.68)}$

Hydraulic Conductivity, k
For $1.0 < Ic < 3.27$ $k = 10^{(0.952 - 3.04Ic)}$
For $3.27 < Ic < 4.0$ $k = 10^{(-4.52 - 1.37Ic)}$

REPORTED PARAMETERS

CPT logs as provided, at a minimum, report the data as required by ASTM D5778 and ASTM D7400 (if applicable). This minimum data include tip resistance, sleeve resistance, and porewater pressure. Other correlated parameters may also be provided. These other correlated parameters are interpretations of the measured data based upon published and reliable references, but they do not necessarily represent the actual values that would be derived from direct testing to determine the various parameters. The following chart illustrates estimates of reliability associated with correlated parameters based upon the literature referenced below.

RELATIVE RELIABILITY OF CPT CORRELATIONS



* improves with seismic Vs measurements

Reliability of CPT-predicted N_{60} values as commonly measured by the Standard Penetration Test (SPT) is not provided due to the inherent inaccuracy associated with the SPT test procedure.

WATER LEVEL

The groundwater level at the CPT location is used to normalize the measurements for vertical overburden pressures and as a result influences the normalized soil behavior type classification and correlated soil parameters. The water level may either be "measured" or "estimated:"

Measured - Depth to water directly measured in the field

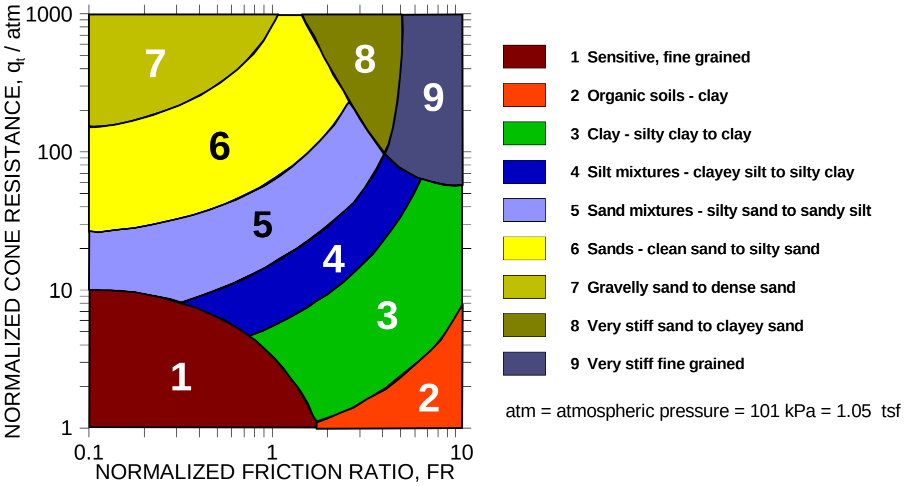
Estimated - Depth to water interpolated by the practitioner using pore pressure measurements in coarse grained soils and known site conditions

While groundwater levels displayed as "measured" more accurately represent site conditions at the time of testing than those "estimated," in either case the groundwater should be further defined prior to construction as groundwater level variations will occur over time.

CONE PENETRATION SOIL BEHAVIOR TYPE

The estimated stratigraphic profiles included in the CPT logs are based on relationships between corrected tip resistance (q_t), friction resistance (fs), and porewater pressure (U2). The normalized friction ratio (FR) is used to classify the soil behavior type.

Typically, silts and clays have high FR values and generate large excess penetration porewater pressures; sands have lower FRs and do not generate excess penetration porewater pressures. Negative pore pressure measurements are indicative of fissured fine-grained material. The adjacent graph (Robertson et al.) presents the soil behavior type correlation used for the logs. This normalized SBT chart, generally considered the most reliable, does not use pore pressure to determine SBT due to its lack of repeatability in onshore CPTs.



atm = atmospheric pressure = 101 kPa = 1.05 tsf

REFERENCES

Kulhawy, F.H., Mayne, P.W., (1997). "Manual on Estimating Soil Properties for Foundation Design," Electric Power Research Institute, Palo Alto, CA.
Mayne, P.W., (2013). "Geotechnical Site Exploration in the Year 2013," Georgia Institue of Technology, Atlanta, GA.
Robertson, P.K., Cabal, K.L. (2012). "Guide to Cone Penetration Testing for Geotechnical Engineering," Signal Hill, CA.
Schmertmann, J.H., (1970). "Static Cone to Compute Static Settlement over Sand," *Journal of the Soil Mechanics and Foundations Division*, 96(SM3), 1011-1043.

Exhibit C-5

RECORD DRAWINGS

OF

CHATHAM COUNTY FUELING STATION

CHATHAM COUNTY , GEORGIA

PREPARED FOR:

CHATHAM COUNTY
BOARD OF COMMISSIONERS
124 BULL STREET
SAVANNAH GEORGIA 31412

JANUARY 16, 2017
LATEST REVISION:

J- 25236

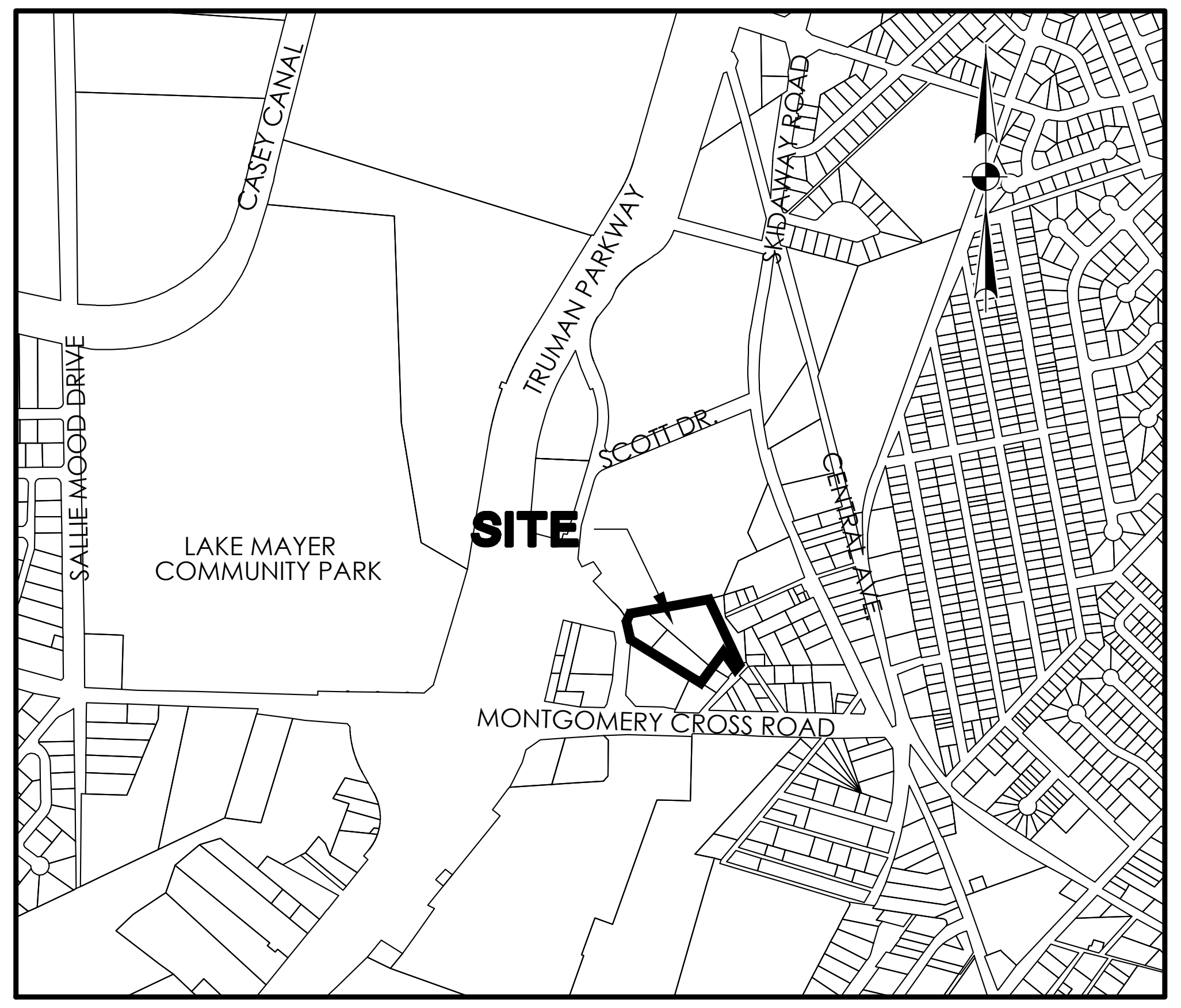
PREPARED BY:

THOMAS & HUTTON
Engineering | Surveying | Planning | GIS | Consulting

No. 034622
JOHN VINCENT GIORDANO

RECORD DRAWING NOTE:

THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED ON THE AS-BUILT SURVEY PREPARED BY BREWER LAND SURVEYING SIGNED AND LAST REVISED JANUARY 9, 2017. THOMAS & HUTTON HAS NOT FIELD VERIFIED ANY OF THE INFORMATION PROVIDED BY BREWER SURVEYING AND MAKES NO WARRANTY OR GUARANTEE AS TO HORIZONTAL AND/OR VERTICAL LOCATION OF ANY UTILITIES OR STRUCTURES AS DEPICTED.



