ECS SOUTHWEST, LLP

Geotechnical Engineering Report

Proposed Dominion Creek Development

IH-10 Frontage Road
Leon Springs, Texas

ECS Project No. 20:1519

October 4, 2022

ECS SOUTHWEST, LLP

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October 4, 2022

Mr. Allen Tharp
GC SA Properties, LLC
16109 University Oak
San Antonio, Texas 78249

ECS Project No. 20:1519

Reference: Geotechnical Engineering Report
Proposed Dominion Creek Development
IH-10 Frontage Road
Leon Springs, Texas

Dear Mr. Tharp:

ECS Southwest, LLP (ECS) has completed the subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-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 GC SA Properties, 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 subsurface conditions assumed for this report. Should you have questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

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TABLE OF CONTENTS

APPENDICES

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 conditions that need to be addressed at the site are the surficial fill and the underlying low to moderately plasticity soils.

- Groundwater was not encountered in the test borings.

- We estimate the existing PVR at the site to be about 1 inch or less at the boring locations drilled for the planned development. Therefore, mitigation of expansive soil-related movement is not required.

- The proposed residential building foundation can be supported using monolithic beam and slab-on-grade foundations provided our recommended earthwork remediation is performed as recommended in this report.

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

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of the foundations for the proposed single-story Dominion Creek Development. The recommendations developed for this report are based on project information supplied by the client.

Our services were provided in accordance with our Proposal No. 20:1275-GP, including our Terms and Conditions of Service, and dated September 6, 2022, was authorized by Mr. Allen Tharp via the signed acceptance of the proposal on September 8, 2022.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, a review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

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 retaining wall design and construction.
- Recommendations for pavement 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. Statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

ECS did not provide any service to investigate or detect the presence of moisture, mold, or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The project site is located north of the existing Dominion Creek development on the IH-10 Frontage Road in Leon Springs, Texas. The site location is shown in the following figure and the Site Location Diagram is included in Appendix A. The subject site is undeveloped and is clear of vegetation.

A cursory review of the historical aerial images suggests the ground surface was disturbed after about 2010 and portions of the site were rough graded in 2019 during construction of the adjacent Dominion Creek retail development.

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including the proposed buildings and related infrastructure**:**

Subject	Design Information / Assumptions
Building Footprints	2,400 sq ft with drive thru lane
	5,000 sq. ft
# of Stories	Single-Story buildings
Usage	Restaurant buildings with associated improvements
Framing	Anticipating wood-framed or light-gauge steel frame structure
Column Loads	Anticipated to be less than 50 kips
Wall Loads	Anticipated 1 to 2 kips/ft
Finish Floor Elevation	Anticipated to be within 2 feet of existing site grade

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 exploration procedures are explained in greater detail in Appendix B. Our scope of work included drilling 4 borings to depths of approximately 15 feet below the existing ground surface at the building locations and 3 borings drilled to 5 feet in the planned pavement areas. Our borings were located with a handheld GPS unit, and their approximate locations are shown on the Boring Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

A review of the *Geologic Atlas of Texas, San Antonio Sheet*, suggests that this site is naturally underlain with the rock of the Glen Rose formation (Kgru). The Glen Rose formation in generally characterized as limestone, dolomite and marl as alternating resistant and recessive beds that form a stairstep topography. The limestone is generally fine grained and marly. The dolomite is also fine grained, porous, and fossiliferous. The Glen Rose formation is divided into and upper and a lower part with the upper part being relatively thinner bedded, more dolomitic, and less fossiliferous. The lower part being more massive in nature. A Site Geologic Diagram is presented in Appendix A.

Although not indicated on the geologic maps, alluvial soils (Qt) associated with nearby Leon Creek also occur in the area. The alluvium soils are floodplain deposits and consist primarily of clays containing various amounts of silt, sand, and gravel.

The subsurface conditions encountered in the borings included a layer of fill over clays and gravels. The following sections provide generalized characterizations of the soil strata. Please refer to the boring logs in Appendix B for detailed information.

Stratum	Approximate Range of Depth (Feet)	Material Description	PI (1) Range	N (2) Range
FILL	0 to 2 – 6	(SC) CLAYEY SAND, (GC) CLAYEY GRAVEL, (CL) LEAN CLAY, light gray, light brown, tan, medium dense to very dense	25 to 39	18 to 50/1”
I	2 - 6 to (5 – 13)	(CL) LEAN CLAY, dark brown, brown, stiff to hard	24 to 31	9 to 36
II	5 to 8	(SC) CLAYEY SAND, brown, dense	25	43 to 44
III	5 – 13 to 15	(CL) LEAN CLAY, (CH) FAT CLAY, brown, firm, to hard	33 to 38	6 to 32

Notes: (1) Plasticity Index
(2) Standard Penetration Test (SPT) Value, blows per foot

The observations during drilling and a review of the N-values from SPT sampling suggest the fill soils were likely placed in compacted lifts. The fill soils were observed to be consistent in plasticity with a low to moderate shrink/swell potential. We consider the existing fill soils to be appropriate to support of the lightly loaded slab foundations.

3.2 GROUNDWATER OBSERVATIONS

The borings were advanced using relatively dry techniques to their full depths, enabling the potential detection of the presence of groundwater during exploration operations. Groundwater was not observed during or upon completion of drilling the borings at the site. 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 and intact limestone 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.

3.3 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples in general accordance with the following standards:

Laboratory Test	Test Standard
Moisture Content	ASTM D2216
Sieve Analyses	ASTM D1140 and ASTM D422
Atterberg Limits	ASTM D4318

Each sample was visually classified on the basis of texture and plasticity in general accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System (USCS)). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The USCS classification 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.

Samples not tested in the laboratory will be stored for a period of 60 days subsequent to submittal of this report and will be discarded after this period, unless we receive alternate instructions regarding their disposition.

4.0 DESIGN RECOMMENDATIONS

The following recommendations have been developed based on the previously described project characteristics and subsurface conditions. If there are 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.

Site grading information was not provided during the preparation of this report; however, due to the sloping topography of the site, we have considered that cuts and fills will be required to achieve the finished floor elevation of the building will be within about 2 feet of existing site grade. If the finished ground surface elevations deviate from these grades, the recommendations provided below should be evaluated by our office.

4.1 POTENTIAL VERTICAL RISE & SUBGRADE IMPROVEMENTS

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

Several methods exist to evaluate swell potential of expansive clay soils. 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 size analyses, and water contents of the soils. The PVR is estimated in the seasonally active zone. The active zone at this site is limited to about 12-foot depth.

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 could exceed the estimated values if actual soil moisture content changes are greater than anticipated. These conditions can occur as the result of excessive droughts, flooding, “perched” groundwater infiltration, poor surface-drainage, excessive irrigation adjacent to building foundations, and/or leaking irrigation lines or plumbing.

We estimate the existing PVR at the boring locations is about 1 inch or less. Therefore, no remedial earthwork is required to reduce the PVR. If fill is required to increase the planned FFE elevations, we recommend select fill materials be used for site grading to maintain the current PVR.

4.2 SHALLOW FOUNDATIONS

The planned building can be supported on a monolithic beam and slab-on-grade foundation systems.

4.2.1 Beam and 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 adequate to provide adequate rigidity to the slab element. The grade beam width and depth will be established 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 as required 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	**Approximately 1-inch PVR Design Values**
e_m Edge	4.8 Feet
e_m Center	9.0 Feet
y_m Edge	1.5 Inches
y_m Center	1.3 Inches
BRAB/WRI Slab Parameters	
Design Parameter	**Approximately 1-inch PVR Design Values**
Effective PI	22
Climatic Rating	17
Unconfined Compressive Strength (tsf)	1.5
Soil-Climate Support Index (1-C)	0.07

Grade beams and widened column areas at least 12 inches wide and 18 inches deep can be designed using a net allowable bearing capacity of 2,500 psf. To utilize the parameters listed above, the subgrade should be prepared in accordance with Section 5.0 “Site Construction Recommendations” sections of this report.

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 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. 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 Perimeter Conditions

The upper 18 inches of soil placed along the exterior of the structures should consist of lean clayey 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 structure. This clay layer may be replaced with concrete flatwork and/or pavement that extends to the edge of the structure foundation. Additionally, where penetrations into the structure such as utility trenches occur, a clay plug (or adequate synthetic alternative) should be placed at the building lines to reduce the opportunity for infiltrating water, regardless of the selected building pad materials.

Positive drainage away from the structures should also be provided. Soil areas within 10 feet of the building should slope at a minimum of 5 percent away from the structure. Adjacent pavements and concrete hardscape should slope at 1½ to 2 percent away from the structure. Roof leaders and downspouts should discharge onto paved surfaces sloping away from the structure 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 building. Where flatwork is placed against or near the structure, 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.

4.3 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. At least two 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 60
E	Soft Soil Profile	Vs < 600 fps	<15

ECS utilized the SPT-N-vale to classifying the site. in our opinion the site soil and rock can be characterized as Site Class C. The site class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. Our deepest borings at the project site extended to depths of approximately 15 feet beneath the existing ground surface, whereas IBC site classifications are based on characterization of the upper 100 feet of the soil profile.

Ground Motion Parameters: In addition to the seismic site classification, ECS has verified the design spectral response acceleration parameters following the IBC methodology. The Mapped Reponses were estimated from the USGS website https://seismicmaps.org/. 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 [IBC 2018 Method]								
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	0.048	F_a	1.3	$S_{MS}=F_aS_s$	0.062	$S_{DS}=2/3\ S_{MS}$	0.041
1.0	S_1	0.02	F_v	1.5	$S_{M1}=F_vS_1$	0.03	$S_{D1}=2/3\ S_{M1}$	0.02

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, we can provide additional testing methods that may yield more favorable results.

4.4 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 ranging from 3 to 4 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, Both Flexible and Rigid 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 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	--	6.0 in	--	7.0 in	--
Hot Mixed Asphalt Concrete (HMAC)	--	2.0 in	--	2.5 in	--	--
Crushed Limestone Base (CLB)	--	8.0 in	--	10.0 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. An aggressive 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.

4.4.1 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 ASTM D1557. 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.

4.4.2 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 of an 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 can be used to span between construction and isolation (expansion) joints and should consist of at-minimum No. 3 bars spaced 18 inches on-centers 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 joints. Smooth dowels can 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
6.0	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.

4.4.3 Pavement Drainage, Subdrainage, and Trenching

Longitudinal cracks and apparent distress due to expansive soils 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 flexible 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.

4.5 RETAINING WALLS

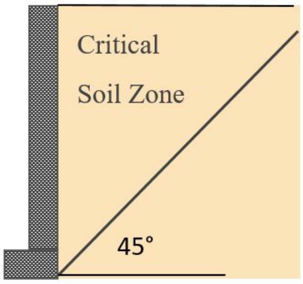
Site grading to increase FFE elevations of the proposed buildings at the site may require the use of landscape walls. The retaining wall structures will need to be designed to resist the lateral earth pressures exerted by the wall backfill.

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 on the following tables.

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)	24°	28°	30°	30°
Coefficient of Active Earth Pressure (K_a)	0.42	0.36	0.33	0.33
Coefficient of At-Rest Earth Pressure (K_o)	0.59	0.53	0.50	0.50
Active Equivalent Fluid Pressure	51 (psf/ft)	43 (psf/ft)	37 (psf/ft)	40 (psf/ft)
At-Rest Earth Equivalent Fluid Pressure	71 (psf/lf)	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 [Concrete on Soil or Bedrock] (μ)	0.44
Ultimate Passive Equivalent Fluid Pressure (Neglect in upper 18 inches)	280 (psf/ft)

It is critical that the soils used to backfill behind the retaining walls meet the soil parameters recommended above. If the soils available do not meet those parameters, 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 should 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 filter fabric) 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 his 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 soils, vegetation, organic soil, existing pavements, foundations or utilities, or similar 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 concluded by ASTM D698 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 and grubbing, as discussed above, 10 feet from the perimeter of the building and 5 feet beyond pavement limits and the toe of fills. ECS should be called to check that topsoil and other surficial materials have been removed before the placement of fill or construction of structures.

Appropriate diligence should be exercised to properly backfill removed below-grade structures. Abandoned subsurface utilities and permeable backfills should be removed and/or grouted an adequate distance from the proposed building to avert the conduit of water beneath the proposed structure.

5.1.2 Proof Rolling

After stripping and grubbing, 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 allowed construction equipment having a minimum axle load of 25 tons (e.g., amply 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 compacting the subgrade or placing fills or other construction materials. Methods of repair of yielding subgrade, such as undercutting, or moisture conditioning should be discussed with the Geotechnical Engineer to determine the appropriate procedure about the existing conditions causing the instability.

