GEOTECHNICAL ENGINEERING STUDY
PROPOSED PARKING LOT AND DRIVES
4139 SOUTH BURLESON BOULEVARD
ALVARADO, TEXAS

Presented To:

Welling Investments, Inc.

December 2022

PROJECT NO. 3048-22-01

CMJ Engineering

December 7, 2022
Report No. 3048-22-01

Welling Investments, Inc.
1250 S. Capital of Texas Highway
Building 3, Suite 400
Austin, Texas 78746

Attn: Mr. Daniel Welling

GEOTECHNICAL ENGINEERING STUDY
PROPOSED PARKING LOT AND DRIVES
4139 SOUTH BURLESON BOULEVARD
ALVARADO, TEXAS

Dear Mr. Welling:

Submitted here are the results of a geotechnical engineering study for the referenced project. This study was performed in general accordance with CMJ Proposal 22-8895 dated November 3, 2022. The geotechnical services were authorized by Mr. Daniel Welling on November 3, 2022.

Engineering analyses and recommendations are contained in the text section of the report. The results of our field and laboratory services are included in the appendix of the report. We would appreciate the opportunity to be considered for providing construction material testing services during the construction phase of this project.

We appreciate the opportunity to be of service to Welling Investments, Inc. Please contact us if you have any questions or if we may be of further service at this time.

Respectfully submitted,
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APPENDIX A

1.0 INTRODUCTION

1.1 Project Description

The site is located at 4139 South Burleson Boulevard, approximately 1,800 feet northwest of Asher Road in Alvarado, Texas. The project consists of new parking lots and drives to support heavy truck traffic. Plate A.1, Plan of Borings, presents the project vicinity and approximate locations of the exploration borings.

1.2 Purpose and Scope

The purpose of this geotechnical engineering study has been to determine the general subsurface conditions, evaluate the engineering characteristics of the subsurface materials encountered, provide pavement subgrade and earthwork recommendations, and provide pavement design guidelines.

To accomplish its intended purposes, the study has been conducted in the following phases: (1) drilling sample borings to determine the general subsurface conditions and to obtain samples for testing; (2) performing laboratory tests on appropriate samples to determine pertinent engineering properties of the subsurface materials; and (3) performing engineering analyses, using the field and laboratory data, to develop geotechnical recommendations for the proposed construction.

The design is currently in progress. Once the final design is near completion (80-percent to 90-percent stage), it is recommended that CMJ Engineering, Inc. be retained to review those portions of the construction documents pertaining to the geotechnical recommendations, as a means to determine that our recommendations have been interpreted as intended.

1.3 Report Format

The text of the report is contained in Sections 1 through 7. All plates and large tables are contained in Appendix A. The alpha-numeric plate and table numbers identify the appendix in which they appear. Small tables of less than one page in length may appear in the body of the text and are numbered according to the section in which they occur.

Units used in the report are based on the English system and may include tons per square foot (tsf), kips (1 kip = 1,000 pounds), kips per square foot (ksf), pounds per square foot (psf), pounds per cubic foot (pcf), and pounds per square inch (psi).

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Subsurface materials were explored by two (2) borings drilled in the existing pavement areas to a depth of 10 feet using continuous flight augers at the approximate locations shown on the Plan of Borings, Plate A.1. The boring logs are included on Plates A.4 and A.5 and keys to classifications and symbols used on the logs are provided on Plates A.2 and A.3.

Undisturbed samples of cohesive soils were obtained with nominal 3-inch diameter thin-walled (Shelby) tube samplers at the locations shown on the logs of borings. The Shelby tube sampler consists of a thin-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the soil by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency with a hand penetrometer, sealed, and packaged to limit loss of moisture.

The consistency of cohesive soil samples was evaluated in the field using a calibrated hand penetrometer. In this test, a 0.25-inch diameter piston is pushed into the relatively undisturbed sample at a constant rate to a depth of 0.25 inch. The results of these tests, in tsf, are tabulated at respective sample depths on the logs. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+.

Groundwater observations during and after completion of the borings are shown on the upper right of the boring log. Upon completion of the borings, the bore holes were backfilled with soil cuttings and tamped at the surface.

2.2 Laboratory Testing

Laboratory soil tests were performed on selected representative samples recovered from the borings. In addition to the classification tests (liquid limits and plastic limits), moisture content, unit weight, and unconfined compressive strength tests were performed. Results of the laboratory classification tests, moisture content, unit weight, and unconfined compressive strength tests conducted for this project are included on the boring logs.

Soluble sulfate tests were conducted on selected soil samples recovered from the borings. The sulfate testing was conducted to help identify lime-induced heaving potential of the soils. Lime-induced heaving can cause detrimental volumetric changes to a lime-stabilized subgrade. The results of the sulfate tests are presented on Plate A.6.

The above laboratory tests were performed in general accordance with applicable ASTM procedures, or generally accepted practice.