VICINITY MAP
SCALE: 1" = 1000'

CHATHAM COUNTY FUELING STATION
RECORD DRAWINGS

J- 25236
01/16/17

Schedule of Drawings

Sheet Number	Sheet Title
C0	COVER SHEET
~~G0.1~~	~~LOCATION MAP & SHEET INDEX~~
~~G0.2~~	~~GENERAL NOTES~~
~~C1.1~~	~~LAYOUT, FENCING, SIGNING AND~~ MARKING PLAN
~~C1.2~~	~~ACCESSIBILTY AND INTERSECTION~~ SIGHT PLAN
C2.1-C2.3	WATER PLAN
~~C2.4~~	~~WATER MAIN PROFILE~~
~~C2.5-C2.7~~	~~WATER DETAILS~~
C3.1	PAVING, GRADING AND DRAINAGE PLAN
~~C3.2~~	~~STORM DRAINAGE PROFILES~~
~~C3.3~~-C3.4	PAVING, GRADING AND DRAINAGE DETAILS
~~EC0.1-EC0.3~~	~~EROSION CONTROL NOTES~~
~~EC1.1-EC1.3~~	~~EROSION AND SEDIMENTATION C~~ONTROL PLAN - INITIAL
~~EC2.1-EC2.3~~	~~EROSION AND SEDIMENTATION C~~ONTROL PLAN- INTERMEDIATE
~~EC3.1-EC3.3~~	~~EROSION AND SEDIMENTATION C~~ONTROL PLAN - FINAL
~~EC4.1-EC4.2~~	~~EROSION CONTROL DETAILS~~
~~S1.1~~	~~STRUCTURAL SITE PLAN AND SECTI~~ONS (OMITTED)
~~S1.2~~	~~STRUCTURAL NOTES AND TYPICAL~~ SECTIONS (OMITTED)
~~S1.3~~	~~STRUCTURAL TYPICAL DETAILS (OM~~ITTED)
~~S1.4~~	~~BUILDING FOUNDATION AND DETA~~ILS (OMITTED)
LS1.1	LANDSCAPE PLAN
~~LS2.1~~	~~LANDSCAPE NOTES~~
~~LS2.2~~	~~LANDSCAPE DETAILS~~
~~LS2.3~~	~~GRASSING SPECIFICATIONS~~

REVISION HISTORY

REV. NO.	REVISION	BY	DATE

SUBMITTAL HISTORY

SUBMITTED TO	DATE
CITY OF SAVANNAH - CHECK SET	3/1/17
CITY OF SAVANNAH - CHECK SET	1/17/17

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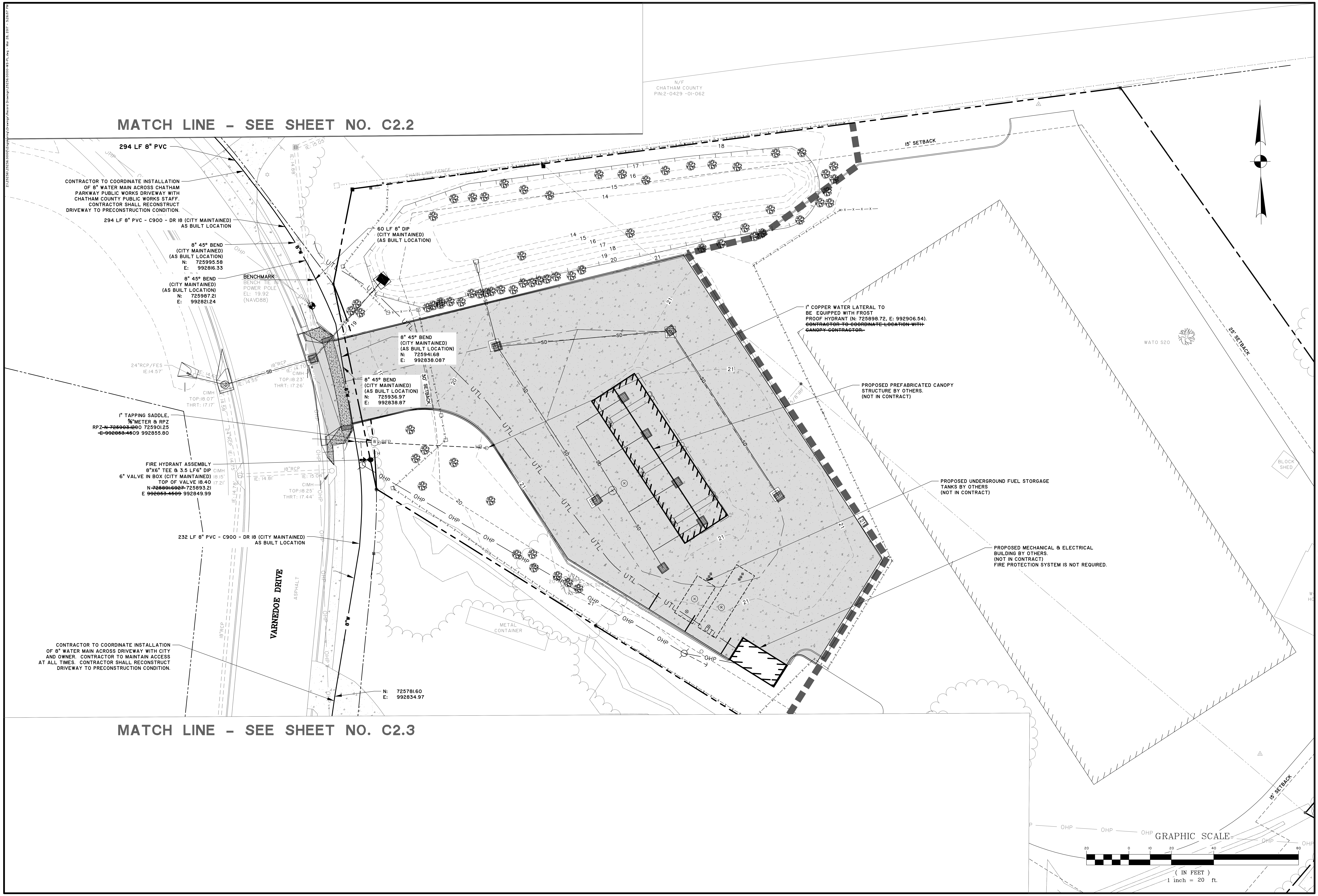

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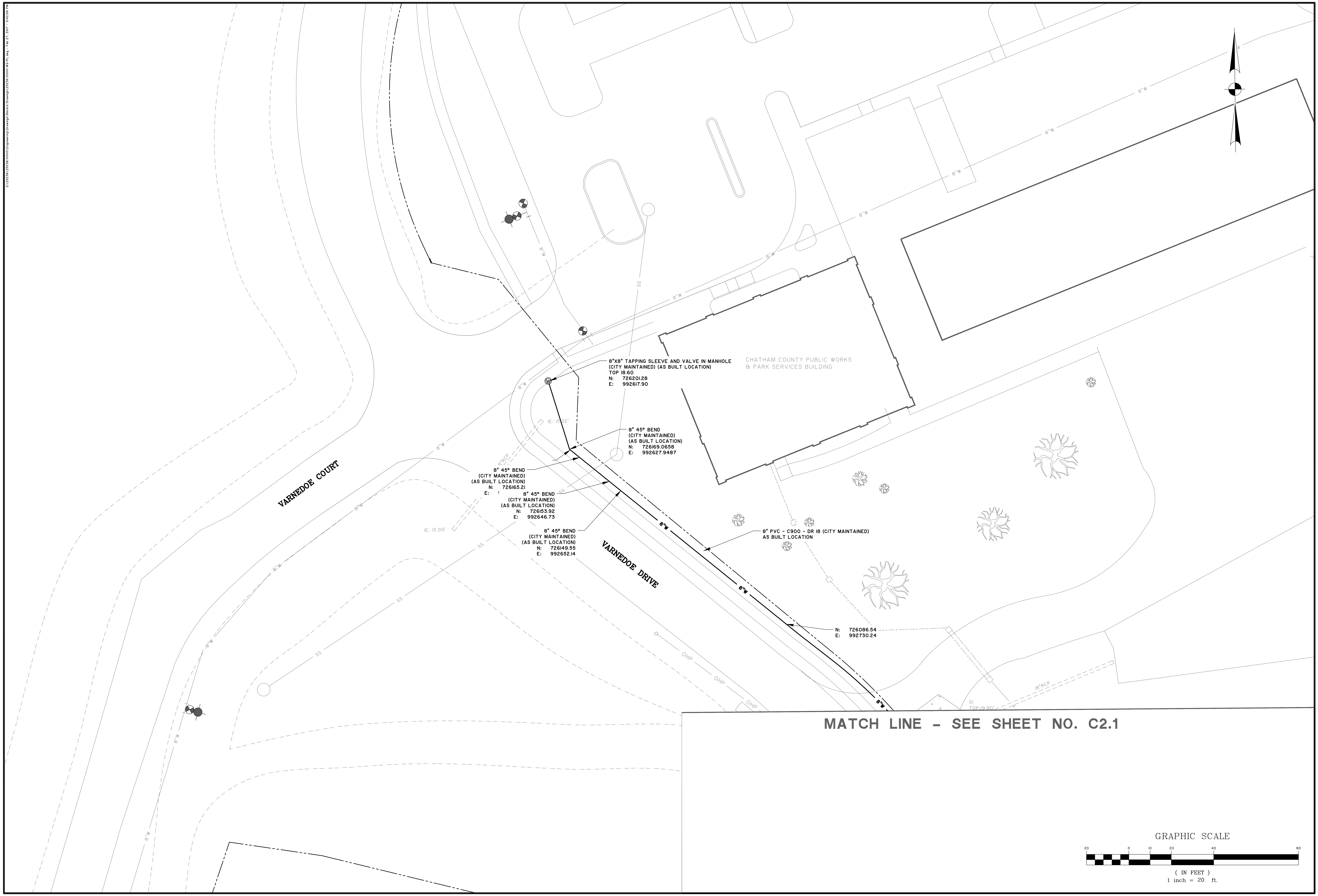
CHATHAM COUNTY FUELING STATION