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.

5.2 EARTHWORK OPERATIONS

It is recommended that the building pad be prepared according to report section 4.1 “Potential Vertical Rise & Subgrade Improvements”. The stripping and removal operations and fill placement to finished 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 area should consist of a properly compacted low permeability clay soil to reduce infiltration of moisture into the adjacent select fill materials.

To mitigate the potential for differential settlements for building areas straddling cut and fill boundaries, it is recommended that cut areas and near cut areas be over-excavated such that the building pads are constructed with at least one-third the depth of select fill as the maximum proposed fill depth of the building pad. It is recommended that a minimum of 2 feet of select fill be placed beneath the building floor slab.

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

Fill slopes should be constructed no steeper than 3:1 horizontal to vertical. Fills placed on existing grades steeper than 5:1 horizontal to vertical should be properly benched and keyed into the existing slope, such that all fills are placed on horizontal surfaces. Please contact ECS for additional consultation for cut slopes with steeper inclinations. Exposed slopes should be planted with drought resistant vegetation to promote surficial stability. Interim measures such as erosion control fabrics are also recommended prior to the establishment of vegetation.

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. 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 avert water from migrating through the utility trench backfill to beneath the proposed structure.

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 2,500 square feet per lift is recommended in the building 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.

5.2.1 General Fill

General fill should consist of on-site or imported soils, provided they meet the requirements described below. General fill materials should be without organics, construction debris, deleterious materials, and should be without rocks larger than 4 inches in greatest dimension. In addition, general fill materials should have a Plasticity Index of 30 or less. 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 (ASTM D698).

5.2.2 Select Fill

Select fill materials should be without organics, construction debris, deleterious materials, and should be without rocks larger than 4 inches in greatest dimension. Select fill should have a Plasticity Index of between 5 and 20. 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 (ASTM D698).

5.3 FOUNDATION AND SLAB OBSERVATIONS

Protection of Foundation Excavations: Exposure to the environment may weaken the soils at the foundation bearing level if the foundation excavations remain open for too long a time. Therefore, concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must 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 should be placed on the bearing soils before the placement of reinforcing steel.

Footing and Slab Subgrade Observations: The soils at the foundation bearing elevation are anticipated to be adequate for support of the proposed structure. It is important to have ECS observe the foundation and slab subgrade prior to placing concrete, to confirm the bearing and subgrade soils and bedrock are what was anticipated.

5.4 UTILITY INSTALLATIONS

5.4.1 Utility Subgrades

The soils encountered in our exploration are expected to be generally adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or inadequate materials encountered should be removed and replaced with adequately compacted General Fill or pipe stone bedding material.

5.4.2 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 areas. 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 the building pad has 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 the original building pad construction. Mixing of these two soil types should be avoided.

5.4.3 Utility Connections

Flexible connections should be considered where utilities connect to the building or pass-through the building foundation/slab 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.

5.5 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 durable 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 is 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 Client. If this information is incorrect 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.

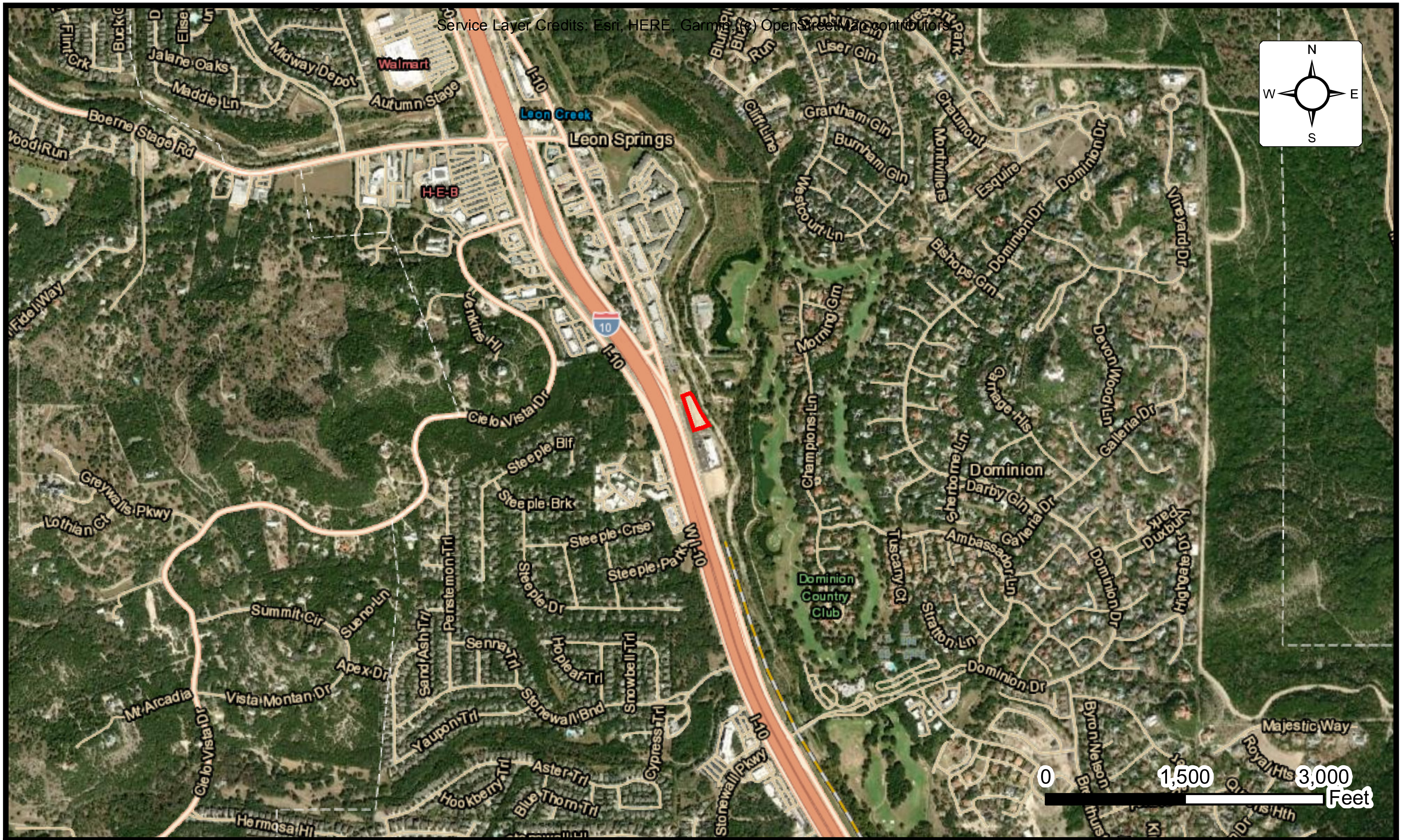
Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation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

Site Location Diagram
Boring Location Diagram
Site Geologic Diagram
Generalized Subsurface Soil Profile



