

RECEIVED

NOV 0 4 2019

**Development Services** 

## Geotechnical Engineering Report

Paragon Star Village Lee's Summit, Missouri August 2, 2019 Terracon Project No. 02195181

> Prepared for: GBA Lenexa, Kansas

Prepared by: Terracon Consultants, Inc. Lenexa, Kansas

8

August 2, 2019

GBA: 9801 Renner Boulevard Lenexa, Kansas 66219

Terracon GeoReport

Attn: Mr. Clint Loumaster, P.E.

(913) 577-8266

·E:

cloumaster@gbateam.com

Re:

Geotechnical Engineering Report

Paragon Star Village I-470 and View High Drive

Lee's Summit, Missouri

Terracon Project No. 02195181

Dear Mr. Loumaster:

We have completed a subsurface exploration and geotechnical engineering evaluation for the referenced project. This study was performed in general accordance with Terracon Proposal No. P02195181, dated July 16, 2019. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the project. Preliminary geotechnical considerations for future structures, along with a discussion of additional subsurface exploration requirements for future structures, are also provided.

We appreciate the opportunity to be of continued service to you on the Paragon Star development. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

Kevin D. Friedrichs, P.E. Project Engineer

Missouri: PE 2013010325

Kill C. Bey. Kole C. Berg, P.E.

Senior Engineer

Missouri: PE 2002016417

15.

#### REPORT TOPICS

INTRODUCTION	1
SITE CONDITIONS	
PROJECT DESCRIPTION	
GEOTECHNICAL CHARACTERIZATION	
GEOTECHNICAL OVERVIEW	
EARTHWORK	4
DEEP FOUNDATIONS	8
GROUND IMPROVEMENT	
SHALLOW FOUNDATIONS FOR ANCILLARY STRUCTURES	
SEISMIC CONSIDERATIONS	
FLOOR SLABS	13
LATERAL EARTH PRESSURES	
PRELIMINARY CONSIDERATIONS FOR FUTURE STRUCTURES	
ADDITIONAL EXPLORATION FOR FUTURE STRUCTURES	17
GENERAL COMMENTS	
FIGURES	19

Note: This report was originally delivered in a web-based format. Orange Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the **GeoReport** logo will bring you back to this page. For more interactive features, please view your project online at <u>client.terracon.com</u>.

#### **ATTACHMENTS**

EXPLORATION AND TESTING PROCEDURES SITE LOCATION AND EXPLORATION PLANS EXPLORATION RESULTS SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

# Geotechnical Engineering Report Paragon Star Village I-470 and View High Drive Lee's Summit, Missouri Terracon Project No. 02195181 August 2, 2019

#### INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering evaluation performed for the proposed Paragon Star Village development to be located at I-470 and View High Drive in Lee's Summit, Missouri. Fourteen exploratory borings (designated B-1 to B-14) were performed for the initial phase of development for Paragon Star Village. The initial phase of development will consist of a planned 3-story office building and 2 two-story retail/restaurant/office buildings, and this report provides geotechnical design and construction recommendations for these structures. This report describes the subsurface conditions encountered at the boring locations for the initial development, presents the test data, and provides geotechnical recommendations for the following Items:

- earthwork
- foundations
- floor slabs.

- lateral earth pressures
- seismic site class

Seven auger probes (designated B-15 to B-21) were performed at the site of future structures planned in the development for preliminary planning purposes. Borings and auger probes were advanced to depths ranging from approximately 20 to 50 feet below existing site grades. This report provides preliminary geotechnical considerations to assist in the planning stage of these future structures. Additional exploration will be required for future structures to provide site specific design and construction recommendations based on final design, grading, and foundation loads.

Maps showing the site and boring locations are shown in the Site Location and Exploration Plan section. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs in the Exploration Results section.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



#### SITE CONDITIONS

Item	Description
Project Location	The project is located northeast of !-470 and View High Drive in Lee's Summit, Missouri.
Existing Improvements	The site is presently a grass-covered, undeveloped field.
Existing Topography	The site is relatively flat.

