

**GEOTECHNICAL INVESTIGATION  
PROPOSED SUBDIVISION  
1511 S. MUNSON ROAD  
ROYSE CITY, TEXAS**

**SEG REPORT NO. 121-1122**

**REPORT TO:**

**MR. GEORGE RODDY  
RODDY REAL ESTATE INVESTMENT  
1415 LEGACY DR, SUITE 350  
FRISCO, TX 75034**

**JANUARY 2022**



January 25, 2022

Mr. George Roddy  
Roddy Real Estate Investment  
1415 Legacy Dr, Suite 350  
Frisco, Tx 75034

Via Email: [george@rosohomes.com](mailto:george@rosohomes.com)

**RE: GEOTECHNICAL INVESTIGATION**

Proposed Subdivision  
1511 S. Munson Road  
Royse City, Texas  
SEG Project No. 121-1122

Dear Mr. Roddy:

We have completed a geotechnical Investigation for the referenced site. This study contains the results of our findings, an engineering interpretation of these with respect to the available project characteristics, and recommendations to aid in design of the pavement section and other earth connected phases of this project.

We appreciate the opportunity to provide these services. If you have questions regarding this report, please call.

Very truly yours,

**Syntec Engineering Group, Inc.**



Ralph B. Mansour, P.E.

1/25/2022

Principal Engineer

RBM/CM

Copies Submitted: -

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PROPOSED SUBDIVISION  
1511 S. MUNSON ROAD  
ROYSE CITY, TEXAS  
SEG PROJECT NO. 121-1122**

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## **1.0 INTRODUCTION**

Syntec Engineering Group, Inc. (SEG) completed a geotechnical investigation for the proposed subdivision to be located at 1511 S. Munson Road in Royse City, Texas. The purpose of this study was to determine the general subsurface conditions at the site by drilling test borings and evaluating the borings with respect to foundation concept and design. Also included is an evaluation of the site with respect to potential construction problems and recommendations dealing with the earthwork quality control testing during construction.

## **2.0 PROJECT CHARACTERISTICS**

The site consists of approximately 30-acre of undeveloped land located at 1511 S. Munson Road in Royse City, Texas. It is our understanding that the proposed development will consist of constructing fifteen (15), one or two story, wood-framed, single-family residences supported by stiffened slab-on-grade foundation systems. Structural information is not available at this time, but the structural loads are expected to be light (on the order of 1 to 2 kips per linear foot for exterior and interior wall loads). We anticipate minor cuts and fills will be required to establish the building pads of the proposed residences. The pavement is assumed to be reinforced concrete.

## **3.0 SUBSURFACE EXPLORATION**

The subsurface conditions of the proposed residential subdivision were evaluated by advancing a total of 15 sample borings (i.e. one boring in each residential lot.)

The borings were drilled between January 4<sup>th</sup> and January 5<sup>th</sup>, 2022 at the approximate locations shown on Figure 1 in the Appendix of this report. The results of the field exploration program are presented on the Boring Logs (Figures 2 through 16) in the Appendix. A Soil

Classification Chart containing the keys to symbols and the description of terms used on the boring logs are presented on Figure 17.

Undisturbed cohesive soil samples were obtained using a 3-inch diameter thin-walled tube sampler pushed into the soil. The undrained compressive strength of cohesive soils was estimated in the field using a calibrated pocket penetrometer. All soil samples were extruded from the samplers in the field, visually classified, and placed in appropriate containers to prevent loss of moisture or disturbance during transfer to the laboratory.

Samples will be retained for 30 days from the date of this report, after which time they will be discarded unless client requests otherwise.

#### **4.0 LABORATORY ANALYSIS**

The laboratory-testing program was directed toward the determination of the physical and engineering classification and evaluation of the physical conditions of the soils encountered. The soil samples were inspected by a geotechnical engineer and classified in accordance with the Unified Soil Classification System (ASTM D 2487-93), and the boring logs were edited as necessary. Natural moisture content tests (ASTM D-2216), and Atterberg Limit tests (ASTM D-4318) were performed on selected samples to aid in classifying the subsurface materials and to determine the material's engineering characteristics.

Selected samples of the near-surface cohesive soils were subjected to Free Swell tests. In the Free Swell test, a sample is placed in a consolidometer and subjected to the estimated overburden pressure. The sample is then inundated with water and allowed to swell. Moisture contents are determined both before and after completion of the test. Test results are recorded as the percent swell, with initial and final moisture content. The Free Swell test results are shown on Figure 18.

The tests were performed in general accordance with applicable ASTM procedures. The

results are presented on the individual boring logs.

## 5.0 SITE AND SUBSURFACE CONDITIONS

### 5.1 Subsurface Conditions

Details concerning the subsurface materials and conditions encountered are shown on the boring log. The stratification lines shown on the boring log represent **approximate** locations of changes between soil types; in-situ, the transition between materials may be gradual. Generally, subsurface materials within the 20-ft maximum depths explored can be summarized in the following table:

**TABLE -1 SOIL STRATIFICATIONS**

| Stratum                                                                                                                     | Description                                                                   | First Encountered (ft) | Bottom of Stratum (ft) |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------|------------------------|
| I                                                                                                                           | CLAY (CH), dark brown to brown, stiff to hard, with calcareous nodules, silty | 0                      | 3-10                   |
| II                                                                                                                          | CLAY (CH), light brown to tannish brown and gray, very stiff to hard, sandy   | 3-6                    | 14 <sup>1</sup>        |
| III                                                                                                                         | SHALEY CLAY (CH), tan and light gray, silty, becomes blocky with depth        | 3-10                   | 20 <sup>2</sup>        |
| 1. Encountered only at the locations of Borings B-2 and B-15.<br>2. Remained to the 20- ft completion depth of all Borings. |                                                                               |                        |                        |

### 5.3 Groundwater Observations

All borings were advanced using continuous flight auger drilling and intermittent sampling techniques in order to observe groundwater seepage levels. At the time of the drilling operations, groundwater seepage was not encountered in any of the test borings advanced.

Future construction activities may alter the surface and subsurface drainage characteristics of this site. It is not uncommon to encounter perched groundwater seepage within the cracks and fissures in the upper clay and shaley clay stratum. If there is a noticeable change from the conditions reported herein, this office should be notified immediately to review the effect it may have on the design recommendations. It is not possible to accurately predict the

magnitude of subsurface water fluctuations that might occur based upon short-term observations.

## 6.0 DESIGN RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered. **If there are any changes in the project criteria, such as the amount of cutting and filling, a review should be made by the geotechnical engineer to evaluate if any further field exploration and/or modifications in our recommendations contained herein will be required.** The geotechnical engineer should be retained to review final project plans and specifications for compliance with the recommendations of this study.

### 6.1 General Considerations

The near-surface clays are considered highly expansive and are capable of significant vertical and horizontal ground movements due to soil swell and shrinkage which occurs with changes in soil moisture content. The magnitude of the movements experienced by the foundation will depend on the moisture content and the thickness of clays at the time of construction, soil plasticity, rainfall moisture index, the local drainage characteristics, and other related factors.

Potential Vertical Movement estimates of the ground surface beneath covered areas constructed at or near existing grade were developed using TxDOT Method 124-E and our experience with similar sites. TxDOT Method 124-E is an empirical procedure based on the moisture contents, plasticity characteristics, and thickness of the expansive clays and it was assumed that the soils would be in a **dry state** at the time of construction. For slabs constructed near the existing grades over the expansive clays, Potential Vertical Rise (PVR) of 5 to 6 inches is estimated at the boring locations.

The most viable foundation system to support lightly loaded structures on expansive clay soils would be a pier and beam foundation system. However, it is our understanding that it is desired to support the residence foundation on slab-on-grade foundation system. Recommendations for slab-on-grade foundation system will be provided in the following paragraphs.