SITE LOCATION DIAGRAM
PROPOSED DOMINION CREEK DEVELOPMENT

IH-10 FRONTAGE ROAD, LEON SPRINGS, TEXAS

GC SA PROPERTIES, LLC

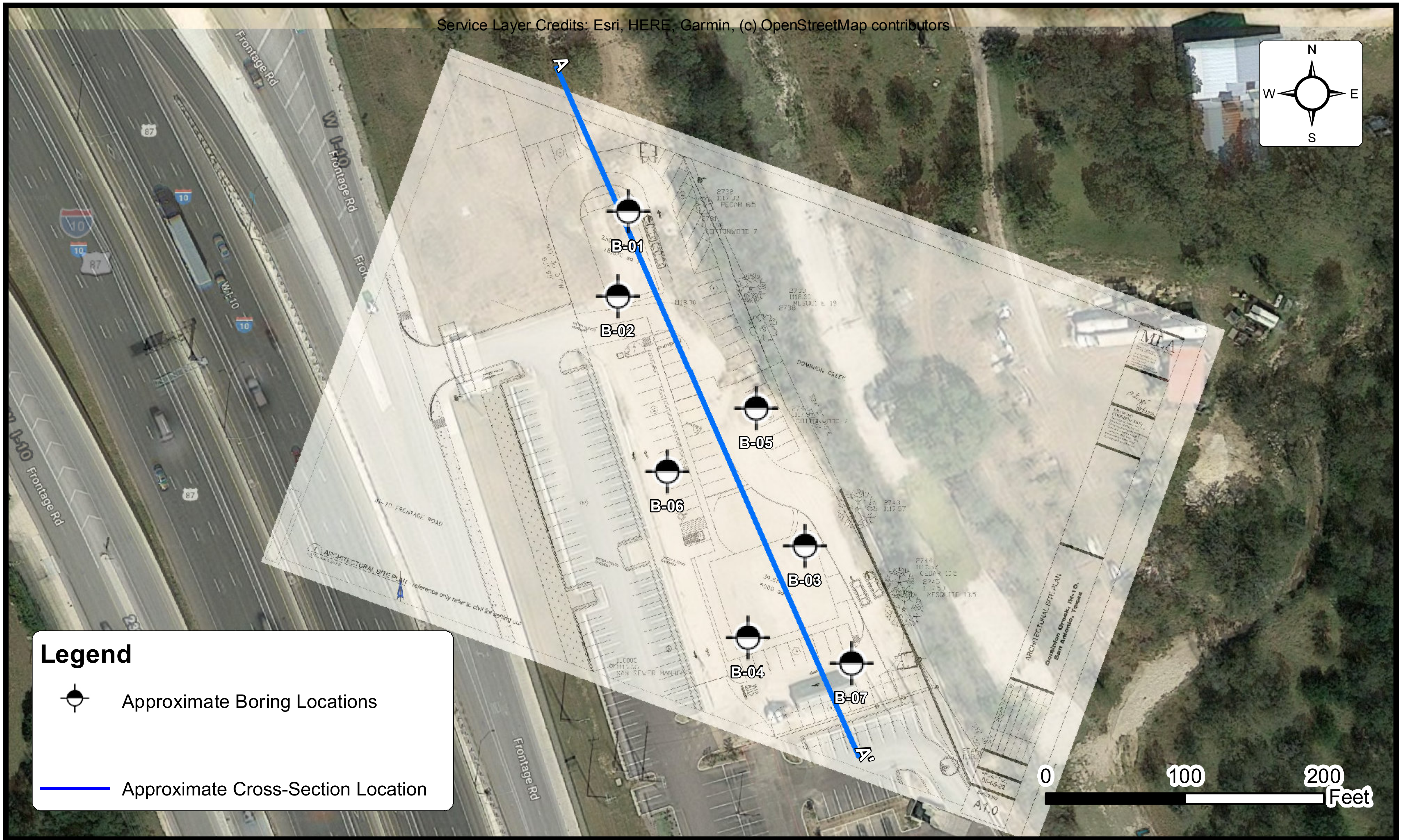
ENGINEER
REW

SCALE
AS NOTED

PROJECT NO.
20:1519

FIGURE
1 OF 1

DATE
10/3/2022

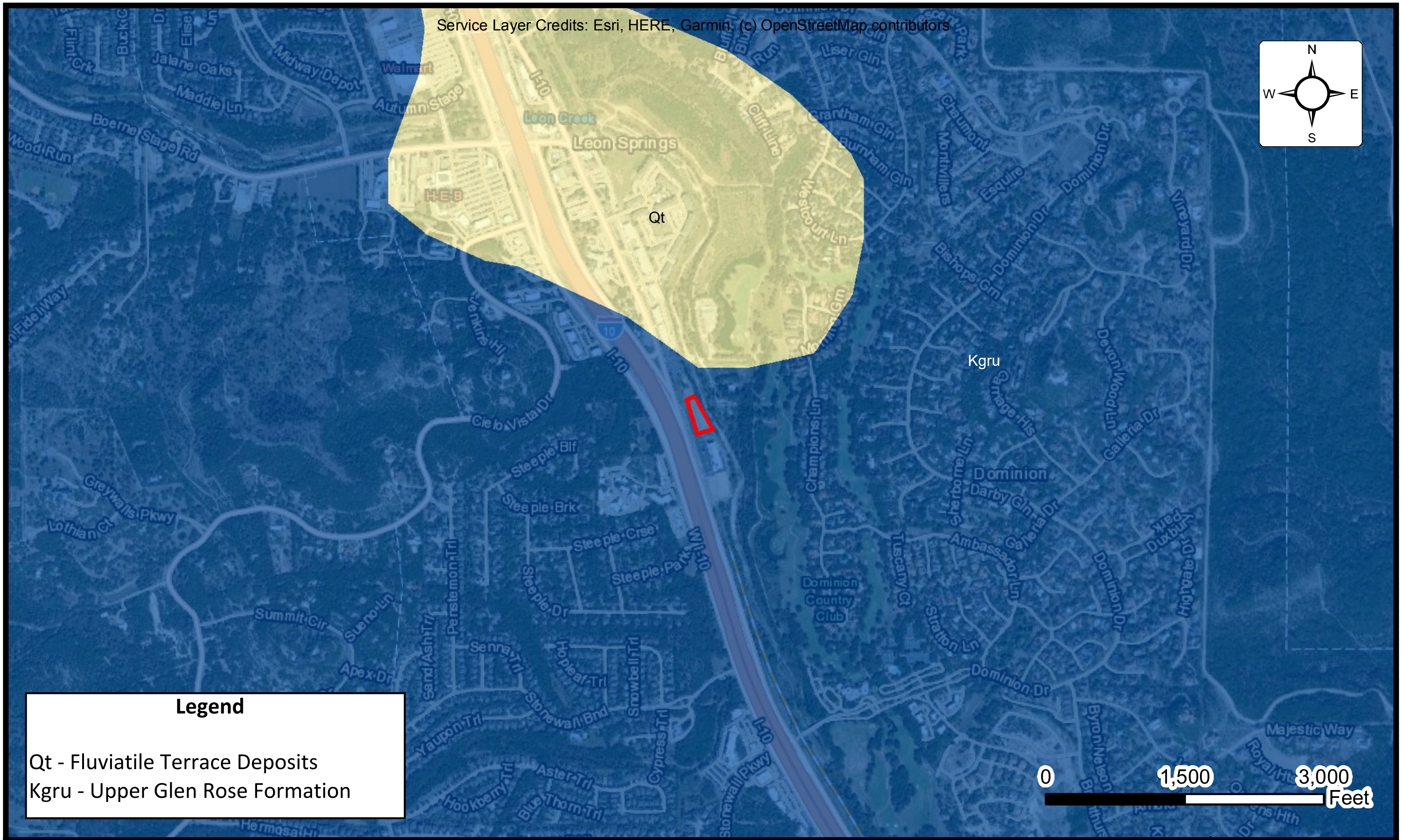


Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors

BORING LOCATION DIAGRAM
PROPOSED DOMINION CREEK DEVELOPMENT

IH-10 FRONTAGE ROAD, LEON SPRINGS, TEXAS
GC SA PROPERTIES, LLC

ENGINEER	REW
SCALE	AS NOTED
PROJECT NO.	20:1519
FIGURE	1 OF 1
DATE	10/3/2022

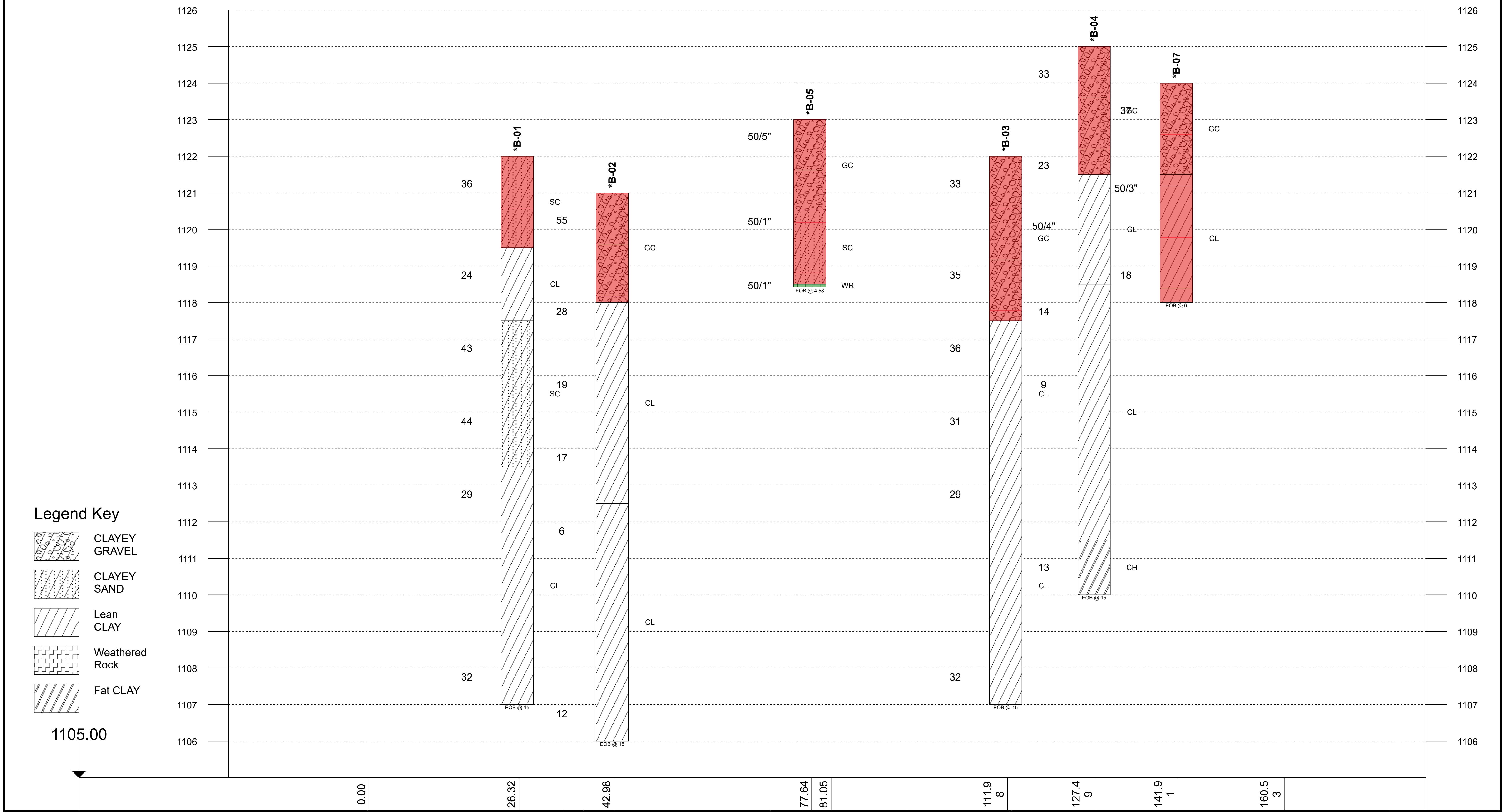


SITE GEOLOGIC DIAGRAM
PROPOSED DOMINION CREEK DEVELOPMENT

IH-10 FRONTAGE ROAD, LEON SPRINGS, TEXAS

GC SA PROPERTIES, LLC

ENGINEER	REW
SCALE	AS NOTED
PROJECT NO.	20:1519
FIGURE	1 OF 1
DATE	10/3/2022



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———●———△		▽	WL (First Encountered)	🟥	Fill
[FINES CONTENT %]		▼	WL (Completion)	🟪	Possible Fill
◀	BOTTOM OF CASING	▽	WL (Estimated Seasonal High Water)	🟥	Probable Fill
100%	LOSS OF CIRCULATION	▽	WL (Stabilized)	🟩	Rock

GENERALIZED SUBSURFACE SOIL PROFILE Section line A-A'

Proposed Dominion Creek Development
GC SA Properties, LLC
IH-10 Frontage Road, Leon Springs, Texas, 78257

Project No: 20:1519 Date: 10/03/2022

APPENDIX B – Field Operations

Reference Notes for Boring Logs
Subsurface Exploration Procedure
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.

SITE EXPLORATION PROCEDURE

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms and to evaluate subsequent field and laboratory data to assist in the determination of geotechnical recommendations.

The subsurface conditions were explored by 7 borings drilled to approximate depths ranging from 5 to 15 feet below the existing site grades. A truck-mounted drill rig with continuous flight augers was utilized to drill the borings. The boring locations were determined by and identified in the field by ECS personnel. The approximate as-drilled boring locations are shown on the Boring Location Diagram in Appendix A. The ground surface elevations noted in this report were estimated using Google Earth Pro.

Standard Penetration Tests (SPTs) were performed to obtain representative samples and penetration resistance measurements in general accordance with ASTM D 1586. Soil samples were obtained at various intervals with the 1.625-inch inside diameter, 2-inch outside diameter, Split-Barrel sampler. The Split-Barrel sampler was first seated 6 inches to penetrate any loose cuttings, and then was driven an additional 12 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler each 6-inch increment was recorded. The penetration resistance “N-value” is defined as the number of hammer blows required to drive the sampler the final 12 inches and is indicated on the test boring logs. In very dense materials such as weathered rock material, the SPT test is usually stopped after 50 blows from the hammer and the measurement is recorded as 50 blows per distance penetrated (i.e., 50 over 3 inches).

Field logs of the soils encountered in the borings were maintained by the drill crew. After recovery, each geotechnical soil sample was removed from the sampler and visually classified. Representative portions of each soil sample were then wrapped in plastic and transported to our laboratory for further visual examination and laboratory testing. After completion of the drilling operations, the boreholes were backfilled with auger cuttings to the existing ground surface.

CLIENT: **GC SA Properties, LLC**	PROJECT NO.: **20:1519**	BORING NO.: **B-01**	SHEET: **1 of 1**
PROJECT NAME: **Proposed Dominion Creek Development**	DRILLER/CONTRACTOR:		

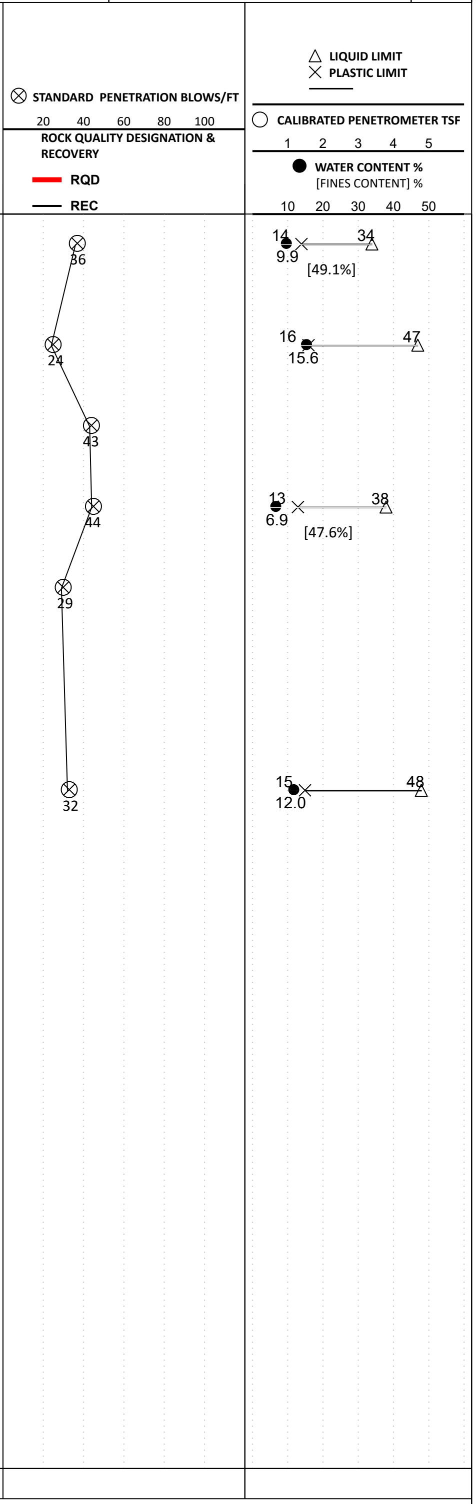
SITE LOCATION:
IH-10 Frontage Road, Leon Springs, Texas, 78257

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
3000423.8	**865334.8**		**1122.00**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(SC) CLAYEY SAND WITH GRAVEL, light gray, dense [FILL]			28-18-18 (36)
	S-2	SS	18	18	(CL) SANDY LEAN CLAY, dark brown, very stiff			9-13-11 (24)
5	S-3	SS	18	18	(SC) CLAYEY SAND, brown, dense		1117	13-20-23 (43)
	S-4	SS	18	18				14-18-26 (44)
	S-5	SS	18	18	(CL) LEAN CLAY, brown, very stiff to hard			10-13-16 (29)
10							1112	
	S-6	SS	18	18				9-14-18 (32)
15					**END OF BORING AT 15 FT**		1107	
20							1102	
25							1097	
30							1092	



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

▽ WL (First Encountered)	BORING STARTED: **Sep 16 2022**		CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED: **Sep 16 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY:	DRILLING METHOD:
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:
GC SA Properties, LLC

PROJECT NO.: **20:1519**

BORING NO.: **B-02**

SHEET: **1 of 1**

PROJECT NAME:
Proposed Dominion Creek Development

DRILLER/CONTRACTOR:

SITE LOCATION:
IH-10 Frontage Road, Leon Springs, Texas, 78257

LOSS OF CIRCULATION

BOTTOM OF CASING

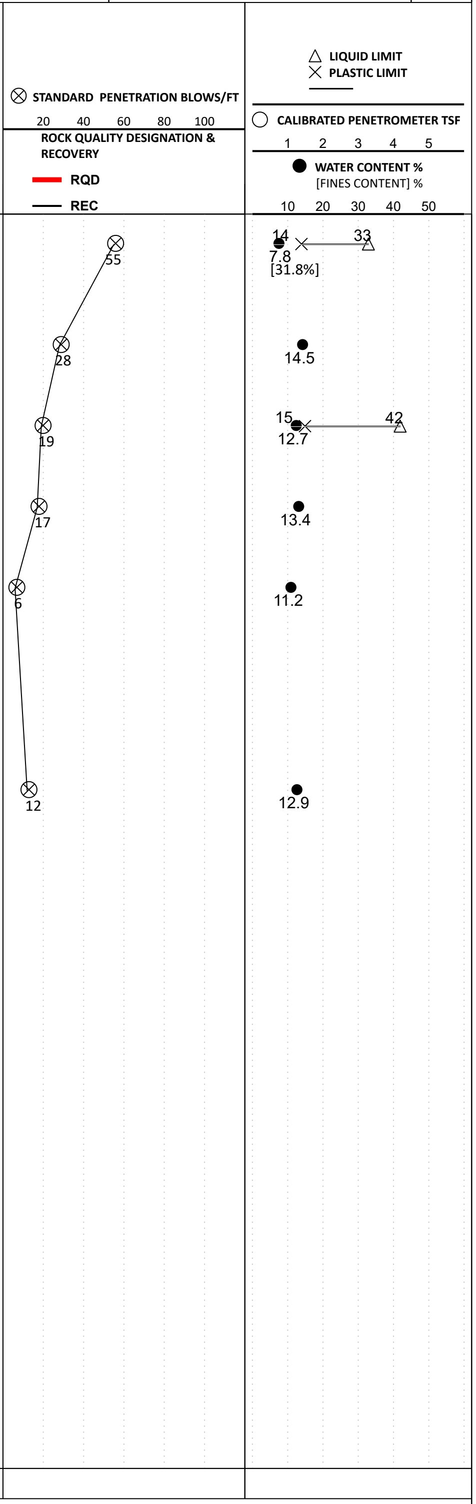
NORTHING: **3000405.3**

EASTING: **865333.7**

STATION:

SURFACE ELEVATION: **1121.00**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND, light brown, very dense [FILL]			15-25-30 (55)
	S-2	SS	18	18	(CL) LEAN CLAY WITH SAND, dark brown to brown, very stiff			9-10-18 (28)
5	S-3	SS	18	18			1116	8-8-11 (19)
	S-4	SS	18	18				7-7-10 (17)
	S-5	SS	18	18	(CL) LEAN CLAY, brown, firm to stiff			3-3-3 (6)
10							1111	
	S-6	SS	18	18				5-5-7 (12)
15					**END OF BORING AT 15 FT**		1106	
20							1101	
25							1096	
30							1091	



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

▽ WL (First Encountered)

▼ WL (Completion)

▼ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Sep 16 2022**

BORING COMPLETED: **Sep 16 2022**

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

EQUIPMENT: **Truck**

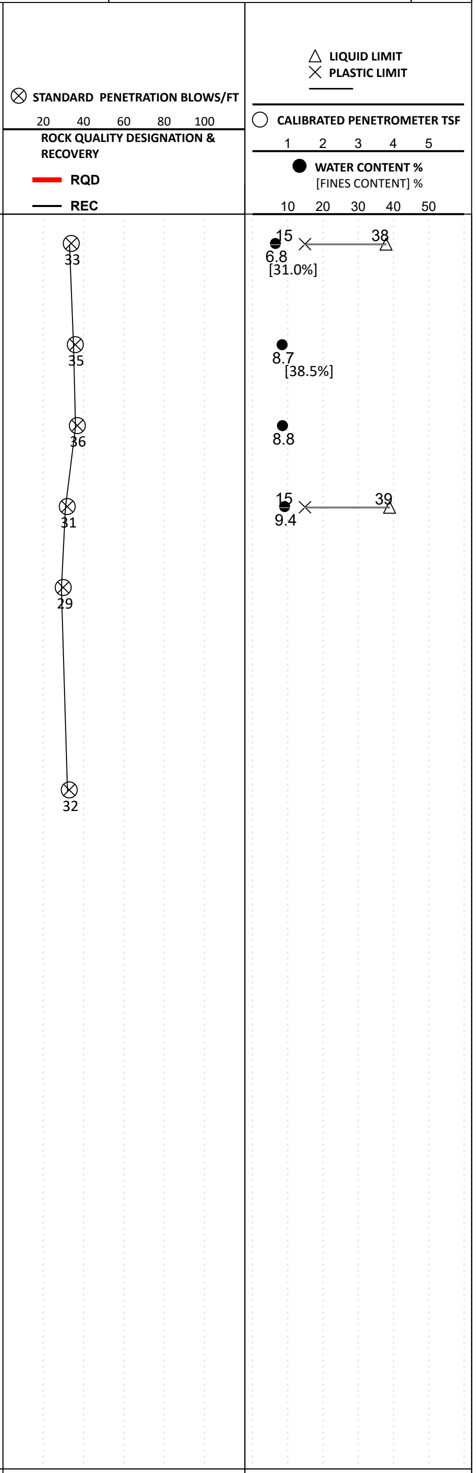
LOGGED BY:

DRILLING METHOD:

GEOTECHNICAL BOREHOLE LOG

CLIENT: **GC SA Properties, LLC**	PROJECT NO.: **20:1519**	BORING NO.: **B-03**	SHEET: **1 of 1**
PROJECT NAME: **Proposed Dominion Creek Development**	DRILLER/CONTRACTOR:		
SITE LOCATION: **IH-10 Frontage Road, Leon Springs, Texas, 78257**	LOSS OF CIRCULATION 100%		
NORTHING: **3000347.5**	EASTING: **865374.1**	STATION:	SURFACE ELEVATION: **1122.00**
			BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND, tan, dense [FILL]			27-18-15 (33)
	S-2	SS	18	18				20-20-15 (35)
5	S-3	SS	18	18	(CL) SANDY LEAN CLAY WITH GRAVEL, dark brown and tan, hard		1117	12-16-20 (36)
	S-4	SS	18	18				10-20-11 (31)
	S-5	SS	18	18	(CL) LEAN CLAY WITH GRAVEL, brown, very stiff to hard			10-16-13 (29)
10							1112	
	S-6	SS	18	18				12-16-16 (32)
15					**END OF BORING AT 15 FT**		1107	
20							1102	
25							1097	
30							1092	



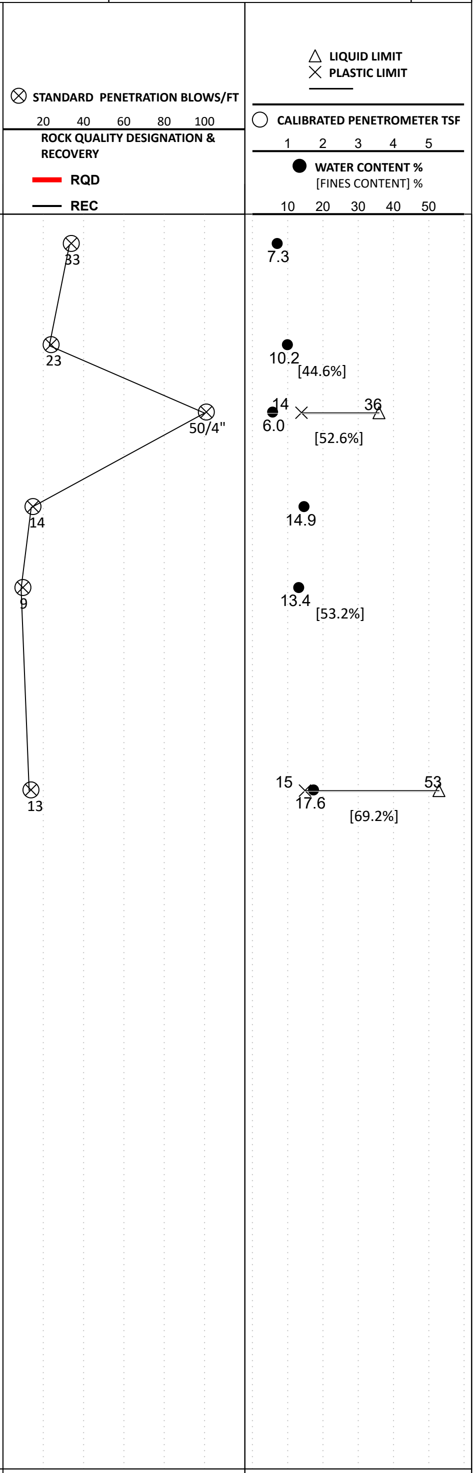
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED:	**Sep 16 2022**	CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED:	**Sep 16 2022**	HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)			
▽ WL (Stabilized)	EQUIPMENT: **Truck**	LOGGED BY:	DRILLING METHOD:

GEOTECHNICAL BOREHOLE LOG

CLIENT: **GC SA Properties, LLC**	PROJECT NO.: **20:1519**	BORING NO.: **B-04**	SHEET: **1 of 1**
PROJECT NAME: **Proposed Dominion Creek Development**	DRILLER/CONTRACTOR:		
SITE LOCATION: **IH-10 Frontage Road, Leon Springs, Texas, 78257**	LOSS OF CIRCULATION ⟩100%⟩		
NORTHING: **3000325.7**	EASTING: **865362.7**	STATION:	SURFACE ELEVATION: **1125.00**
BOTTOM OF CASING ➡			

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND, light grayish brown, very stiff to hard [FILL]			21-18-15 (33)
	S-2	SS	18	18				12-10-13 (23)
					(CL) GRAVELLY LEAN CLAY WITH SAND, grayish brown, very hard [FILL]			
5	S-3	SS	10	10			1120	15-50/4" (50/4")
	S-4	SS	18	18	(CL) SANDY LEAN CLAY, brown, stiff			5-6-8 (14)
	S-5	SS	18	18				3-5-4 (9)
10							1115	
	S-6	SS	18	18	(CH) SANDY FAT CLAY, brown, stiff			5-5-8 (13)
15					**END OF BORING AT 15 FT**		1110	
20							1105	
25							1100	
30							1095	



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

▽ WL (First Encountered)	BORING STARTED: **Sep 16 2022**	CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED: **Sep 16 2022**	HAMMER TYPE: **Auto**
▽ WL (Seasonal High Water)	EQUIPMENT: **Truck** / LOGGED BY:	DRILLING METHOD:
▽ WL (Stabilized)		

GEOTECHNICAL BOREHOLE LOG

CLIENT:
GC SA Properties, LLC

PROJECT NO.:
20:1519

BORING NO.:
B-05

SHEET:
1 of 1

PROJECT NAME:
Proposed Dominion Creek Development

DRILLER/CONTRACTOR:

SITE LOCATION:
IH-10 Frontage Road, Leon Springs, Texas, 78257

LOSS OF CIRCULATION ⟩100%⟩

BOTTOM OF CASING ➡

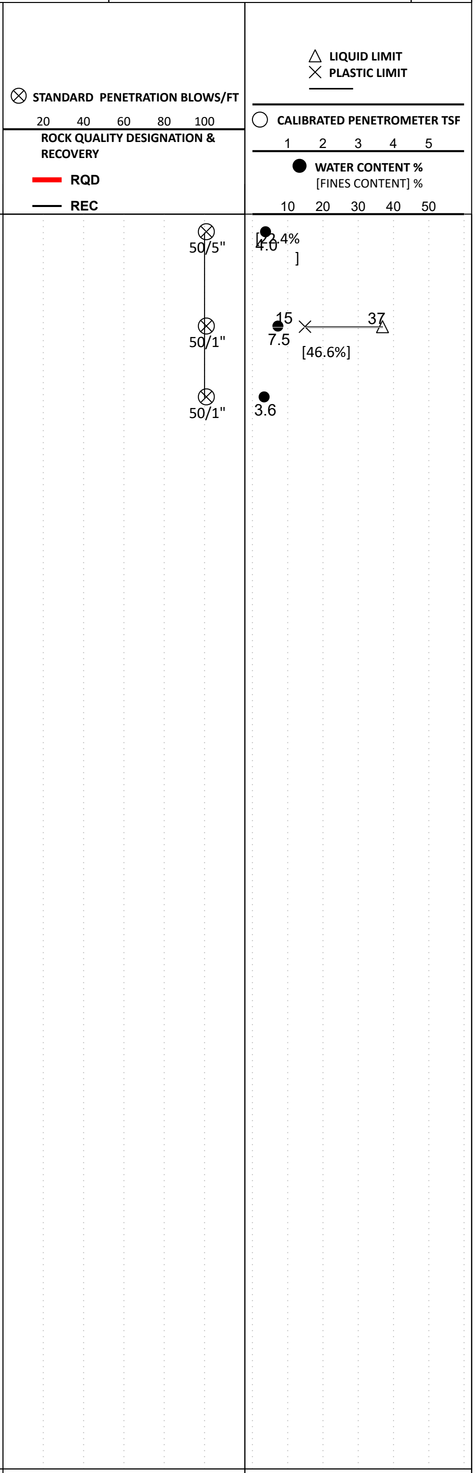
NORTHING:
3000379.6

EASTING:
865361.8

STATION:

SURFACE ELEVATION:
1123.00

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	11	11	(GC) CLAYEY GRAVEL WITH SAND, grayish tan, very dense [FILL]			25-50/5" (50/5")
	S-2	SS	7	7	(SC) CLAYEY SAND WITH GRAVEL, grayish brown, very dense [FILL]			27-50/1" (50/1")
	S-3	SS	1	1	WEATHERED LIMESTONE, light gray, very hard			50/1" (50/1")
5					**END OF BORING AT 4.58 FT**		1118	
10							1113	
15							1108	
20							1103	
25							1098	
30							1093	



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

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

BORING STARTED: **Sep 16 2022**

CAVE IN DEPTH:

BORING COMPLETED: **Sep 16 2022**

HAMMER TYPE: **Auto**

EQUIPMENT:
Truck

LOGGED BY:

DRILLING METHOD:

GEOTECHNICAL BOREHOLE LOG

CLIENT:
GC SA Properties, LLC

PROJECT NO.:
20:1519

BORING NO.:
B-06

SHEET:
1 of 1

PROJECT NAME:
Proposed Dominion Creek Development

DRILLER/CONTRACTOR:

SITE LOCATION:
IH-10 Frontage Road, Leon Springs, Texas, 78257

LOSS OF CIRCULATION ⟩100%⟩

BOTTOM OF CASING ▶

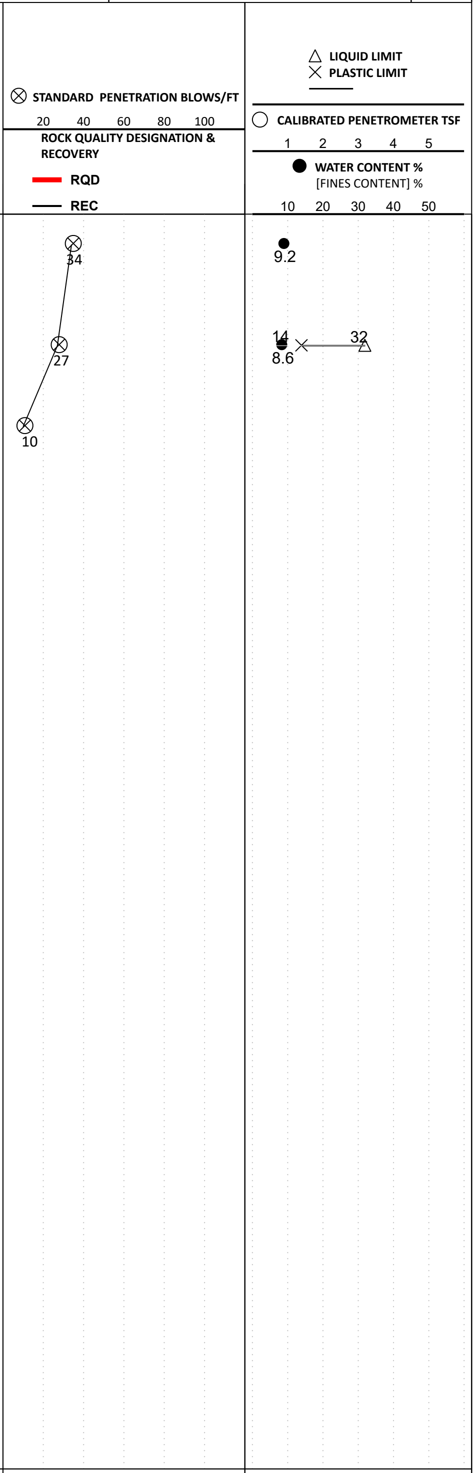
NORTHING:
3000366.6

EASTING:
865340.2

STATION:

SURFACE ELEVATION:
1125.00

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND, tan, dense [FILL]			25-17-17 (34)
	S-2	SS	18	18	(CL) LEAN CLAY WITH GRAVEL, dark brown and tan, very stiff [FILL]			9-11-16 (27)
5	S-3	SS	18	18	(CL) LEAN CLAY, dark brown, stiff		1120	8-6-4 (10)
					END OF BORING AT 6 FT			
10							1115	
15							1110	
20							1105	
25							1100	
30							1095	



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

▽ WL (First Encountered)

▼ WL (Completion)

⧗ WL (Seasonal High Water)

▽ WL (Stabilized)

BORING STARTED: **Sep 16 2022**

BORING COMPLETED: **Sep 16 2022**

CAVE IN DEPTH:

HAMMER TYPE: **Auto**

EQUIPMENT:
Truck

LOGGED BY:

DRILLING METHOD:

GEOTECHNICAL BOREHOLE LOG

CLIENT: **GC SA Properties, LLC**	PROJECT NO.: **20:1519**	BORING NO.: **B-07**	SHEET: **1 of 1**
PROJECT NAME: **Proposed Dominion Creek Development**	DRILLER/CONTRACTOR:		

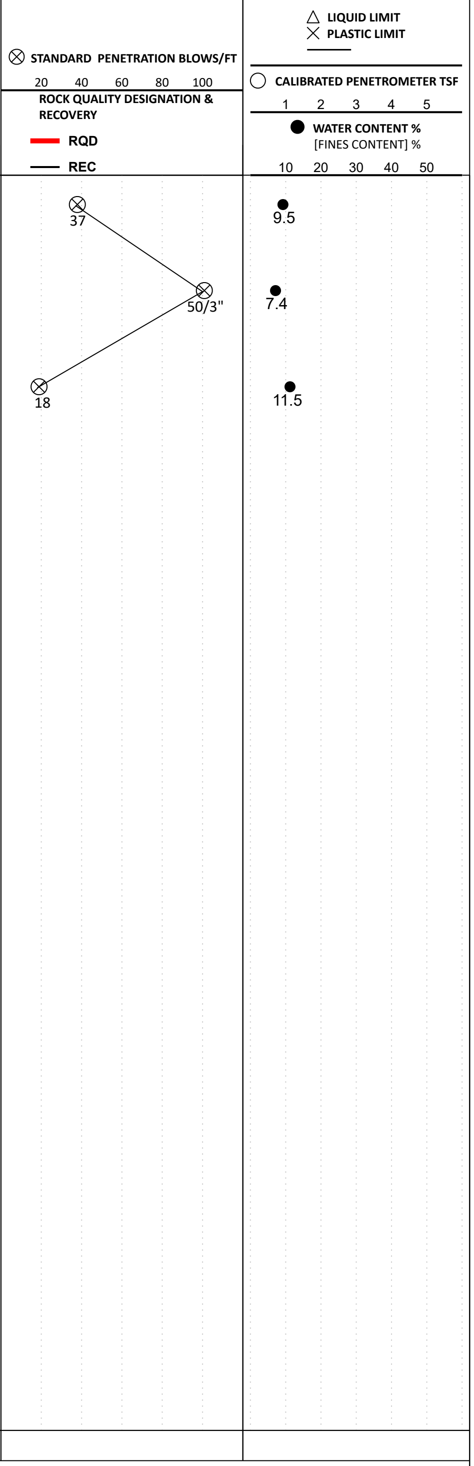
SITE LOCATION:
IH-10 Frontage Road, Leon Springs, Texas, 78257

LOSS OF CIRCULATION 100%

BOTTOM OF CASING

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:
3000319.2	**865384.2**		**1124.00**

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
	S-1	SS	18	18	(GC) CLAYEY GRAVEL WITH SAND, tan, dense [FILL]			15-15-22 (37)
	S-2	SS	9	9	(CL) SANDY LEAN CLAY WITH GRAVEL, grayish tan, very stiff to very hard [FILL]			20-50/3" (50/3")
5	S-3	SS	18	18			1119	5-8-10 (18)
					END OF BORING AT 6 FT			
10							1114	
15							1109	
20							1104	
25							1099	
30							1094	



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

▽ WL (First Encountered)	BORING STARTED: **Sep 16 2022**		CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED: **Sep 16 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck**	LOGGED BY:	DRILLING METHOD:
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

APPENDIX C – Laboratory Testing

Laboratory Testing Summary
Particle Size Distribution

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-01	S-1	0-1.5	9.9	SC	34	14	20	49.1					
B-01	S-2	2.5-4	15.6		47	16	31						
B-01	S-4	6.5-8	6.9	SC	38	13	25	47.6					
B-01	S-6	13.5-15	12.0		48	15	33						
B-02	S-1	0-1.5	7.8	GC	33	14	19	31.8					
B-02	S-2	2.5-4	14.5										
B-02	S-3	4.5-6	12.7		42	15	27						
B-02	S-4	6.5-8	13.4										
B-02	S-5	8.5-10	11.2										
B-02	S-6	13.5-15	12.9										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

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

Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC

Project No.: 20:1519
Date Reported: 9/30/2022

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received
ARobles	ARobles	ARobles	9/29/2022

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-03	S-1	0-1.5	6.8	GC	38	15	23	31.0					
B-03	S-2	2.5-4	8.7					38.5					
B-03	S-3	4.5-6	8.8										
B-03	S-4	6.5-8	9.4		39	15	24						
B-04	S-1	0-1.5	7.3										
B-04	S-2	2.5-4	10.2					44.6					
B-04	S-3	4.5-5.33	6.0	CL	36	14	22	52.6					
B-04	S-4	6.5-8	14.9										
B-04	S-5	8.5-10	13.4					53.2					
B-04	S-6	13.5-15	17.6	*CH	53	15	38	69.2					

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

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

Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC

Project No.: 20:1519
Date Reported: 9/30/2022

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received
ARobles	ARobles	ARobles	9/29/2022

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
B-05	S-1	0-0.92	4.0					22.4					
B-05	S-2	2.5-3.08	7.5	SC	37	15	22	46.6					
B-05	S-3	4.5-4.58	3.6										
B-06	S-1	0-1.5	9.2										
B-06	S-2	2.5-4	8.6		32	14	18						
B-07	S-1	0-1.5	9.5										
B-07	S-2	2.5-3.25	7.4										
B-07	S-3	4.5-6	11.5										

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

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

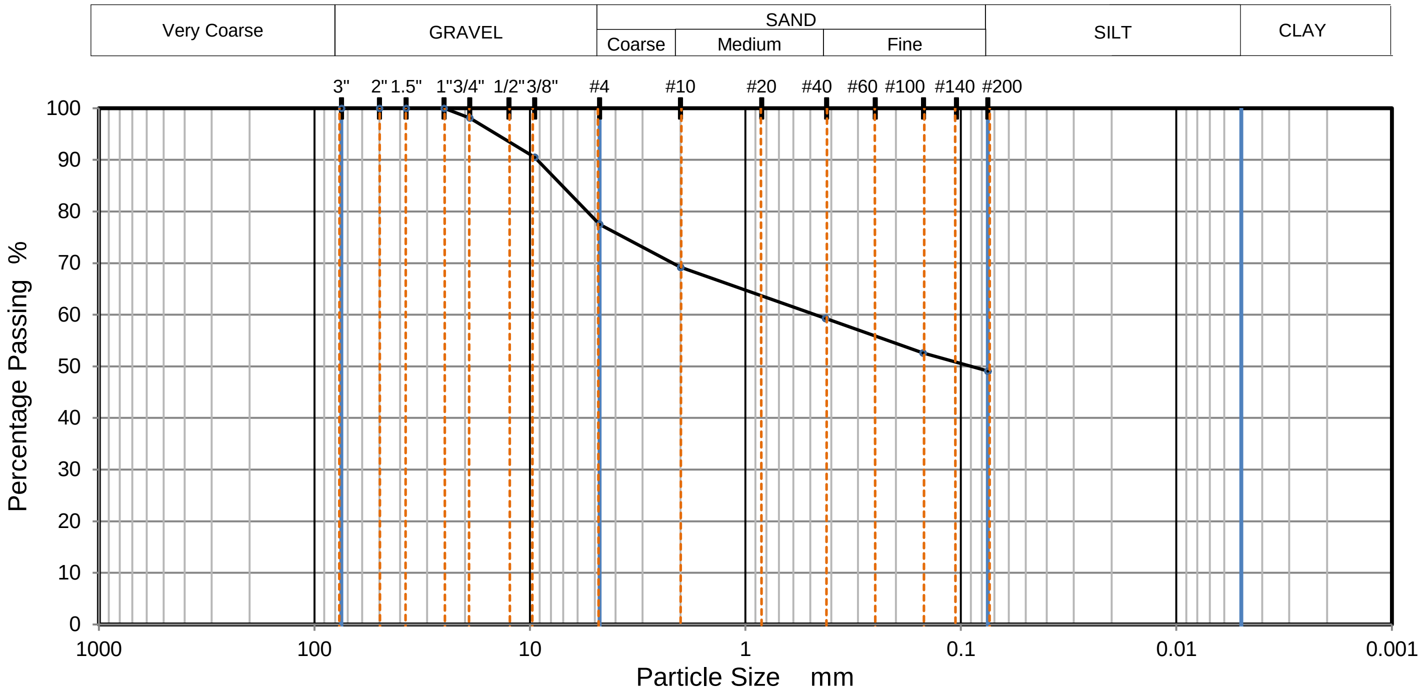
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC

Project No.: 20:1519
Date Reported: 9/30/2022

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received
ARobles	ARobles	ARobles	9/29/2022

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	98.1		
3/8"	90.5		
#4	77.5		
#10	69.2		
#40	59.3		
#100	52.6		
#200	49.1		

Dry Mass of sample, g	288.7

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	22.5
Coarse Sand, #4 to #10 sieve	8.3
Medium Sand, #10 to #40	9.9
Fine Sand, #40 to #200	10.2
Fines <#200	49.1

USCS	SC	Liquid Limit	34	D90	9.250	D50	0.090	D10	
AASHTO	A-6	Plastic Limit	14	D85	7.085	D30		Cu	
USCS Group Name	Clayey sand with gravel	Plasticity Index	20	D60	0.474	D15		Cc	

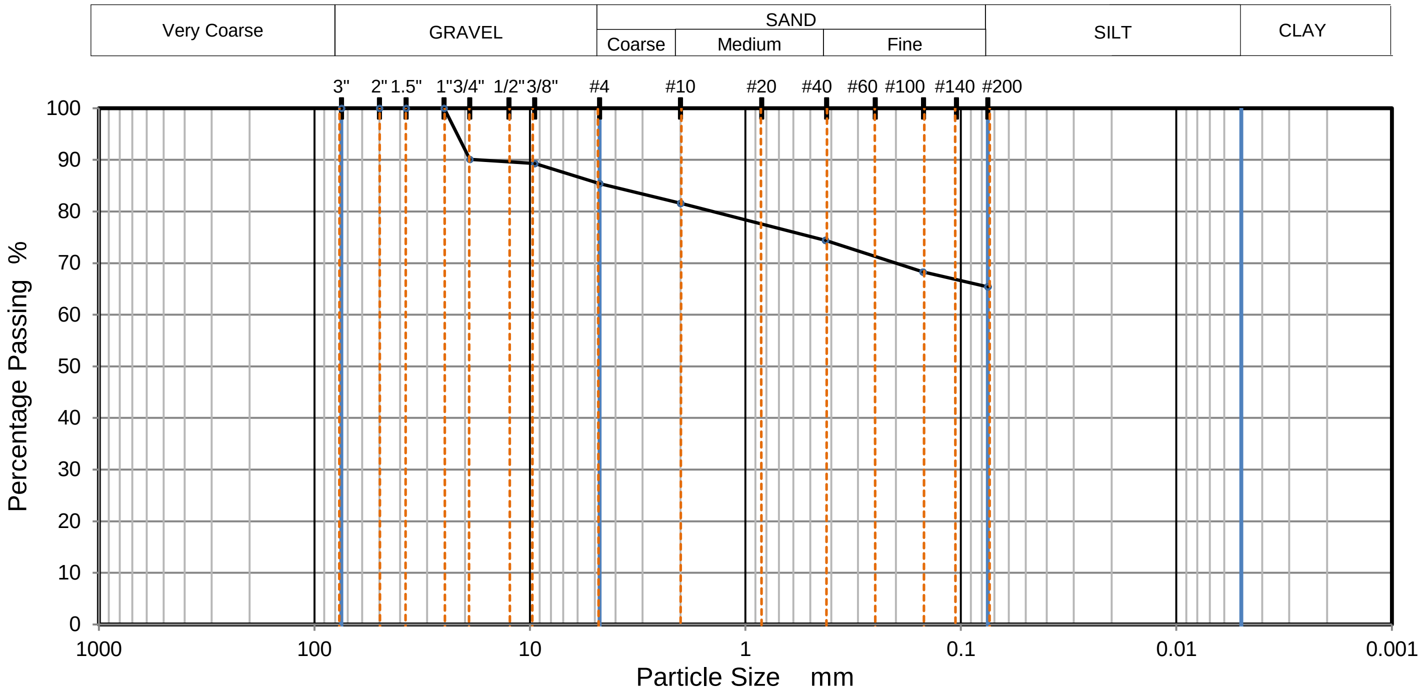
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-01

Project No.: 20:1519
Depth (ft): 0 - 1.5
Sample No.: S-1
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	90.1		
3/8"	89.3		
#4	85.4		
#10	81.6		
#40	74.4		
#100	68.3		
#200	65.4		

Dry Mass of sample, g: 279.9

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	14.6
Coarse Sand, #4 to #10 sieve	3.8
Medium Sand, #10 to #40	7.2
Fine Sand, #40 to #200	9.0
Fines <#200	65.4

USCS	CL	Liquid Limit	47	D90	17.420	D50		D10	
AASHTO	A-7-6	Plastic Limit	16	D85	4.337	D30		Cu	
USCS Group Name	Sandy lean clay	Plasticity Index	31	D60		D15		Cc	

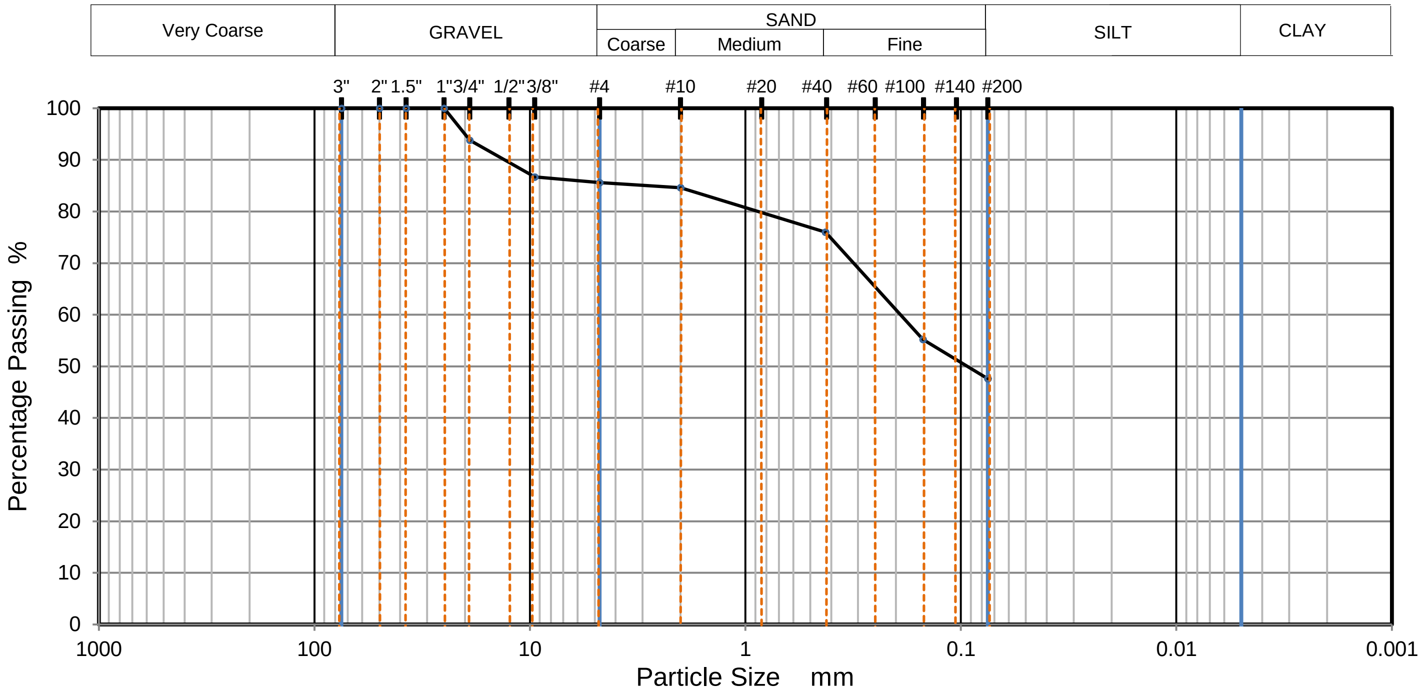
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-01

Project No.: 20:1519
Depth (ft): 2.5 - 4
Sample No.: S-2
Date Reported: 9/30/2022

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	93.8		
3/8"	86.7		
#4	85.6		
#10	84.6		
#40	76.0		
#100	55.2		
#200	47.6		

Dry Mass of sample, g	290.6

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	14.4
Coarse Sand, #4 to #10 sieve	1.0
Medium Sand, #10 to #40	8.6
Fine Sand, #40 to #200	28.4
Fines <#200	47.6

USCS	SC	Liquid Limit	38	D90	13.110	D50	0.093	D10	
AASHTO	A-6	Plastic Limit	13	D85	2.827	D30		Cu	
USCS Group Name	Clayey sand	Plasticity Index	25	D60	0.191	D15		Cc	

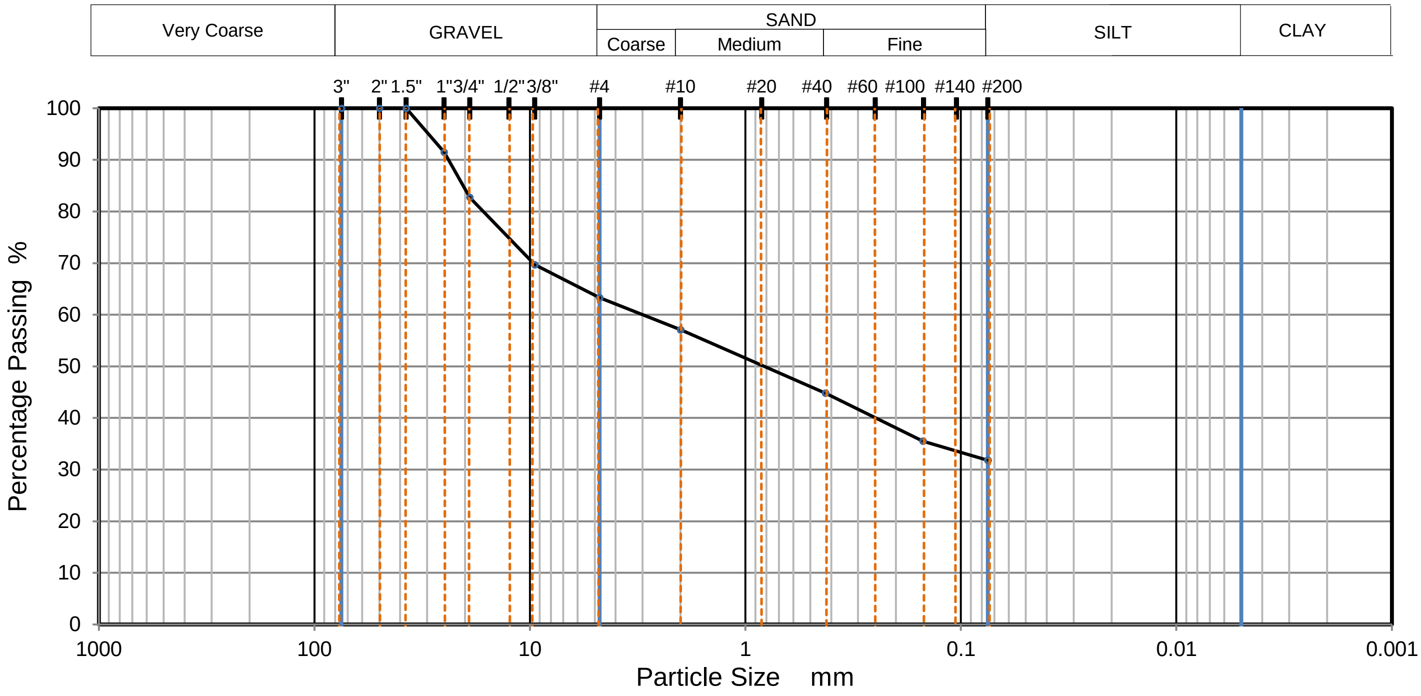
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-01