WATER PLAN

JOB NO:	J- 25236
DATE:	02/02/15
DRAWN:	SCY
DESIGNED:	JVG
REVIEWED:	EGC
APPROVED:	DDK
SCALE:	1" = 20'

C2.1



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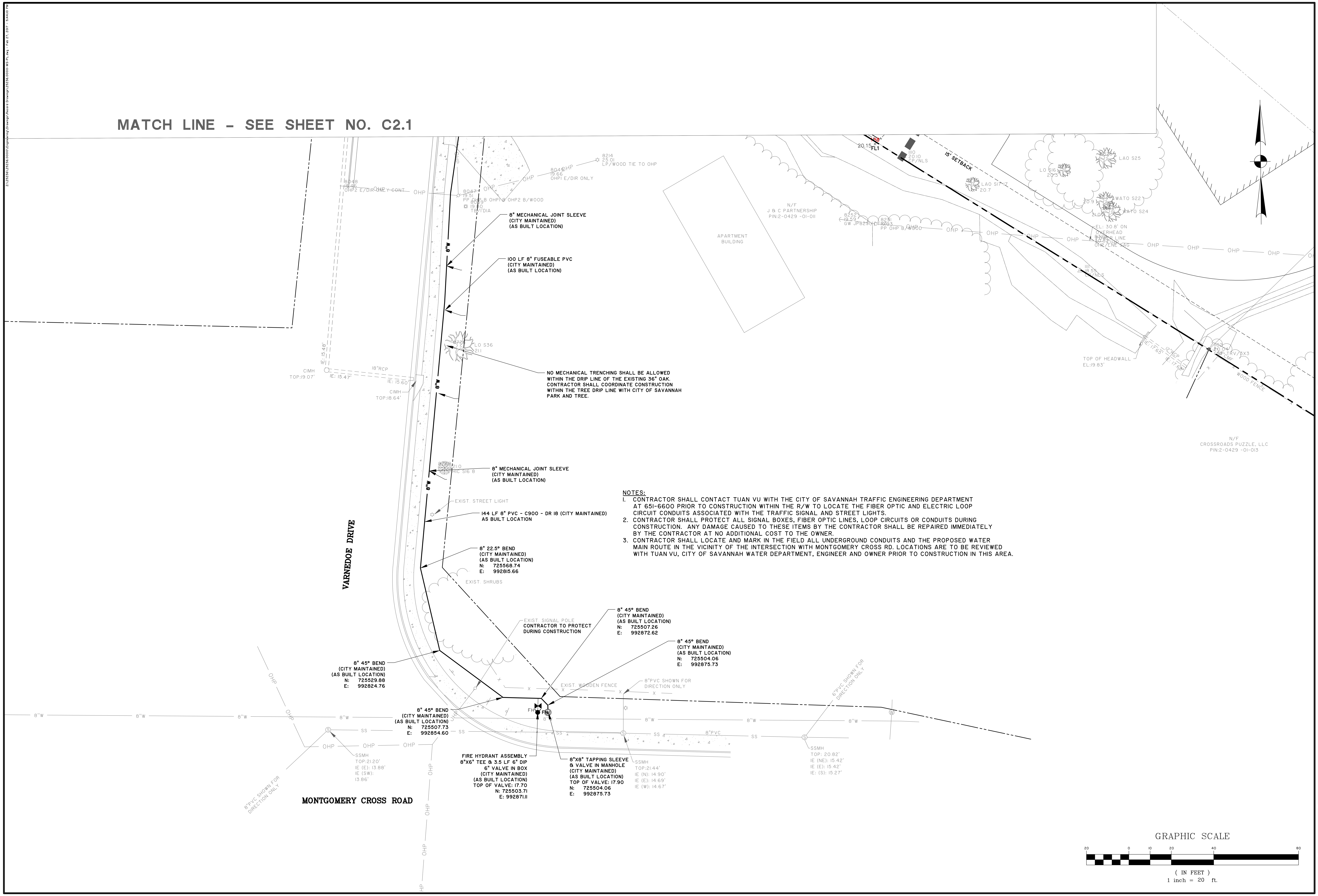
REVIEWED: EGC
APPROVED: DDK
SCALE: 1" = 20'

C2.2



NOTES:

1. CONTRACTOR SHALL CONTACT TUAN VU WITH THE CITY OF SAVANNAH TRAFFIC ENGINEERING DEPARTMENT AT 651-6600 PRIOR TO CONSTRUCTION WITHIN THE R/W TO LOCATE THE FIBER OPTIC AND ELECTRIC LOOP CIRCUIT CONDUITS ASSOCIATED WITH THE TRAFFIC SIGNAL AND STREET LIGHTS.
2. CONTRACTOR SHALL PROTECT ALL SIGNAL BOXES, FIBER OPTIC LINES, LOOP CIRCUITS OR CONDUITS DURING CONSTRUCTION. ANY DAMAGE CAUSED TO THESE ITEMS BY THE CONTRACTOR SHALL BE REPAIRED IMMEDIATELY BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
3. CONTRACTOR SHALL LOCATE AND MARK IN THE FIELD ALL UNDERGROUND CONDUITS AND THE PROPOSED WATER MAIN ROUTE IN THE VICINITY OF THE INTERSECTION WITH MONTGOMERY CROSS RD. LOCATIONS ARE TO BE REVIEWED WITH TUAN VU, CITY OF SAVANNAH WATER DEPARTMENT, ENGINEER AND OWNER PRIOR TO CONSTRUCTION IN THIS AREA.

No. 034526
JOHN VINCENT GIORDANO

NO.	REVISIONS	BY	DATE
1	RECORD DRAWING	JVG	1/6/17

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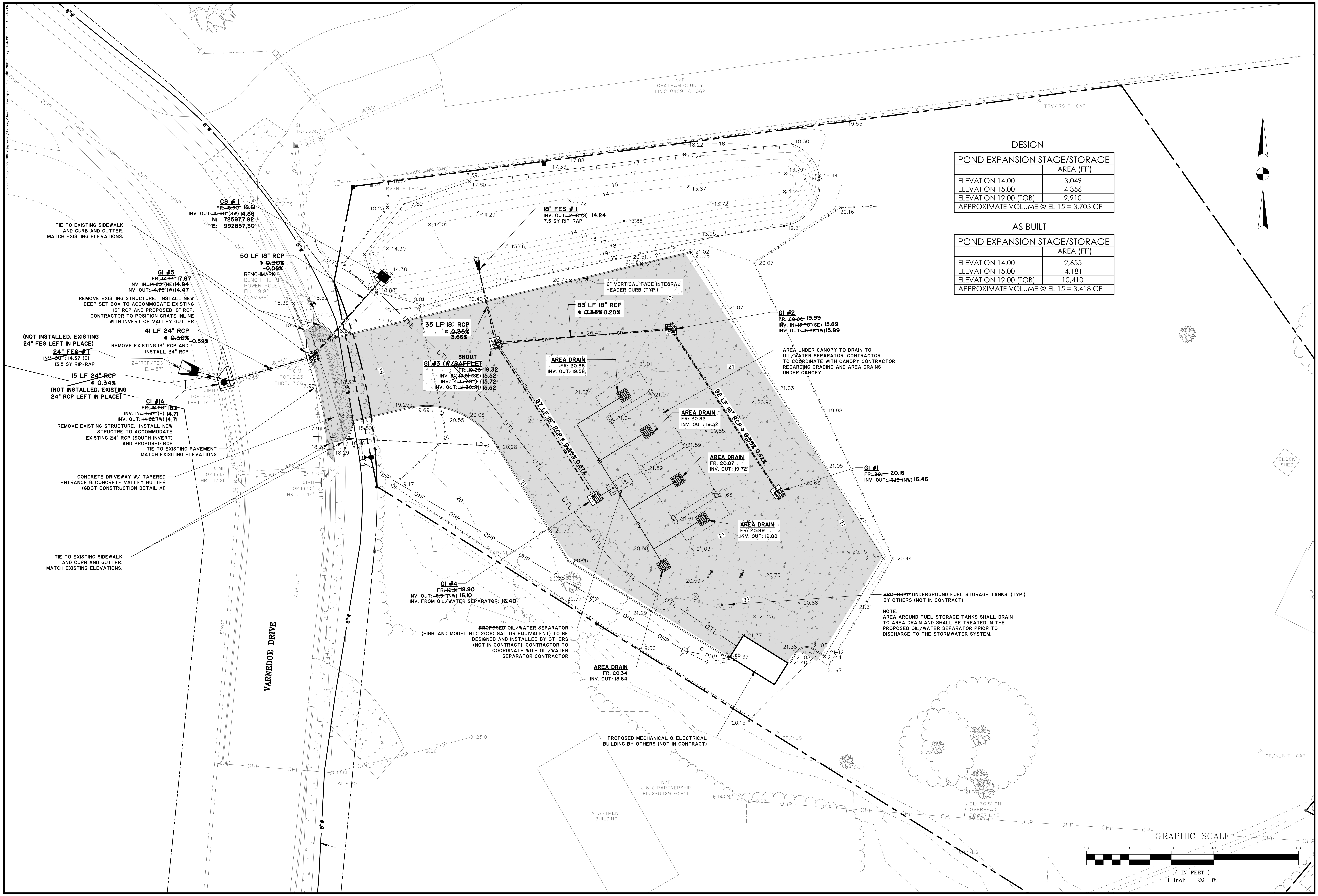
CHATHAM COUNTY FUELING STATION