## **6.2 Site Preparation for Residence Pads**

In order to limit the soils PVR to acceptable levels (4 to 4-1/2 inches), SEG recommends the following subgrade improvements:

1. Clear the site of existing vegetation.
2. Excavate the building area to a depth of 6 feet below the desired pad elevations. The excavation should extend 5 feet beyond building lines or 6 inches beyond entry slab and adjacent sidewalks. The exposed subgrade should be sloped to the edges and corners of the excavation to provide a positive gravity flow of groundwater seepage, if encountered. The excavated materials should be stockpiled on site for later re-use in the excavation and elsewhere.
3. The exposed bottom of the excavations should be proofrolled to expose any weak, soft, wet, or otherwise unsuitable soils. Proofrolling should be performed as described in Section 8.0 of this report.
4. Scarify, rework, and re-compact the upper 6 inches of the exposed subgrade of the entire building lot areas. (The scarified soils should be recompact to 95 percent of the maximum density as determined by ASTM D 698 between +2 and +5 percentage points above its optimum moisture content).
5. Fill in the building pad up to 4.5 feet with on-site clay materials placed under controlled conditions. On-site clay soils with PI's above 25 should be placed between 92 to 98 percent of the maximum dry density at a moisture contents ranging from +3 to +7 percent of the optimum moisture content.
6. Place a moisture barrier consisting of a minimum of 10-mil plastic sheeting to cover the moisture conditioned subgrade. Moisture-conditioned soils should be maintained in a moist condition prior to placement of the plastic sheeting. Note that the moisture barrier provisions could be deleted if the foundation construction will proceed immediately after the subgrade improvements.

7. Place a minimum of 12 to 18 inches of soils above the moisture barrier.
8. Fill up the remaining 1.5 feet using on site fill materials as specified above.
9. Additional fill, if required, should consist of select fill soils. Specifications and placement guidelines of the select fill soils are discussed in detail in Section 8.0 of this report. Select fill should be placed above the compacted subgrade.

All work should be performed in accordance with the **Earthwork Guidelines** section of this report. Care must be taken to prevent landscape watering, surface drainage or other sources of water from entering the compacted clay or the select fill. The upper 8 inches of fill in all landscaped (non-paved) areas should consist of compacted clay.

### **6.3 Slab-On-Grade Foundation Systems**

Stiffened integral slab and grade beams (waffle type) foundation system may support the structural loads imposed by the lightly loaded residence. The slab may be post-tensioned or conventionally reinforced and should be designed by a structural engineer to withstand the estimated vertical soil movements that could be expected at the project site. Grade beams founded in native soils or on compacted fill may be designed using an allowable soil bearing pressure of 1,600 pounds per square foot. We recommend a minimum depth of 1.5 feet and a minimum width of 10 inches for the beams to provide a margin of safety against a local or punching shear failure of the foundation soils. Also, a moisture barrier of polyethylene sheeting or similar material should be placed between the slab and the subgrade soils to retard moisture migration through the slab.

The following parameters for post-tensioned slab-on-grade foundation systems may be used at the site provided that subgrade improvements as outlined above are implemented.

| <b>POST-TENSION PARAMETERS</b><br><b>MOISTURE CONDITIONS SUBGRADE</b><br><b>(Post-Tensioning Institute Third Edition with 2008 Supplement Design )</b> |                     |                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------|
| Minimum Grade Beam Depth:                                                                                                                              | 24 Inches           | Edge Moisture Variation Distance:<br>Center Lift: 8.3 ft.<br>Edge Lift: 4.7 ft.                   |
| Minimum Grade Beam Width:                                                                                                                              | 10 Inches           |                                                                                                   |
| Plasticity Index (PI)                                                                                                                                  | 0-12' PI : 49       | Differential Swell/shrinkage<br>Swell: 2.3 inches<br>Shrink: 1.9 inches                           |
| Depth to Constant Soil Suction:                                                                                                                        | Approximately 12-ft |                                                                                                   |
| Principal Clay Mineral:                                                                                                                                | Montmorillonite     | Allowable bearing capacity at the bottom of the grade beam: 1,600 psf                             |
| Constant Suction Value:                                                                                                                                | pF = 3.2            |                                                                                                   |
| Thornthwaite Moisture Index:                                                                                                                           | 0 TO -10            | 3) Slab subgrade coefficient<br>Slab-on-sand bedding: 1.0<br>Slab-on-polyethylene over sand: 0.75 |
| Estimated Moisture Velocity:                                                                                                                           | 0.7 in/month        |                                                                                                   |

The Post-Tensioning Institute (PTI) method incorporates numerous design assumptions associated with the derivation of required variables needed to determine the soil design criteria. The PTI method of predicting differential soil movement is

applicable only when site moisture conditions are controlled by the climate alone on well-graded pads (i.e. no improper drainage, water leaks or free water sources). Under these conditions, moisture increases within the supporting soils and the resulting differential foundation movements are much lower than upward movements that can occur due to post-construction movements caused by free water sources near or beneath the house pad. The performance of a slab foundation can be significantly influenced by yard maintenance, recessed landscaping additions near the foundation, water line leaks and any other free water sources, and deep-rooted trees and shrubs.

## **6.5 Site Grading and Drainage**

All grading should provide positive drainage away from the proposed residences and should prevent water from collecting or discharging near the foundations. Water must not be permitted to pond adjacent to the structures during or after construction.

Surface drainage gradients should be designed to divert surface water away from the residences and edges of sidewalks and towards suitable collection and discharge facilities. Unpaved areas and permeable surfaces should be provided with steeper gradients than paved areas. Sidewalk drainage gradients within 5 feet of residences should be constructed with a minimum slope of one inch per foot to prevent negative drainage gradients (ponding water conditions) from developing due to differential upward pavement movements. Sidewalk drainage gradients should be along maximum slopes allowed by local codes.

Roofs should be provided with gutters and downspouts to prevent the discharge of rainwater directly onto the ground adjacent to the residence foundations. Downspouts should not discharge into any landscaped bed near the foundations. Downspouts should discharge directly into storm drains or drainage swales, if possible. Roof downspouts and surface drain outlets should discharge into erosion-resistant areas, such as paving or rock riprap. Recessed landscaped areas

filled with pervious sandy loam or organic soil should not be used near the foundation. Landscaped beds should be elevated above a compacted and well-graded clay surface. Sealed planters are preferred. All trees should be a minimum of one-half their mature height away from the residence or pavement edges to reduce potential moisture losses. Water permitted to pond in planters, open areas, or areas with unsealed joints next to structures can result in on-grade slab or pavement movements, which exceed those, indicated in this report.

Exterior sidewalks and pavements will be subject to some post construction movement as indicated in this report. These potential movements should be considered during preparation of the grading plan. Flat grades should be avoided. Where concrete pavement is used, joints should be sealed to prevent the infiltration of water. Some post-construction movement of pavement and flatwork may occur. Particular attention should be given to joints around the residence. These joints should be periodically inspected and resealed where necessary.

## **7.0 PAVEMENT RECOMMENDATIONS**

Specific wheel loading and traffic volume characteristics have not been provided to us, but we assume that passenger vehicles traffic will be predominant in the parking areas and some relatively heavy truck traffic will occur in drive areas. We have developed Portland cement pavement designs for light traffic and heavy traffic areas.

For heavy traffic areas, we have assumed 5 equivalent 18-kip axle loadings per day for a design period of 15 years. For light traffic areas, we have assumed 1 equivalent 18-kip axle loadings per day for a design period of 15 years.

## Concrete Pavement

The following concrete pavement sections are recommended for this site:

|                          |  | Thickness<br>(inches) |
|--------------------------|--|-----------------------|
| <b>Light Traffic</b>     |  |                       |
| Portland Cement Concrete |  | 6.0                   |
| Lime Treated Subgrade    |  | 6.0                   |

The subgrade soils should be lime stabilized to a depth of six inches and compacted to a minimum of 95 percent of the maximum Standard Proctor dry density (ASTM D 698) at moisture content within 2 percentage points of optimum. We recommend that the subgrade soils be stabilized with 7 % lime (32 pounds per square yard for a 6-inch thick stabilized layer). Lime stabilization should be in accordance with Item 260 of the Texas Department of Transportation Standard Specifications for Construction of Highways, Streets and Bridges (1993). The actual percentage of lime should be confirmed by laboratory tests at the time of construction. ***Lime-stabilization may be deleted if the pavement section increased by one-inch.***

On-site soils can be used as fill to raise site grade provided that undesirable objects are removed. The fill should be placed in 8-inch loose lifts and compacted to between 92 to 98 percent of the maximum Standard Proctor dry density at moisture contents between +2 to +6 of the optimum moisture contents.

