ECS Southwest, LLP

Geotechnical Engineering Report

Proposed Sherwin Williams Retail Store

South Colorado Street and East Martin Luther King Jr. Industrial Blvd
Lockhart, Caldwell County, Texas

ECS Project Number 17:6722

October 29, 2024

ECS SOUTHWEST, LLP
TX Registered Engineering Firm F-8461
Geotechnical • Construction Materials • Environmental • Facilities

October 29, 2024

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ECS Project No. 17:6722

Reference: Geotechnical Engineering Report
Proposed Sherwin Williams Retail Store
South Colorado Street and East Martin Luther King Jr. Industrial Blvd
Lockhart, Caldwell County, Texas

Dear Mr. Waltz:

ECS Southwest, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and laboratory testing conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Lockhart QOZII, LLC during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify the subsurface conditions considered for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southwest, LLP

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EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal geotechnical recommendations are summarized. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- The predominant geotechnical and geological constraint that needs to be addressed at the site is the highly expansive soil conditions.

- We have estimated potential heave in the proposed building areas utilizing the TxDOT PVR method (Tex-124-E). We estimate the existing PVR at the site to be about 4½ inches. To mitigate soil expansion potential in the proposed building areas, it is recommended that the building pads be improved according to this report's Section 4.1 "Potential Vertical Rise & Subgrade Improvements."

- The proposed buildings can be supported by monolithic beam and slab-on-grade foundation systems or shallow footing foundation systems. Please refer to Section 4.2 "Shallow Foundations" for geotechnical design parameters and other recommendations for design

- Flexible and rigid pavements can be utilized. Refer to this report's Section 4.6 "Pavement Sections" for additional recommendations.

- It is recommended that ECS conduct a geotechnical review of the project plans (prior to issuance for construction) to check to see that ECS' geotechnical recommendations have been properly interpreted and implemented.

- To prevent misinterpretation of our recommendations, ECS should be retained to perform quality control testing and documentation during construction of the earthwork and foundations for the project.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the foundation design of a 4,500 square foot Sherwin Williams retail building, future hotel and retail buildings, pavements, and associated appurtenances.

Our scope of services was provided in general accordance with those presented in ECS Proposal No. 17-9667-GP dated September 23, 2024, which included our Terms and Conditions of Service. This study was authorized on October 2, 2024, by Mr. Steffen Waltz with Lockhart QOZII, LLC via signature of the acceptance page of the referenced proposal.

The report includes the following items.

- A brief review and description of our field and laboratory test procedures and the results of testing conducted.
- A review of surface topographical features and site conditions.
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- A final copy of our soil test boring logs.
- Recommendations for site preparation, grading, and drainage.
- Recommendations for foundation design and construction.
- Recommendations for pavement design and construction.
- Recommendations for retaining wall design and construction.

The scope of services for this project did not include an environmental assessment for determining the presence or absence of wetlands, or corrosive, hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The site is located about 500 feet southeast of the intersection od East Martin Luther King Jr. Industrial Boulevard and South Colorado Street in Lockhart, Texas. The location is depicted below and on the Site Location Diagram in Appendix A.

The subject site is undeveloped and existing conditions include a grassed field. A review of past aerial imagery indicates that the site has been historically undeveloped. Based on a review of topographic information from Google Earth terrain elevation data, the site is generally flat with elevations ranging from about EL. 529 feet at the northeastern corner to about EL. 528 feet at the southwestern corner.

2.2 PROPOSED CONSTRUCTION

It is understood that the proposed development will consist of the construction of a Sherwin Williams retail store, pavements, and associated appurtenances. It is also understood that future retail and hotel buildings are planned. Proposed grading and building structural loading information was not available at the time of this report.

SUBJECT	**DESIGN INFORMATION / CONSIDERATIONS**
Building Finished Floor Elevations	Not provided, considered to be within ±5 feet of existing grades
Column Loads	Not provided, < 70 kips considered
Wall Loads	Not provided, < 3 kips/ft considered

If ECS' understanding of the project is not correct, especially if the structural loads are different, please contact ECS so that we may review these changes and revise our recommendations as appropriate.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our subsurface findings and procedures are included in Appendix B. Our scope of work included drilling six borings to depths of about 15 feet each beneath the existing ground surface in the proposed building areas.

Our borings were located with a handheld GPS unit and their approximate locations are shown on the Boring Location Diagram in Appendix A. The approximate ground surface elevations shown on the boring logs were selected based on a review of the Google Earth terrain elevation data. The accuracy of this data should be considered to be approximate.

3.1 SUBSURFACE CHARACTERIZATION

The *Geologic Atlas of Texas, Seguin Sheet,* indicates that the site is underlain by the Fluviatile terrace deposits (Qle), which generally consist of a mix of clay, silt, sand and gravel placed in various lenses and layers by stream processes. The approximate location of the site on the geologic map is provided on the Site Geologic Diagram in Appendix A.

The following table provides generalized characterizations of the soil strata encountered during our subsurface exploration. For specific information refer to the boring logs in Appendix B.

Approximate Range of Depth (feet)	Stratum	Material Description	PI (1) Range	PI(1) Average
0 – 15	I	(CH) FAT CLAY, FAT CLAY WITH SAND and (CL) LEAN CLAY, LEAN CLAY WITH SAND; dark brown, grayish dark brown, brown, tannish light brown, mottled light brown; stiff to very stiff	16-56	37
6-13½	II(2)	(GC) CLAYEY GRAVEL WITH SAND, brown to light brown, medium dense	48	

Notes: Depths are approximate.
(1) Plasticity Index
(2) Observed in boring B-06

3.2 GROUNDWATER OBSERVATIONS

Groundwater level observations were made in the borings during drilling operations. In air rotary drilling operations, water is not introduced into the borehole and the groundwater position can often be determined by observing water flowing into the excavation. Furthermore, visual observation of soil samples retrieved can often be used in evaluating the groundwater conditions. Groundwater was not observed in the borings during or upon completion of drilling. Upon completion of field operations, the boreholes were backfilled with soil cuttings generated during our field operations.

Water levels in open excavations may require several hours to several days to stabilize depending on the permeability of the soils and that groundwater levels at the site may be subject to seasonal conditions, recent rainfall, drought or temperature effects. Clays are generally not conducive to the presence of groundwater; however, gravels, sands and silts, and open fractures and solution features; where present, can store and transmit "perched" groundwater flow or seepage.

The groundwater conditions at this site are expected to be significantly influenced by surface water runoff and rainfall and should therefore be evaluated just prior to construction. Specifically, rainfall that enters the site, either directly from overland flow or adjacent properties, begins to percolate through surficial soils and within granular seams and fissures. This groundwater flow continues downhill with the water table occasionally surfacing to form wet springs and intermittent streams. In low-lying areas and areas adjacent to existing creeks or ponds, shallow groundwater tables can be present continuously.

3.3 LABORATORY TESTING

The laboratory testing was performed by ECS on selected samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples obtained from the test borings to aid in classifying soils and to quantify and correlate engineering properties. The soil samples were tested for moisture content (ASTM D2216), Atterberg Limits (ASTM D4318), and gradation tests (percent passing No. 200 sieve – ASTM D1140).

A geotechnical engineer visually classified the soil samples from the test borings based on texture and plasticity in general accordance with ASTM D2487 (Unified Soil Classification System (USCS)) and ASTM D2488 (Description and Identification of Soils-Visual/Manual Procedures). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

4.0 DESIGN RECOMMENDATIONS

The following recommendations have been developed according to the previously described project characteristics and subsurface conditions. If there are any changes to the project characteristics or if different subsurface conditions are encountered during construction, ECS should be consulted so that the recommendations of this report can be reviewed.

4.1 POTENTIAL VERTICAL RISE & SUBGRADE IMPROVEMENTS

Structural damage and/or cosmetic/operational distress can be caused by volume changes in clay soils. The clay soils found at this site exhibit moderate volume change capability dependent on potentially changing soil water conditions during or after construction. Clayey soils can shrink when they lose water and swell (increase in volume) when they gain water. The potential of clayey soils to shrink and swell is related to; amongst other things, the Plasticity Index (PI). Clayey soils with a higher PI generally have a greater potential for soil volume changes due to moisture content variations.

We have estimated potential heave for this site utilizing the TxDOT PVR method (Tex-124-E). The Tex-124-E method provides an estimate of potential vertical rise (PVR) using the liquid limits, plasticity indices, grain sizes, and existing water contents for soils. The PVR is estimated in the seasonally active zone, which can be up to about 12 feet in the site vicinity.

Estimated PVR values are based upon anticipated typical changes in soil moisture content from a dry to wet condition; however, soil movements in the field depend on the actual changes in moisture content. Thus, actual soil movements could be less than that calculated if little soil moisture variations occur, or the actual movement could exceed the estimated values if actual soil moisture content changes exceed those anticipated. These conditions are often the result of excessive droughts, flooding, “perched” groundwater infiltration, poor surface-drainage, excessive irrigation adjacent to building foundation, and/or leaking irrigation lines or plumbing.

We estimate the existing PVR at the site to be about 4½ inches. To reduce the PVR to about 1 inch in the proposed building areas, it is recommended that the existing ground be undercut as required to allow for either at least 5½ feet of select fill or at least 7½ feet of moisture-conditioned fill and a 1½ foot select fill cap beneath finished pad grade. To reduce the PVR to about ¾ inches in the proposed building areas, it is recommended that the existing ground be undercut as required to allow for either at least 6½ feet of select fill or at least 9 feet of moisture-conditioned fill and a 1½ foot select fill cap beneath finished pad grade.

In this general area, it is common for structural and geotechnical engineers to consider a PVR of ¾ inch to 1 inch to be tolerable for properly designed foundation systems. However, this movement does not take into consideration the movement criteria required or perceived by the facility owner or occupants. These “operational” performance criteria may be, and often are, more restrictive than the structural criteria or tolerances.

Grade-supported foundation or floor slab movements that approach ¾ inch to 1 inch may cause doors to stick, cracks in sheetrock or brittle floor covering, cracks in exterior finishes and other forms of cosmetic distress. Measures can and should be taken during the design and construction of the facility to help limit the extent and severity of these types of distress. However, these magnitudes of movement typically do not cause "structural distress."

Where movement sensitive flatwork will be constructed adjacent to the buildings, consideration should be given to reducing the PVR value in the flatwork areas to reduce differential movements and associated door jamming, tripping hazards, grout columns, etc. Doweling the flatwork to the building foundations at common openings will further help to reduce the potential for differential movements and trip hazards.

4.2 SHALLOW FOUNDATIONS

The proposed buildings can be supported by either slab-on-grade foundation systems or shallow footing foundation systems.

4.2.1 Slab-on-Grade Foundations

The rigidity of a slab-on-grade foundation system can reduce the effects of differential soil movement due to compression of soils due to structural loads or shrink-swell due to expansive soils. This type of slab can be designed with conventionally reinforced perimeter and interior stiffening grade beams, and/or with post-tensioning to provide rigidity to the slab element. The grade beam width and depth will be determined by the project Structural Engineer. Grade beams may be thickened and widened at column or load bearing wall locations to support concentrated load areas, if necessary. Grade beams and floor slabs should be reinforced with steel to reduce cracking and support bending moments caused by loading and minor movements of foundation soils.

The design values below are based on the subsurface conditions encountered during this exploration and the recommendations for building pad grading provided herein. If the project information changes, we should be contacted to review; and if necessary, provide alternate design parameters based on the changed conditions. These parameters are provided to assist the Structural Engineer in design of a foundation that is stiffened using grade beams (ribs), post tensioning, or a combination thereof.

POST-TENSIONED SLAB PARAMETERS PTI 3RD EDITION WITH 2008 SUPPLEMENTS	
Design Parameter	**1 Inch PVR Design Values**
e_m Edge	4.5 Feet
e_m Center	8.7 Feet
y_m Edge	1.4 Inches
y_m Center	1.0 Inches

BRAB/WRI SLAB PARAMETERS	
Design Parameter	**1 Inch PVR Design Values**
Effective PI	30
Climatic Rating	18
Unconfined Compressive Strength (TSF)	1.5
Soil-Climate Support Index (1-C)	0.16

The recommended net allowable bearing capacity for beams and widened column areas at least 10 inches wide and 18 inches deep is 3,000 psf. Where an all select fill building pad is constructed (no moisture-conditioned fill), an allowable bearing capacity of 4,000 pounds per square foot (psf) can be used for design. To utilize the parameters listed above, the subgrade should be prepared in accordance with Section 5.0 “Site Construction Recommendations” section of this report, including improving the PVR to 1 inch in accordance with Section 4.1 “Potential Vertical Movements & Subgrade Improvements”.