WATER PLAN

JOB NO:	J- 25236
DATE:	02/02/15
DRAWN:	SCY
DESIGNED:	JVG
REVIEWED:	EGC
APPROVED:	JVG
SCALE:	1" = 20'

C2.3



DESIGN

POND EXPANSION STAGE/STORAGE	
	AREA (FT²)
ELEVATION 14.00	3,049
ELEVATION 15.00	4,356
ELEVATION 19.00 (TOB)	9,910
APPROXIMATE VOLUME @ EL 15 = 3,703 CF	

AS BUILT

POND EXPANSION STAGE/STORAGE	
	AREA (FT²)
ELEVATION 14.00	2,655
ELEVATION 15.00	4,181
ELEVATION 19.00 (TOB)	10,410
APPROXIMATE VOLUME @ EL 15 = 3,418 CF	

No. 034622
JOHN VINCENT GIORDANO

NO.	REVISIONS	BY	DATE
1	RECORD DRAWING	JVG	1/16/17

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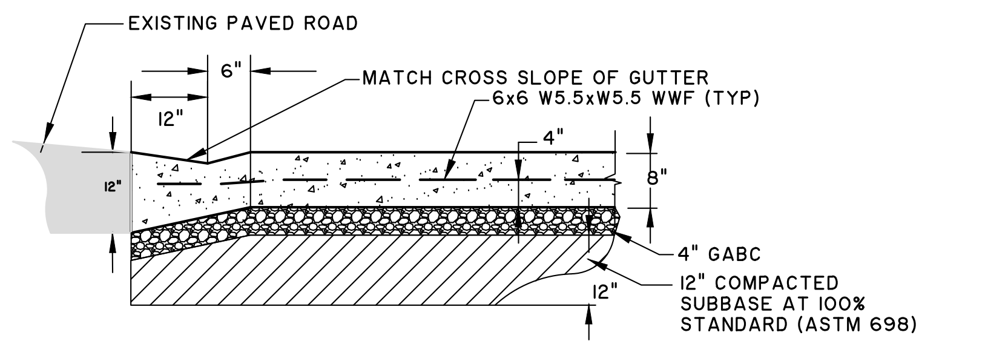
BOARD OF COMMISSIONERS
CHATHAM COUNTY , GEORGIA

CHATHAM COUNTY FUELING STATION

PAVING, GRADING AND DRAINAGE PLAN

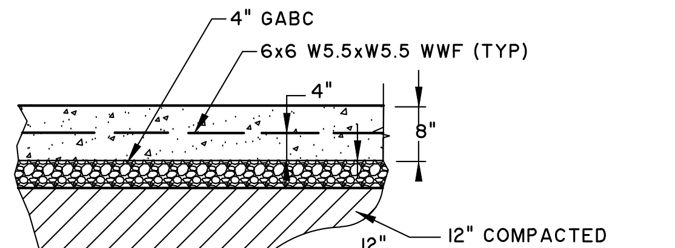
JOB NO: J- 25236
DATE: 1/16/17
DRAWN: JVG
DESIGNED: JVG
REVIEWED: EGC
APPROVED: DDK
SCALE: 1" = 20'

C3.1



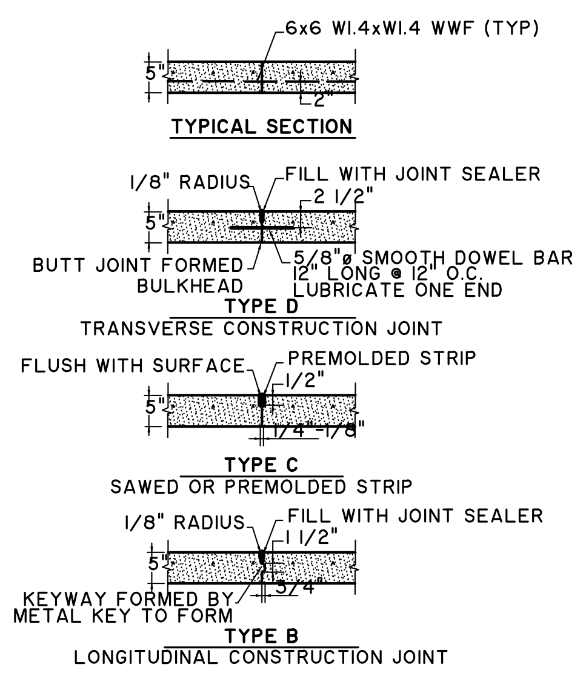
NOTE:
1. CONTRACTOR TO MAINTAIN GUTTER FLOW
2. CONCRETE TO BE 5,000 PSI.
3. AT LOCATION WHERE SIDEWALK CROSSES THE PROPOSED DRIVEWAY, A 4' PAHTWYA SHALL BE MAINTAINED AND THE CROSS SLOPE OF THE SIDEWALK PATH SHALL NOT EXCEED 2%.

REINFORCED CONCRETE PAVEMENT APRON SECTION



NOTE:
1. CONTRACTOR TO PREPARE JOINTING PLAN AND SUBMIT TO ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION OF CONCRETE PAVEMENT

REINFORCED CONCRETE PAVEMENT SECTION



1. ALL CATCH BASINS SHALL BE SEPARATED FROM THE PAVEMENT AND CURB BY BOXING OUT AROUND BASIN AS SHOWN ABOVE. EXPANSION JOINT MATERIAL SHALL PASS COMPLETELY THROUGH CURB AND SLAB. MANHOLE CASTINGS WITHIN THE PAVEMENT SHALL BE BOXED IN LIKE MANNER EXCEPT WHEN TELESCOPING TYPE CASTINGS ARE USED.

2. WHEN A JOINT FALLS WITHIN 5' OF OR CONTACTS BASINS, MANHOLES, OR OTHER STRUCTURES, SHORTEN ONE OR MORE PANELS EITHER SIDE OF OPENING TO PERMIT JOINT TO FALL ON ROUND STRUCTURES AND AT OR BETWEEN CORNERS OF RECTANGULAR STRUCTURES.

3. ALL TRANSVERSE JOINTS MUST EXTEND THROUGH CURBS AND MUST BE CONTINUOUS ACROSS PAVEMENT, EXCEPT TIED TRANSVERSE CONSTRUCTION JOINTS. EXPANSION JOINTS WILL NOT BE REQUIRED EXCEPT AT STRUCTURES OR AS SHOWN ON THE PLANS.