The above pavement recommendations are based on assumed loading conditions and commonly accepted design procedures that should provide satisfactory performance with relatively low maintenance for the design life of 15 years for the assumed traffic loadings. Thinner pavement sections could be used if greater maintenance costs and shorter pavement life is acceptable, or if our assumed loading conditions are too severe. We will be happy to review these pavement thicknesses if design traffic volume and characteristics can be specified to us.

Design of the concrete pavements should specify a minimum 28-day concrete compressive strength of 3500 psi with 4 percent to 6 percent entrained air. Hand-placed concrete should have a maximum slump of five inches. The concrete should be placed within one and one-half hours of batching. During hot weather, the concrete placement should follow ACI 311 Hot Weather concreting. In no case should concrete temperature exceed 95°F. Consideration should be given to limiting concrete placement to the time of day, which will minimize large differences in the ambient and concrete temperature. Use of superplasticizer should be considered to improve the concrete workability without increasing water cement ratio.

## **8.0 EARTHWORK GUIDELINES**

### **8.1 Site Grading and Drainage**

Site grading operations, where required, should be performed in accordance with the recommendations provided in this report. The site grading plans should include provisions for positive drainage around the perimeters of all slab foundations, structures, and pavements. Preferably, the final site grade around slab perimeter should slope downward away from the slab for a distance of 10 feet on a slope not flatter than 20 horizontal to 1 vertical (20H:1V) and not steeper than 5 horizontal to 1 vertical (5H:1V). Inadequate drainage around soil supported slabs and pavements can result in excessive vertical differential movements after construction is completed.

Earth slopes subjected to concentrated runoff flows should be adequately protected with a vegetated cover, riprap, special synthetic fabric, or by other means to minimize the potential for soil loss due to erosion. Slopes subjected to wave action should be protected by riprap.

In general, final grades should not be steeper than 4 horizontal to 1 vertical (4H:1V) for either fill or cut slopes taller than 4 feet. Slopes steeper than 4H:1V may experience shallow translational slope failures if the soils become desiccated. If slopes steeper than 4H:1V are required, then site-specific studies as well as measures reducing the desiccation of the soils will be required. Such measures would include irrigation, vegetation, and the use of polyethylene sheeting. The guidelines presented in Figure No. 29-1 of the 1991 Unified

Building Code (UBC) should be used in determining the minimum distances that should be maintained between the slope and the foundations.

Structural retaining walls should be designed by the Structural Engineer to resist anticipated earth and surcharge loads. Provision should be included for positive drainage of the backfill and slopes in the vicinity of the walls, consistent with the design assumptions. Additional geotechnical information for design and construction of structural retaining walls can be provided on request.

## **8.2 Site Preparation**

Preparation of the site for construction operations should include the removal and proper disposal of all obstructions and materials which would hinder preparation of the site for construction. These obstructions should include all abandoned structures, foundations, debris, water wells, septic tanks, and loose, soft, or otherwise unsuitable materials. The existing water wells need to be removed and capped only if structures or roads are to be constructed in these areas.

## **8.3 Clearing and Evaluating Areas to be Filled**

In areas to be filled, all trees, stumps, brush, abandoned structures, roots, topsoil, vegetation, sediments, large rock fragments, rubbish, and any other undesirable or deleterious matter should be properly removed and disposed of. All topsoil, roots, and other vegetation should be stripped to a depth of 6 inches. The topsoil could be selectively stockpiled and reused in landscaped areas. Brush and trees could be shredded and placed in areas not supporting residences or structures. Otherwise, they could be burnt in burn piles. Although soft soil was not observed in our borings, it is possible that soft soils could be encountered in localized areas between the borings or during wet weather conditions. Consequently, if soft soils are encountered or suspected during the site preparation operations, they should be evaluated by proofrolling the suspected areas with a rubber-tired, heavy construction vehicle weighing at least 25 tons, such as a loaded scraper. The proofrolling should consist of several overlapping passes in mutually perpendicular directions over a given area. If rutting and/or pumping is not

observed, the evaluated subgrade could be considered competent to support additional fill. If rutting and/or pumping is observed, the soil should be undercut to a depth where further rutting or pumping is not observed. Then, the exposed and evaluated surface should be prepared in accordance with the recommendations presented in the following section. If severe pumping occurs, the compaction efforts should be halted and evaluated by the geotechnical engineer.

It is the intent of these recommendations to evaluate the subgrade for soft soils and provide a loose surface with no features that would tend to prevent uniform compaction by the equipment to be used.

Trees that are scheduled for removal could be removed during the site grading operations. They should be excavated to below their rootball level or below their visible root level. The exposed soils in the over-excavation should be scarified, moisture-conditioned, and compacted. Then, additional moist fill could be placed under controlled conditions to develop design grades. Recommendations for these procedures are presented in the next several sections.

#### **8.4 Preparing the Subgrade of the Areas to be Filled**

All areas to be filled should be disced, bladed, or scarified until uniform and free from large rock fragments, clods, and deleterious or unsuitable materials. The discing, blading, or scarifying operations should be performed to a depth of about 6 inches. For clays, the soil should be dried or moisture added to achieve a moisture content ranging between +2 to +6 of the optimum moisture contents and compacted to between 92 and 98 percent of optimum density in accordance with ASTM D 698.

#### **8.5 Fill Materials**

All soils used for controlled fill should be free of roots, vegetation, other deleterious or undesirable matter, and rocks fragments larger than 6 inches in diameter. On-site soils meeting the aforementioned criteria could be used for fill. Soils imported from off-site for use as fill should be approved by the Geotechnical Engineer.

## **8.6 Mixing of Fill Lifts and Benching**

The fill material should be placed in level, uniform lifts, with each lift compacted to the minimum dry density within the compaction soil moisture ranges recommended herein. Each lift should be thoroughly mixed during placement and spreading to help insure the uniformity of the layer.

The loose lift thickness should not exceed 8 to 9 inches. Light compaction equipment such as walk behind rollers, jumping jacks, etc., is used to compact backfill placed immediately behind retaining walls or around grade beams constructed in trenches. The light compaction equipment reduces the likelihood of overstressing the structural elements and causing retaining walls to rotate, etc. Should light compaction equipment be used, the thickness of the loose lift should be adjusted so that the compaction equipment could adequately compact the newly placed lift without performing excessive passes.

In areas where new fill is placed over sloping ground (steeper than 5 horizontal to 1 vertical (5H:1V)), it is recommended that the new fill be "tied in" to the underlying soils with deep benches (3 to 10-foot horizontal bench dimension, depending on the steepness of the slope) so that the new fill can be placed and compacted in level lifts. Additionally, the fill should be uniformly compacted on each bench to avoid leaving soft or loose zones which could affect the stability of the final fill slopes.

## **8.7 Compaction Moisture Content**

Prior to and in conjunction with the compacting operations, each fill lift should be brought to the proper moisture content. The moisture content at the time of compaction should be between +2 to +6 percentage points above the optimum moisture content (ASTM D 698) for clays and within 3 percentage points of optimum (-3 to +3 percent) for sands and select fill.

## **8.8 Degree of Compaction**

After each layer has been properly placed, mixed and spread, it should be uniformly compacted to between 92 and 98 percent of Standard Proctor Density as determined by ASTM D 698. Typically, engineered fill is expected to settle by about 1 to 2% of the fill thickness.

## **8.9 Compaction Equipment**

The selected compaction equipment should be of appropriate type and weight for the soil to be compacted. The equipment should be capable of compacting the soil to the specified degree of compaction (as measured with field density tests) uniformly for the full depth of each lift. Additionally, the compaction of each lift shall be continuous over its entire area.

## **8.10 Field Density Tests**

Field density tests should be performed on each fill lift by the Geotechnical Engineer or his representative to help confirm that an adequate degree of compaction is achieved. These tests should be taken in the compacted material below the disturbed surface. At a minimum, each lift of compacted fill should be tested at a frequency of one test per 2 lots or every 5,000 square feet. Each lift of compacted backfill placed in utility line trenches should be tested at the rate of one test per 75 to 100 feet. If the compacted materials fail to meet the density specified, the lift should be reworked and recompacted as necessary to obtain the specified compaction.