Foundations at this site should be expected to undergo some vertical movements. These movements can potentially cause cosmetic distress and should be accounted for in the design process. Contraction, control, or expansion joints should be designed and placed in various portions of the structures. Properly planned placement of these joints will assist in controlling the degree and location of material cracking which normally occurs due to material shrinkage, thermal effects, soil movements, and other related structural conditions.

Where moisture sensitive floor coverings or equipment will be installed, we recommend that at least a 10-mil vapor retarder be used beneath the slabs. The vapor retarder should conform to ASTM E1745, Class C or better and have a maximum water vapor permeance of 0.044 when tested in accordance with ASTM E96. Consideration to specifying a thicker, more durable vapor retarder should also be made where anticipated construction traffic dictates. Please refer to the latest edition of ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials and ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs for additional guidance on this issue.

4.2.2 Shallow Footing Foundations

An allowable bearing capacity of 3,000 pounds per square foot (psf) can be used for design of shallow footing foundations at least 12 inches wide and deep bearing on compacted fill pad improved to an as-built PVR or ¾ inch. Where an all select fill building pad is constructed (no moisture-conditioned fill), an allowable bearing capacity of 4,000 pounds per square foot (psf) can be used for design. Perimeter footings should be embedded at least 18 inches beneath finished grade to reduce the potential for water intrusion into the building pad soils.

For resistance to lateral loads, an ultimate coefficient of friction of 0.34 between the base of the foundation elements and underlying soils can be used. In addition, for footings cast directly against excavation sidewalls, an ultimate passive resistance equal to an equivalent fluid applying 230 pcf may be used to resist lateral forces for undisturbed soils. The passive resistance should be neglected in the upper 18 inches unless the ground immediately in front of the footing is covered with concrete or other, impervious pavement. The recommended lateral resistance values are ultimate values, and a factor of safety should be in design.

The uplift resistance of a shallow foundation formed in an open excavation will be limited to the weight of the foundation concrete and the soil above it. For design purposes, the ultimate uplift resistance should be based on total unit weights of 105 and 150 pcf for soil and concrete, respectively. This value should be reduced by an appropriate factor of safety to arrive at the allowable uplift load. If there is a chance of submergence, the buoyant unit weights should be used.

Where utility trenches or other excavations are located adjacent to foundations, the bottom of the footing should be located below an imaginary 1:1 (horizontal to vertical) plane upward from the nearest bottom edge of the utility trench.

Post-construction total and differential (over a 40-foot distance) settlements for foundations constructed as recommended herein are anticipated to be about 1 inch and ½ inch, respectively. Contraction, control, or expansion joints should be designed and placed in various portions of the structure. Properly planned placement of these joints will assist in controlling the degree and location of material cracking which normally occurs due to material shrinkage, thermal effects, soil movements, and other related structural conditions.

Footing excavations should have firm bottoms and be free from slough prior to concrete or reinforcing steel placement. The foundation excavations should be observed by ECS prior to placement of reinforcing steel or concrete to observe the exposed ground conditions.

4.3 NON-STRUCTURAL SLAB-ON-GRADE FLOORS

The design of grade-supported floor slabs should take into consideration the interaction between the slab and the supporting soils in resisting moments and shears induced by applied loads. Several design methods use the modulus of subgrade reaction, k_1, to account for soil properties in design. The k_1-value presented in the following table can be used for the design of flat, grade-supported floor slabs for this project. The k_1-value considers that soil materials have been properly placed and compacted beneath the slab, PVR has been reduced to 1 inch or better, and that site drainage is good. Adequate construction joints and reinforcement should be provided to reduce the potential for cracking of the floor slabs due to differential movement.

Subgrade Type	k_1-Value, pci
Select Fill	100
1+ Foot Select Fill below 6 Inches Compacted TxDOT Item 247 Type A, Grade 1-2 Base	150
½+ Foot Select Fill below 12 Inches Compacted TxDOT Item 247 Type A, Grade 1-2 Base	200

Where moisture sensitive floor coverings or equipment will be installed, we recommend that at least a 10-mil vapor retarder be used beneath the slab. The vapor retarder should conform to ASTM E1745, Class C or better and should have a maximum water vapor permeance of 0.044 when tested in accordance with ASTM E96. Consideration to specifying a thicker, more durable vapor retarder should also be made where anticipated construction traffic dictates. If a vapor retarder is considered to provide moisture protection, special attention should be given to the surface curing of the slabs to reduce uneven drying of the slabs and associated cracking and/or slab curling. Please refer to the latest edition of ACI 302.2 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials and ASTM E1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs for additional guidance on this issue.

4.4 PERIMETER CONDITIONS

The upper 18 inches of soil placed along the exterior of the foundations should consist of lean clay soils placed and compacted in accordance with this report. The purpose of this clay backfill is to reduce the opportunity for surface or subsurface water infiltration beneath the structures. Additionally, where penetrations into the structure occur such as utility trenches, a clay plug (or a synthetic alternative) should be placed at the building lines to reduce the opportunity for infiltrating water, regardless of the selected building pad materials. A typical clay plug detail is provided in Appendix D of the report.

Positive drainage away from the structures should also be provided. Soil areas within 10 feet of the buildings should slope at a minimum of 5 percent away from the structures. Adjacent hardscape (flatwork) should slope at 1½ to 2 percent away from the structures. Roof leaders and downspouts should discharge onto paved surfaces sloping away from the buildings or into a closed pipe system which outfalls to the street gutter pan or directly to the storm drain system.

Additionally, irrigation of lawn and landscaped areas should be moderate, with no excessive wetting or drying of soils around the perimeter of the structures allowed. Trees and bushes/shrubs planted near the perimeter of the structures can withdraw large amounts of water from the soils and should be planted at least one-half their anticipated mature height away from the buildings. Where flatwork is placed against or near the structures, a positive seal should be installed and adequately maintained to reduce water intrusion.

Routine maintenance is required to ensure that the recommendations contained in this report are followed and maintained. Greater potential movements could occur with extreme wetting or drying of the soils due to poor drainage, ponding of water, plumbing leaks, lack of irrigation, and/or lack of routine maintenance, etc.

4.5 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The International Building Code (IBC) 2018 requires site classification for seismic design based on the upper 100 feet of a soil profile. Methods are utilized in classifying sites, namely the shear wave velocity (v_s) method and the Standard Penetration Resistance (N-value) method. The seismic site class definitions for the average of shear wave velocity or SPT N-value in the upper 100 feet of the soil profile are shown in the table below:

SEISMIC SITE CLASSIFICATION			
Site Class	**Soil Profile Name**	**Shear Wave Velocity, Vs, (ft./s)**	**N value (bpf)**
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very Dense Soil and Soft Rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 50
E	Soft Soil Profile	Vs < 600 fps	<15

Based on International Building Code (IBC) 2018 Site Class Definitions, in our opinion the site soil and rock can be characterized as Site Class D. The site class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. The deepest borings at the project site extended to depths of 15 feet beneath the existing ground surface, whereas IBC site classifications are based on characterization of the upper 100 feet of the soil profile.

In addition to the seismic site classification, ECS has determined the design spectral response acceleration parameters following the ASCE 7-16 methodology. The Mapped Reponses were estimated from the SEAOC OSHPD Seismic Design Maps https://seismicmaps.org/ using the coordinates Lat: 29.8601° N, Long: -97.6677° W. The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted at the far-right end of the following table.

GROUND MOTION PARAMETERS [ASCE 7-16 Design Code]								
Period (sec)	**Mapped Spectral Response Accelerations (g)**		**Values of Site Coefficient for Site Class**		**Maximum Spectral Response Acceleration Adjusted for Site Class (g)**		**Design Spectral Response Acceleration (g)**	
Reference	Figures 1613.3.1 (1) & (2)		Tables 1613.3.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	S_S	0.053	F_a	1.6	$S_{MS}=F_aS_s$	0.086	$S_{DS}=2/3\,S_{MS}$	0.057
1.0	S_1	0.029	F_v	2.4	$S_{M1}=F_vS_1$	0.069	$S_{D1}=2/3\,S_{M1}$	0.046

4.6 PAVEMENT SECTIONS

ECS has prepared the following recommendations for the design and construction of both flexible and rigid pavement systems for use on the subject project. The "AASHTO Guide for Design of Pavement Structures" published by the American Association of State Highway and Transportation Officials was used to develop the pavement thickness recommendations in this report. This method of design considers pavement performance, traffic, roadbed soil, pavement materials, environment, drainage and reliability. Each of these items is incorporated into the design methodology.

We have based our analysis on the following ESAL information and pavement-related subgrade design parameters, which are considered to be typical for the area. A CBR (California Bearing Ratio) value of 2 percent was selected for design purposes. The CBR value was estimated based on ECS' knowledge and experience with similar soils and projects in this area.

Reliability	70
Initial Serviceability Index, Flexible Pavements	4.2
Initial Serviceability Index, Rigid Pavements	4.5
Terminal Serviceability Index, All Pavements	2.0
Standard Deviation, Flexible Pavements	0.45
Standard Deviation, Rigid Pavements	0.35

Based on the design parameters listed above, we developed recommendations for “light-duty,” “moderate-duty” and “heavy-duty” pavement sections. “Light-duty” pavements are intended for general parking areas with passenger vehicles only and have an approximate capacity of 20,000 ESAL. “Moderate-duty” pavements are intended for areas subject to channelized traffic and fire lanes and have an approximate capacity of 80,000 ESAL. “Heavy-duty” pavements are intended for areas subject to heavier vehicles with extensive turning, starting and stopping, such as pavement aprons associated with trash enclosures, and have an approximate capacity of 250,000 ESAL. If the owner or other members of the design team feel that the ESAL values used for design are not appropriate, ECS should be notified in writing, so any new information can be reviewed, and if necessary, the pavement recommendations revised accordingly.

The minimum recommended thickness for both hot mixed asphalt concrete (HMAC) and reinforced Portland cement concrete (PCC) pavement sections are presented in the table below for the described “light”, “moderate” and “heavy” traffic conditions.

Recommended Pavement Section Options

Component	**Light-Duty** **20,000 ESALs**		**Moderate-Duty** **80,000 ESALs**		**Heavy-Duty** **250,000 ESALs**	
	Rigid	**Asphalt**	**Rigid**	**Asphalt**	**Rigid**	**Asphalt**
Portland Cement Reinforced Concrete (PCC)	5.0 in	--	5.5 in	--	7.0 in	--
Hot Mixed Asphalt Concrete (HMAC)	--	2.0 in	--	2.5 in	--	--
Crushed Limestone Base (CLB)	--	10.0 in	--	12.0 in	--	--

The pavement sections described above are for general-purpose usage for the anticipated subgrade conditions and were designed using the AASHTO Pavement and Analysis System. A maintenance program to keep joints and cracks sealed to prevent moisture infiltration will help extend the pavement life.

We recommend that rigid pavement sections be used in heavy truck traffic areas. The concrete pavement should extend throughout the areas that require extensive turning and maneuvering of the delivery vehicles, etc. Waste dumpster pads, loading areas and other heavily loaded pavement areas that are not designed to accommodate these conditions often experience localized pavement failures, particularly if flexible pavement sections are used.

4.6.1 Pavement Materials

Recommendations regarding material requirements for the various pavement sections are summarized below:

> **Portland Cement Concrete** – Concrete used for paving should have a minimum compressive strength of 3,500 psi at 28-days. The air content at the point of placement should range from 2 to 4 percent. The concrete pavements should be reinforced and jointed per current ACI recommendations.

Hot Mix Asphalt Concrete (HMAC) Surface Course – The asphalt concrete surface course should be plant mixed, hot laid Type D (Fine Graded Surface) or Type C (Coarse Graded Surface Course) meeting the specifications requirements of TxDOT Item 340 and specific criteria for the job mix formula. The mix should be compacted to between 92 and 97 percent of the maximum theoretical density as determined by Tex-227-F.