3.0 SUBSURFACE CONDITIONS

3.1 Site Geology

The Dallas Sheet of the Geologic Atlas of Texas indicates the project site is located in the Eagle Ford Formation of the Upper Cretaceous age. The Eagle Ford Formation is composed primarily of dark shales with an occasional very thin sandstone or limestone stratum. Calcareous concretions, roughly spherical and up to 18 inches in diameter are found throughout this formation. The Eagle Ford weathers to a tan or tan and gray shaly clay with a dark brown to black residual soil, both of which are highly active.

3.2 Soil Conditions

Specific types and depths of subsurface strata encountered at the boring locations are shown on the boring logs in Appendix A. The generalized subsurface stratigraphy encountered in the borings is discussed below. Note that depths on the borings refer to the depth from the existing grade or ground surface present at the time of the investigation, and the boundaries between the various soil types are approximate.

Crushed rock base material is present at the surface in Borings B-1 and B-2 with thicknesses of 5 to 8 inches. Concrete with a thickness of 6 inches is present beneath the crushed rock material in Boring B-2.

Natural soils encountered beneath the paving materials consists of dark brown clays overlying light brown and gray shaly clays. Ironstone nodules and occasional calcareous nodules and pebbles are present within the soils. Occasional sand seams are noted above 4 feet in Boring B-2, and occasional sandstone seams are noted below a depth of 10 feet within the shaly clays in Boring B-2. The borings were terminated within the various natural soils at a depth of 10 feet.

The various soils encountered in the borings had Liquid Limits (LL) ranging from 54 to 71 with Plasticity Indices (PI) ranging from 36 to 49 and are classified as CH by the USCS. The various clayey (cohesive) soils are generally soft to stiff (soil basis) in consistency with pocket penetrometer readings of 0.75 to 2.25 tsf. Tested unit weight values varied from 88 to 95 pcf and tested unconfined compressive strengths were 2,000 to 3,010 psf.

The Atterberg Limits tests indicate the various clays encountered at this site are highly active with respect to moisture-induced volume changes. Active clays can experience volume changes (expansion or contraction) with fluctuations in their moisture content.

3.3 Groundwater Observations

The borings were drilled using continuous flight augers in order to observe groundwater seepage during drilling. No groundwater seepage was encountered during drilling and the borings were dry at drilling completion.

While it is not possible to accurately predict the magnitude of subsurface water fluctuation that might occur based upon these short-term observations, it should be recognized that groundwater conditions will vary with fluctuations in rainfall.

Fluctuations of the groundwater level can occur due to seasonal variations in the amount of rainfall; site topography and runoff; hydraulic conductivity of soil strata; and other factors not evident at the time the borings were performed. During wet periods of the year, seepage can occur in joints in the clays or via more permeable strata. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 PAVEMENTS

4.1 General Pavement Considerations

The subgrade soil encountered in the borings consists of primarily highly plastic clays. The success of the pavement subgrade is subgrade soil strength and control of water. Adequate subgrade performance can be achieved by stabilizing existing soils and fills used to construct the pavement subgrade. Stabilization of the clay subgrade soils can be accomplished with the addition of hydrated lime.

On-site soils are highly plastic and subject to expansive movement with soil wetting and drying. Estimates of expansive movement potential are on the order of 4 to 5 inches. Movements in excess of this estimate can occur if poor drainage, excessive water collection, leaking pipelines, etc. occur. Any such excessive water conditions should be rectified as soon as possible. In order to minimize rainwater infiltration through the pavement surface, and thereby minimizing future upward movement of the pavement slabs, all cracks and joints in the pavement should be sealed on a routine basis after construction.

4.2 Lime-Induced Heaving

Soluble sulfate tests were conducted to check for lime-induced heaving potential. Lime-induced heaving is caused when hydrated lime is added to a soil with a high sulfate concentration. The lime reacts with the sulfates when water is present to cause potentially large volumetric changes in the soil.

Soluble sulfate levels in soils on the order of 2,000 parts-per-million (ppm) or less are usually of low concern and warrant only observation of the subgrade during the stabilization process. Soluble sulfate levels on the order of 2,000 to 6,000 ppm usually warrant a double lime process, with the first treatment of lime consisting of ½ the recommended concentration and a second lime treatment consisting of the full recommended concentration. Sulfate levels on the order of 6,000+ ppm may require a double-lime process, with the two full-concentration lime treatments.

The soluble sulfate levels of the tested samples were less than 100 ppm. Since the samples tested were below 2,000 ppm, a single-lime process is recommended at this time. The single-lime treatment is described in Section 4.3. In addition, it is recommended that during the curing period of the lime treatment, the subgrade be supplied with ample moisture and it should be checked for any volumetric changes that may indicate a lime-induced heaving condition.