## **8.11 Construction Observations**

The Geotechnical Engineer or a qualified technician under the geotechnical engineer's direct supervision should observe the earthwork construction at periodic intervals with adequate frequency or on a full-time basis to enable him to provide a professional opinion that all subgrade preparation, fill placement, and related work were completed in accordance with the project specifications.

## **8.12 Erosion Control During Construction**

Granular and clayey soils become eroded at runoff velocities of 2 to 3 and 4 to 5 feet per second, respectively. Therefore, all exposed earthwork construction areas and earth slopes should be adequately protected against soil runoff using erosion control, embankment stabilization, slope control measures, and pollution prevention measures as required by the Civil Engineer and by applicable regulations. If the surface runoff velocities cannot be

reduced, the exposed soils need to be vegetated or reinforced against erosion. It is possible that variations in subsurface conditions will be encountered during construction. Construction problems, particularly as to degree or magnitude, cannot be anticipated until the course of construction. Recommendations offered in the following paragraphs are not intended to limit or preclude other conceivable solutions but rather to provide the client with our observations based on our experience and our understanding of the project characteristics and subsurface conditions. To ensure that the recommendations contained in this study are adhered to, the geotechnical engineer should be retained by the client to review tests and observations performed during construction.

### **8.13 Groundwater**

Groundwater seepage was not encountered in any of the boring advanced. Therefore, SEG does not anticipate that groundwater seepage will be encountered during the pad excavations of grading or pavement construction. If groundwater seepage is encountered during the residence pad excavation, we recommend grading the subgrade toward the corners of the excavations and pump the water out to a suitable drainage system.

## **9.0 GENERAL COMMENTS**

The analysis and recommendations presented in this study are based upon the data obtained from the test borings at the indicated locations and from any other information discussed herein. If variations appear evident, it will be necessary to re-evaluate the recommendations of this study.

It is recommended that the geotechnical engineer be given the opportunity to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. It is further recommended that the geotechnical engineer be retained to review tests and observations performed during earthwork and foundation construction phases to help verify that design requirements are fulfilled.

This study has been prepared for the exclusive use of our client for specific application to the project described herein and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. In the event that any changes in the nature, design or location of the project as outlined in this study are planned, the conclusions and recommendations contained in this study shall not be considered valid unless the changes are reviewed and the conclusions of this study modified or verified in writing by the geotechnical engineer.

Environmental issues regarding this site are not addressed in this study. Only geotechnical recommendations for use in design of specific construction elements, earthwork and quality control testing during construction are presented herein.

Caution should always be exercised when working around excavations; a collapse hazard may exist and particular care should be taken when working in/or near excavations 4-ft deep or greater. This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations and we cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if any of the recommended actions presented herein are considered to be unsafe.

## **APPENDIX**

Boring Locations Plan  
Logs of Exploratory Borings  
Key to Soil Symbols and Classifications  
Free Swell Test Results

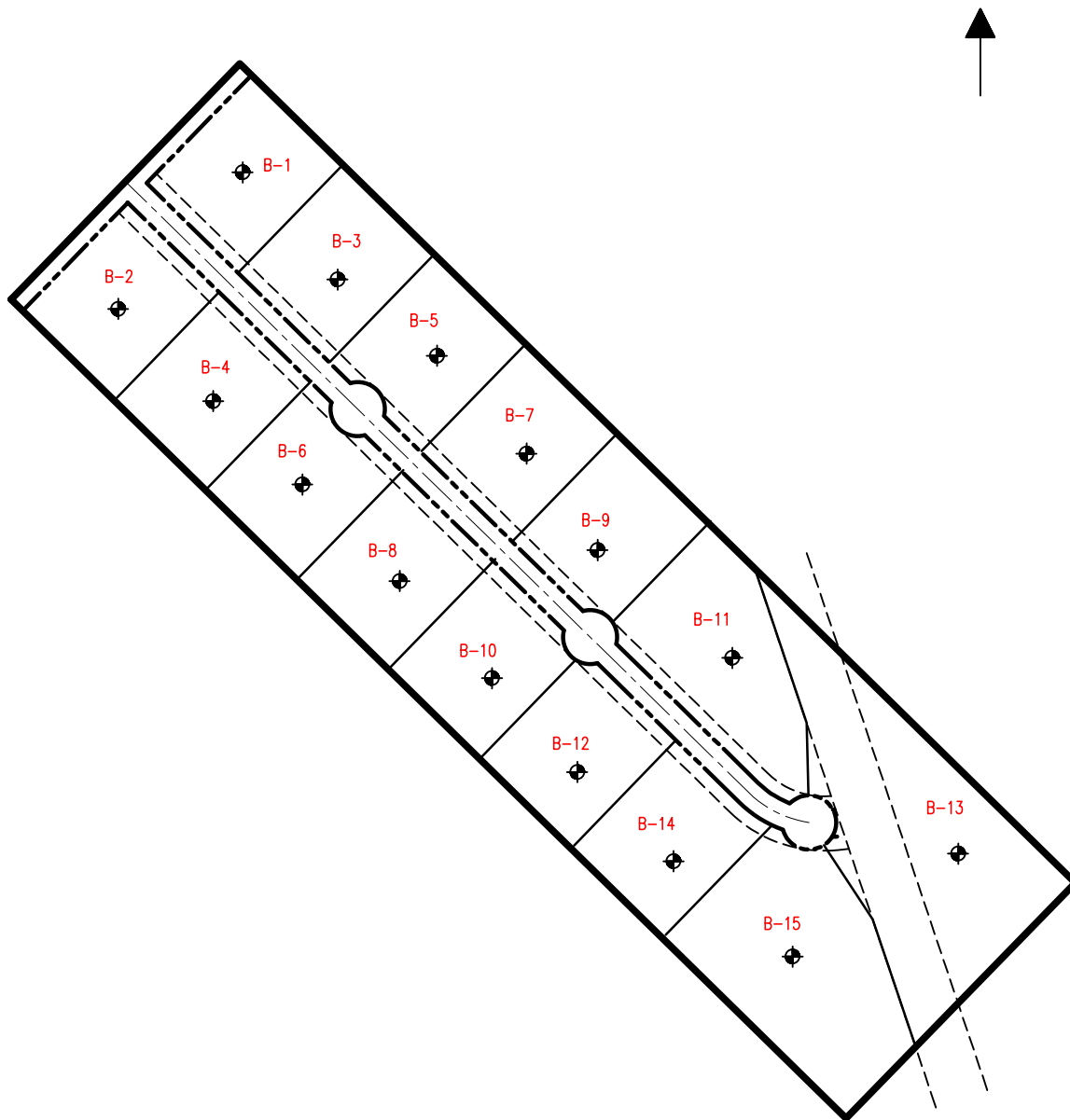


FIGURE 1: BORING LOCATIONS PLAN

**SYNTEC ENGINEERING GROUP, INC**

2639 WALNUT HILL LANE  
DALLAS, TX 75229  
TEL (214) 329-1777

SEG#121-1122

PROPOSED SUBDIVISION

1511 S. MUNSON ROAD  
ROYSE CITY, TEXAS

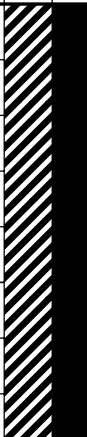
NOT TO SCALE

11/18/2021

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122 Boring No.: **B-1**  
 Project: Proposed Residential Subdivision Boring Location: See Plan of Borings  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22 Drill Type: Intermittent Sampling  
 Groundwater: ATD: --- Static: --- Ground Elev.: Not Surveyed

| Depth in Feet             | Graphic Log                                                                         | Sample Type                                                                         | Shelby Tube                                                               | Water Level ATD  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|                           |                                                                                     |                                                                                     | Static Water Table                                                        | SOIL DESCRIPTION |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 5                         |   |   | <u>CLAY (CH)</u> dark brown, hard, with silt seams and calcareous nodules |                  | P=4.5                                                           | 20                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                     |                                                                                     | - grades stiff below 2 feet                                               |                  | P=2.0                                                           | 15                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                     |                                                                                     |                                                                           |                  | P=2.0                                                           | 30                   | 88                | 27               | 61                |                      |          |                           |
|                           |                                                                                     |                                                                                     | - grades to very stiff below 6 feet                                       |                  | P=3.0                                                           | 34                   |                   |                  |                   |                      |          |                           |
| 10                        |  |  | <u>SHALEY CLAY (CH)</u> tan and gray, hard, silty, blocky                 |                  | P=4.5                                                           | 36                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                     |                                                                                     | P=4.5                                                                     | 36               |                                                                 |                      |                   |                  |                   |                      |          |                           |
|                           |                                                                                     |                                                                                     | P=4.5                                                                     | 34               |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 20                        |  |  | Bottom of Boring @ 20 feet                                                |                  | P=4.5                                                           | 34                   |                   |                  |                   |                      |          |                           |
| Syntech Engineering, Inc. |                                                                                     |                                                                                     |                                                                           |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |

Syntech Engineering, Inc.