Crushed Limestone Base Course – Crushed limestone base should be placed in maximum 6-inch compacted lifts. The base materials should be compacted to at least 98 percent of the maximum dry density as determined by TxDOT Tex-113-E. Flexible base materials should be moisture conditioned to between -2 and +3 percentage points of the optimum moisture content during compaction. Flexible base materials should meet the requirements specified in 2014 TxDOT Standard Specification Item 247, Type A, Grade 1-2.

4.6.2 Rigid Pavement Considerations

Joints are typically placed in rigid pavements to control cracking, to facilitate construction, and to isolate a section of pavement from a structure or an adjacent pavement section. Joints used to control cracking are typically known as contraction or control joints as they are intended to control cracking that arises out of the shrinkage of concrete as it cures. Construction joints are used to provide clean breaks between pavement sections that result from the construction process. Isolation joints (or expansion joints) are used to separate the pavement from other structures or pavements and typically include the use of compressible materials in the joint as opposed to contraction or construction joints. Contraction joints should be spaced no greater than 15 feet between the nearest parallel joints with joint depths of at least ¼ of the slab thickness. Contraction and construction joints should be no wider than ⅛ inch whereas isolation joints may be up to 1 inch wide.

Steel reinforcement is commonly used where subgrade conditions are not likely to provide uniform support to the concrete pavement. Generally, sites with expansive soils present are often unable to provide such support to rigid pavement sections. Therefore, reinforcing steel should be used to span between contraction joints and should consist of at-minimum No. 3 bars spaced 18 inches on-center, each way. The rebar should be Grade 60 steel.

As with steel reinforcement, in situations where the subgrade may not provide uniform support to the pavement, dowels are commonly used to transfer loads across construction joints. Smooth dowels should be used for this purpose and should be utilized as recommended in the following table.

DOWEL DESIGN INFORMATION

Slab Thickness, In.	Dowel Diameter, In.	Min. Dowel Embedment Each Side, In.	Min. Dowel Length, In.	Dowel Spacing On-Centers, In
5.0	⅝	5	10	12
5.5	¾	6	12	12
7.0	⅞	7	16	12

The joint and reinforcing design of a rigid pavement system is largely a function of geometry for the pavement area. The proper length of concrete panels (defined as the distance between discontinuous pavement sections, e.g., between construction or isolation joints, or a combination of the two) and the location of contraction, construction, and isolation (expansion) joints are not included as a function of the above concrete pavement guidelines. Rather, these features should be determined based on the geometry and construction sequencing of the pavement. Actual joint spacing should be based on actual pavement areas and final panel lengths so that joints are evenly spaced. Joints should be designed to form approximately square panels where geometrically feasible.

The values provided herein are guidelines and the recommendations selected by the project civil engineer and guidelines not provided or mentioned herein should not exceed the American Concrete Institute (ACI) 330R recommendations.

4.6.3 Pavement Drainage, Subdrainage, and Trenching

Longitudinal cracks and apparent distress due to expansive clays may appear in the pavement after construction and the introduction of landscape irrigation. These cracks and distress are not pavement failures with respect to traffic support, although they may be aesthetically undesirable. In addition, without regular maintenance, the cracks can allow additional moisture intrusion and rapid degradation of the pavement section. The pavement sections are primarily designed to support the traffic and will not resist the forces generated by swelling soils.

Positive drainage should be provided on and around pavement areas to avoid ponding of water. Irrigation of lawn and landscaped areas adjacent to the pavements should be moderate, with no excessive wetting or drying of soils. If landscaped islands are provided, they should be designed to restrict excess water from migrating to the pavement subgrade by using self-contained beds, raised planter boxes, vertical moisture barriers, and/or edge drains. Curbs should extend through the base course and at least 4 inches into the underlying subgrade. Good perimeter surface drainage guiding surface water away from the pavement area is also recommended.

4.7 RETAINING WALLS

The magnitude of the lateral earth pressures on retaining walls is dependent upon the in-situ material behind the wall; and if displaced, the type of material used to backfill the “critical zone” behind the wall. The magnitude of the earth pressure is also dependent upon whether the critical zone is allowed to drain water freely. The critical zone can be considered as the area behind the structure within a boundary created by a 45-degree angle extending from the outside edge of the foundation heel upward to the ground surface.

The lateral earth pressures for drained, level soil backfill are expressed in terms of pounds per cubic foot (psf/ft) “equivalent fluid” weight applied in a triangular distribution pattern as listed below. If the walls are free to deflect or rotate slightly at the top, they may be designed using “active” lateral earth pressures. If the walls are laterally restrained at the top, “at-rest” lateral earth pressures should be used for the retaining wall design. Where multiple material types are used within the critical zone, the higher values below should be used. The equivalent fluid weights shown in the table do not include safety factors and do not account for surcharges. Lateral loads from uniform surcharges on the wall backfill can be calculated by multiplying the vertical surcharge by the below earth pressure coefficients and should be considered as rectangular loads acting on the full wall height. An increase of 1 pcf and 1.5 pcf should be added to the active and at-rest earth pressures; respectively, for each degree of inclination of backfill.

For the design of site retaining walls, we recommend the soil parameters provided in the table on the following page.

RETAINING WALL BACKFILL IN THE CRITICAL SOIL ZONE				
Soil Parameter	**Estimated Value**			
Soil Classification	Undisturbed or Compacted Native Soil	Select Fill	ASTM C33 Size #56, #57 or #467 Stone	Compacted Manufactured Sand (< 8% Fines)
Retained Soil Moist Unit Weight (γ)	120 pcf	120 pcf	110 pcf	120 pcf
Angle of Internal Friction (ϕ)	19°	28°	30°	30°
Coefficient of Active Earth Pressure (K_a)	0.51	0.36	0.33	0.33
Coefficient of At-Rest Earth Pressure (K_o)	0.68	0.53	0.50	0.50
Active Equivalent Fluid Pressure	61 (psf/ft)	43 (psf/ft)	37 (psf/ft)	40 (psf/ft)
At-Rest Earth Equivalent Fluid Pressure	82 (psf/ft)	64 (psf/ft)	55 (psf/ft)	60 (psf/ft)

RETAINING WALL FOUNDATIONS	
Parameter	**Undisturbed or Compacted Native Soil**
Allowable Bearing Pressure	2,500 psf
Minimum Wall Embedment Below Grade	12 inches
Ultimate Sliding Friction Coefficient for Concrete on Soil or Bedrock (μ)	0.34
Ultimate Passive Equivalent Fluid Pressure for Soil or Bedrock (Neglect in upper 12 inches of soil)	230 (psf/ft)

It is critical that the soils proposed to be used for backfilling retaining walls be appropriately accounted for in design. If the soils available differ from the above soil classifications, then ECS should be contacted to provide revised values, and to confirm that only appropriate soils will be used for wall backfill.

Care should be used to avoid the operation of heavy equipment to compact the wall backfill since it may overload and damage the wall. In addition, such loads are not typically considered in the design of site retaining walls and are not provided for in our recommendations.

Wall Drainage: Retaining walls should be provided with a wall and foundation drainage system to relieve hydrostatic pressures which may develop behind the walls. This system can consist of weepholes through the wall and/or a 4-inch perforated, closed joint drain line located along the backside of the walls above the top of the footing. The drain line should be surrounded by a minimum of 6 inches of AASHTO #57 Stone wrapped with an approved non-woven geotextile, such as Mirafi 140N, Mirafi 160N or equivalent. Wall drains can consist of a 12-inch-wide zone of free draining gravel, such as AASHTO #57 Stone, employed directly behind the wall to within 2 feet of the ground surface and separated from the soils beyond with a non-woven geotextile.

Alternatively, the wall drain can consist of a geocomposite drainage board material such as MiraDRAIN 2000 or reviewed equivalent. The wall drain should be hydraulically connected to the foundation drain. The drainboard should extend from the base of the wall to within two feet of the ground surface and should be installed in accordance with manufacturer specifications. A subdrain collector pipe surrounded with at least 5 cubic feet per foot size #57 stone (wrapped in a geotextile) should be installed at the base of the drainboard; or alternatively, an engineered system can be selected with sufficient capacity for direct connectivity to a closed pipe system. The groundwater should be conducted to an appropriate discharge or sump pump facility.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

In a dry and undisturbed state, the soils at the site are expected to provide good subgrade support for fill placement and construction operations. However, when wet, this soil will degrade quickly with disturbance from contractor operations. Therefore, good site drainage should be maintained during earthwork operations, which would help maintain the integrity of the soil. We recommend that an attempt be made to enhance the natural drainage without interrupting its pattern.

The soils at the site are moisture and disturbance-sensitive and contain fines that are considered moderately erodible. Therefore, the contractor should carefully plan their operation to reduce exposure of the subgrade to weather and construction equipment traffic and provide and maintain good site drainage during earthwork operations to help maintain the integrity of the surficial soils. Erosion and sedimentation should be controlled per sound engineering practice and current jurisdictional requirements.

In preparing the site for construction, loose or soft existing soils, vegetation, organic soil, undocumented fill, existing pavements, foundations or utilities, or other deleterious materials should be removed from proposed structural and paving areas, and areas receiving new fill.

After stripping and required cuts have been completed, the subgrade soils should be scarified, moisture conditioned and compacted to at least 95 percent of the maximum dry density as determined by TxDOT Tex-114-E to a depth of at least 8 inches. The soils should be moisture conditioned to between optimum and +4 percentage points of the optimum moisture content just prior to compaction.

5.1.1 Removals, Stripping and Grubbing

The subgrade preparation should consist of stripping deleterious materials (as discussed above) 5 feet from the perimeter of the buildings and 5 feet beyond pavement limits and the toe of fills. ECS should be called on to check that topsoil and deleterious surficial materials have been removed before the placement of fill or construction of structures.

5.1.2 Proof Rolling

After stripping and removing deleterious surface materials, cutting to the proposed grade, and before compacting the subgrade or placing of structural fill, the exposed subgrade should be reviewed by the Geotechnical Engineer or authorized representative. The exposed subgrade should be proof rolled with previously approved construction equipment having a minimum axle load of 25 tons (e.g., fully loaded tandem-axle dump truck). The areas subject to proof rolling should be traversed by the equipment in two perpendiculars (orthogonal) directions with overlapping passes of the vehicle under the observation of the Geotechnical Engineer or authorized representative. This procedure is intended to assist in identifying localized yielding materials. If yielding or “pumping” subgrade is identified by the proof rolling, those areas should be marked for repair before the placement of subsequent fill or other construction materials. Subgrade repair methods, such as undercutting, moisture conditioning, geogrid or lime/cement treatment, should be discussed with the Geotechnical Engineer to determine the appropriate procedure to mitigate the conditions causing the yielding.

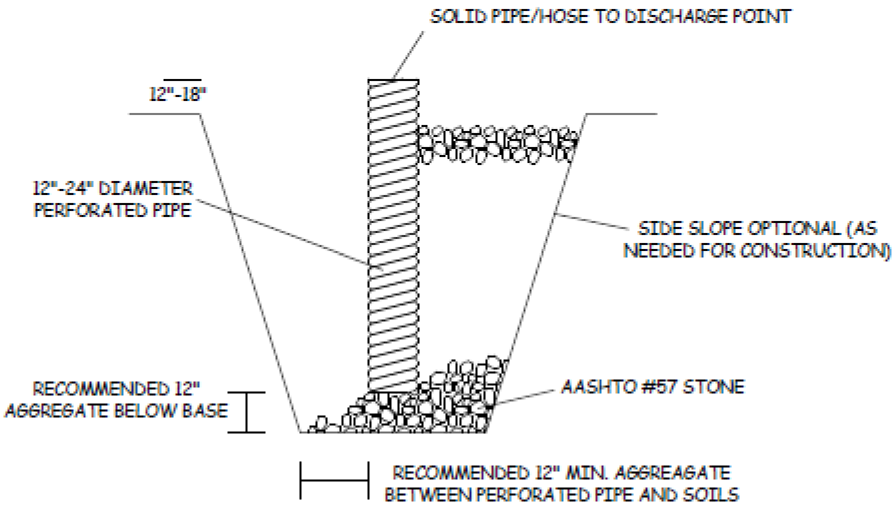
If the area is deemed too small for a piece of equipment to traverse, the excavated area should be probed by the Geotechnical Engineer or authorized representative.