#### PROJECT DESCRIPTION

ltem	Description Description
Project Description	Paragon Star Village is a master-planned development. The initial development will include a three-story office building and 2 two-story retail/restaurant/office buildings. The buildings will be steel framed with grade-supported concrete floor slabs. Future development includes multi-family buildings, restaurants, hotels and other mixed-use development.
Finished Floor Elevation	The FFEs of the structures were not provided. We anticipate the FFEs of the proposed buildings will be within $\pm 5$ feet of existing grades.
Maximum Loads	Anticipated structural loads for the new building were not provided. Based on our experience with similar structures, we have considered the following maximum loads:  Columns: 300 kips Walls: 5 kips per tinear foot Slabs: 100 pounds per square foot
Grading	A site grading plan was not provided. We have considered up to 2 feet of cut and 5 feet of fill will be required to develop final grades.
Below-Grade Structures	No basements or free-standing retaining walls are planned. The buildings will have elevator pits.
Pavements	No borings were requested in the parking and drive areas. Therefore, recommendations regarding pavements and pavement subgrade preparation are not included in Terracon's scope of services.

#### **GEOTECHNICAL CHARACTERIZATION**

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the Exploration Results section and the GeoModel can be found in the Figures section of this report.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name:	General Description
1	Native Clay	Lean Clay (CL) – very soft to medium stiff
2	Shale	Shale highly to moderately weathered

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was consistently observed in the boreholes at elevations ranging from approximately 800 to 802 feet during our subsurface exploration. Long-term observations in piezometers or observation wells, sealed from the influence of surface water, would be needed to develop more detailed groundwater information. Groundwater level fluctuations occur due to variations in rainfall, runoff, water level in the nearby Little Blue River, and other factors not evident at the time we performed the borings. The potential for groundwater level fluctuations should be considered when developing the design and construction plans for the project.

#### **GEOTECHNICAL OVERVIEW**

The soils in the 5 to 10 feet generally consisted of lean clay with consistencies ranging from medium stiff to stiff. However, the soils below this upper zone consisted of very soft alluvial (riverdeposited) clays that extended from depths of about 5 to 10 feet below the existing ground surface to the shale bedrock at a depth of 40 to 45 feet.

The loads induced by structures and new fill placed about these very soft soils could result in significant settlement. Support of new structures on conventional shallow footing foundations bearing in the native soils is not recommended, as new structures supported in this manner could experience larger-than-normal total settlement and excessive differential settlement, resulting in cracking, uneven floors, and other damage to the buildings. Based on conditions encountered at the boring locations, it appears feasible to support the new buildings on drilled shafts bearing in the underlying shale bedrock, or on shallow foundations constructed on subgrade that has been improved with a ground improvement system such as rammed aggregate piers or stone columns.

We understand the existing grade will be raised 1 to 2 feet within the planned building pads. Provided the thickness of new fill is no more than 2 feet above existing grades, settlement of the underlying soft alluvial soils under the weight of the new fill is not expected to be significant. However, if the grading plans are revised such that more than 2 feet of new fill will be placed, Terracon should be notified so we can review the grading plans and provide additional geotechnical recommendations regarding settlement monitoring and time delays between completion of fill placement and commencement of building construction.

The General Comments section provides an understanding of the report limitations.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



#### EARTHWORK

Site preparation, excavation, subgrade preparation and placement of engineered fills should conform to recommendations presented in this section. The recommendations presented for design and construction of earth-supported elements including foundations and floor slabs are contingent upon the recommendations outlined in this section being followed. We recommend earthwork on this project be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of subgrade preparation, engineered fill, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

#### Site Preparation

Vegetation, topsoil, and any loose, soft or otherwise unsultable soils present within the proposed construction areas should be stripped. Based on information obtained at the boring locations, stripping depths on the order of 6 inches should be anticipated to remove the root zone materials. However, greater stripping depths may be required in areas not explored by the borings. Organic soils removed during site preparation should not be used as fill beneath the proposed new building and pavement areas.