4.3 Pavement Subgrade Preparation

The highly plastic clays are subject to loss in support value with the moisture increases which occur beneath pavement sections. They react with hydrated lime, which serves to improve and maintain their support value. Treatment of these soils with hydrated lime will improve their subgrade characteristics to support area paving. Lime treatment is recommended for all subgrade areas.

Alternatively, in lieu of a lime-stabilized subgrade, a minimum of 6-inch thick crushed stone flexible base meeting TxDOT Item 247, Type A, Grade 1/2 may be utilized on an equal basis and placed atop a properly compacted subgrade. The option of using a flexible base in lieu of lime stabilizing the subgrade presents a relatively quick, straight forward solution to preparing the subgrade prior to pavement placement.

Prior to lime stabilization or compaction, the subgrade should be proofrolled with heavy pneumatic equipment. Any soft or pumping areas should be undercut to a firm subgrade and properly backfilled as described in the Earthwork section. The subgrade should be scarified to a minimum depth of 6 inches and uniformly compacted to a minimum of 95 percent of Standard Proctor density (ASTM D 698), to minus 2 to plus 4 percentage points of the optimum moisture content determined by that test. It should then be protected and maintained in a moist condition until the pavement is placed. The presence of ironstone nodules, pebbles, and calcareous nodules in the surficial soils can complicate mixing of the soil and lime.

We recommend a minimum of 8 percent hydrated lime be used to modify the clay subgrade soils. The amount of hydrated lime required to stabilize the subgrade should be on the order of 36 pounds per square yard for a 6-inch depth based on a dry unit weight of 100 pcf. The hydrated lime should be thoroughly mixed and blended with the upper 6 inches of the clay subgrade (TxDOT Item 260). The hydrated lime should meet the requirements of Item 260 (Type A) in the Texas Department of Transportation (TxDOT) Standard Specifications for Construction of Highways, Streets and Bridges, 2014 Edition. Lime treatment should extend beyond exposed pavement edges to reduce the effects of shrinkage and associated loss of subgrade support.

We recommend that subgrade stabilization extend to at least one foot beyond pavement edges to aid in reducing pavement movements and cracking along the curb line due to seasonal moisture variations after construction. Each construction area should be shaped to allow drainage of surface water during earthwork operations, and surface water should be pumped immediately from each construction area after each rain and a firm subgrade condition maintained. Water should not be allowed to pond in order to prevent percolation and subgrade softening, and lime should be added to the subgrade after removal of all surface vegetation and debris. Sand should be specifically prohibited beneath pavement areas, since these more porous soils can allow water inflow, resulting in heave and strength loss of subgrade soils (lime-stabilized soil will be allowed for fine grading).

After fine grading each area in preparation for paving, the subgrade surface should be lightly moistened, as needed, and recompacted to obtain a tight non-yielding subgrade.
Surface drainage is critical to the performance of this pavement. Water should be allowed to exit the pavement surface quickly. All pavement construction should be performed in accordance with the following procedures.

4.4 Pavement Sections

The project will include the construction of parking and drives subject to heavy-duty trucks, to include vehicles with anticipated loads of 80,000 lbs., with on the order of 2 passes per week. The pavement sections below and in Section 4.5 are presented for an approximate 20-year design life based on our experience with similar facilities.

We recommend that rigid pavements be utilized at this project whenever possible, since they tend to provide better long-term performance when subjected to significant slow moving and turning traffic.

If asphaltic concrete pavement is used, we recommend a full depth asphaltic concrete section having a minimum total thickness of 6 inches for paving subject to 80-kip trucks. A minimum surface course thickness of 2 inches is recommended for asphaltic concrete pavements.

If Portland cement concrete pavement is used, a minimum thickness of 6 inches for paving subject to 80-kip trucks.

In the event a lime-stabilized subgrade is not used in conjunction with a PCC pavement section, the total concrete thickness should be increased by 2 inches for a total of 8 inches.

A California Bearing Ratio or other strength tests were not performed because they were not within the scope of our services on this project. A subgrade modulus of 100 psi was considered appropriate for the near-surface soils. If heavier vehicles are planned, the above cross sections can be confirmed by performing strength tests on the subgrade materials once the traffic characteristics are established. Periodic maintenance of pavement structures normally improves the durability of the overall pavement and enhances its expected life.

The above sections should be considered minimum pavement thicknesses and higher traffic volumes and heavy trucks may require thicker pavement sections. These recommendations must be reviewed once traffic volumes and loads are known. Periodic maintenance should be anticipated for minimum pavement thickness. This maintenance should consist of sealing cracks and timely repair of isolated distressed areas.