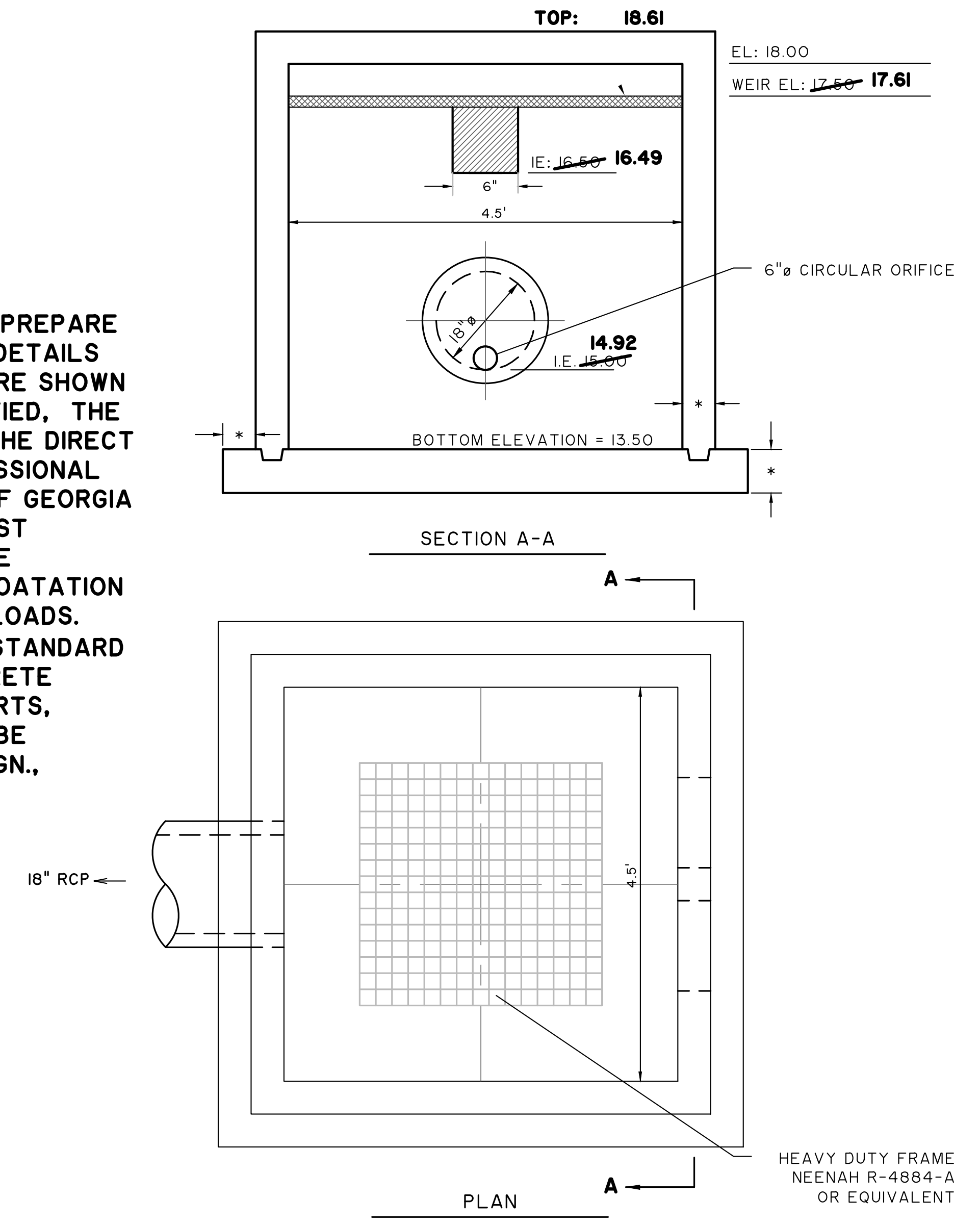
4. ALL SOFT AND YIELDING MATERIAL AND OTHER PORTIONS OF THE SUBGRADE WHICH WILL NOT COMPACT READILY WHEN ROLLED OR TAMPED SHALL BE REMOVED AS DIRECTED AND REPLACED WITH SUITABLE MATERIAL PLACED AND COMPACTED. THE SUBGRADE SHALL BE THOROUGHLY COMPACTED WITH SUITABLE EQUIPMENT SO AS TO HAVE UNIFORM DENSITY AT MOISTURE CONTENTS OF NOT LESS THAN STANDARD OPTIMUM (AASHTO T98). ALL SEWER TRENCHES AND STRUCTURE EXCAVATIONS SHALL BE BACKFILLED TO NATURAL OR FINISHED GRADE AS SOON AS CONDITIONS PERMIT. ALL BACKFILL SHALL BE COMPACTED WITH MECHANICAL TAMPERS IN LAYERS OF NOT OVER 8" LOOSE MATERIAL. IN ORDER TO PREVENT DIFFERENTIAL HEAVE, THE BACKFILL MATERIAL SHALL BE THE SAME MATERIAL AS THE SUBGRADE ADJACENT TO THE TRENCH.

5. THE MINIMUM CEMENT CONTENT SHALL NOT BE LESS THAN 6.0 SACKS (94 lb. PER SACK) PER CU. YD. OF CONCRETE. THE MAXIMUM SIZE AGGREGATE SHALL NOT EXCEED 1/4 OF THE SLAB THICKNESS. THE MAXIMUM SLUMP SHALL NOT EXCEED 3". ALL CONCRETE SHALL BE AIR ENTRAINED IN ACCORDANCE WITH THE FOLLOWING TABLE:

MAX. SIZE OF COARSE AGGREGATE, INCHES	AIR CONTENT, PER CENT BY VOLUME
1-1/2 , 2	5 ± 1
3/4 , 1	6 ± 1
3/8 , 1/2	7-1/2 ± 1

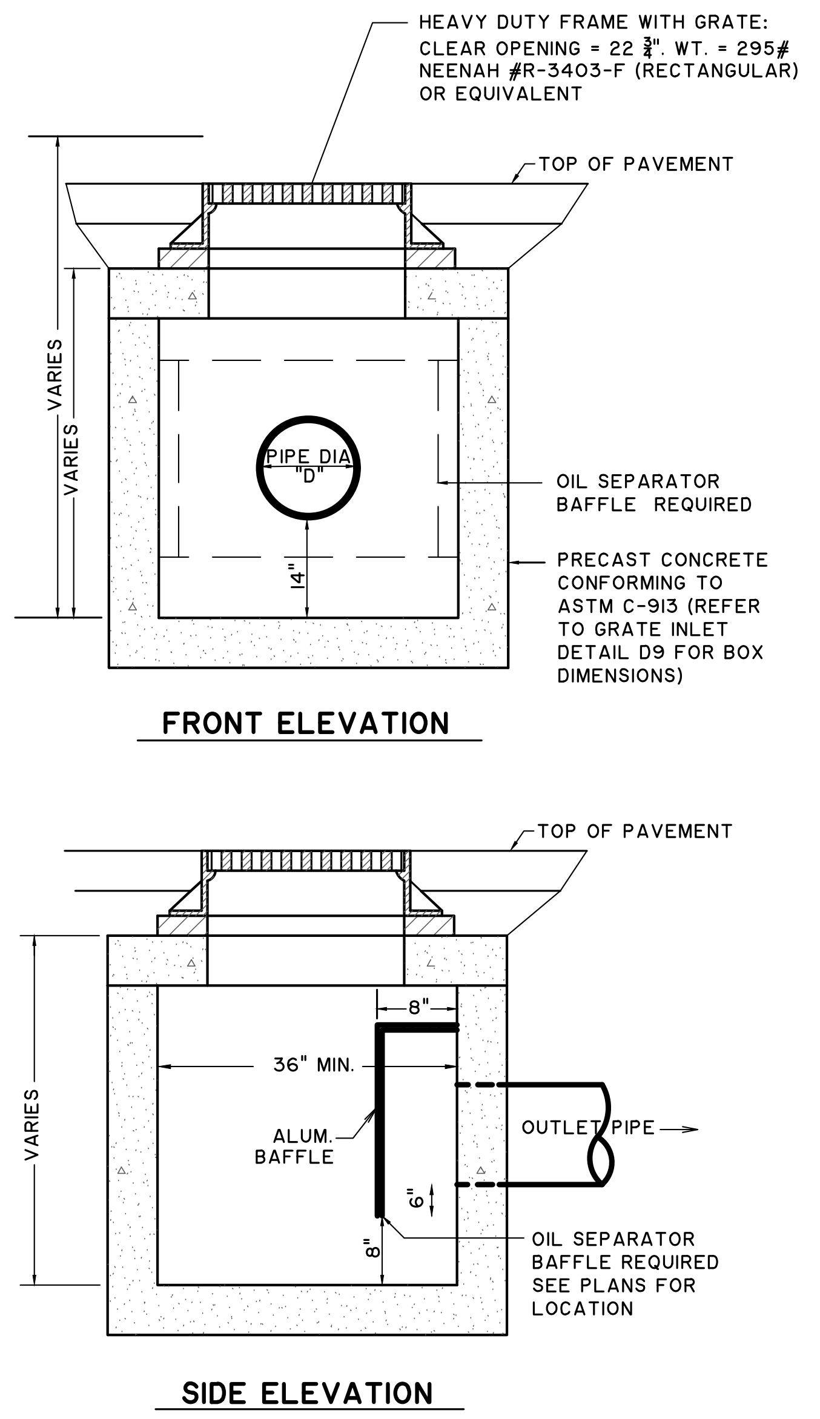
CONCRETE PAVEMENT NOTES AND DETAILS

*** THE PRECAST MANUFACTURER IS TO PREPARE AND SUBMIT TO THE ENGINEER DESIGN DETAILS AND CALCULATIONS FOR THE STRUCTURE SHOWN BASED ON THE DESIGN CRITERIA SPECIFIED, THE DESIGN SHALL BE PERFORMED UNDER THE DIRECT SUPERVISION AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF GEORGIA EXPERIENCED IN THE DESIGN OF PRECAST CONCRETE. THE DESIGN SHALL INCLUDE PROVISIONS FOR HANDLING STRESS, FLOATATION CONSIDERATIONS, AND CONSTRUCTION LOADS. REPRODUCED COPIES OF ASTM C1433 "STANDARD SPECIFICATION FOR REINFORCED CONCRETE MONOLITHIC BOX SECTIONS FOR CULVERTS, STORM DRAINS AND SEWERS WILL NOT BE ACCEPTED AS A SUBSTITUTE FOR DESIGN.,**