Following initial stripping, the exposed soils should be proofrolled. A Terracon representative should observe the proofrolling. Proofrolling can be accomplished using a loaded tandem-axle dump truck with a gross weight of at least 20 tons, or similarly loaded equipment. Areas that display excessive deflection (pumping) or rutting during proofroll operations should be improved by scarification/compaction or by removal and replacement with engineered fill.

## Geotechnical Engineering Report Paragon Star Village **a** Lee's Summit, Missouri August 2, 2019 **a** Terracon Project No. 02195181



#### Fill Material Types

A sample of each fill material type should be tested prior to being used on the site. Our professional opinions concerning suitability of fill materials are presented in the following table.

Fill Type 😉	USCS Classification	Acceptable Location for Placement	
Low Volume Change (LVC) material	GM <sup>2</sup> or CL (LL<45 and PI<23)	All locations and elevations, except where free- draining material is required	
On-site soils (r	CL	All locations and elevations, except where free- draining material is required (provided the soils have an LL<45 and PI<23) <sup>4</sup>	
	(native clay soils and existing fill soils)	Existing fill should be observed, tested and approved by Terracon. Organics, rock/rubble fragments larger than 3 inches, debris, or other unsuitable materials should be removed prior to re-use of the existing fill in engineered fill sections.	
Well-graded granular	GW ³	Where free-draining material is required	

- 1. Engineered fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.
- 2. MoDOT Type 5 or an approved alternate gradation of crushed limestone aggregate
- Granular materials with less than 5 percent fines (material passing the #200 steve), such as ASTM C33 Size No. 57
  aggregate or an approved alternate gradation
- 4. The on-site soils classified as lean clay. However, of the 8 samples tested for Atterberg limits, 5 samples had either an LL>45 and/or a PI>23, so a significant portion of the on-site soils do not meet the LVC requirements. Additional sampling and testing will be required during construction to define locations and depths where LVC materials is present. If on-site soils will be used as LVC materials, the contractor should expect that separation, stockpilling, and double-handling of these materials should be expected. There may also be delays during construction to allow laboratory testing to confirm that the materials meet the LVC criteria.

We understand the existing grade will be raised 1 to 2 feet within the planned building pads. Low volume change (LVC) material placed below the building floor slabs can consist of well-graded crushed stone aggregate (e.g., MoDOT Type 5). Lean clay soils with a liquid limit less than 45 and plasticity index less than 23 could also be used as LVC material, but these solls would be susceptible to softening and disturbance if they become wetted by surface water and precipitation. If a granular leveling course (such as crushed stone aggregate) is used immediately below the floor slabs, this material can be considered part of the LVC zone.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



#### Fill Compaction Requirements

ltem			
Lift Thickness (maximum)		9 inches in loose thickness when large, self-propelled compaction equipment is used.	
		4 inches when small, hand-guided equipment (plate or "jumping jack" compactor) is used.	
Minimum Compaction Requirements 1		At least 95 percent of the material's maximum dry density <sup>1</sup>	
LL<45		-2 to +2 percent of optimum moisture content value 1	
Moisture Content of Clay Soil LL>45		0 to 4 percent above the optimum moisture content value <sup>1</sup>	
Moisture Content of Granular N	laterial	Sufficient to achieve compaction without pumping when proofrolled	
1. As determined by the standard	Proctor to	est (ASTM D 698)	

We recommend that engineered fill be tested for moisture content and compaction during placement. If the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

#### **Utility Trench Backfill**

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. If utility trenches are backfilled with relatively clean granular material, they should be capped with at least 18 inches of clay fill to reduce the infiltration and conveyance of surface water through the trench backfill.

Utility trenches are common sources of water infiltration and migration. All utility trenches that penetrate beneath buildings should be effectively sealed to restrict water intrusion and flow through the trenches that could migrate below the building. We recommend constructing an effective "trench plug" that extends at least 5 feet out from the face of the building exterior. The plug material should consist of clay compacted as recommended in Earthwork. The clay fill should be placed to completely surround the utility line and be compacted in accordance with recommendations in this report. Alternatively, flowable fill could be used to construct the trench plug.