4.5 All-Weather Surface

For an all-weather surface for the proposed parking and drives, we recommend a minimum of 12 inches of flexible base over a properly compacted subgrade to support an 80-kip truck. Flexible base material should meet the requirements of TxDOT Item 247, Type A, Grade 1/2 and should be compacted to a minimum of 95 percent of ASTM D 698 and at a moisture content between minus 2 to plus 5 percentage points of the optimum moisture value. The section may alternatively consist of a minimum of 8 inches of flexible base placed atop a geotechnical grid, Tensar TriAx Geogrid TX140 or equivalent overlying a properly compacted subgrade. Placement of the geogrid should be installed in accordance with the manufacturer's specifications. The above section is intended to support the given 80,000 lb. truck only. Increased traffic and/or wheel loads may cause undue rutting and distress. Regardless, the owner should anticipate and preserve a regular maintenance budget and schedule when utilizing a flexible base pavement section.

This pavement section should not be considered equivalent to full-depth concrete or asphalt sections and will result in higher maintenance costs. More frequent pavement maintenance in these areas should be anticipated and regularly scheduled. More frequent heavy vehicles and/or tractor trailer traffic may cause significant rutting and shoving of this pavement section and should be expected if so exposed. Particular attention should be given to proper drainage at the interface of concrete or asphalt sections at the flexible base section should this be planned. The underlying clay subgrade is subject to strength loss with increases in moisture content. It is very difficult to provide a proper water-tight seal between two different pavement types. Water infiltrates at this joint between the two pavement types with pavement distress typically occurring at this joint.

Surface drainage is critical to the performance of this pavement. Water should be allowed to exit the pavement surface quickly.

4.6 Pavement Material Requirements

<u>Reinforced Portland Cement Concrete</u>: Reinforced Portland cement concrete pavement should consist of Portland cement concrete having a 28-day compressive strength of at least 3,500 psi. The mix should be designed in accordance with the ACI Code 318 using 3 to 6 percent air entrainment.

The pavement should be adequately reinforced with temperature steel and all construction joints or expansion/contraction joints should be provided with load transfer dowels. The spacing of the joints will depend primarily on the type of steel used in the pavement. We recommend using No. 3 steel rebar spaced at 18 inches on center in both the longitudinal and transverse direction. Control joints formed by sawing are recommended every 12 to 15 feet in both the longitudinal and transverse directions. The cutting of the joints should be performed as soon as the concrete has "set-up" enough to allow for sawing operations.

Hot Mix Asphaltic Concrete Surface Course: Item 340, Type D, Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, 2014 Edition.

Hot Mix Asphaltic Concrete Base Course: Item 340, Type A or B, Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, 2014 Edition.

Lime Stabilized Subgrade: Lime treatment for the base course (road mix) - Item 260, Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, 2014 Edition.

Flexible Base: Crushed Stone Flexible Base – Item 247, Type A, Grade 1/2, Texas Department of Transportation Standard Specifications for Construction of Maintenance of Highways, Streets, and Bridges, 2014 Edition.

5.0 EARTHWORK

5.1 Site Preparation

The subgrade should be firm and able to support the construction equipment without displacement. Soft or yielding subgrade should be corrected and made stable before construction proceeds. The subgrade should be proof rolled to detect soft spots, which if exist, should be reworked to provide a firm and otherwise suitable subgrade. Proof rolling should be performed using a heavy pneumatic tired roller, loaded dump truck, or similar piece of equipment. The proof rolling operations should be observed by the project geotechnical engineer or his/her representative. Prior to fill placement, the subgrade should be scarified to a minimum depth of 6 inches, its moisture content adjusted, and recompacted to the moisture and density recommended for fill.

The on-site soils are suitable for use in general site grading. Imported fill material should be clean soil with a Liquid Limit less than 60 and no rock greater than 4 inches in maximum dimension. The fill materials should be free of vegetation and debris.

5.2 Placement and Compaction

Fill material should be placed in loose lifts not exceeding 8 inches in uncompacted thickness. The uncompacted lift thickness should be reduced to 4 inches for structure backfill zones requiring hand-operated power compactors or small self-propelled compactors. The fill material should be uniform with respect to material type and moisture content. Clods and chunks of material should be broken down and the fill material mixed by disking, blading, or plowing, as necessary, so that a material of uniform moisture and density is obtained for each lift. Water required for sprinkling to bring the fill material to the proper moisture content should be applied evenly through each layer.

The fill material should be compacted to a minimum of 95 percent of the maximum dry density determined by the Standard Proctor test, ASTM D 698. In conjunction with the compacting operation, the fill material should be brought to the proper moisture content. The moisture content for general earth fill should range from 2 percentage points below optimum to 5 percentage points above optimum (-2 to +5). These ranges of moisture contents are given as maximum recommended ranges. For some soils and under some conditions, the contractor may have to maintain a more narrow range of moisture content (within the recommended range) in order to consistently achieve the recommended density.

Field density tests should be taken as each lift of fill material is placed. As a guide, one field density test per lift for each 5,000 square feet of compacted area is recommended. For small areas or critical areas the frequency of testing may need to be increased to one test per 2,500 square feet. A minimum of 2 tests per lift should be required. The earthwork operations should be observed and tested on a continuing basis by an experienced geotechnician working in conjunction with the project geotechnical engineer.