CONTROL STRUCTURE #1

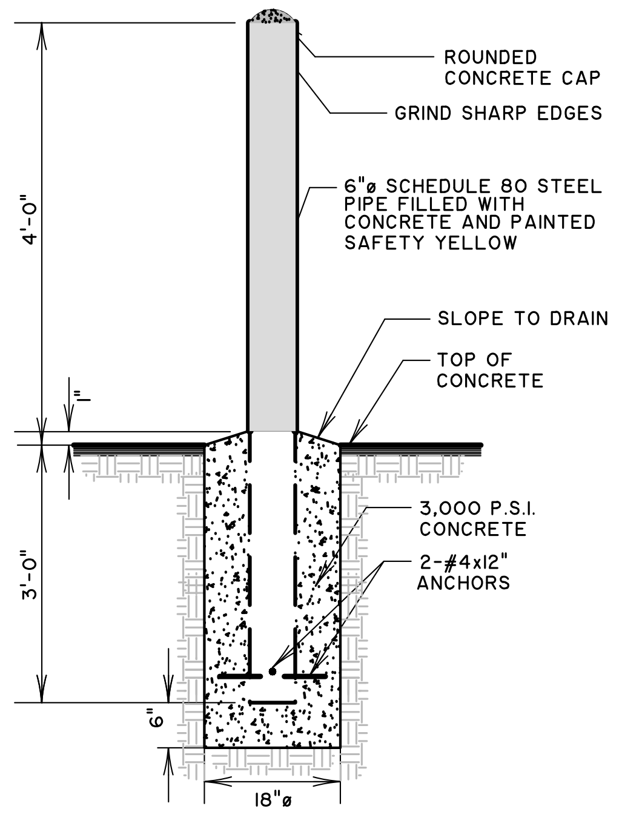
NOT TO SCALE



NOTE: OIL/WATER SEPARATOR BAFFLE TO BE INSTALLED ON GRATE INLET #3

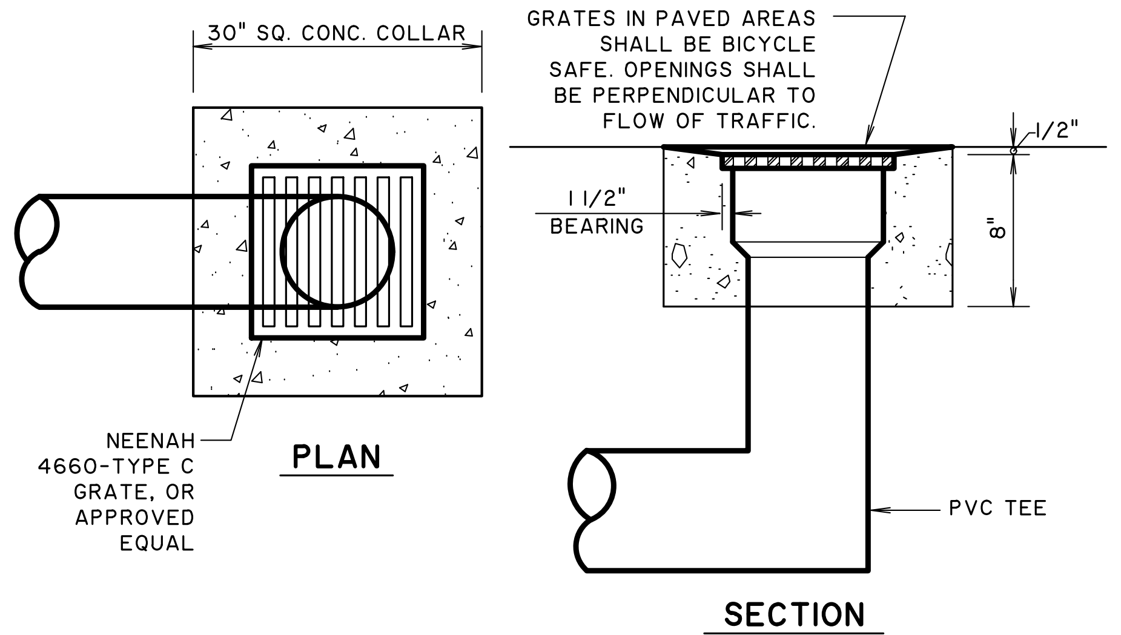
STANDARD GRATE INLET DETAIL WITH OIL/WATER SEPARATOR BAFFLE

NOT TO SCALE



STEEL BOLLARD DETAIL

NOT TO SCALE



AREA DRAIN INLET

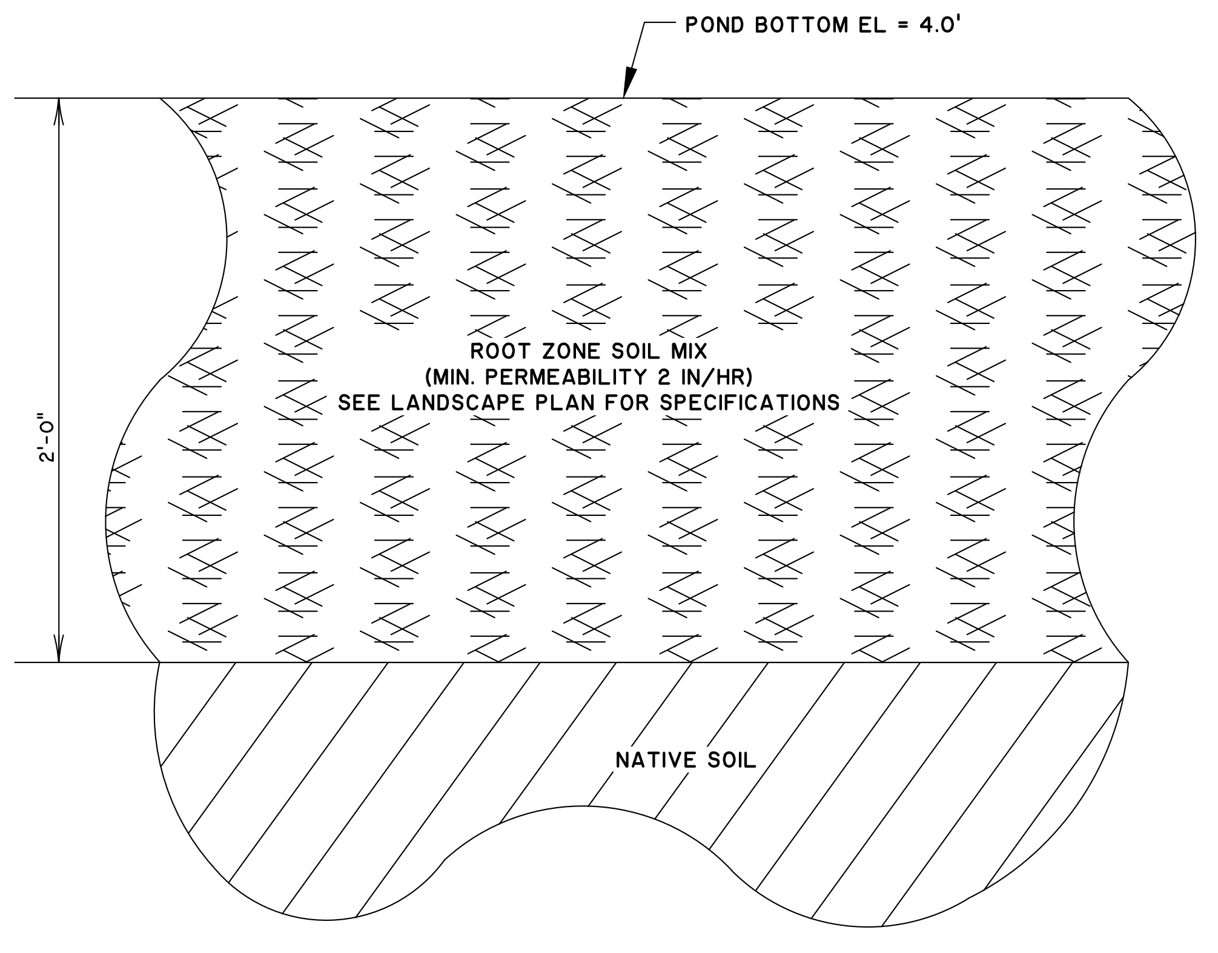
NOT TO SCALE

GEORGIA DEPT. OF TRANSPORTATION (GDOT) CONSTRUCTION STANDARDS & DETAILS

CONSTRUCTION DETAILS:
- GDOT DETAIL A-1, DRIVEWAY WITH TAPERED ENTRANCES CONCRETE VALLEY GUTTERS, LAST REVISED JULY 2011
- GDOT DETAIL T-1, DETAILS OF SIGN PLATES, LAST REVISED JANUARY 2000
- GDOT DETAIL T-3A, TYPE 7, 8, AND 9 SQUARE TUBE POST INSTALLATION DETAIL, LAST REVISED JULY 2002