#### **Grading and Drainage**

During construction, grades should be developed to direct surface water flow away from or around the site. Exposed subgrades should be sloped to provide positive drainage so that saturation of subgrades is avoided. Surface water should not be permitted to accumulate on the site. Final surrounding grades should promote rapid surface drainage away from the structures. Accumulation

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



of water adjacent to the structure could contribute to significant moisture increases in the subgrade soils and subsequent softening/settlement or expansion/heave.

After construction of the structures and pavements have been completed, we recommend verifying final grades to document that effective drainage has been achieved. Grades around the structures should also be periodically inspected and adjusted as necessary, as part of the structure's maintenance program.

#### Earthwork Construction Considerations

Due to the presence of soils with high moisture content and relatively low strength, some means of subgrade stabilization may be required to facilitate construction, especially if wet soils are encountered during site preparation or if the subgrade becomes saturated by precipitation during site preparation/earthwork operations. In general (weather permitting), scarifying, drying and compacting the exposed subgrades is expected to be the most economical means of improving these soils prior to placing new fill. However, this option is typically less effective where soft/wet soils are more than about one foot thick. Alternatives for subgrade stabilization could include undercutting unsuitable (wet, low strength, and/or disturbed) soils followed by the addition of crushed stone aggregate (typically on the order of 12 to 18 inches thick) to improve subgrade stability, or the incorporation of a chemical additive such as class C fly ash, portland cement, lime, or lime kiln dust ("Code L"). The need for stabilization and most appropriate type of stabilization will be dependent upon soil, groundwater and weather conditions, as well as the proposed grading plan, the construction schedule and construction methods. Terracon should be retained during construction to help provide recommendations as needed.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proofrolling, placement and compaction of engineered fill, backfilling of excavations into completed subgrades, and just prior to construction of foundations, slabs, and pavements.

Care should be taken to avoid disturbance of prepared subgrades. Unstable subgrade conditions can develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. If unstable subgrade conditions develop, stabilization measures will need to be employed. Construction traffic over the completed subgrade should be avoided to the extent practical. If the subgrade becomes frozen, desiccated, saturated, or disturbed, the affected materials should be removed or these materials should be scarified, moisture conditioned, and compacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be llable and subject to substantial penalties. Under no circumstances should the Information provided in this report be interpreted to mean that Terracon is responsible for construction site safety or the contractor's activities. Construction site safety is the sole responsibility of the contractor who shall also be solely responsible for the means, methods, and sequencing of the construction operations.

#### DEEP FOUNDATIONS

We recommend the 3-story office building, and 2-story retail/restaurant/office buildings be supported on drilled shaft foundations that extend at least 2 shaft diameters into the moderately weathered shale bedrock. At our boring locations, the upper contact elevation of the moderately weathered shale bedrock ranged from approximately 768 to 772 feet.

#### **Drilled Shaft Design Parameters**

Description	Value / State
Alfowable end bearing pressure <sup>1</sup>	40 ksf
Minimum shaft diameter	30 inches
Minimum penetration into shale	2 shaft diameters
Estimated total settlement	½ inch
Estimated differential settlement	<1/2 inch between columns

Allowable compressive capacity may be computed by multiplying the end area of the shaft times the end bearing
value. The base of the drilled shaft must extend at least two shaft diameters into shale bedrock. The structural
engineer should refer to the appended boring logs and exploration plan to evaluate the estimated shaft tip
elevations based on the structural loading, shaft diameter, and embedment depth.