Each lift should be compacted, tested, and approved before another lift is added. The purpose of the field density tests is to provide some indication that uniform and adequate compaction is being obtained. The actual quality of the fill, as compacted, should be the responsibility of the contractor and satisfactory results from the tests should not be considered as a guarantee of the quality of the contractor's filling operations.

5.3 Excavation

The side slopes of excavations through the overburden soils should be made in such a manner to provide for their stability during construction. Existing structures, pipelines or other facilities, which are constructed prior to or during the currently proposed construction and which require excavation, should be protected from loss of end bearing or lateral support.

Temporary construction slopes and/or permanent embankment slopes should be protected from surface runoff water. Site grading should be designed to allow drainage at planned areas where erosion protection is provided, instead of allowing surface water to flow down unprotected slopes.

Trench safety recommendations are beyond the scope of this report. The contractor must comply with all applicable safety regulations concerning trench safety and excavations including, but not limited to, OSHA regulations.

5.4 Acceptance of Imported Fill

Any soil imported from off-site sources should be tested for compliance with the recommendations for the particular application and approved by the project geotechnical engineer prior to the materials being used. The owner should also require the contractor to obtain a written, notarized certification from the landowner of each proposed off-site soil borrow source stating that to the best of the landowner's knowledge and belief there has never been contamination of the borrow source site with hazardous or toxic materials. The certification should be furnished to the owner prior to proceeding to furnish soils to the site. Soil materials derived from the excavation of underground petroleum storage tanks should not be used as fill on this project.

5.5 Erosion and Sediment Control

All disturbed areas should be protected from erosion and sedimentation during construction, and all permanent slopes and other areas subject to erosion or sedimentation should be provided with permanent erosion and sediment control facilities. All applicable ordinances and codes regarding erosion and sediment control should be followed.

6.0 CONSTRUCTION OBSERVATIONS

In any geotechnical investigation, the design recommendations are based on a limited amount of information about the subsurface conditions. In the analysis, the geotechnical engineer must assume the subsurface conditions are similar to the conditions encountered in the borings. However, quite often during construction anomalies in the subsurface conditions are revealed. Should such anomalies be discovered Welling Investments, Inc. or their consultants should immediately notify CMJ Engineering, Inc. before proceeding further with construction to allow CMJ Engineering, Inc. to reconsider its recommendations as necessary. It is also recommended that Welling Investments, Inc. retain CMJ Engineering, Inc. to observe earthwork and foundation installation and perform materials evaluation during the construction phase of the project. This enables the geotechnical engineer to stay abreast of the project and to be readily available to evaluate unanticipated conditions, to conduct additional tests if required and, when necessary, to recommend alternative solutions to unanticipated conditions. Until these construction phase services are performed by the project geotechnical engineer, the recommendations contained in this report on such items as final foundation bearing elevations, proper soil moisture condition, and other such subsurface-related recommendations shall only be considered as preliminary, and not final, recommendations.

It is proposed that construction phase observation and materials testing commence by the project geotechnical engineer at the outset of the project. Experience has shown that the most suitable method for procuring these services is for the owner or the owner's design engineers to contract directly with the project geotechnical engineer. This results in a clear, direct line of communication between the owner and the owner's design engineers and the geotechnical engineer.

7.0 REPORT CLOSURE

The boring logs shown in this report contain information related to the types of soil encountered at specific locations and times and show lines delineating the interface between these materials. The logs also contain our field representative's interpretation of conditions that are believed to exist in those depth intervals between the actual samples taken. Therefore, these boring logs contain both factual and interpretive information. Laboratory soil classification tests were also performed on samples from selected depths in the borings. The results of these tests, along with visual-manual procedures were used to generally classify each stratum. Therefore, it should be understood that the classification data on the logs of borings represent visual estimates of classifications for those portions of each stratum on which the full range of laboratory soil classification tests were not performed. It is not implied that these logs are representative of subsurface conditions at other locations and times.

With regard to groundwater conditions, this report presents data on groundwater levels as they were observed during the course of the field work. In particular, water level readings have been made in the borings at the times and under conditions stated in the text of the report and on the boring logs. It should be noted that fluctuations in the level of the groundwater table can occur with the passage of time due to variations in rainfall, temperature, and other factors. Also, this report does not include quantitative information on rates of flow of groundwater into excavations, on pumping capacities necessary to dewater the excavations, or on methods of dewatering excavations. Unanticipated soil conditions at a construction site are commonly encountered and cannot be fully predicted by mere soil samples, test borings, or test pits. Such unexpected conditions frequently require that additional expenditures be made by the owner to attain a properly designed and constructed project. Therefore, provision for some contingency fund is recommended to accommodate such potential extra cost.