Figure-2

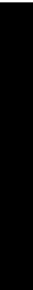
SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:35 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-2**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                         | Sample Type                                                                         | Shelby Tube                                                                | Water Level ATD  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|               |                                                                                     |                                                                                     | Static Water Table                                                         | SOIL DESCRIPTION |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 5             |    |    | <u>CLAY (CH)</u> dark brown, stiff, with silt seams and calcareous nodules |                  | P=2.0                                                           | 27                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     | <u>CLAY (CH)</u> tan and gray, hard, sandy                                 |                  | P=4.0                                                           | 20                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                            |                  | P=4.0                                                           | 32                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                            |                  | P=4.5                                                           | 42                   | 89                | 26               | 63                |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                            |                  | P=4.5                                                           | 32                   |                   |                  |                   |                      |          |                           |
| 10            |                                                                                     |                                                                                     |                                                                            |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 15            |  |  | <u>SHALEY CLAY (CH)</u> tan and gray, hard, blocky, silty                  |                  | P=4.5                                                           | 34                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                            |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 20            |                                                                                     |                                                                                     | Bottom of Boring @ 20 feet                                                 |                  | P=4.5                                                           | 34                   |                   |                  |                   |                      |          |                           |

Syntech Engineering, Inc.

Figure-3

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-3**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log | Sample Type |  Shelby Tube<br>Water Level ATD<br>Static Water Table | SOIL DESCRIPTION                                                          | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------|-------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|               |             |             |                                                                                                                                        |                                                                           |                                                                 |                      |                   |                  |                   |                      |          |                           |
|               |             |             |                                                                                                                                        | <u>CLAY (CH)</u> dark brown, hard, with silt seams and calcareous nodules | P=4.5                                                           | 19                   |                   | 62               | 22                | 40                   |          |                           |
|               |             |             |                                                                                                                                        |                                                                           | P=4.5                                                           | 11                   |                   |                  |                   |                      |          |                           |
| 5             |             |             |                                                                                                                                        | <u>SHALEY CLAY (CH)</u> tan and gray, very stiff, silty, blocky           | P=3.75                                                          | 32                   |                   |                  |                   |                      |          |                           |
|               |             |             |                                                                                                                                        |                                                                           | P=3.5                                                           | 34                   |                   |                  |                   |                      |          |                           |
|               |             |             |                                                                                                                                        |                                                                           | P=3.5                                                           | 34                   |                   |                  |                   |                      |          |                           |
| 10            |             |             |                                                                                                                                        |                                                                           |                                                                 |                      |                   |                  |                   |                      |          |                           |
|               |             |             |                                                                                                                                        |                                                                           | P=4.5                                                           | 37                   |                   |                  |                   |                      |          |                           |
| 15            |             |             |                                                                                                                                        | - hard below 14 feet                                                      |                                                                 |                      |                   |                  |                   |                      |          |                           |
|               |             |             |                                                                                                                                        |                                                                           | P=4.5                                                           | 33                   |                   | 84               | 24                | 60                   |          |                           |
| 20            |             |             |                                                                                                                                        | Bottom of Boring @ 20 feet                                                |                                                                 |                      |                   |                  |                   |                      |          |                           |

Syntech Engineering, Inc.

Figure-4

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:36 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-4**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet              | Graphic Log                                                                        | Sample Type                                                                        | <div><div></div> Shelby Tube</div>                                        | Water Level<br>ATD | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture<br>Content (%) | Dry Density<br>(pcf) | Liquid<br>Limit (%) | Plastic<br>Limit (%) | Plasticity<br>Index (%) | -200<br>(%) | Unconfined<br>Strength (tsf) |
|----------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------|-------------------------|----------------------|---------------------|----------------------|-------------------------|-------------|------------------------------|
|                            |                                                                                    |                                                                                    | Static Water<br>Table                                                     | SOIL DESCRIPTION   |                                                                 |                         |                      |                     |                      |                         |             |                              |
| 5                          |  |  | <u>CLAY (CH)</u> dark brown, hard, with silt seams and calcareous nodules |                    | P=4.5                                                           | 23                      |                      |                     |                      |                         |             |                              |
|                            |                                                                                    |                                                                                    |                                                                           |                    | P=4.5                                                           | 17                      |                      |                     |                      |                         |             |                              |
|                            |                                                                                    |                                                                                    |                                                                           |                    | P=4.5                                                           | 23                      |                      |                     |                      |                         |             |                              |
|                            |                                                                                    |                                                                                    |                                                                           |                    | P=4.25                                                          | 30                      | 80                   | 27                  | 53                   |                         |             |                              |
|                            |                                                                                    |                                                                                    |                                                                           |                    | P=4.25                                                          | 29                      |                      |                     |                      |                         |             |                              |
|                            |                                                                                    |                                                                                    |                                                                           |                    | P=4.0                                                           | 35                      |                      |                     |                      |                         |             |                              |
|                            |                                                                                    |                                                                                    |                                                                           |                    | P=4.5                                                           | 35                      |                      |                     |                      |                         |             |                              |
| Bottom of Boring @ 20 feet |                                                                                    |                                                                                    |                                                                           |                    |                                                                 |                         |                      |                     |                      |                         |             |                              |
| Syntech Engineering, Inc.  |                                                                                    |                                                                                    |                                                                           |                    |                                                                 |                         |                      |                     |                      |                         |             |                              |

Syntech Engineering, Inc.

Figure-5

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-5**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet              | Graphic Log                                                                       | Sample Type                                                                       | Shelby Tube                                                               | Water Level ATD  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|----------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|                            |                                                                                   |                                                                                   | Static Water Table                                                        | SOIL DESCRIPTION |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 5                          |  |  | <u>CLAY (CH)</u> dark brown, hard, with silt seams and calcareous nodules |                  | P=4.5                                                           | 23                   |                   | 67               | 24                | 43                   |          |                           |
|                            |                                                                                   |                                                                                   | <u>SHALEY CLAY (CH)</u> tan and gray, hard, silty, blocky                 |                  | P=4.25                                                          | 15                   |                   |                  |                   |                      |          |                           |
|                            |                                                                                   |                                                                                   |                                                                           |                  | P=4.5                                                           | 30                   |                   |                  |                   |                      |          |                           |
|                            |                                                                                   |                                                                                   |                                                                           |                  | P=4.5                                                           | 35                   |                   | 81               | 28                | 53                   |          |                           |
|                            |                                                                                   |                                                                                   |                                                                           |                  | P=4.5                                                           | 31                   |                   |                  |                   |                      |          |                           |
|                            |                                                                                   |                                                                                   |                                                                           |                  | P=4.0                                                           | 33                   |                   |                  |                   |                      |          |                           |
|                            |                                                                                   |                                                                                   |                                                                           |                  | P=4.5                                                           | 33                   | 90                |                  |                   |                      |          |                           |
|                            |                                                                                   |                                                                                   |                                                                           |                  | P=4.5                                                           | 33                   | 90                |                  |                   |                      |          |                           |
| Bottom of Boring @ 20 feet |                                                                                   |                                                                                   |                                                                           |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
| Suntech Engineering, Inc.  |                                                                                   |                                                                                   |                                                                           |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |

Syntech Engineering, Inc.