5.1.3 Site Temporary Dewatering

The contractor should make their own assessment of temporary dewatering needs based upon the limited subsurface groundwater information presented in this report. Soil sampling is not continuous, and thus soil and groundwater conditions may vary between sampling intervals (typically 5 feet). If the contractor believes additional subsurface information is needed to assess dewatering needs, they should obtain such information at their own expense. ECS makes no warranties or guarantees regarding the adequacy of the provided information to determine dewatering requirements; such recommendations are beyond our scope of services.

Dewatering systems are a critical component of many construction projects. Dewatering systems should be selected, designed, and maintained by a qualified and experienced (specialty or other) contractor familiar with the succinct geotechnical and other aspects of the project. The failure to properly design and maintain a dewatering system for a given project can result in delayed construction, unnecessary foundation subgrade undercuts, detrimental phenomena such as "running sand" conditions, internal erosion (i.e., "piping"), the migration of "fines" down-gradient towards the dewatering system, localized settlement of nearby infrastructure, foundations, slabs-on-grade and pavements, etc. Water discharged from site dewatering system should be discharged in accordance with local, state and federal requirements.

Strategies for Addressing Perched Groundwater: The typical primary strategy for addressing perched groundwater seeping into excavations is pumping from trenches (or French drains) and sump pits with sump pumps. A typical sump pump drain (found in a sump pit or along a French drain) is depicted on the following page. The inlet of the sump pump is placed at the bottom of the corrugated pipe and the discharge end of the sump is directed to an appropriate stormwater drain.



Sump Pit/Pump Diagram

A typical French drain consists of an 18-to-24-inch-wide bed of AASHTO #57 (or similar open-graded aggregate) aggregate wrapped in a medium duty, non-woven geotextile such as Mirafi 140N or 160N and (often) containing a 4 to 6-inch diameter, Schedule 40 PVC perforated or slotted pipe. Actual dimensions should be as determined necessary by ECS during construction. After the installation has been completed, the geotextile should be wrapped over the top of the aggregate and pipe followed by placement of backfill. The top of the drain should be positioned at least 18 inches beneath the design subgrade elevations. Drains should not be routed within the expanded building limits.

Pumping wells or a vacuum system could also be used to address perched groundwater. These techniques often are only effective during the initial depletion of the perched water quantity and may quickly be ineffective at addressing accumulation of water from rain, lake level, etc.

5.2 EARTHWORK OPERATIONS

It is recommended that the proposed building pad areas be improved according to report Section 4.1 “Potential Vertical Rise & Subgrade Improvements” to mitigate PVR. The stripping and removal operations and fill placement to finished building pad grade should extend at least 5 feet beyond the building perimeters and beneath adjacent movement sensitive concrete flatwork. The upper 18 inches of fill outside of the building areas should consist of a properly compacted low permeability clay (CL) soil to reduce infiltration of moisture into the adjacent select fill materials.

After stripping and grubbing, undercutting/removals, subgrade preparation (including proof rolling) and evaluation has been completed, fill placement may begin. Fills in the building pad areas should consist of materials meeting the requirements of the Select Fill and Moisture-Conditioned Fill sections below. Fills in pavement and landscape areas can consist of materials meeting the requirements of the General Fill section below.

Consideration should be given to creating an “all weather” working surface with the upper 6 inches of the select fill building pads. Such a working surface should consist of compacted TxDOT Item 247 Type A, Grade 1-2 Flexible Base material. The use of an “all weather” working surface can significantly improve the accessibility of the site to construction traffic during periods of wet weather.

Soil moisture levels should be preserved (by various methods that can include covering with plastic, watering, etc.) until new fill, pavements, or slabs are placed. Fill soils should be placed in 8 inches loose lifts for mass grading operations and 4-inch lifts for trench type excavations where walk-behind or “jumping jack” compaction equipment is used.

Upon completion of the filling operations, care should be taken to maintain the soil moisture content before the construction of floor slabs and pavements. If the soil becomes desiccated, the affected material should be removed and replaced, or these materials should be scarified, moisture conditioned, and re-compacted.

Utility cuts should not be left open for extended periods and should be properly backfilled. Backfilling should be accomplished with properly compacted on-site soils, rather than granular materials. If granular materials are used, a utility trench cut-off at the building line is recommended to help prevent water from migrating through the utility trench backfill to beneath the proposed structures.

Field density and moisture tests should be performed on each lift as necessary to check that adequate compaction is achieved. As a guide, one test per 5,000 square feet per lift is recommended in the building areas (two tests minimum per lift) and one test per 10,000 square feet per lift is recommended for paving areas (two tests minimum per lift). Utility trench backfill should be tested at a rate of one test per lift per every 150 linear feet of the trench (two tests minimum per lift). Certain jurisdictional requirements may require testing in addition to that noted previously. Therefore, these specifications should be reviewed, and more stringent specifications should be followed.

5.3 MATERIAL SPECIFICATIONS

5.3.1 General Fill

General fill should consist of on-site or imported soils, provided they meet the requirements described below. General fill materials should be free of organics, construction debris, deleterious materials, and should be free of rocks larger than 4 inches in greatest dimension. Proposed general fill should be evaluated and tested by ECS prior to placement in the field.

ECS recommends that general fill be placed in horizontal loose lifts of not more than 8 inches in thickness. Lift thickness should be decreased when using light compaction equipment. General fill should be compacted to at least 95% of the maximum dry density at moisture contents within the range of optimum to +4 percentage points of the optimum moisture content (Tex-114-E).

5.3.2 Select Fill

Select fill materials should be free of organics, construction debris, deleterious materials, and should be free of rocks larger than 4 inches in greatest dimension. Select fill should have a Plasticity Index of between 5 and 20. Where an all select fill pad is to be constructed, select fill should also contain at least 35% material passing the No. 200 sieve (by dry unit weight). Select fill should be evaluated and tested by ECS prior to placement in the field.

ECS recommends that select fill be placed in horizontal loose lifts of not more than 8 inches in thickness. Select fill should be compacted to at least 95% of the maximum dry density at moisture contents within the range of -1 to +3 percentage points of the optimum moisture content (Tex-114-E).

5.3.3 Moisture-Conditioned Fill

Moisture-conditioned fill materials for use in PVR mitigation should be clean of organics, construction debris, deleterious materials, and should contain less than 15 percent gravel (material retained on the No. 4 sieve (by dry unit weight)). Material proposed for use as moisture-conditioned fill should be relatively consistent in composition and should be evaluated and tested by ECS in the laboratory prior to placement in the field. Some of the soils explored at this site are not appropriate for use as moisture-conditioned fill and some selective grading should be expected if this methodology is used.

ECS recommends that moisture-conditioned fill be placed in horizontal loose lifts of not more than 8 inches in thickness. Moisture-conditioned fill for the purposes of PVR reduction in the building pads should be compacted to between 90% and 95% of the maximum dry density (Tex-114-E) at moisture contents demonstrated to limit swell or consolidation to less than 0.75 percent at the modeled in-situ overburden pressures (ASTM D4546).

ECS recommends that moisture-density relationships and swell test bulk samples be collected for soils proposed for moisture conditioned fill approximately 1 to 2 weeks prior to commencement of earthwork operations. Moisture-conditioning recommendations may need to be adjusted based upon testing performed during construction. It is recommended that moisture-conditioned building pads have slab-on-grade constructed as soon as possible after grading to help seal in the moisture and reduce evapotranspiration. Owners and landscape architects should be advised that trees should not be located closer than one-half their mature height from the foundations.

If the moisture-conditioned fill option is implemented to reduce the PVR, the earthwork contractor should be aware that there is a high probability that soils placed in the building pads will be compacted at well above their optimum moisture content. Soils compacted several percentage points above their optimum moisture content are typically soft and susceptible to rutting, and appropriate construction equipment capable of maneuvering on soft ground conditions should be considered.

5.4 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed as soon as possible after the excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils should be removed from the foundation excavation bottom prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete is suggested to be placed on the bearing soils before the placement of reinforcing steel.

Footing and Slab Subgrade Observations: It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what was anticipated.

5.5 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally appropriate for support of utility pipes. The pipe subgrades should be observed and probed by ECS. Loose or deleterious materials encountered should be removed and replaced with compacted General Fill, or pipe stone bedding material.

Utility Backfilling: The granular bedding material (often AASHTO #57 stone) should be at least 4 inches thick, but not less than that specified by the civil engineer’s project drawings and specifications. We recommend that the bedding materials be placed up to at least the springline of the pipe. Utility trenches in the building pad should be backfilled above the utility bedding and shading materials with similar materials to original building pad construction, and general fill materials outside the building pad area. The backfill materials should be placed in lifts not to exceed 8 inches loose measure or 6 inches compacted measure. Thinner lifts may be required when using handheld compaction equipment. Backfill materials should be moisture conditioned and compacted in accordance with the moisture-conditioned fill, select fill and general fill sections of this report. Where building pads have been constructed using moisture-conditioned soils and a select fill cap, care should be exercised to separate out these materials during trenching and place them back in a similar manner to original building pad construction. Mixing of these two soil types should be prevented.

Utility Connections: Flexible connections should be considered where utilities connect to the buildings or pass-through building foundations/slabs to allow for the anticipated Potential Vertical Rise differential. This could be provided by special flexible connections, pipe sleeving with appropriate waterproofing, or other methods.

Excavation Safety: Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by the Client. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings and tests performed at the locations as indicated on the Boring Location Diagram and other information referenced in this report. This report does not reflect any variations which may occur between the borings. In the performance of the subsurface exploration, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in subsurface conditions exist on most sites between boring locations and also such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, after performing on-site observations during the construction period and noting characteristics and variations, a reevaluation of the recommendations for this report will be necessary.

Appendix A - Drawings and Reports

Site Location Diagram
Boring Location Diagram(s)
Subsurface Cross-Section(s)
Geologic Survey Map

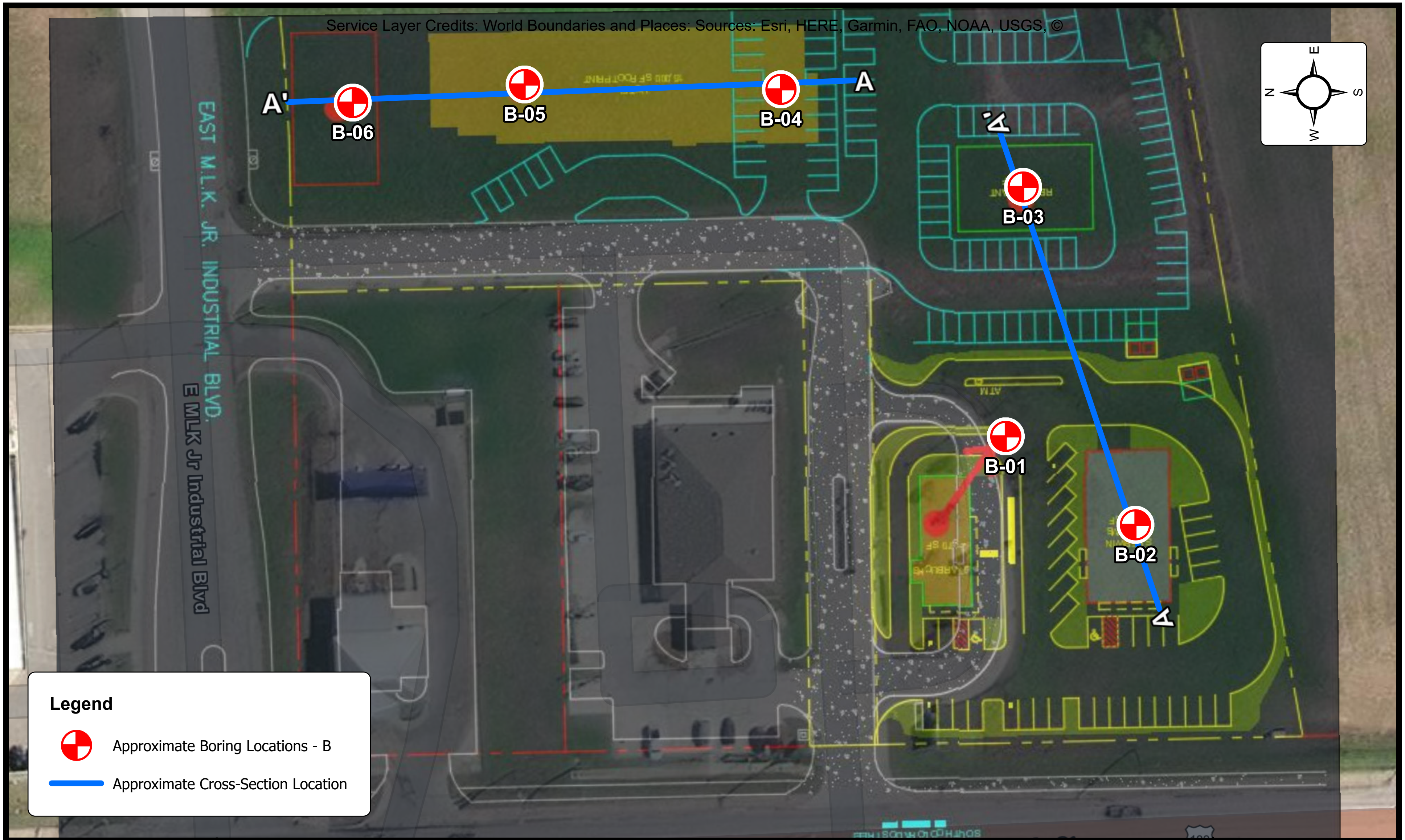
Service Layer Credits: World Boundaries and Places: Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, ©