The analyses, conclusions, and recommendations contained in this report are based on site conditions as they existed at the time of our field investigation and further on the assumption that the exploratory borings are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the borings at the time they were completed. If during construction, different subsurface conditions from those encountered in our borings are observed, or appear to be present in excavations, we must be advised promptly so that we can review these conditions and reconsider our recommendations where necessary. If there is a substantial lapse of time between submission of this report and the start of the work at the site (more than twelve months is considered a substantial lapse of time; however, depending on the circumstances, less than six months may be considered a substantial lapse of time), if conditions have changed due either to natural causes or to construction operations. at or adjacent to the site, or if structure locations, structural loads or finish grades are changed, we urge that we be promptly informed and retained to review our report to determine the applicability of the conclusions and recommendations, considering the changed conditions and/or time-lapse. In this regard, if (a) construction at the site does not start within twelve months of the date of this report and (b) CMJ Engineering, Inc. is not present at the site when construction starts to confirm that conditions have not changed since the date of this report, the information in this report cannot be relied upon or used for any purpose.

Further, it is urged that CMJ Engineering, Inc. be retained to review those portions of the plans and specifications for this particular project that pertains to earthwork and foundations as a means to determine whether the plans and specifications are consistent with the recommendations contained in this report. In addition, we are available to observe construction, particularly the compaction of structural fill, or backfill and the construction of foundations as recommended in the report, and such other field observations as might be necessary.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around the site.

This report has been prepared for use in developing an overall design concept and is a preliminary document. Paragraphs, statements, test results, boring logs, diagrams, etc. should not be taken out of context, nor utilized without knowledge and awareness of their intent within the overall concept of this report. The reproduction of this report, or any part thereof, supplied to persons other than the owner, should indicate that this study was made for design purposes only and that verification of the subsurface conditions for purposes of determining the difficulty of excavation, trafficability, etc. are responsibilities of the contractor.

This report has been prepared for the exclusive use of Welling Investments, Inc. and their consultants for specific application to design of this project only, and not for additions or modifications to the project. The only warranty made by us in connection with the services provided is that we have used that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made or intended.

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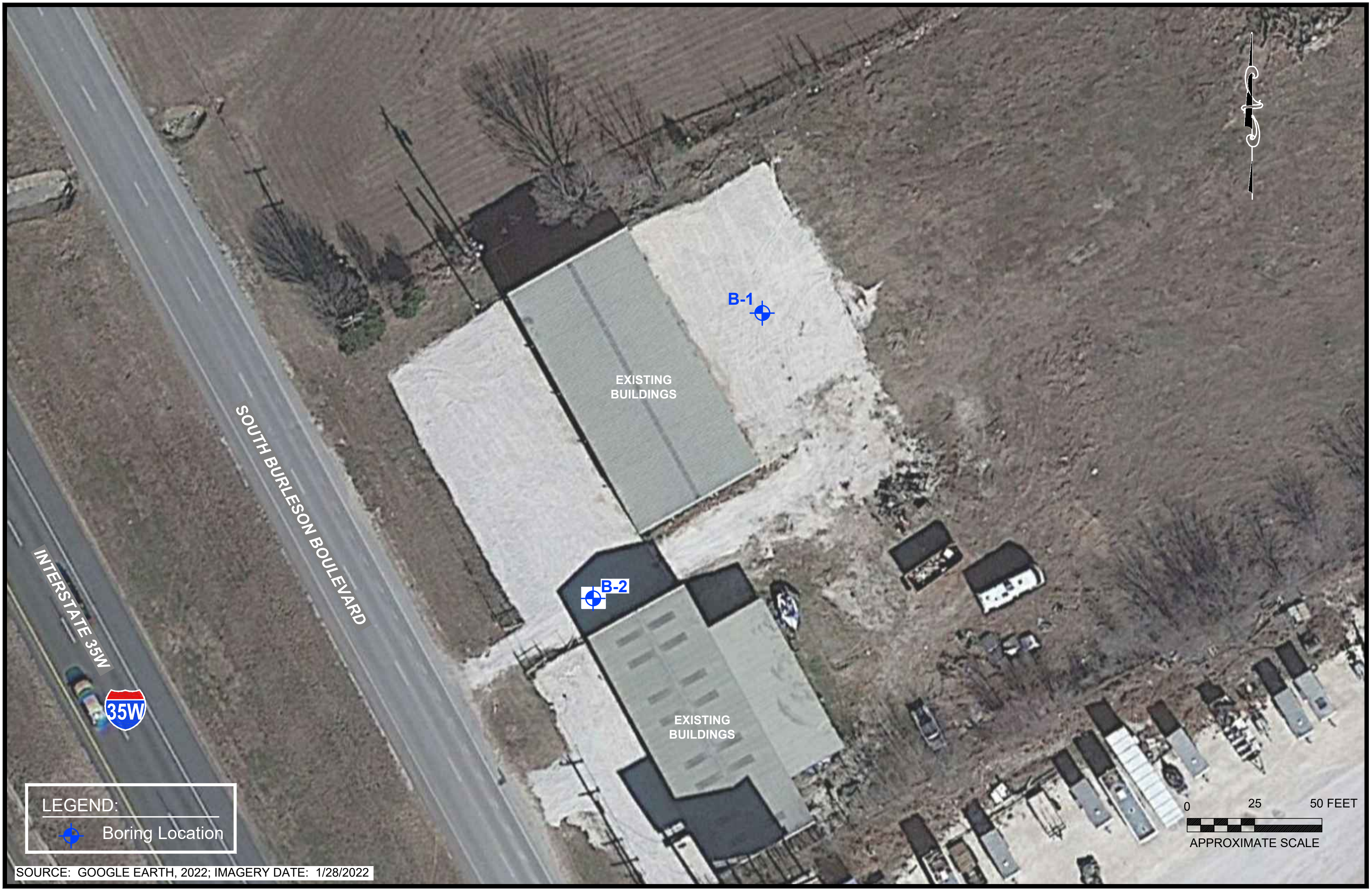