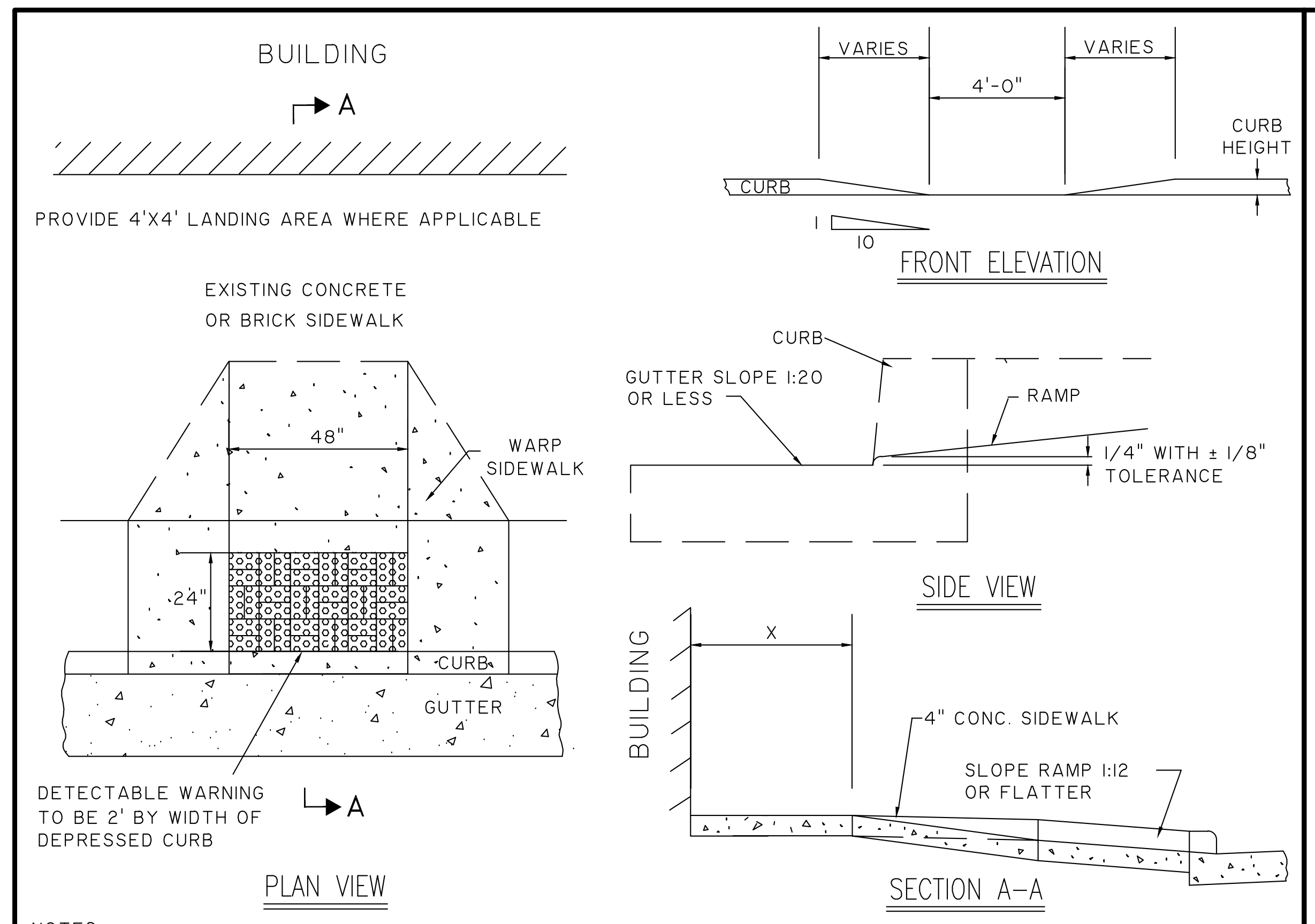
NOTE:

1. CONTRACTOR RESPONSIBLE FOR ACCESSING AND REVIEWING GDOT CONSTRUCTION STANDARDS AND DETAILS.



DRY DETENTION POND BOTTOM DETAIL

NOT TO SCALE



NOTES:

1. HANDICAP RAMP CONSTRUCTION SHALL CONFORM TO ALL FEDERAL, STATE AND CITY OF SAVANNAH CODES AND SPECIFICATIONS.

2. SURFACES SHALL MEET THE GUIDELINES OF THE ADA STANDARDS FOR ACCESSIBILITY, APPENDIX A, PART 36.

3. WHERE SIDEWALK IS FLUSH WITH BACK OF CURB, DELETE ADDITIONAL 4' CONCRETE SIDEWALK AND TRANSITION THE CURB AND SIDEWALK SUCH THAT THE MAXIMUM SLOPE OF THE RAMP AND TRANSITION SIDEWALK IS 1:12.

4. THE FLARED SIDES MUST HAVE A 1:10 SLOPE. IF THE DISTANCE X IS LESS THAN 48", THEN THE SLOPE OF THE FLARED SIDES SHALL NOT EXCEED 1:12.

5. THE SLOPE OF THE GUTTER MUST NOT EXCEED 1:20 ADJACENT TO THE RAMP.

6. DETECTABLE WARNING SHALL CONSIST OF RAISED TRUNCATED DOMES WITH A DIAMETER OF NOMINAL 0.9 INCHES, A HEIGHT OF NOMINAL 0.2 INCHES AND A CENTER TO CENTER SPACING OF NOMINAL 2.35 INCHES AND SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES. IF THE SIDEWALK AND RAMP ARE CONSTRUCTED OF CONCRETE, THE WARNING AREA SHALL BE RED BRICK IN COLOR. IF THE SIDEWALK AND RAMP ARE CONSTRUCTED OF RED BRICK, THE WARNING AREA SHALL BE GRAY IN COLOR. THE COLOR USED TO PROVIDE CONTRAST SHALL BE AN INTEGRAL PART OF THE WALKING SURFACE.

7. BRICK PAVERS SHALL BE SET IN A WET MORTAR BED. THE BED SHALL BE PLACED ON CONCRETE. THE CONCRETE SHALL BE A MINIMUM OF FOUR INCHES THICK.