SITE LOCATION DIAGRAM

Sherwin Williams Retail Store

East MLK Jr. Industrial Blvd, Lockhart, Texas
Lockhart QOZII, LLC

ENGINEER	CFR
SCALE	1" = 1500'
PROJECT NO.	17:6722
SHEET	1 OF 1
DATE	OCTOBER 2024

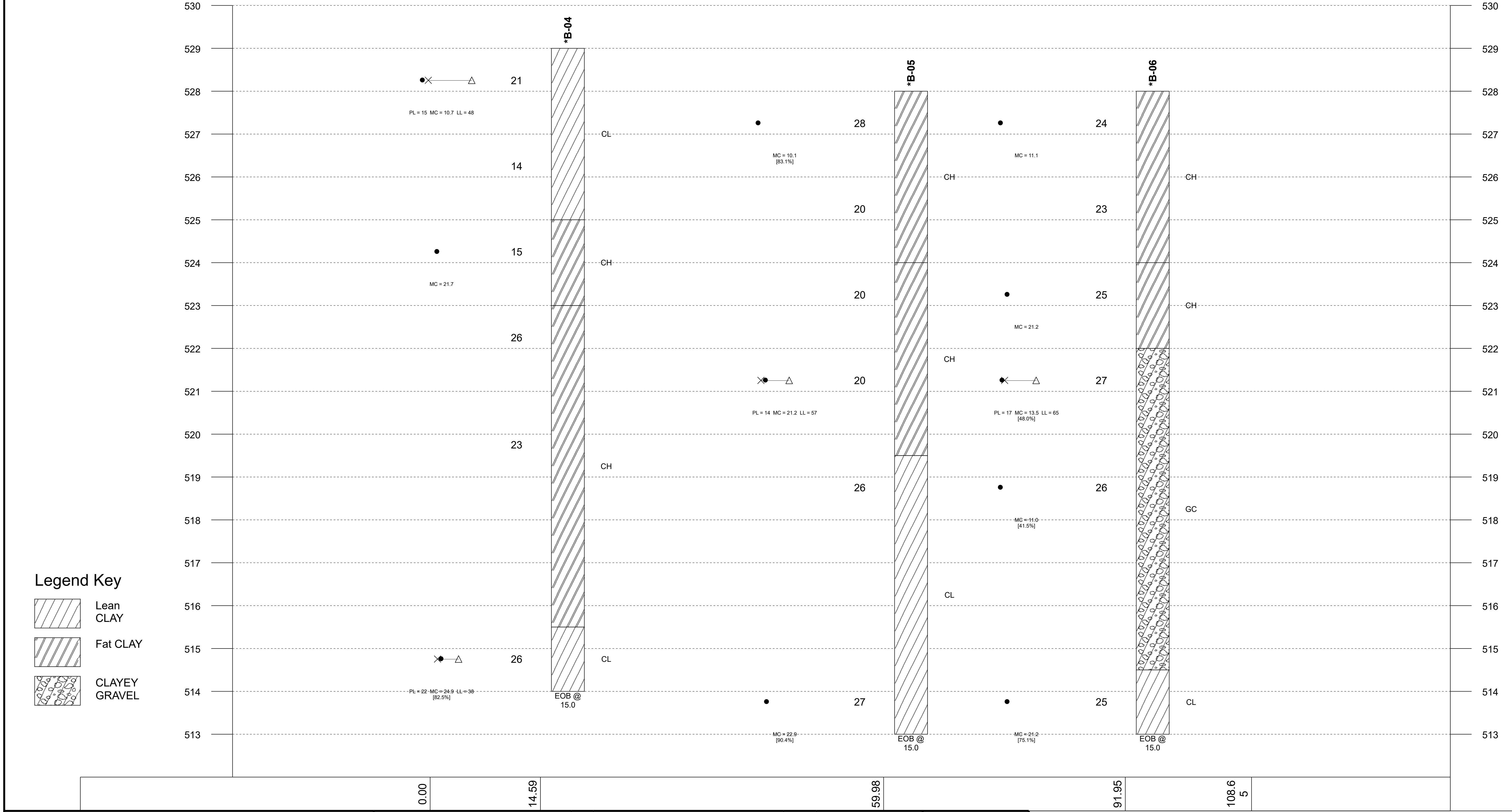


BORING LOCATION DIAGRAM

Sherwin Williams Retail Store

East MLK Jr. Industrial Blvd, Lockhart, Texas
Lockhart QOZII, LLC

ENGINEER
CFR
SCALE
1" = 80'
PROJECT NO.
17:6722
SHEET
1 OF 1
DATE
OCTOBER 2024



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit
X ——●—— △
[FINES CONTENT %]
➡ BOTTOM OF CASING
⇨ LOSS OF CIRCULATION
○ CALIBRATED PENETROMETER

▽ WL (First Encountered)
▼ WL (Completion)
▼ WL (Estimated Seasonal High Water)
▽ WL (Stabilized)

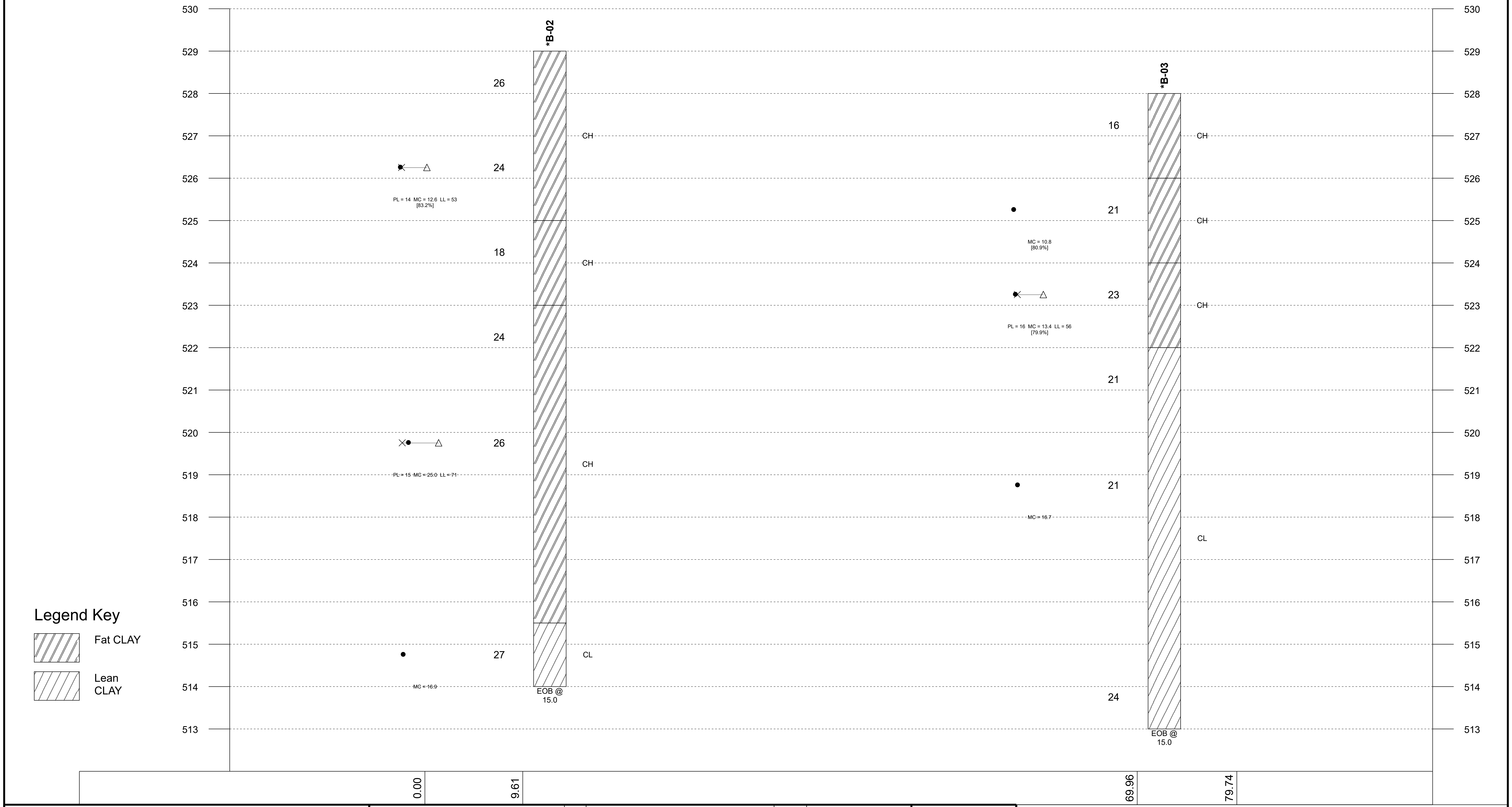
🟥 Fill
🟪 Possible Fill
▨ Probable Fill
🟩 Rock

ECS

GENERALIZED SUBSURFACE SOIL PROFILE

Section line 1
Sherwin Williams Retail Store
Lockhart QOZII, LLC
East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644

Project No: 17:6722
Date: OCTOBER 2024



Notes:

1- EOB: END OF BORING AR: AUGER REFUSAL SR: SAMPLER REFUSAL.
2- THE NUMBER BELOW THE STRIPS IS THE DISTANCE ALONG THE BASELINE.
3- SEE INDIVIDUAL BORING LOG AND GEOTECHNICAL INFORMATION.
4- STANDARD PENETRATION TEST RESISTANCE (LEFT OF BORING) IN BLOWS PER FOOT (ASTM D1586).