Figure-6

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:36 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

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Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-6**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                         | Sample Type                                                                         |  Shelby Tube | Water Level ATD                                                                     | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf)             | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|               |                                                                                     |                                                                                     | Static Water Table                                                                            | SOIL DESCRIPTION                                                                    |                                                                             |                      |                   |                  |                   |                      |          |                           |
| 5             |    |    |              |    | <u>CLAY (CH)</u> dark brown, stiff , with silt seams and calcareous nodules | P=1.5                | 30                |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.5                                                                       | 20                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.5                                                                       | 30                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.5                                                                       | 29                   | 71                | 26               | 45                |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.5                                                                       | 28                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.0                                                                       | 33                   | 86                |                  |                   |                      |          |                           |
| 20            |  |  |            |  | <u>SHALEY CLAY (CH)</u> tan and gray, hard, silty, blocky                   | P=4.5                | 32                |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | Bottom of Boring @ 20 feet                                                  |                      |                   |                  |                   |                      |          | 1                         |

Syntech Engineering, Inc.

Figure-7

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:36 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-7**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                         | Sample Type                                                                         | <div><div></div> Shelby Tube</div>                                        | Water Level<br>ATD | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture<br>Content (%) | Dry Density<br>(pcf) | Liquid<br>Limit (%) | Plastic<br>Limit (%) | Plasticity<br>Index (%) | -200<br>(%) | Unconfined<br>Strength (tsf) |
|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------|-------------------------|----------------------|---------------------|----------------------|-------------------------|-------------|------------------------------|
|               |                                                                                     |                                                                                     | Static Water<br>Table                                                     | SOIL DESCRIPTION   |                                                                 |                         |                      |                     |                      |                         |             |                              |
| 5             |   |   | <u>CLAY (CH)</u> dark brown, hard, with silt seams and calcareous nodules |                    | P=4.0                                                           | 26                      |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                           |                    | P=4.5                                                           | 23                      |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                           |                    | P=2.5                                                           | 32                      |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                           |                    | P=4.5                                                           | 31                      |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                           |                    | P=4.5                                                           | 32                      | 67                   | 28                  | 39                   |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                           |                    | P=4.0                                                           | 33                      |                      |                     |                      |                         |             |                              |
| 20            |  |  |                                                                           | P=4.5              | 34                                                              |                         |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     | Bottom of Boring @ 20 feet                                                |                    |                                                                 |                         |                      |                     |                      |                         |             |                              |

Syntech Engineering, Inc.

Figure-8

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:36 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-8**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet             | Graphic Log                                                                       | Sample Type                                                                       | Shelby Tube                                                                     | Water Level ATD  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|                           |                                                                                   |                                                                                   | Static Water Table                                                              | SOIL DESCRIPTION |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 5                         |  |  | <u>CLAY (CH)</u> dark brown, very stiff, with silt seams and calcareous nodules |                  | P=2.75                                                          | 31                   |                   | 62               | 24                | 38                   |          |                           |
|                           |                                                                                   |                                                                                   | - hard below 2 feet                                                             |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   | <u>SHALEY CLAY (CH)</u> tan and gray, hard, silty, blocky                       |                  | P=4.25                                                          | 18                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                 |                  | P=4.0                                                           | 32                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                 |                  | P=4.5                                                           | 35                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                 |                  | P=4.5                                                           | 32                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                 |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                 |                  | P=4.0                                                           | 27                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                 |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                 |                  | P=4.5                                                           | 34                   |                   | 81               | 28                | 53                   |          |                           |
|                           |                                                                                   | Bottom of Boring @ 20 feet                                                        |                                                                                 |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
| Suntech Engineering, Inc. |                                                                                   |                                                                                   |                                                                                 |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |

Syntech Engineering, Inc.

Figure-9

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-9**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet             | Graphic Log | Sample Type | <div><div></div>Shelby Tube</div> | Water Level<br>ATD         | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture<br>Content (%) | Dry Density<br>(pcf) | Liquid<br>Limit (%) | Plastic<br>Limit (%) | Plasticity<br>Index (%) | -200<br>(%) | Unconfined<br>Strength (tsf) |
|---------------------------|-------------|-------------|-----------------------------------|----------------------------|-----------------------------------------------------------------|-------------------------|----------------------|---------------------|----------------------|-------------------------|-------------|------------------------------|
|                           |             |             |                                   | Static Water<br>Table      |                                                                 |                         |                      |                     |                      |                         |             |                              |
| 5                         | <div></div> | <div></div> | <div></div>                       |                            | P=4.5                                                           | 20                      |                      |                     |                      |                         |             |                              |
|                           |             |             |                                   |                            | P=4.25                                                          | 24                      |                      | 72                  | 26                   | 46                      |             |                              |
|                           |             |             |                                   |                            | P=4.0                                                           | 18                      |                      |                     |                      |                         |             |                              |
|                           |             |             |                                   |                            | P=4.5                                                           | 35                      |                      |                     |                      |                         |             |                              |
|                           |             |             |                                   |                            | P=4.5                                                           | 38                      |                      |                     |                      |                         |             |                              |
| 10                        | <div></div> | <div></div> | <div></div>                       |                            | P=4.5                                                           | 38                      |                      |                     |                      |                         |             |                              |
|                           |             |             |                                   |                            | P=4.0                                                           | 36                      |                      | 75                  | 27                   | 48                      |             |                              |
|                           |             |             |                                   |                            | P=4.5                                                           | 32                      |                      |                     |                      |                         |             |                              |
| 20                        | <div></div> | <div></div> | <div></div>                       |                            |                                                                 |                         |                      |                     |                      |                         |             |                              |
|                           |             |             |                                   | Bottom of Boring @ 20 feet |                                                                 |                         |                      |                     |                      |                         |             |                              |
| Suntech Engineering, Inc. |             |             |                                   |                            |                                                                 |                         |                      |                     |                      |                         |             |                              |

Syntech Engineering, Inc.

Figure-10

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:36 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

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Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-10**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                        | Sample Type                                                                        | <div><div></div> Shelby Tube</div>                                        | Water Level<br>ATD | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture<br>Content (%) | Dry Density<br>(pcf) | Liquid<br>Limit (%) | Plastic<br>Limit (%) | Plasticity<br>Index (%) | -200<br>(%) | Unconfined<br>Strength (tsf) |
|---------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------|-------------------------|----------------------|---------------------|----------------------|-------------------------|-------------|------------------------------|
|               |                                                                                    |                                                                                    | Static Water<br>Table                                                     | SOIL DESCRIPTION   |                                                                 |                         |                      |                     |                      |                         |             |                              |
| 5             |   |   | <u>CLAY (CH)</u> dark brown, hard, with silt seams and calcareous nodules |                    | P=4.5                                                           | 26                      |                      |                     |                      |                         |             |                              |
|               |                                                                                    |                                                                                    |                                                                           |                    | P=4.25                                                          | 21                      |                      | 77                  | 28                   | 49                      |             |                              |
|               |                                                                                    |                                                                                    |                                                                           |                    | P=4.0                                                           | 30                      |                      |                     |                      |                         |             |                              |
|               |                                                                                    |                                                                                    |                                                                           |                    | P=4.5                                                           | 33                      |                      |                     |                      |                         |             |                              |
|               |                                                                                    |                                                                                    |                                                                           |                    | P=4.5                                                           | 27                      |                      | 72                  | 28                   | 44                      |             |                              |
|               |                                                                                    |                                                                                    |                                                                           |                    | P=4.0                                                           | 30                      |                      |                     |                      |                         |             |                              |
| 15            |  |  | <u>SHALEY CLAY (CH)</u> tan and gray, hard, silty, blocky                 |                    | P=4.5                                                           | 31                      |                      | 73                  | 31                   | 42                      |             |                              |
|               |                                                                                    |                                                                                    |                                                                           |                    |                                                                 |                         |                      |                     |                      |                         |             |                              |
| 20            |                                                                                    |                                                                                    | Bottom of Boring @ 20 feet                                                |                    |                                                                 |                         |                      |                     |                      |                         |             |                              |

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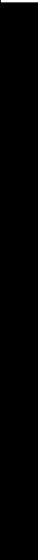
Figure-11