Project No.: 20:1519
Depth (ft): 6.5 - 8
Sample No.: S-4
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	91.5		
3/4"	82.7		
3/8"	69.7		
#4	63.3		
#10	57.1		
#40	44.8		
#100	35.5		
#200	31.8		

Dry Mass of sample, g: 282.5

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	36.7
Coarse Sand, #4 to #10 sieve	6.2
Medium Sand, #10 to #40	12.3
Fine Sand, #40 to #200	13.0
Fines <#200	31.8

USCS	GC	Liquid Limit	33	D90	23.860	D50	0.818	D10	
AASHTO	A-2-6	Plastic Limit	14	D85	20.410	D30		Cu	
USCS Group Name	Clayey gravel with sand	Plasticity Index	19	D60	2.997	D15		Cc	

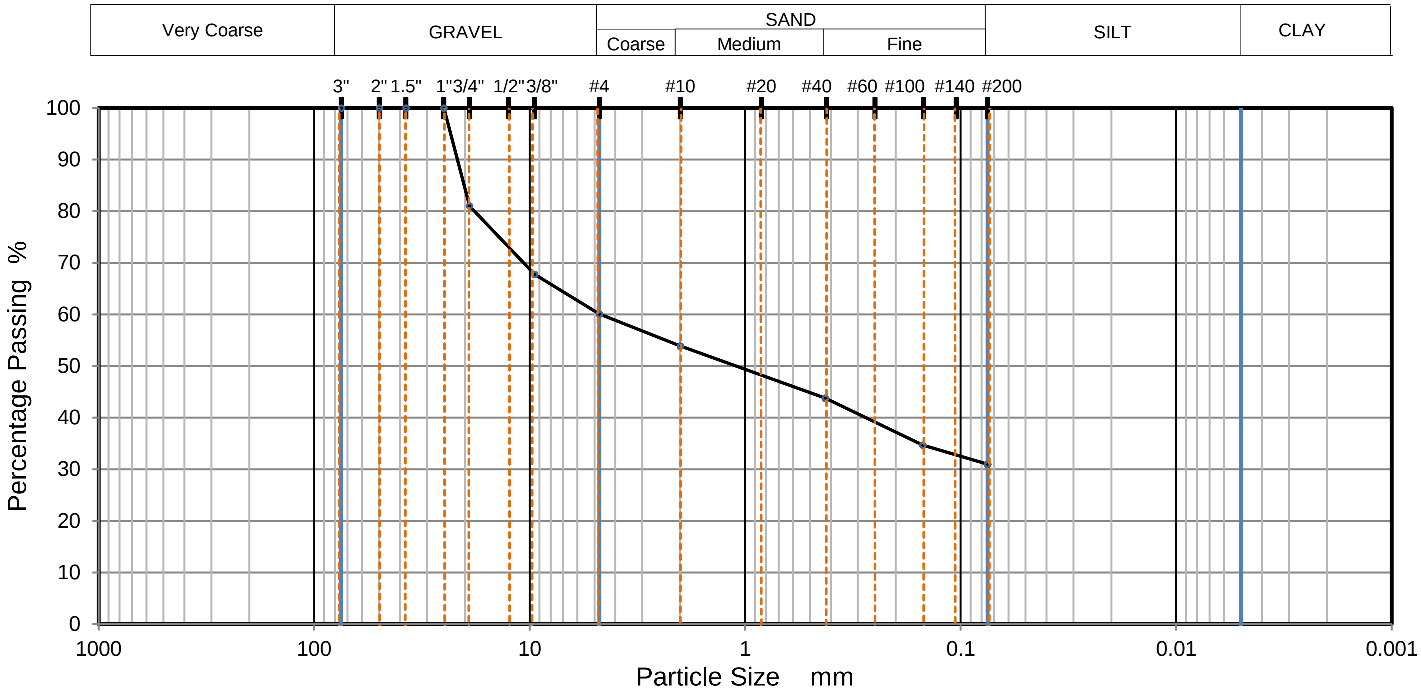
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-02

Project No.: 20:1519
Depth (ft): 0 - 1.5
Sample No.: S-1
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	81.0		
3/8"	67.8		
#4	60.1		
#10	53.9		
#40	43.8		
#100	34.7		
#200	31.0		

Dry Mass of sample, g	296.9

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	39.9
Coarse Sand, #4 to #10 sieve	6.2
Medium Sand, #10 to #40	10.1
Fine Sand, #40 to #200	12.8
Fines <#200	31.0

USCS	GC	Liquid Limit	38	D90	21.640	D50	1.100	D10	
AASHTO	A-2-6	Plastic Limit	15	D85	20.130	D30		Cu	
USCS Group Name	Clayey gravel with sand	Plasticity Index	23	D60	4.684	D15		Cc	

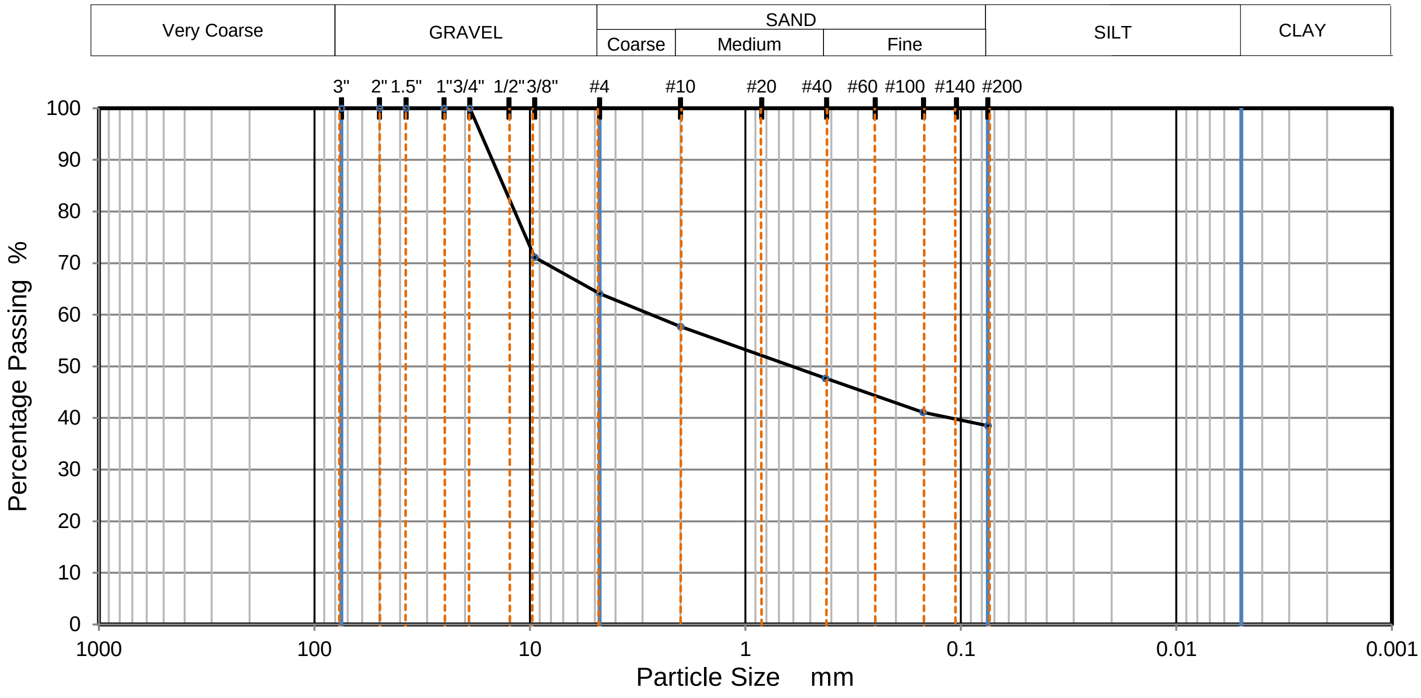
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-03

Project No.: 20:1519
Depth (ft): 0 - 1.5
Sample No.: S-1
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	71.1		
#4	64.1		
#10	57.7		
#40	47.7		
#100	41.1		
#200	38.5		

Dry Mass of sample, g	318.4

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	35.9
Coarse Sand, #4 to #10 sieve	6.4
Medium Sand, #10 to #40	10.0
Fine Sand, #40 to #200	9.2
Fines <#200	38.5

USCS		Liquid Limit		D90	14.950	D50	0.607	D10	
AASHTO	A-4	Plastic Limit		D85	13.260	D30		Cu	
USCS Group Name		Plasticity Index		D60	2.729	D15		Cc	

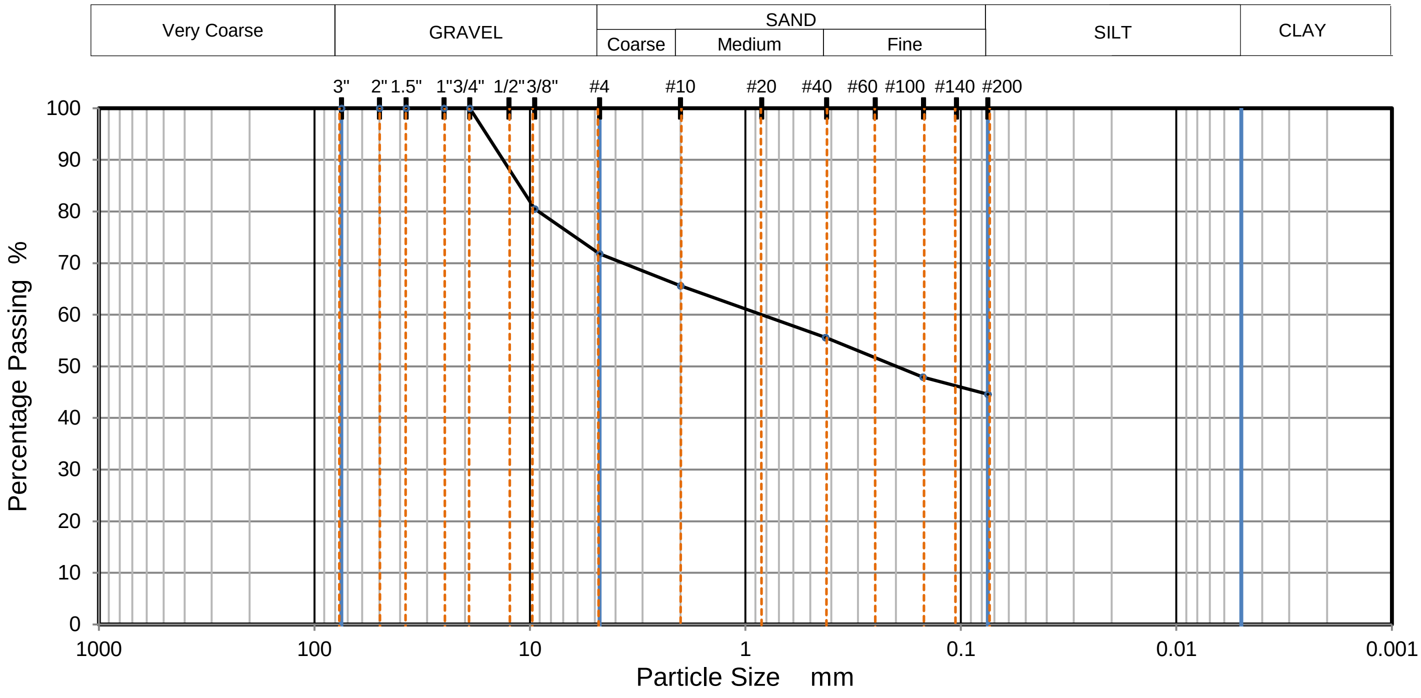
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-03

Project No.: 20:1519
Depth (ft): 2.5 - 4
Sample No.: S-2
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	80.5		
#4	71.8		
#10	65.6		
#40	55.6		
#100	47.9		
#200	44.6		

Dry Mass of sample, g	382.1

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	28.2
Coarse Sand, #4 to #10 sieve	6.2
Medium Sand, #10 to #40	10.0
Fine Sand, #40 to #200	11.0
Fines <#200	44.6