Plastic Limit Water Content Liquid Limit
X———●———△

[FINES CONTENT %]

BOTTOM OF CASING

LOSS OF CIRCULATION

○ CALIBRATED PENETROMETER

▽ WL (First Encountered)

▼ WL (Completion)

▼ WL (Estimated Seasonal High Water)

▽ WL (Stabilized)

🟥 Fill

🟪 Possible Fill

▨ Probable Fill

🟩 Rock

GENERALIZED SUBSURFACE SOIL PROFILE

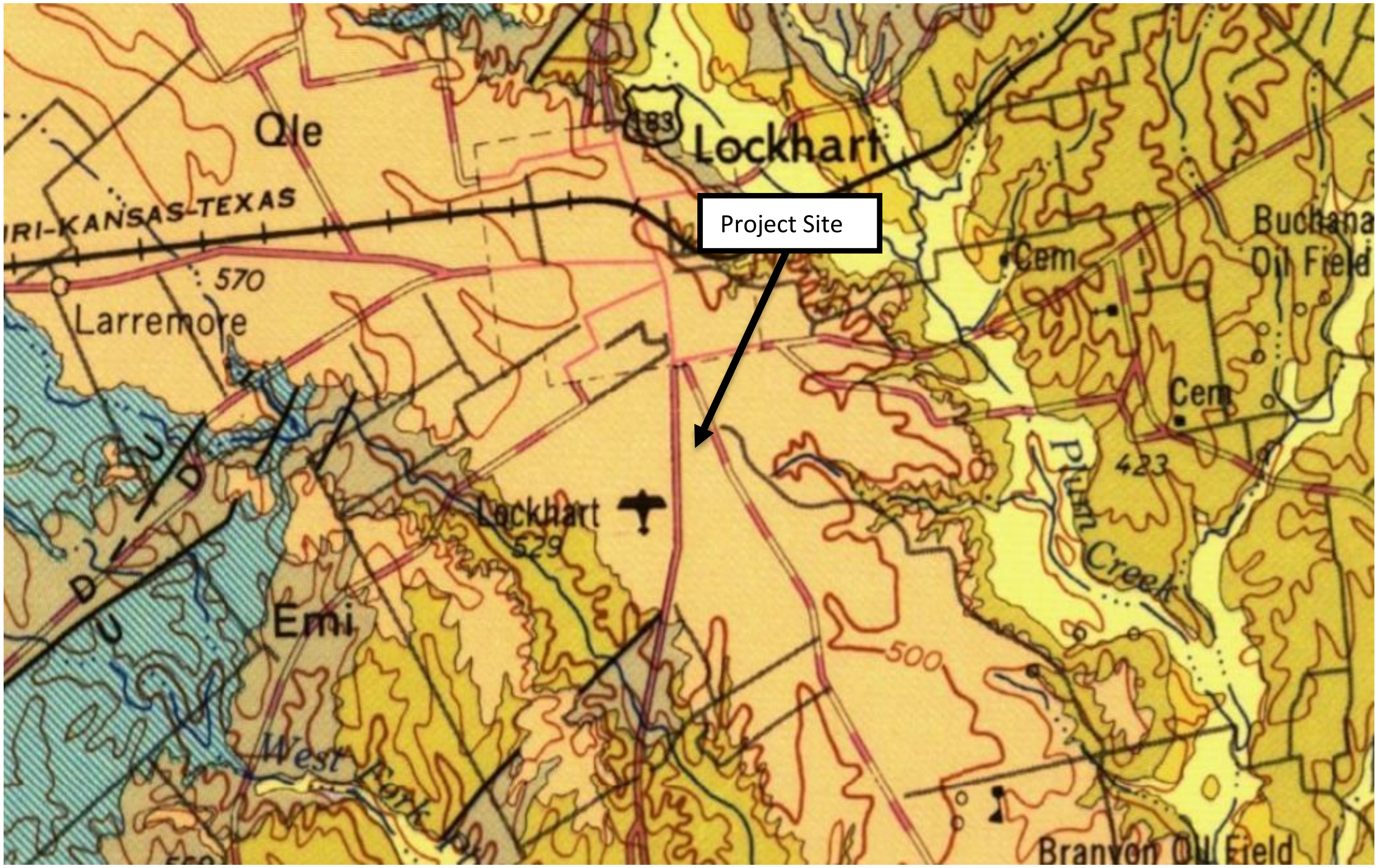
Section line 2

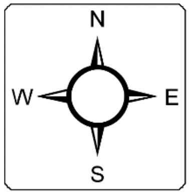
Sherwin Williams Retail Store

Lockhart QOZII, LLC

East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644

Project No: 17:6722 Date: OCTOBER 2024





Fluviatile Terrace Deposits (Qle)

Geologic Atlas of Texas, Seguin Sheet, Texas **UT Bureau of Economic Geology, 1974**

SITE GEOLOGIC DIAGRAM
Sherwin Williams Retail Store

East MLK Jr. Industrial Blvd, Lockhart, Texas
Lockhart QOZII, LLC

ENGINEER	CFR
SCALE	NTS
PROJECT NO.	17:6722
SHEET	1 OF 1
DATE	OCTOBER 2024

Appendix B – Field Operations

Reference Notes
Exploration Procedures
Boring Logs

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

■		**ASPHALT**
░		**CONCRETE**
⁘		**GRAVEL**
▨		**TOPSOIL**
□		**VOID**
⊞		**BRICK**
○		**AGGREGATE BASE COURSE**
▨	**GW**	**WELL-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
▨	**GP**	**POORLY-GRADED GRAVEL** **gravel-sand mixtures, little or no fines**
▨	**GM**	**SILTY GRAVEL** **gravel-sand-silt mixtures**
▨	**GC**	**CLAYEY GRAVEL** **gravel-sand-clay mixtures**
▨	**SW**	**WELL-GRADED SAND** **gravelly sand, little or no fines**
▨	**SP**	**POORLY-GRADED SAND** **gravelly sand, little or no fines**
▨	**SM**	**SILTY SAND** **sand-silt mixtures**
▨	**SC**	**CLAYEY SAND** **sand-clay mixtures**
▥	**ML**	**SILT** **non-plastic to medium plasticity**
▥	**MH**	**ELASTIC SILT** **high plasticity**
▨	**CL**	**LEAN CLAY** **low to medium plasticity**
▨	**CH**	**FAT CLAY** **high plasticity**
▨	**OL**	**ORGANIC SILT or CLAY** **non-plastic to low plasticity**
▨	**OH**	**ORGANIC SILT or CLAY** **high plasticity**
▨	**PT**	**PEAT** **highly organic soils**

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

▽	WL (First Encountered)
▼	WL (Completion)
⧩	WL (Seasonal High Water)
▽	WL (Stabilized)

FILL AND ROCK

🟥	🟪	🟥	🟩
FILL	POSSIBLE FILL	PROBABLE FILL	ROCK

---

[1] Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2] To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3] Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4] Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5] Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6] The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7] Minor deviation from ASTM D 2488-17 Note 14.

[8] Percentages are estimated to the nearest 5% per ASTM D 2488-17.

SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT)
ASTM D 1586
Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth

- Recording the number of hammer blows required to drive split-spoon a distance of 18-24 inches (in 3 or 4 Increments of 6 inches each)

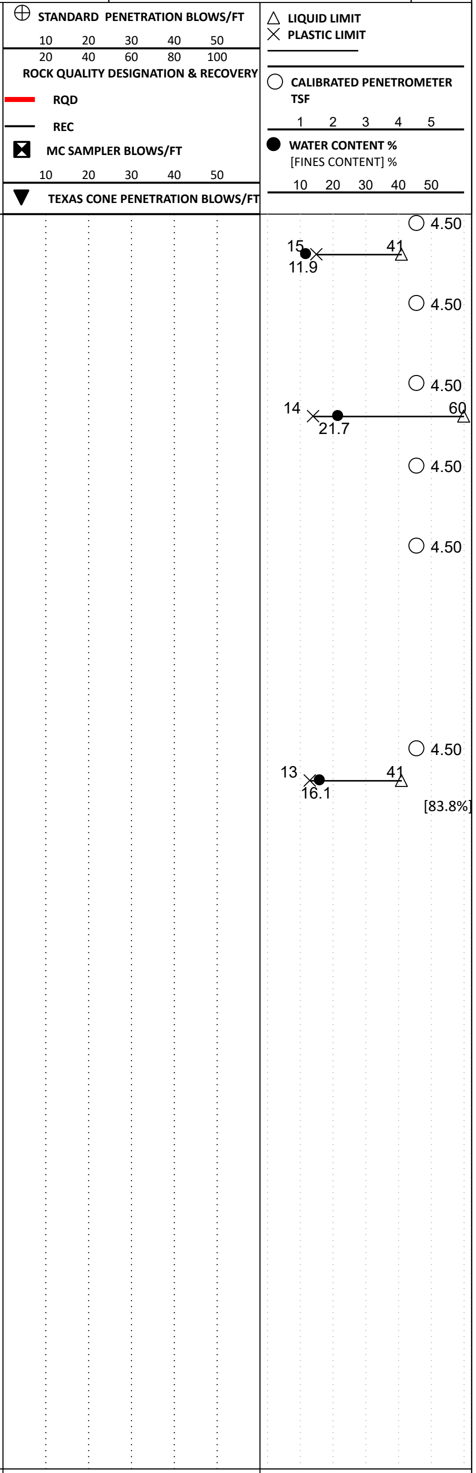
- Auger is advanced* and an additional SPT is performed

- One SPT typically performed for every two to five feet. An approximate 1.5 inch diameter soil sample is recovered.

**Drilling Methods May Vary—* The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.

CLIENT: **Lockhart QOZII, LLC**	PROJECT NO.: **17:6722**	BORING NO.: **B-01**	SHEET: **1 of 1**
PROJECT NAME: **Sherwin Williams Retail Store**	DRILLER/CONTRACTOR: **Burge Engineering And Associates, Inc.**		
SITE LOCATION: **East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644**			LOSS OF CIRCULATION
LATITUDE: **29.860294**	LONGITUDE: **-97.667634**	STATION:	SURFACE ELEVATION: **528.0**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-01	ST	24	24	(CL) LEAN CLAY WITH SAND, dark brown, very stiff			
	S-02	ST	24	24				
5	S-03	ST	24	24	(CH) FAT CLAY, tannish light brown, very stiff		523	
	S-04	ST	24	24				
	S-05	ST	24	24				
10							518	
	S-06	ST	24	24	(CL) LEAN CLAY WITH SAND, mottled light brown to light gray, very stiff, calcareous			
15					**END OF BORING AT 15.0 FT**		513	
20							508	
25							503	
30							498	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED:	Oct 08 2024	CAVE IN DEPTH:
▼ WL (Completion)	Dry	BORING COMPLETED:	Oct 08 2024	HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)		EQUIPMENT: **CME 55**	LOGGED BY:	DRILLING METHOD: **Solid Stem Auger**
▽ WL (Stabilized)				

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Lockhart QOZII, LLC**

PROJECT NO.: **17:6722**

BORING NO.: **B-02**

SHEET: **1 of 1**

PROJECT NAME: **Sherwin Williams Retail Store**

DRILLER/CONTRACTOR: **Burge Engineering And Associates, Inc.**

SITE LOCATION: **East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644**

LOSS OF CIRCULATION

BOTTOM OF CASING

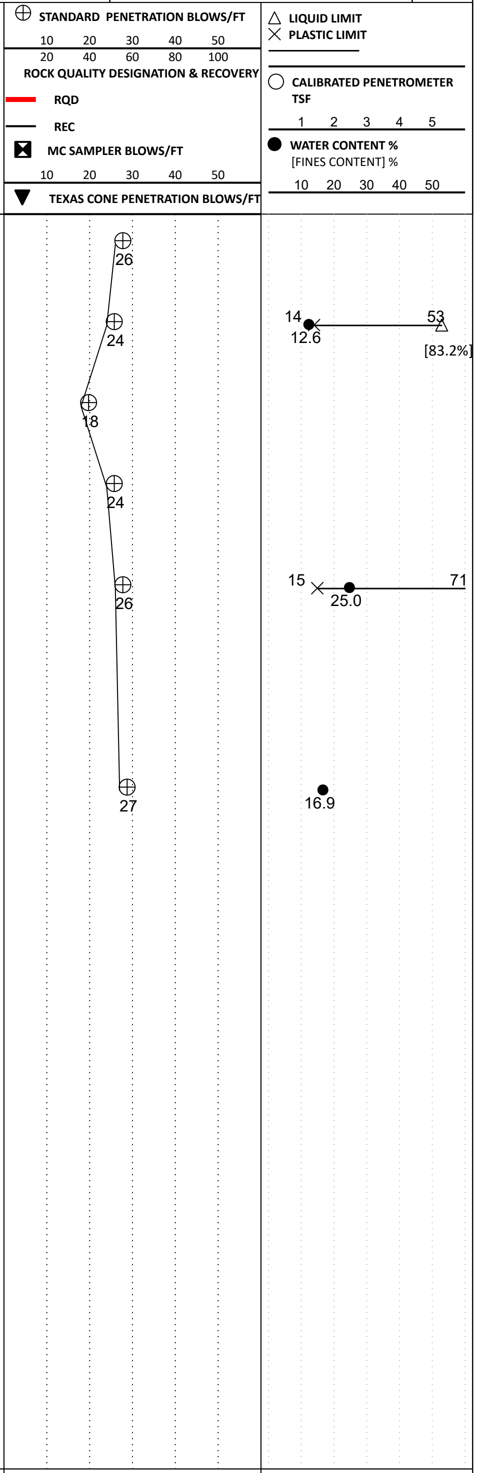
LATITUDE: **29.860069**

LONGITUDE: **-97.667779**

STATION:

SURFACE ELEVATION: **529.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-01	SS	18	18	(CH) FAT CLAY WITH SAND, grayish dark brown, very stiff			6-10-16 (26)
	S-02	SS	18	18				10-12-12 (24)
5	S-03	SS	18	18	(CH) FAT CLAY WITH SAND, grayish dark brown to tannish, very stiff		524	8-8-10 (18)
	S-04	SS	18	18	(CH) FAT CLAY, tannish light brown, very stiff			10-12-12 (24)
	S-05	SS	18	18				8-11-15 (26)
10							519	
	S-06	SS	18	18	(CL) LEAN CLAY, mottled light brown, very stiff, calcareous			10-12-15 (27)
15					**END OF BORING AT 15.0 FT**		514	
20							509	
25							504	
30							499	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	
WL (Completion)	**Dry**
WL (Seasonal High Water)	
WL (Stabilized)	

BORING STARTED: **Oct 08 2024**

CAVE IN DEPTH:

BORING COMPLETED: **Oct 08 2024**

HAMMER TYPE: **Auto**

EQUIPMENT: **CME 55**

LOGGED BY:

DRILLING METHOD: **Solid Stem Auger**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Lockhart QOZII, LLC**

PROJECT NO.: **17:6722**

BORING NO.: **B-03**

SHEET: **1 of 1**

PROJECT NAME: **Sherwin Williams Retail Store**

DRILLER/CONTRACTOR: **Burge Engineering And Associates, Inc.**

SITE LOCATION: **East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

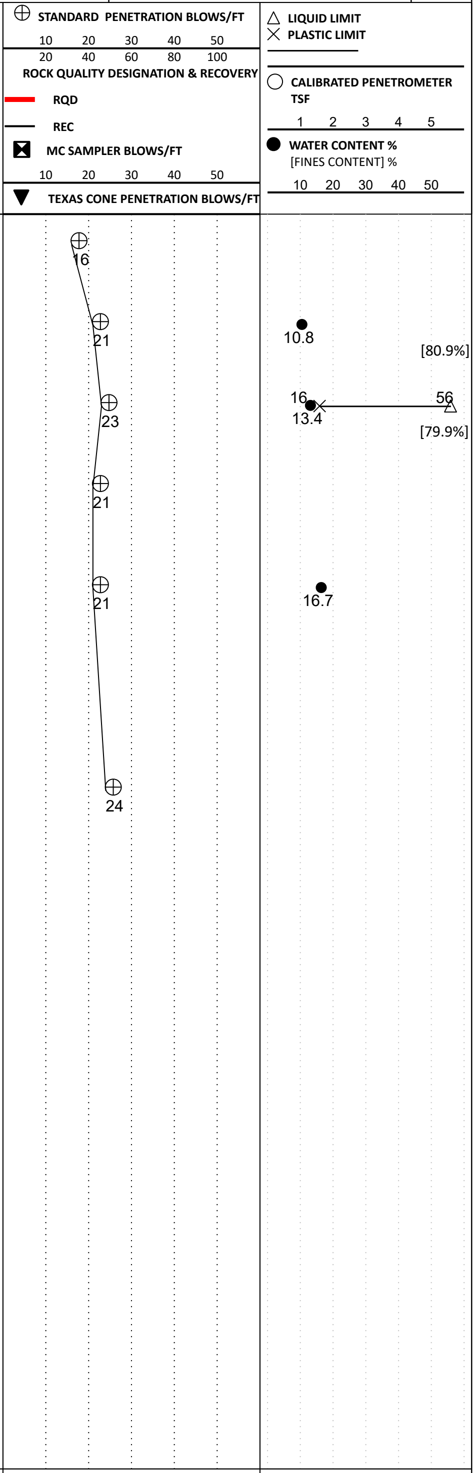
LATITUDE: **29.860255**

LONGITUDE: **-97.667192**

STATION:

SURFACE ELEVATION: **528.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-01	SS	18	18	(CH) FAT CLAY WITH SAND, grayish dark brown, very stiff			6-8-8 (16)
	S-02	SS	18	18	(CH) FAT CLAY WITH SAND, dark brown, very stiff			10-10-11 (21)
5	S-03	SS	18	18	(CH) FAT CLAY WITH SAND, grayish dark brown - brown, very stiff		523	6-11-12 (23)
	S-04	SS	18	18	(CL) LEAN CLAY WITH SAND, tannish to mottled light brown, very stiff			7-10-11 (21)
10	S-05	SS	18	18			518	7-9-12 (21)
	S-06	SS	18	18				10-11-13 (24)
15					**END OF BORING AT 15.0 FT**		513	
20							508	
25							503	
30							498	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Oct 08 2024**

BORING COMPLETED: **Oct 08 2024**

EQUIPMENT: **CME 55**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **Solid Stem Auger**

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
Lockhart QOZII, LLC	**17:6722**	**B-04**	**1 of 1**

PROJECT NAME: **Sherwin Williams Retail Store**

DRILLER/CONTRACTOR: **Burge Engineering And Associates, Inc.**

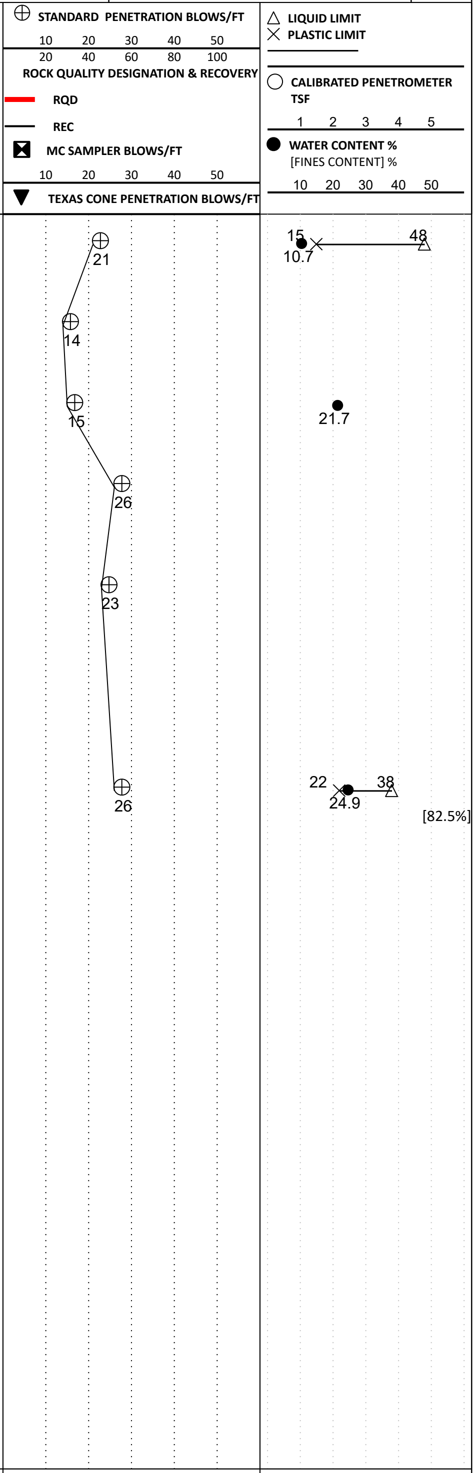
SITE LOCATION: **East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644**

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

LATITUDE:	LONGITUDE:	STATION:	SURFACE ELEVATION:
29.860660	**-97.667027**		**529.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-01	SS	18	18	(CL) LEAN CLAY WITH SAND, grayish dark brown, stiff to very stiff			8-10-11 (21)
	S-02	SS	18	18				7-7-7 (14)
5	S-03	SS	18	18	(CH) FAT CLAY, tannish light brown, stiff		524	5-7-8 (15)
	S-04	SS	18	18	(CH) FAT CLAY, mottled light brown to tannish, very stiff			10-11-15 (26)
	S-05	SS	18	18				10-10-13 (23)
10							519	
	S-06	SS	18	18	(CL) LEAN CLAY WITH SAND, brown, very stiff			8-11-15 (26)
15					**END OF BORING AT 15.0 FT**		514	
20							509	
25							504	
30							499	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Oct 08 2024**

BORING COMPLETED: **Oct 08 2024**

EQUIPMENT: **CME 55**

LOGGED BY:

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

DRILLING METHOD: **Solid Stem Auger**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Lockhart QOZII, LLC**

PROJECT NO.: **17:6722**

BORING NO.: **B-05**

SHEET: **1 of 1**

PROJECT NAME: **Sherwin Williams Retail Store**

DRILLER/CONTRACTOR: **Burge Engineering And Associates, Inc.**

SITE LOCATION: **East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644**

LOSS OF CIRCULATION

BOTTOM OF CASING

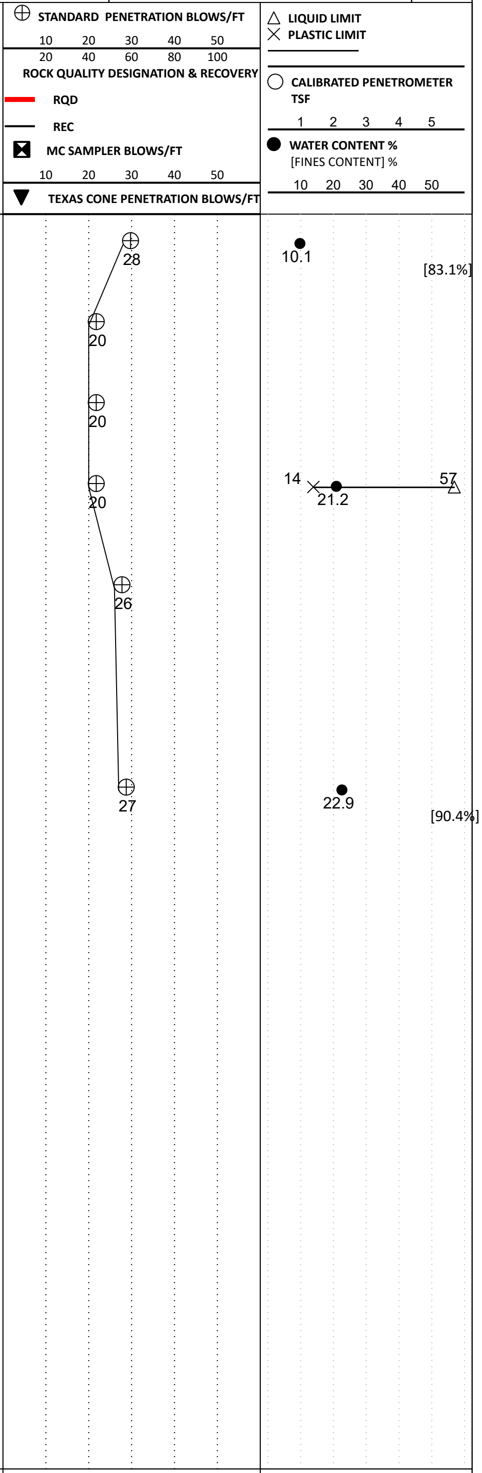
LATITUDE: **29.861070**

LONGITUDE: **-97.667026**

STATION:

SURFACE ELEVATION: **528.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-01	SS	18	18	(CH) FAT CLAY WITH SAND, grayish dark brown, very stiff			8-10-18 (28)
	S-02	SS	18	18				10-10-10 (20)
5	S-03	SS	18	18	(CH) FAT CLAY WITH SAND, tannish light brown, very stiff		523	7-8-12 (20)
	S-04	SS	18	18				8-8-12 (20)
	S-05	SS	18	18	(CL) LEAN CLAY, mottled light brown, very stiff			10-12-14 (26)
10							518	
	S-06	SS	18	18				9-12-15 (27)
15					**END OF BORING AT 15.0 FT**		513	
20							508	
25							503	
30							498	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)

▼ WL (Completion) **Dry**

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Oct 08 2024**

BORING COMPLETED: **Oct 08 2024**

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

EQUIPMENT: **CME 55**

LOGGED BY:

DRILLING METHOD: **Solid Stem Auger**

GEOTECHNICAL BOREHOLE LOG

CLIENT: **Lockhart QOZII, LLC**	PROJECT NO.: **17:6722**	BORING NO.: **B-06**	SHEET: **1 of 1**
PROJECT NAME: **Sherwin Williams Retail Store**	DRILLER/CONTRACTOR: **Burge Engineering And Associates, Inc.**		