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/4/22 Date Completed: 1/4/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-11**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                         | Sample Type                                                                         | Shelby Tube                                                                              | Water Level ATD  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|               |                                                                                     |                                                                                     | Static Water Table                                                                       | SOIL DESCRIPTION |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 5             |   |   | <u>CLAY (CH)</u> dark brown, stiff to very stiff, with silt seams and calcareous nodules |                  | P=2.5                                                           | 29                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     | - hard below 2 feet                                                                      |                  | P=4.5                                                           | 24                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                          |                  | P=4.0                                                           | 18                   | 55                | 18               | 37                |                      |          |                           |
|               |                                                                                     |                                                                                     | - stiff to very stiff below 8 feet                                                       |                  | P=2.5                                                           | 28                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                                          |                  | P=2.0                                                           | 28                   | 76                | 24               | 52                |                      |          |                           |
| 10            |  |  | <u>SHALEY CLAY (CH)</u> tan and gray, hard, silty, blocky                                |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 15            |  |  |                                                                                          |                  | P=4.0                                                           | 34                   |                   |                  |                   |                      |          |                           |
| 20            |  |  |                                                                                          |                  | P=4.5                                                           | 33                   |                   | 73               | 26                | 47                   |          |                           |
|               |                                                                                     |                                                                                     | Bottom of Boring @ 20 feet                                                               |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |

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Figure-12

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/5/22 Date Completed: 1/5/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-12**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet             | Graphic Log                                                                       | Sample Type                                                                       | Shelby Tube                                                                              | Water Level ATD  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|                           |                                                                                   |                                                                                   | Static Water Table                                                                       | SOIL DESCRIPTION |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 5                         |  |  | <u>CLAY (CH)</u> dark brown, stiff to very stiff, with silt seams and calcareous nodules |                  | P=2.5                                                           | 27                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                          |                  | P=3.5                                                           | 32                   |                   | 72               | 23                | 49                   |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                          |                  | P=4.0                                                           | 31                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                          |                  | P=4.5                                                           | 29                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                          |                  | P=4.0                                                           | 30                   |                   |                  |                   |                      |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                          |                  | P=4.0                                                           | 26                   |                   | 61               | 24                | 37                   |          |                           |
|                           |                                                                                   |                                                                                   |                                                                                          |                  | P=4.5                                                           | 30                   | 93                |                  |                   |                      |          |                           |
|                           |                                                                                   | Bottom of Boring @ 20 feet                                                        |                                                                                          |                  |                                                                 |                      |                   |                  |                   |                      |          | 1                         |
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Syntech Engineering, Inc.

Figure-13

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:37 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/5/22 Date Completed: 1/5/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-13**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                         | Sample Type                                                                         | <div><div></div> Shelby Tube</div>                                                  | Water Level<br>ATD                                                                  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf)                  | Moisture<br>Content (%) | Dry Density<br>(pcf) | Liquid<br>Limit (%) | Plastic<br>Limit (%) | Plasticity<br>Index (%) | -200<br>(%) | Unconfined<br>Strength (tsf) |
|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------|----------------------|---------------------|----------------------|-------------------------|-------------|------------------------------|
|               |                                                                                     |                                                                                     | Static Water<br>Table                                                               | SOIL DESCRIPTION                                                                    |                                                                                  |                         |                      |                     |                      |                         |             |                              |
| 5             |    |    |    |    | <u><b>CLAY (CH)</b></u> dark brown, hard, with silt seams and calcareous nodules | P=4.5                   | 19                   | 59                  | 16                   | 43                      |             |                              |
|               |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P=4.0                                                                            | 16                      |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P=4.0                                                                            | 26                      |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P=4.5                                                                            | 27                      | 75                   | 28                  | 47                   |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P=4.0                                                                            | 25                      | 100                  |                     |                      |                         | 1           |                              |
|               |                                                                                     |                                                                                     |                                                                                     |                                                                                     | P=4.0                                                                            | 25                      |                      |                     |                      |                         |             |                              |
| 20            |  |  |  |  | <u><b>SHALEY CLAY (CH)</b></u> tan and gray, hard, silty, blocky                 | P=4.5                   | 28                   |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                     |                                                                                     | Bottom of Boring @ 20 feet                                                       |                         |                      |                     |                      |                         |             |                              |

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Figure-14

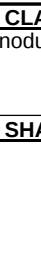
SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:37 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

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Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/5/22 Date Completed: 1/5/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-14**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                         | Sample Type                                                                         |  Shelby Tube | Water Level<br>ATD                                                                  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf)                 | Moisture<br>Content (%) | Dry Density<br>(pcf) | Liquid<br>Limit (%) | Plastic<br>Limit (%) | Plasticity<br>Index (%) | -200<br>(%) | Unconfined<br>Strength (tsf) |
|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-------------------------|----------------------|---------------------|----------------------|-------------------------|-------------|------------------------------|
|               |                                                                                     |                                                                                     | Static Water<br>Table                                                                         | SOIL DESCRIPTION                                                                    |                                                                                 |                         |                      |                     |                      |                         |             |                              |
| 5             |    |    |              |    | <u>CLAY (CH)</u> dark brown, very stiff, with silt seams and calcareous nodules | P=2.75                  | 28                   |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | <u>SHALEY CLAY (CH)</u> tan and gray, hard, silty, blocky                       | P=4.0                   | 19                   |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.0                                                                           | 22                      | 68                   | 24                  | 44                   |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.5                                                                           | 25                      |                      |                     |                      |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.0                                                                           | 20                      | 63                   | 25                  | 38                   |                         |             |                              |
|               |                                                                                     |                                                                                     |                                                                                               |                                                                                     | P=4.0                                                                           | 26                      |                      |                     |                      |                         |             |                              |
| 20            |  |  |            |  | Bottom of Boring @ 20 feet                                                      | P=4.5                   | 29                   |                     |                      |                         |             |                              |

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Figure-15

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:38 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

# LOG OF EXPLORATORY BORING

PAGE 1 OF 1

Job Number: 121-1122  
 Project: Proposed Residential Subdivision  
 Address: 1511 S. Munson Road, Royse City, Texas  
 Date Started: 1/5/22 Date Completed: 1/5/22  
 Groundwater: ATD: --- Static: ---

Boring No.: **B-15**  
 Boring Location: See Plan of Borings  
 Drill Type: Intermittent Sampling  
 Ground Elev.: Not Surveyed

| Depth in Feet | Graphic Log                                                                         | Sample Type                                                                         | Shelby Tube                                                               | Water Level ATD  | N: SPT (blows/ft)<br>T: THD (in/100 blows)<br>P: Hand Pen (tsf) | Moisture Content (%) | Dry Density (pcf) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | -200 (%) | Unconfined Strength (tsf) |
|---------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------|-----------------------------------------------------------------|----------------------|-------------------|------------------|-------------------|----------------------|----------|---------------------------|
|               |                                                                                     |                                                                                     | Static Water Table                                                        | SOIL DESCRIPTION |                                                                 |                      |                   |                  |                   |                      |          |                           |
| 5             |    |    | <u>CLAY (CH)</u> dark brown, hard, with silt seams and calcareous nodules |                  | P=4.5                                                           | 18                   |                   | 55               | 20                | 35                   |          |                           |
|               |                                                                                     |                                                                                     |                                                                           |                  | P=4.5                                                           | 17                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                           |                  | P=4.0                                                           | 35                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                           |                  | P=4.5                                                           | 35                   |                   | 79               | 28                | 51                   |          |                           |
| 10            |   |   | <u>CLAY (CH)</u> tan and gray, hard, sandy                                |                  | P=4.5                                                           | 30                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                           |                  | P=4.5                                                           | 27                   |                   |                  |                   |                      |          |                           |
| 15            |  |  | <u>SHALEY CLAY (CH)</u> tan and gray, hard, blocky, silty                 |                  | P=4.5                                                           | 26                   |                   |                  |                   |                      |          |                           |
|               |                                                                                     |                                                                                     |                                                                           |                  | P=4.5                                                           | 26                   |                   |                  |                   |                      |          |                           |
| 20            |  |  | Bottom of Boring @ 20 feet                                                |                  |                                                                 |                      |                   |                  |                   |                      |          |                           |

Syntech Engineering, Inc.