USCS		Liquid Limit		D90	13.320	D50	0.199	D10	
AASHTO	A-4	Plastic Limit		D85	11.150	D30		Cu	
USCS Group Name		Plasticity Index		D60	0.840	D15		Cc	

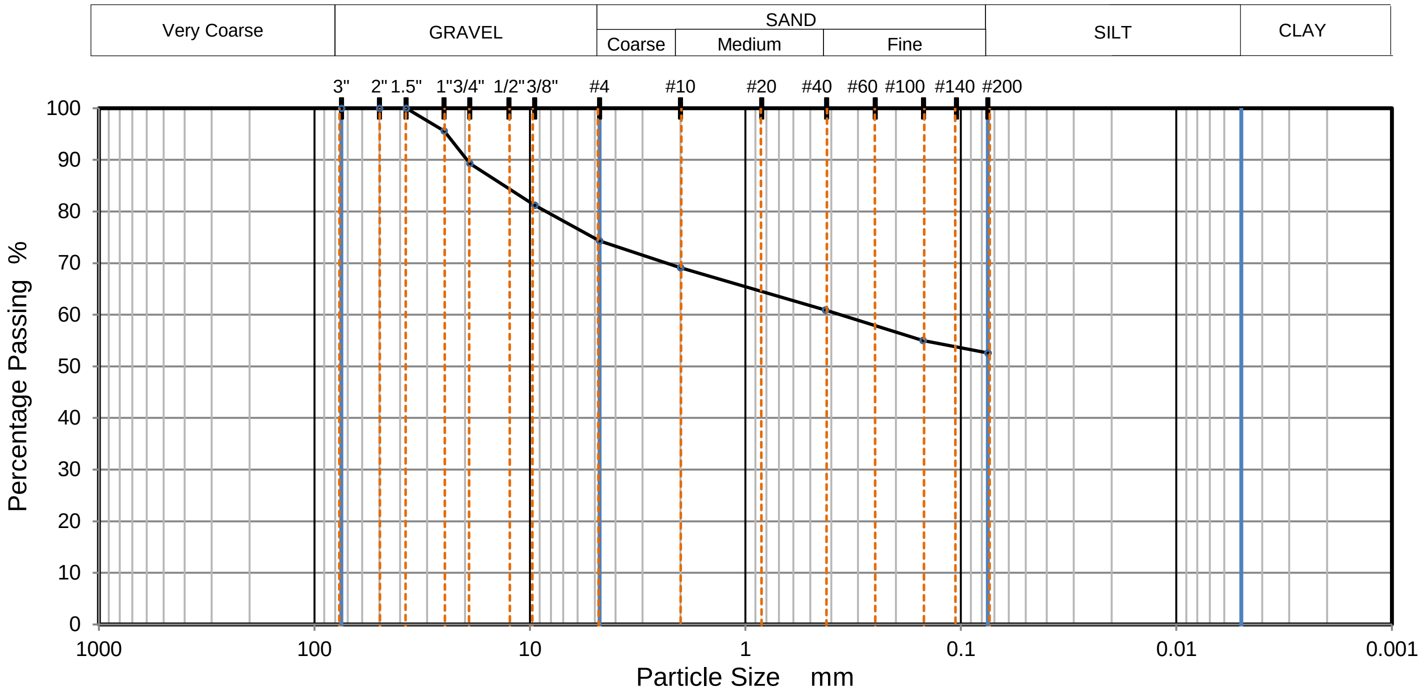
Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-04

Project No.: 20:1519
Depth (ft): 2.5 - 4
Sample No.: S-2
Date Reported:

Office / Lab	Address	Office Number / Fax
ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	95.6		
3/4"	89.3		
3/8"	81.2		
#4	74.3		
#10	69.1		
#40	60.9		
#100	55.0		
#200	52.6		

Dry Mass of sample, g	433.5

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	25.7
Coarse Sand, #4 to #10 sieve	5.2
Medium Sand, #10 to #40	8.2
Fine Sand, #40 to #200	8.3
Fines <#200	52.6

USCS	CL	Liquid Limit	36	D90	19.590	D50		D10	
AASHTO	A-6	Plastic Limit	14	D85	13.150	D30		Cu	
USCS Group Name	Gravelly lean clay with sand	Plasticity Index	22	D60	0.363	D15		Cc	

Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-04

Project No.: 20:1519
Depth (ft): 4.5 - 5.33
Sample No.: S-3
Date Reported:

Office / Lab	Address	Office Number / Fax
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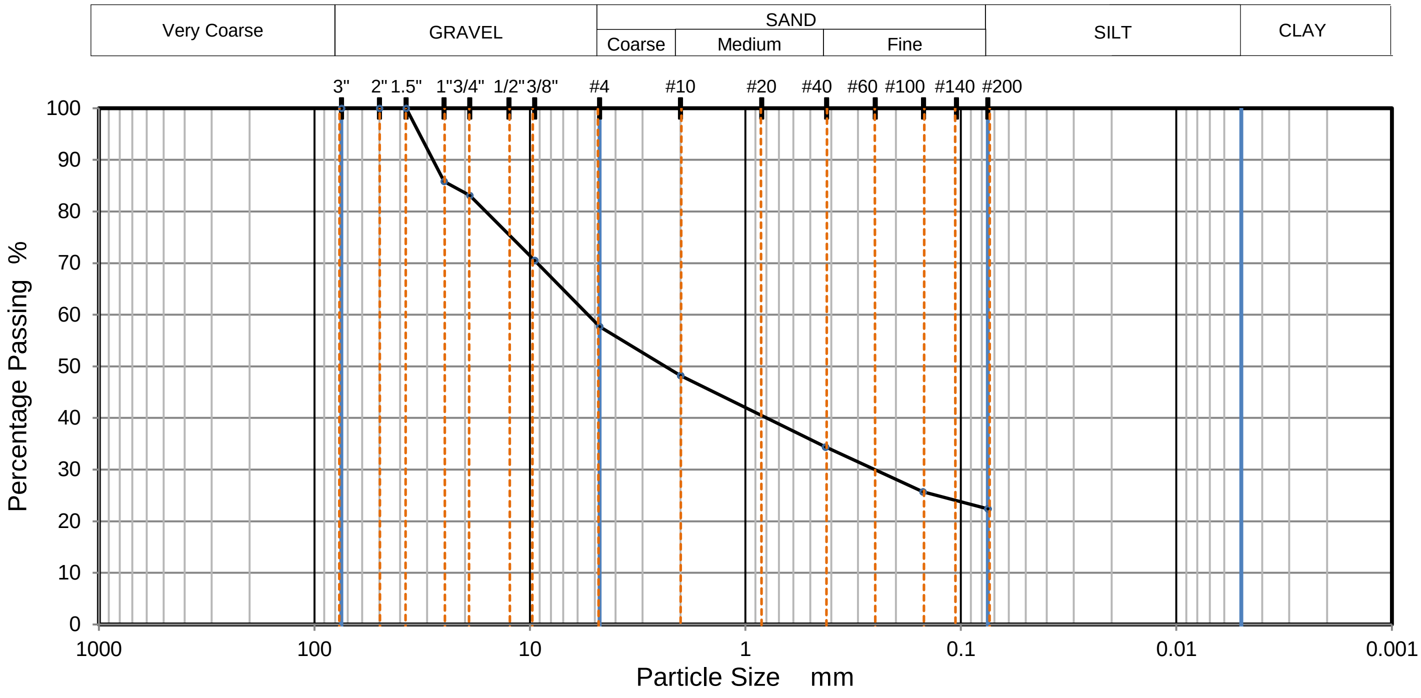
Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	85.8		
3/4"	83.1		
3/8"	70.5		
#4	57.7		
#10	48.2		
#40	34.4		
#100	25.7		
#200	22.4		

Dry Mass of sample, g	399.8

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	42.3
Coarse Sand, #4 to #10 sieve	9.5
Medium Sand, #10 to #40	13.8
Fine Sand, #40 to #200	12.0
Fines <#200	22.4

USCS		Liquid Limit		D90	28.190	D50	2.356	D10	
AASHTO	A-1-b	Plastic Limit		D85	23.050	D30	0.251	Cu	
USCS Group Name		Plasticity Index		D60	5.380	D15		Cc	

Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-05

Project No.: 20:1519
Depth (ft): 0 - 0.92
Sample No.: S-1
Date Reported:

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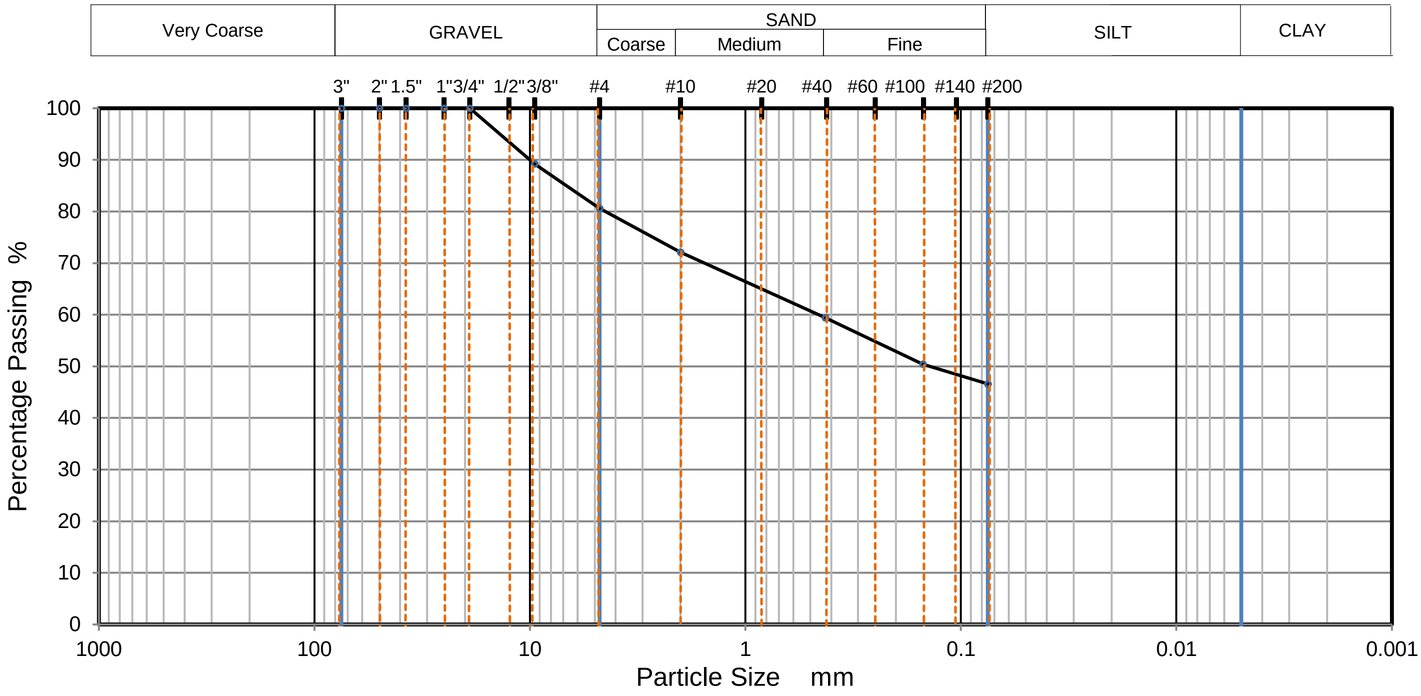
Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D422-63(2007))

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100.0		
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
3/8"	89.2		
#4	80.6		
#10	72.1		
#40	59.4		
#100	50.4		
#200	46.6		

Dry Mass of sample, g	284.4

Sample Proportions	% dry mass
Very coarse, >3" sieve	0.0
Gravel, 3" to # 4 sieve	19.4
Coarse Sand, #4 to #10 sieve	8.5
Medium Sand, #10 to #40	12.7
Fine Sand, #40 to #200	12.8
Fines <#200	46.6

USCS	SC	Liquid Limit	37	D90	10.000	D50	0.139	D10	
AASHTO	A-6	Plastic Limit	15	D85	6.772	D30		Cu	
USCS Group Name	Clayey sand with gravel	Plasticity Index	22	D60	0.457	D15		Cc	

Project: Proposed Dominion Creek Development
Client: GC SA Properties, LLC
Sample Description:
Sample Source: B-05

Project No.: 20:1519
Depth (ft): 2.5 - 3.08
Sample No.: S-2
Date Reported:

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ECS Southwest LLP - San Antonio	431 Isom Road Suite 114 San Antonio, TX 78216	(210)528-1430 (214)483-9684

Tested by	Checked by	Approved by	Date Received	Remarks
ARobles	ARobles	ARobles	9/29/2022	