#### **Drilled Shaft Lateral Resistance**

Recommended soil parameters for analyzing lateral resistance and deflection of drilled shaft foundations under design loading conditions using the computer program LPILE are provided in the following table. LPILE analyzes pile deflection as a function of the design loads and subsurface soil and rock conditions.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



Description (elevation)	LPILE p-y Curve Model	Total Unit Weight, y	Strain Factor (soil), £ <sub>50</sub> K <sub>rm</sub>	Undrained Shear Strength (soll), su 5: Unlaxial Compressive Strength (rock), qu	Initial Modulus of Rock Mass (rock)
Lean Clay (CL) (from 3 feet below top of shaft to between 768 and 772 feet) <sup>1</sup>	Soft clay	120 pcf	0.02	500 psf	N/A
Shale Bedrock (below 768 to 772 feet)	Weak Rock	135 pcf	0.0005	100 psi	10,000 psi

<sup>1.</sup> The lateral parameters within the upper 3 feet of the shaft should be ignored for frost considerations.

If center to center spacing between drilled shafts will be less than 3 diameters in the direction of loading, appropriate reduction factors should be applied to these parameters. If closely-spaced shafts are planned, Terracon should be retained to review the proposed foundation configuration and provide appropriate reduction factors.

The structural capacity of the drilled shafts should be analyzed using the combined stresses induced by axial and lateral forces. The response of drilled shafts to lateral loads is dependent upon the soil/structure interaction as well as the actual cross section, length, stiffness, and "fixity" (fixed or free head condition) of the shafts.

#### Drilled Shaft Construction Considerations

We recommend that Terracon be retained to observe each drilled shaft excavation to verify that conditions in the excavation are consistent with those encountered in our exploratory borings. If unsuitable materials are encountered, it may be necessary to deepen the shaft excavation.

The contractor is responsible for determining the means and methods for effectively performing the shaft excavations. In our opinion, use of a rock auger will likely be required to penetrate the shale bedrock due to the limestone seams encountered in our exploration. We recommend the contractor have at least two types of rock augers (e.g., a spade-tooth bit and bullet-tooth bit) available on-site for each planned shaft diameter.

Based on the groundwater levels encountered in the borings and the proximity to the Little Blue River, seepage should be expected in the drilled shaft excavations. Due to the likelihood of seepage and the presence of soft clay soils that will tend to cave from the excavation sidewalls, temporary casing will be required to complete the drilled shaft excavations. The contractor should also be prepared to dewater the drilled shaft excavations. To facilitate construction, reinforcing steel should be ready and on site, and concrete should be available within a very short period of time for

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



placement after the excavation is completed. If shaft excavations must remain open for an extended time, the bearing conditions at the bottom of the shaft excavation should be re-evaluated immediately prior to placing concrete. The concrete mixture for drilled shafts be designed to have a slump in the range of 5 to 7 inches.

We do not expect that personnel will enter the excavation to clean or observe the bearing materials; however, temporary steel casing must be installed if personnel will enter the shaft excavation. While removing temporary casing from a shaft excavation during concrete placement, the concrete inside the casing should be maintained at a sufficient level to prevent soil intrusion into the shaft excavation and resist any earth pressures outside the casing during the entire casing removal procedure.

#### GROUND IMPROVEMENT

As an alternative to deep foundations, the client could consider ground improvement as a means of improving the existing very soft to medium stiff native soils encountered at the site. A ground improvement system (such as rammed aggregate piers or stone columns) could be utilized to increase the bearing capacity of the on-site soils and decrease the potential settlement. A ground improvement system generally consists of aggregate-filled piers, which results in partial replacement of on-site soils and improves the foundation support capability of the adjacent remaining soils. Where ground improvement will be used, it may be necessary to place a layer of crushed stone aggregate to protect the subgrade from disturbance by the construction equipment. Once the ground improvement system is installed, the buildings could then be supported on conventional shallow footing foundations bearing above the improved soil. Ground improvement systems are procured on a design-build basis from specialty contractors. The design-build specialty contractor would use the subsurface information summarized on the attached boring logs and other project information from the design team to perform their analysis, formulate a design, and prepare a cost estimate. Upon request, Terracon can provide contact information for specialty contractors experienced in these ground improvement methods.