Figure-16

SYNTECH LOG REPORT - SYNTECH ENGINEERING.GDT - 1/26/22 12:38 - C:\PROGRAM FILES\GINT\PROJECTS\121-1122.GPJ

## KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

The abbreviations commonly used on each "Record of Subsurface Exploration", as seen on the figures and in the text of the report, are as follows:

| <p>I. <u>SOIL DESCRIPTION</u></p> <p>(a) Cohesionless Soils</p> <table> <tr> <th><u>Relative Density</u></th> <th><u>N, BLOWS/FT</u></th> </tr> <tr> <td>Very Loose</td> <td>0 to 4</td> </tr> <tr> <td>Loose</td> <td>5 to 10</td> </tr> <tr> <td>Compact</td> <td>11 to 30</td> </tr> <tr> <td>Dense</td> <td>31 to 50</td> </tr> <tr> <td>Very Dense</td> <td>Over 50</td> </tr> </table> <p>(b) Cohesive Soils</p> <table> <tr> <th><u>Consistency</u></th> <th><u>Qu, TSF</u></th> </tr> <tr> <td>Very Soft</td> <td>Less than 0.25</td> </tr> <tr> <td>Soft</td> <td>0.25 to 0.50</td> </tr> <tr> <td>Firm</td> <td>0.50 to 1.00</td> </tr> <tr> <td>Stiff</td> <td>1.00 to 2.00</td> </tr> <tr> <td>Very Stiff</td> <td>2.00 to 4.00</td> </tr> <tr> <td>Hard</td> <td>Over 4.00</td> </tr> </table> | <u>Relative Density</u>                                                                             | <u>N, BLOWS/FT</u>      | Very Loose     | 0 to 4 | Loose  | 5 to 10 | Compact | 11 to 30 | Dense             | 31 to 50 | Very Dense                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Over 50 | <u>Consistency</u> | <u>Qu, TSF</u> | Very Soft | Less than 0.25 | Soft | 0.25 to 0.50 | Firm | 0.50 to 1.00 | Stiff | 1.00 to 2.00 | Very Stiff | 2.00 to 4.00 | Hard | Over 4.00 | <p>V. <u>SOIL PROPERTY SYMBOLS</u></p> <p>N: Standard Penetration Resistance:<br/>Number of blows by a 140 lb hammer dropped 30 in, required to drive a 2 in OD split spoon sampler 1 ft</p> <p>Qu: Unconfined Compressive Strength, TSF</p> <p>Qp: Pocket Penetrometer Unconfined Compressive Strength, TSF</p> <p>Dd: Natural Dry Unit Weight, PCF</p> <p>Λ : Apparent Groundwater Level at Time Noted</p> <p>Mc: Moisture or Water Content, %</p> <p>LL: Liquid Limit</p> <p>PL: Plastic Limit</p> <p>PI: Plasticity Index</p> <p>LI: Liquidity Index (Mc-PL/PI)</p> <p>e: Void Ratio</p> <p>Gs: Specific Gravity of Solid Particles</p> <p>k: Coefficient of Permeability</p> <p>i: Hydraulic Gradient</p> <p>q: Rate of Discharge</p> <p>h: Hydraulic Gradient</p> <p>TSF: Tons per Square Foot</p> <p>PSF: Pounds per Square Foot</p> <p>KSF: Kips per Square Foot</p> <p>PCF: Pounds per Cubic Foot</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-------------------------|----------------|--------|--------|---------|---------|----------|-------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------|----------------|-----------|----------------|------|--------------|------|--------------|-------|--------------|------------|--------------|------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Relative Density</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <u>N, BLOWS/FT</u>                                                                                  |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Very Loose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0 to 4                                                                                              |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Loose                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5 to 10                                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Compact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 11 to 30                                                                                            |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Dense                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 31 to 50                                                                                            |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Very Dense                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Over 50                                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <u>Consistency</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <u>Qu, TSF</u>                                                                                      |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Very Soft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Less than 0.25                                                                                      |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Soft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.25 to 0.50                                                                                        |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Firm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.50 to 1.00                                                                                        |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Stiff                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1.00 to 2.00                                                                                        |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Very Stiff                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2.00 to 4.00                                                                                        |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Hard                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Over 4.00                                                                                           |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>II. <u>PLASTICITY</u></p> <table> <tr> <th><u>Degree of Plasticity</u></th> <th><u>Plasticity Index</u></th> </tr> <tr> <td>None to Slight</td> <td>0 - 4</td> </tr> <tr> <td>Slight</td> <td>5 - 10</td> </tr> <tr> <td>Medium</td> <td>11 - 30</td> </tr> <tr> <td>High to Very High</td> <td>Over 30</td> </tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <u>Degree of Plasticity</u>                                                                         | <u>Plasticity Index</u> | None to Slight | 0 - 4  | Slight | 5 - 10  | Medium  | 11 - 30  | High to Very High | Over 30  | <p>VI. <u>DRILLING/EXCAVATING AND SAMPLING SYMBOLS</u></p> <p>AR: Air Rotary</p> <p>CFA: Continuous Flight Auger</p> <p>HSA: Hollow Stem Auger</p> <p>RW: Rotary Wash</p> <p>BH: Backhoe</p> <p>AU: Auger Sample</p> <p>BS: Bag Sample</p> <p>RC: Rock Core</p> <p>SS: Split-Spoon, 1-3/8 in ID, 2 in OD, Except as Noted</p> <p>TUBE: Shelby Tube, 3 in OD, Except as Noted</p> <p>WS: Wash Sample</p> <p>OD: Outside Diameter</p> <p>ID: Inside Diameter</p> <p>TxC: Texas Department of Transportation Cone Penetrometer Test</p> <p>RQD: Rock Quality Designation</p> <p>CR: Core Recovery, %</p> |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <u>Degree of Plasticity</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <u>Plasticity Index</u>                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| None to Slight                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0 - 4                                                                                               |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Slight                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5 - 10                                                                                              |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Medium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 11 - 30                                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| High to Very High                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Over 30                                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>III. <u>RELATIVE PROPORTIONS</u></p> <table> <tr> <th><u>Descriptive Term</u></th> <th><u>Percent</u></th> </tr> <tr> <td>Trace</td> <td>1 - 10</td> </tr> <tr> <td>Little</td> <td>11 - 20</td> </tr> <tr> <td>Some</td> <td>21 - 35</td> </tr> <tr> <td>And</td> <td>36 - 50</td> </tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <u>Descriptive Term</u>                                                                             | <u>Percent</u>          | Trace          | 1 - 10 | Little | 11 - 20 | Some    | 21 - 35  | And               | 36 - 50  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <u>Descriptive Term</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <u>Percent</u>                                                                                      |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Trace                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 - 10                                                                                              |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Little                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 11 - 20                                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Some                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 21 - 35                                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| And                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 36 - 50                                                                                             |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>IV. <u>PARTICLE SIZE IDENTIFICATION</u></p> <p>Boulders: 8 in diameter or more</p> <p>Cobbles : 3 in to 8 in diameter</p> <p>Gravel : Coarse - 3/4 in to 3 in<br/>: Fine - 5.0 mm to 3/4 in</p> <p>Sand : Coarse - 2.0 mm to 5.0 mm<br/>: Medium - 0.4 mm to 2.0 mm<br/>: Fine - 0.07 mm to 0.4 mm</p> <p>Silt : - 0.002 mm to 0.07 mm</p> <p>Clay : - less than 0.002 mm</p>                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>NOTE: SOILS ARE CLASSIFIED IN GENERAL ACCORDANCE WITH THE UNIFIED SOIL CLASSIFICATION SYSTEM</p> |                         |                |        |        |         |         |          |                   |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |                    |                |           |                |      |              |      |              |       |              |            |              |      |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## FREE SWELL TEST RESULTS

**GEOTECHNICAL INVESTIGATION  
PROPOSED SUBDIVISION  
1511 S. MUNSON ROAD  
ROYSE CITY, TEXAS  
SEG PROJECT NO. 121-1122**

| Boring Number                   | B-3 | B-5 | B-12 | B-13 |
|---------------------------------|-----|-----|------|------|
| Sample Depth, ft.               | 1-2 | 6-7 | 2-3  | 1-2  |
| Liquid Limit                    | 62  | 81  | 55   | 59   |
| Plastic Limit                   | 22  | 28  | 18   | 16   |
| Plasticity Index                | 40  | 53  | 37   | 43   |
| Applied Surcharge Pressure, psf | 180 | 780 | 300  | 180  |
| Initial Moisture Content, %     | 19  | 35  | 18   | 19   |
| Final Moisture Content, %       | 21  | 37  | 27   | 23   |
| Vertical Swell, %               | 1.4 | 1.3 | 3.5  | 4.6  |

Figure 18