SITE LOCATION:
East MLK Jr. Industrial Blvd, Lockhart, Texas, 78644

LOSS OF CIRCULATION ⟩100⟩

BOTTOM OF CASING ▶

LATITUDE: **29.861357**	LONGITUDE: **-97.667066**	STATION:	SURFACE ELEVATION: **528.0**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6" (TCP/MC/SPT-N value)*
	S-01	SS	18	18	(CH) FAT CLAY WITH SAND, grayish dark brown, very stiff			15-12-12 (24)
	S-02	SS	18	18				17-11-12 (23)
5	S-03	SS	18	18	(CH) FAT CLAY, tannish light brown, very stiff		523	10-12-13 (25)
	S-04	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND, brown to light brown, medium dense			20-15-12 (27)
	S-05	SS	18	18				18-13-13 (26)
10							518	
	S-06	SS	18	18	(CL) LEAN CLAY WITH SAND, mottled light brown, very stiff, calcareous			8-11-14 (25)
15					**END OF BORING AT 15.0 FT**		513	
20							508	
25							503	
30							498	

⊕ STANDARD PENETRATION BLOWS/FT
10 20 30 40 50

ROCK QUALITY DESIGNATION & RECOVERY
20 40 60 80 100
🟥 RQD
— REC

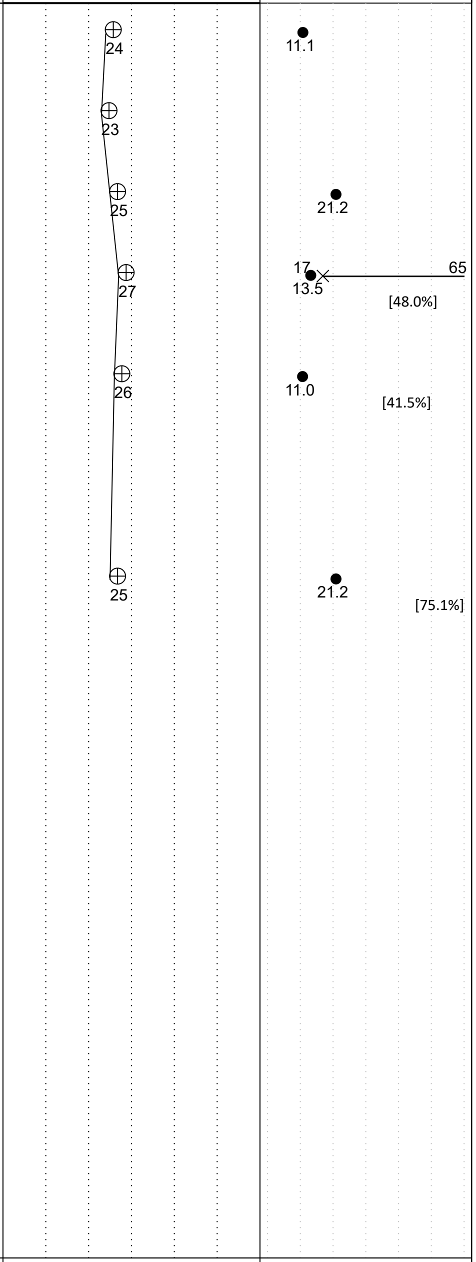
☒ MC SAMPLER BLOWS/FT
10 20 30 40 50

▼ TEXAS CONE PENETRATION BLOWS/FT

△ LIQUID LIMIT
× PLASTIC LIMIT

○ CALIBRATED PENETROMETER TSF
1 2 3 4 5

● WATER CONTENT %
[FINES CONTENT] %
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)		BORING STARTED: **Oct 08 2024**	CAVE IN DEPTH:
▼ WL (Completion)	**Dry**	BORING COMPLETED: **Oct 08 2024**	HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **CME 55** LOGGED BY:	DRILLING METHOD: **Solid Stem Auger**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

Appendix C – Laboratory Testing

Laboratory Testing Summary
Grain Size Analysis/Analyses

Laboratory Testing Summary

Page 1 of 2

Sample Source	Sample Number	Start Depth (feet)	End Depth (feet)	Sample Distance (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Organic Content (%)
							LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-01	S-01	0.0	2.0	2.0	11.9		41	15	26					
B-01	S-03	4.0	6.0	2.0	21.7		60	14	46					
B-01	S-06	13.0	15.0	2.0	16.1	CL	41	13	28	83.8				
B-02	S-02	2.0	3.5	1.5	12.6	CH	53	14	39	83.2				
B-02	S-05	8.5	10.0	1.5	25.0		71	15	56					
B-02	S-06	13.5	15.0	1.5	16.9									
B-03	S-02	2.0	3.5	1.5	10.8					80.9				
B-03	S-03	4.0	5.5	1.5	13.4	CH	56	16	40	79.9				
B-03	S-05	8.5	10.0	1.5	16.7									
B-04	S-01	0.0	1.5	1.5	10.7		48	15	33					
B-04	S-03	4.0	5.5	1.5	21.7									
B-04	S-06	13.5	15.0	1.5	24.9	CL	38	22	16	82.5				
B-05	S-01	0.0	1.5	1.5	10.1					83.1				
B-05	S-04	6.0	7.5	1.5	21.2		57	14	43					
B-05	S-06	13.5	15.0	1.5	22.9					90.4				
B-06	S-01	0.0	1.5	1.5	11.1									
B-06	S-03	4.0	5.5	1.5	21.2									
B-06	S-04	6.0	7.5	1.5	13.5		65	17	48	48.0				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ration, OC: Organic Content (ASTM D 2974)

Project No.: **17:6722**
Project Name: **Sherwin Williams Retail Store**
PM: **Layane Thuise Mester**
PE: **Connor Roman**
Printed On: **October 29, 2024**

ECS Southwest, LLP - Austin
14050 Summit Drive Suite 101,
Austin, TX 78728
Phone: 512-837-8005
Fax: 512-388-8914

Laboratory Testing Summary

Sample Source	Sample Number	Start Depth (feet)	End Depth (feet)	Sample Distance (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Organic Content (%)
							LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-06	S-05	8.5	10.0	1.5	11.0					41.5				
B-06	S-06	13.5	15.0	1.5	21.2					75.1				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ration, OC: Organic Content (ASTM D 2974)

Project No.: **17:6722**
Project Name: **Sherwin Williams Retail Store**
PM: **Layane Thuise Mester**
PE: **Connor Roman**
Printed On: **October 29, 2024**

ECS Southwest, LLP - Austin
14050 Summit Drive Suite 101,
Austin, TX 78728
Phone: 512-837-8005
Fax: 512-388-8914

Grain Size Distributions

Boring	Depth (ft)	% Fines	% Gravel	% Sand	USCS Soil Type
B-01	13-15	83.8	0.0	16.2	(CL) LEAN CLAY WITH SAND
B-02	2-3.5	83.2	0.3	16.5	(CH) FAT CLAY WITH SAND
B-03	2-3.5	80.9	0.0	19.1	(CH) FAT CLAY WITH SAND
B-03	4-5.5	79.9	0.8	19.3	(CH) FAT CLAY WITH SAND
B-04	13.5-15	82.5	2.8	14.8	(CL) LEAN CLAY WITH SAND
B-05	0-1.5	83.1	0.0	16.9	(CH) FAT CLAY WITH SAND
B-05	13.5-15	90.4	0.7	8.9	(CL) LEAN CLAY
B-06	6-7.5	48.0	29.6	22.3	(GC) CLAYEY GRAVEL WITH SAND
B-06	8.5-10	41.5	40.0	18.5	(GC) CLAYEY GRAVEL WITH SAND
B-06	13.5-15	75.1	5.4	19.5	(CL) LEAN CLAY WITH SAND

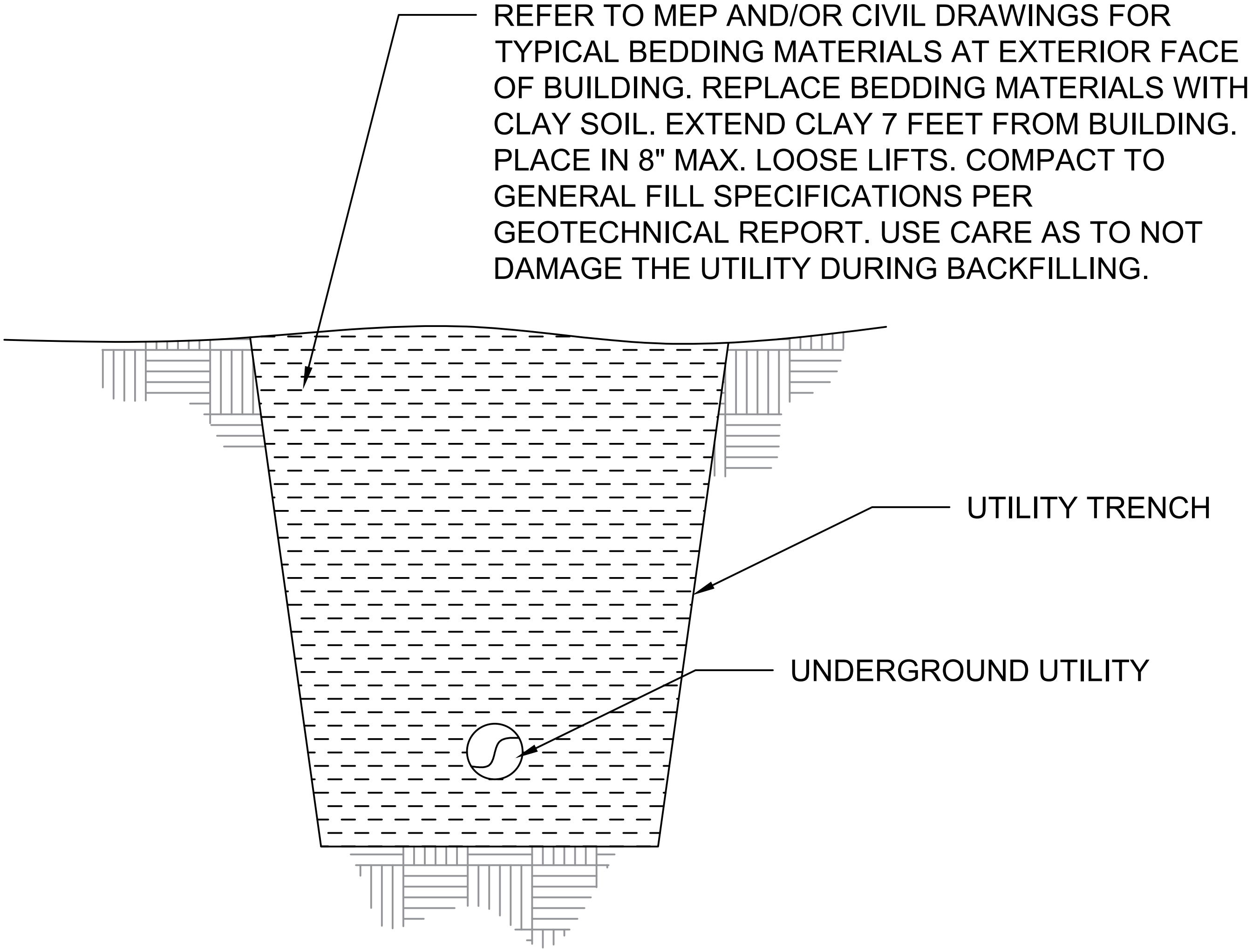
ECS Southwest, LLP
14050 Summit Drive, Suite 101
Austin, Texas 78728

Sherwin Williams Retail Store
East MLK Jr. Industrial Blvd
Lockhart, Texas

Project Number: 17:6722| Date: October 2024

Appendix D – Supplemental Documents

Drawings/Details



ECS	Title: CLAY PLUG DETAIL	Project: **Sherwin Williams Retail Store** East MLK Jr. Industrial Boulevard Lockhart, Texas
	ECS Southwest, LLP 14050 Summit Drive, Suite 101 Austin Texas 78728	Notes:

Project No.: 17-6722	Date: October 2024	Scale: NTS	Figure No.: 5