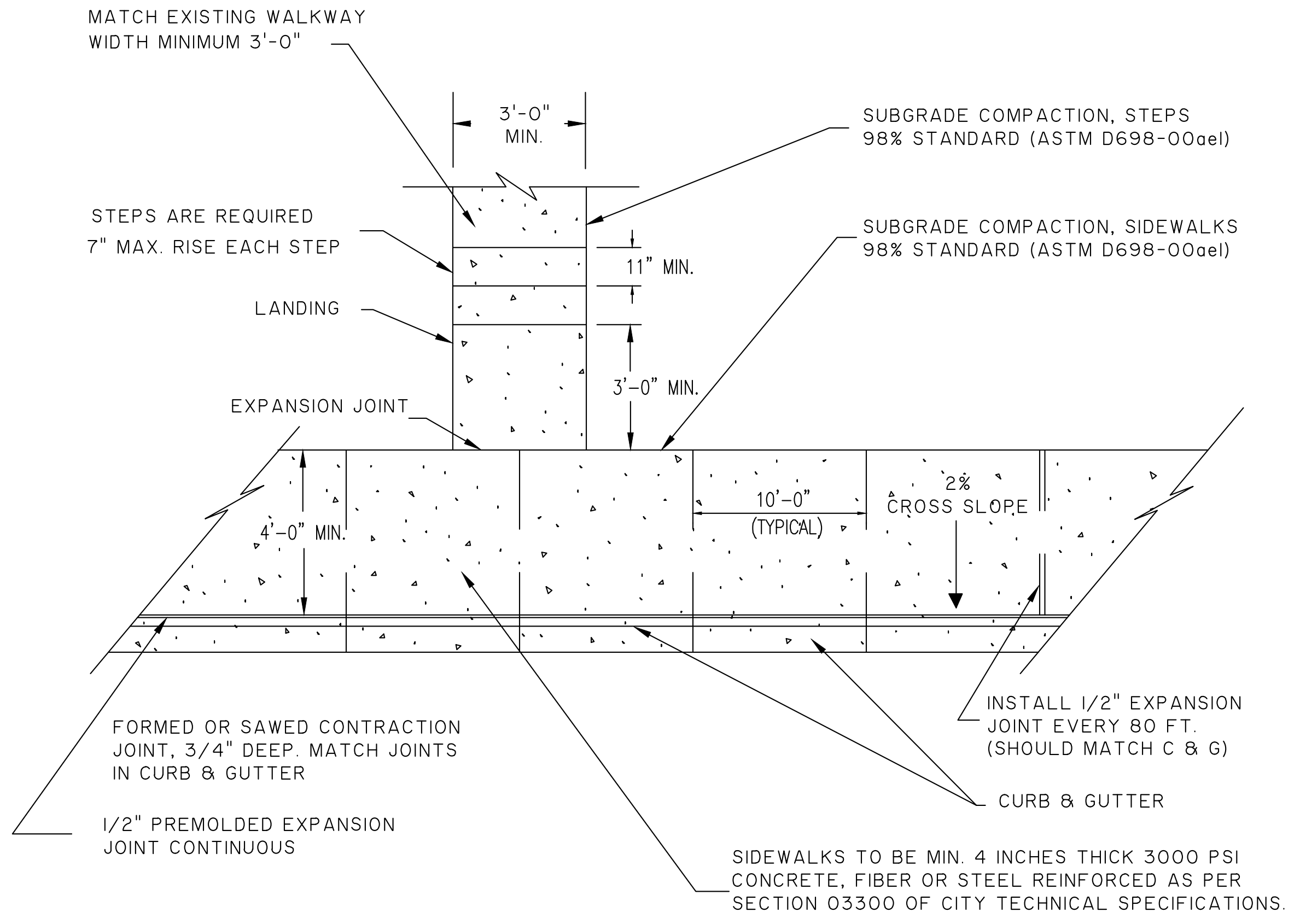
STANDARD CONSTRUCTION DETAILS

CITY OF Savannah

HANDICAP RAMP

PLATE NUMBER: P06

APPROVED: SIGNATURE ON FILE
CITY ENGINEER
SCALE: N.T.S.
DATED: JANUARY 2009



NOTES:
1. ALL CONSTRUCTION SHALL CONFORM TO THE CITY OF SAVANNAH DEVELOPMENT GUIDELINES AND TECHNICAL SPECIFICATIONS INCLUDING, BUT NOT LIMITED TO, SECTION 02200 - EARTHWORK AND SECTION 03300 - CAST-IN-PLACE CONCRETE.

2. CONTRACTION JOINTS SHOULD BE FORMED OR SAWED COINCIDENT WITH THE 10' JOINTS IN THE CURB.

3. ALL NEW CONCRETE IN THE HISTORIC DISTRICT AND AS OTHERWISE SPECIFIED BY THE STREET MAINTENANCE DIRECTOR MUST BE TINTED. THE TINT SHALL BE LAMBERT CORPORATION SAVANNAH BROWN' #4658 OR EQUAL TO BE SUPPLIED BY THE CONTRACTOR.

4. ADA COMPLIANT WHEELCHAIR RAMPS SHALL BE INSTALLED AT EACH INTERSECTION OR DESIGNATED CROSSWALK LOCATION AND MUST MEET THE MOST CURRENT ADA STANDARDS AND CITY OF SAVANNAH SPECIFICATIONS AT THE TIME OF CONSTRUCTION.

STANDARD CONSTRUCTION DETAILS

CITY OF Savannah

SIDEWALK AND WALKWAY DETAILS

PLATE NUMBER: P03

APPROVED: SIGNATURE ON FILE
CITY ENGINEER
SCALE: N.T.S.
DATE: FEBRUARY 2009

No. 034622
JOHN VINCENT GIORDANO

NO.	REVISIONS	BY	DATE
1	RECORD DRAWING	JVG	1/16/17

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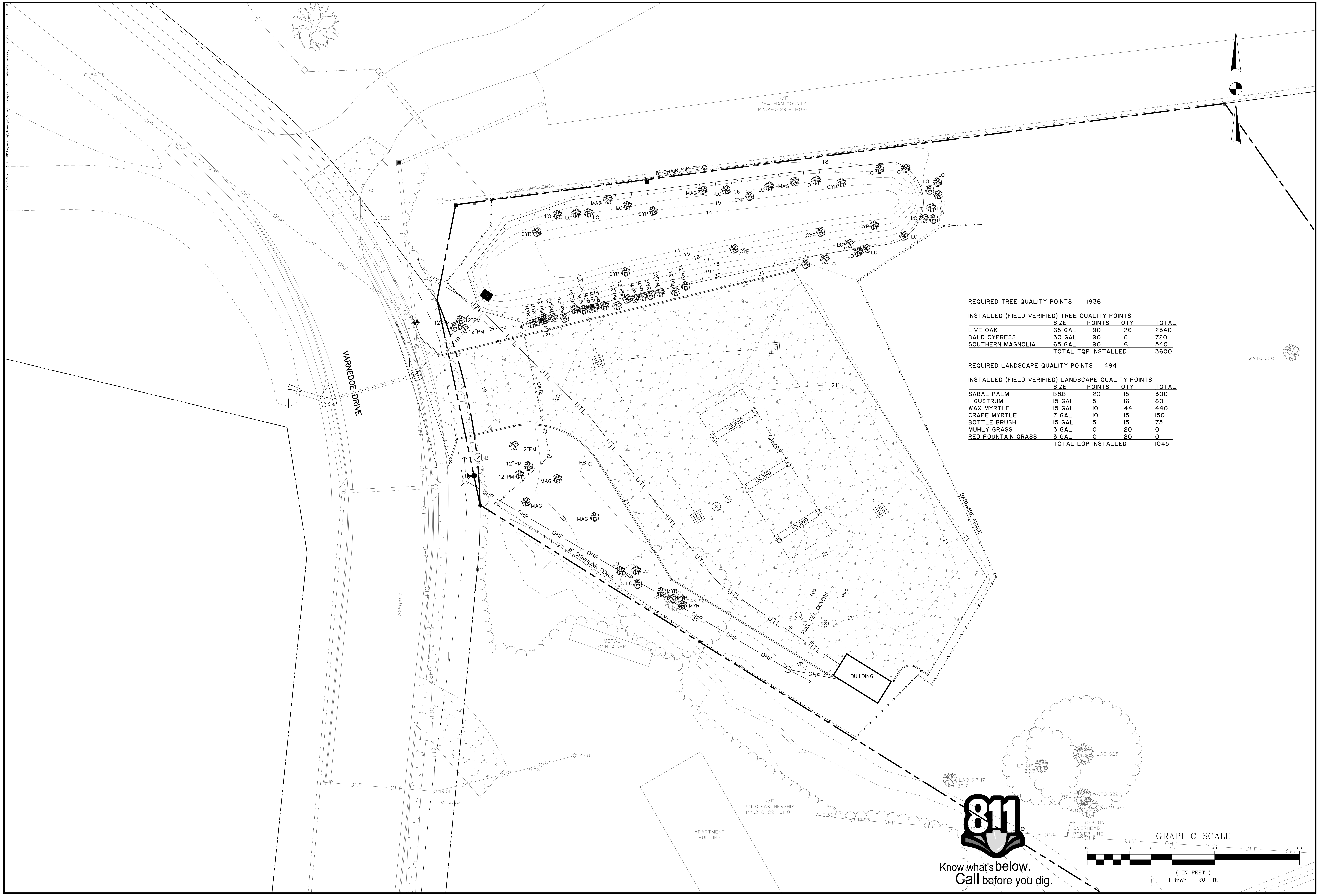
CHATHAM COUNTY
BOARD OF COMMISSIONERS
CHATHAM COUNTY , GEORGIA

CHATHAM COUNTY FUELING STATION

PAVING, GRADING AND DRAINAGE DETAILS

JOB NO: J- 25236
DATE: 02/02/15
DRAWN: SCY
DESIGNED: JVG
REVIEWED: EGC
APPROVED: JVG
SCALE: 1" = 1'

C3.4



811

Know what's below.
Call before you dig.

REQUIRED TREE QUALITY POINTS 1936

INSTALLED (FIELD VERIFIED) TREE QUALITY POINTS

	SIZE	POINTS	QTY	TOTAL
LIVE OAK	65 GAL	90	26	2340
BALD CYPRESS	30 GAL	90	8	720
SOUTHERN MAGNOLIA	65 GAL	90	6	540
	TOTAL TQP INSTALLED			3600

REQUIRED LANDSCAPE QUALITY POINTS 484

INSTALLED (FIELD VERIFIED) LANDSCAPE QUALITY POINTS

	SIZE	POINTS	QTY	TOTAL
SABAL PALM	B&B	20	15	300
LIGUSTRUM	15 GAL	5	16	80
WAX MYRTLE	15 GAL	10	44	440
CRAPE MYRTLE	7 GAL	10	15	150
BOTTLE BRUSH	15 GAL	5	15	75
MUHLY GRASS	3 GAL	0	20	0
RED FOUNTAIN GRASS	3 GAL	0	20	0
	TOTAL LQP INSTALLED			1045

No. 00854
JOHN LAWRENCE GARCEAU

NO.	REVISIONS	BY	DATE
1	RECORD DRAWING	JVG	1/16/17

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CHATHAM COUNTY BOARD OF COMMISSIONERS
CHATHAM COUNTY , GEORGIA

CHATHAM COUNTY FUELING STATION

LANDSCAPE PLANS

JOB NO:	J- 25236
DATE:	02/02/15
DRAWN:	SCY
DESIGNED:	JVG
REVIEWED:	EGC
APPROVED:	JVG
SCALE:	1" = 20'

LS1.1