SOURCE: GOOGLE EARTH, 2022; IMAGERY DATE: 1/28/2022

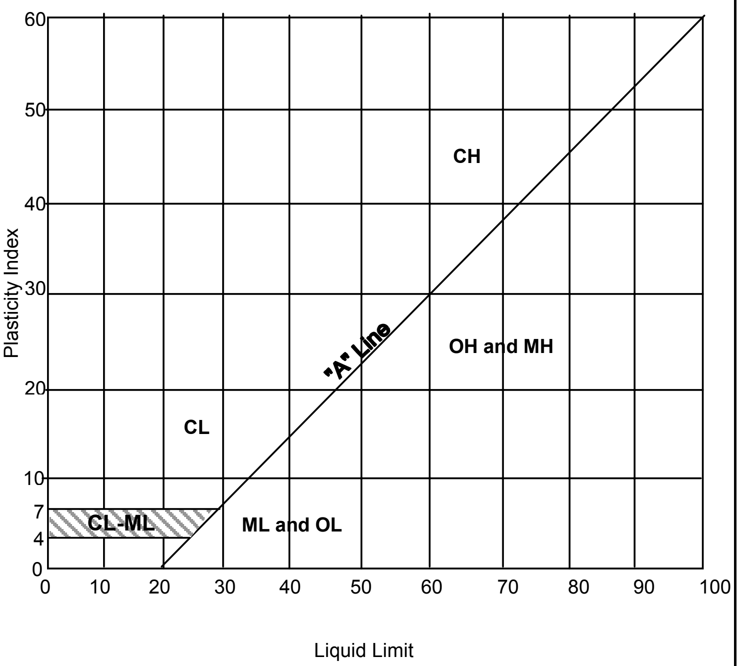
PLATE A.1

PLAN OF BORINGS

PARKING LOT AND DRIVES
ALVARADO, TEXAS

CMJ ENGINEERING, INC.

CMJ PROJECT NO. 3048-22-01

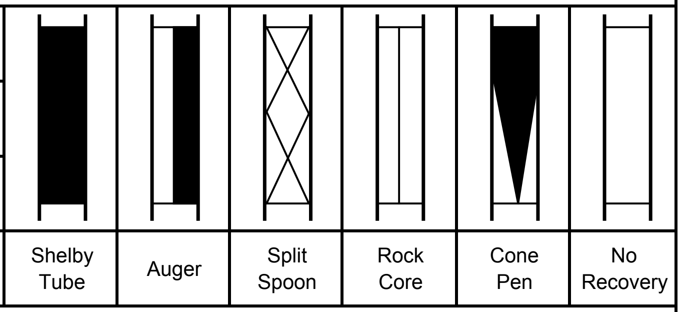
Major Divisions			Grp. Sym.	Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (more than half of the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent..........GW, GP, SW, SP More than 12 percent..........GM, GC, SM, SC 5 to 12 percent..........*Borderline* cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4: $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures		Liquid and Plastic limits below "A" line or P.I. greater than 4	Liquid and plastic limits plotting in hatched zone between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Liquid and Plastic limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6: $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands; gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures		Liquid and Plastic limits below "A" line or P.I. less than 4	Liquid and plastic limits plotting between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Liquid and Plastic limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	 Plasticity Chart		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, and lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly Organic soils		Pt	Peat and other highly organic soils			

UNIFIED SOIL CLASSIFICATION SYSTEM

PLATE A.2

SOIL OR ROCK TYPES

⬬	GRAVEL	▨	LEAN CLAY	▦	LIMESTONE
●	SAND	●	SANDY	☰	SHALE
‖	SILT	‖	SILTY	⁘	SANDSTONE
▨	HIGHLY PLASTIC CLAY	▨	CLAYEY	▦	CONGLOMERATE



TERMS DESCRIBING CONSISTENCY, CONDITION, AND STRUCTURE OF SOIL

Fine Grained Soils (More than 50% Passing No. 200 Sieve)

Descriptive Item	Penetrometer Reading, (tsf)
Soft	0.0 to 1.0
Firm	1.0 to 1.5
Stiff	1.5 to 3.0
Very Stiff	3.0 to 4.5
Hard	4.5+

Coarse Grained Soils (More than 50% Retained on No. 200 Sieve)

Penetration Resistance (blows/foot)	Descriptive Item	Relative Density
0 to 4	Very Loose	0 to 20%
4 to 10	Loose	20 to 40%
10 to 30	Medium Dense	40 to 70%
30 to 50	Dense	70 to 90%
Over 50	Very Dense	90 to 100%

Soil Structure

Calcareous	Contains appreciable deposits of calcium carbonate; generally nodular
Slickensided	Having inclined planes of weakness that are slick and glossy in appearance
Laminated	Composed of thin layers of varying color or texture
Fissured	Containing cracks, sometimes filled with fine sand or silt
Interbedded	Composed of alternate layers of different soil types, usually in approximately equal proportions

TERMS DESCRIBING PHYSICAL PROPERTIES OF ROCK

Hardness and Degree of Cementation

Very Soft or Plastic	Can be remolded in hand; corresponds in consistency up to very stiff in soils
Soft	Can be scratched with fingernail
Moderately Hard	Can be scratched easily with knife; cannot be scratched with fingernail
Hard	Difficult to scratch with knife
Very Hard	Cannot be scratched with knife
Poorly Cemented or Friable	Easily crumbled
Cemented	Bound together by chemically precipitated material; Quartz, calcite, dolomite, siderite, and iron oxide are common cementing materials.

Degree of Weathering

Unweathered	Rock in its natural state before being exposed to atmospheric agents
Slightly Weathered	Noted predominantly by color change with no disintegrated zones
Weathered	Complete color change with zones of slightly decomposed rock
Extremely Weathered	Complete color change with consistency, texture, and general appearance approaching soil

KEY TO CLASSIFICATION AND SYMBOLS **PLATE A.3**

Project No.	Boring No.	Project
3048-22-01	B-1	Parking Lot and Drives Alvarado, Texas

Location: **See Plate A.1**

Water Observations: **No seepage encountered during drilling; dry at completion**

Completion Depth: **10.0'**

Completion Date: **11-16-22**

Surface Elevation:

Type: **B-47, w/ CFA**

Stratum Description

Depth, Ft.	Stratum Description	REC %	RQD %	Blows/Ft. or Pen Reading, T.S.F.	Passing No 200 Sieve, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index	Moisture Content, %	Unit Dry Wt. Lbs./Cu. Ft.	Unconfined Compression Pounds/Sq. Ft.
	CRUSHED ROCK BASE, 8 inches thick										
	CLAY, dark brown, w/ occasional ironstone nodules, calcareous nodules, and pebbles, firm to stiff			2.25		66	20	46	26	95	
				1.25					32	88	2000
	- soft, 4' to 6'			0.75					32		
5											
				2.0					30		
	SHALY CLAY, light brown, w/ occasional ironstone nodules, calcareous nodules, and pebbles, firm			1.0					28		
10											

Project No. **3048-22-01**

Boring No. **B-2**

Project **Parking Lot and Drives**
Alvarado, Texas

Location **See Plate A.1**

Water Observations **No seepage encountered during drilling; dry at completion**

Completion Depth **10.0'**

Completion Date **11-16-22**

Surface Elevation

Type **B-47, w/ CFA**

Depth, Ft.	Stratum Description	REC %	RQD %	Blows/Ft. or Pen Reading, T.S.F.	Passing No 200 Sieve, %	Liquid Limit, %	Plastic Limit, %	Plasticity Index	Moisture Content, %	Unit Dry Wt. Lbs./Cu. Ft.	Unconfined Compression Pounds/Sq. Ft.
	CRUSHED ROCK BASE, 5 inches thick										
	CONCRETE, 6 inches thick			1.75					28	95	3010
	CLAY, dark brown, w/ occasional ironstone nodules, calcareous nodules, and pebbles, stiff			2.0		71	22	49	28	92	
	- w/ occasional sand seams above 4'			2.0					29		
5				2.0					27		
	SHALY CLAY, light brown and gray, w/ occasional ironstone nodules, calcareous nodules, and sandstone seams, stiff			2.0		54	18	36	26		
10											

SOLUBLE SULFATE TEST RESULTS

Project: Proposed Parking Lot and Drives
4139 South Burleson Boulevard – Alvarado, Texas

Project No.: 3048-22-01

Boring No.	Depth (ft.)	Material	Soluble Sulfates (ppm)
B-1	8”–2	Clay	<100
B-2	2–4	Clay	<100

Note: Test Method TxDOT Tex 145-E.