#### SHALLOW FOUNDATIONS FOR ANCILLARY STRUCTURES

As discussed above, the new building should be supported on drilled shaft foundations or on shallow foundations bearing on a ground improvement system such as rammed aggregate piers or stone columns. However, we understand lightly-loaded features that are not structurally connected to the building (e.g., site retaining walls, planters, and HVAC equipment) are planned to be supported on shallow footing foundations. Specific details concerning these structures (locations, bearing elevations, and structural loads) were not available at the time this report was prepared. In our opinion, these lightly-loaded structures can be supported by conventional spread footing foundations bearing on medium stiff native clay soils or newly placed engineered fill.



#### Shallow Foundation Design Parameters for Ancillary Structures Only

Description	Value Talue
Maximum net allowable bearing pressure 1	1,500 psf
Minimum embedment below finished grade for frost protection <sup>2</sup>	3 feet
Minimum footing widths	isolated footings: 30 inches Continuous footings: 16 inches
Estimated total settlement <sup>3</sup>	1 inch or less
Estimated differential settlement 3	1/2 to 2/3 of the total settlement over a horizontal distance of 50 feet

- The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. This pressure assumes that any soft soils or other unsuitable materials, if encountered, will be undercut and replaced with engineered fill.
- 2. This embedment depth is recommended to provide frost protection and to reduce the effects of seasonal moisture variations in the foundation bearing solls.
- 3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of engineered fill below the footings, and the quality of the earthwork operations and footing construction.

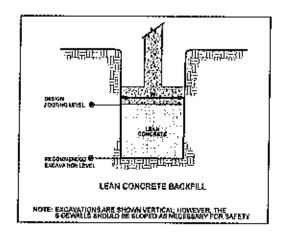
#### Shallow Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose materials prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. If the soils at the bearing level become excessively dry, disturbed, saturated, or frozen, the affected soil should be removed prior to placing concrete. If the excavations must remain open overnight or for an extended period of time, placement of a lean concrete mud-mat over the bearing soils should be considered.

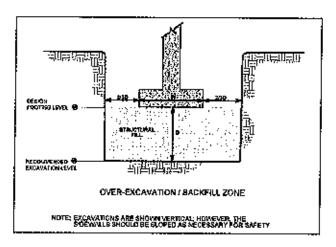
All footing bearing surfaces should be observed and tested by Terracon. If unsuitable conditions are encountered, footing excavations should be extended deeper to suitable bearing materials. Footings can bear directly on suitable soils at the lower level or on lean concrete backfill as shown in the following figure.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181





The footings could also bear on properly compacted backfill extending down to suitable soils as shown in the following figure. Overexcavation for compacted engineered fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing elevation. The overexcavation should then be backfilled up to the footing base elevation with well graded granular material (e.g., MoDOT Type 5 aggregate or an approved alternate gradation) placed and compacted as recommended in Earthwork.



#### SEISMIC CONSIDERATIONS

Code	Site Class
2012 International Building Code (IBC)	D 1

1. The 2012 International Building Code (IBC) seismic site class definitions are based on average properties of the subsurface profile to a depth of 100 feet. The exploratory borings terminated within shale bedrock at a maximum depth of 50 feet. Our opinion of site class is based on boring data and our knowledge of local geological and geotechnical conditions.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



#### FLOOR SLABS

Floor Slab Design Parameters

item	Description
Floor Slab Support	Native soils or newly placed engineered fill materials that meet low volume change (LVC) criteria
Modulus of Subgrade Reaction	100 pounds per square Inch per inch of deflection (psi/in or pci) for point loading conditions
Granular Leveling Course Layer Thickness 1	4 inches (minimum)
1 Well graded crushed stone (e.g. MoDOT Type 5	aggregate) or open-graded crushed stone (e.g. ASTM C33,

Well graded crushed stone (e.g., MoDOT Type 5 aggregate) or open-graded crushed stone (e.g. ASTM C33, Size No. 57 aggregate) can be used as the leveling course.

As noted in the Earthwork section, the on-site soils classified as lean clay. However, of the 8 samples tested for Atterberg limits, 5 samples had either an LL>45 and/or a Pl>23, so some of the on-site soils do not meet the LVC requirements. Additional sampling and testing will be required during construction to define locations and depths where LVC material is present. If on-site soils will be used as LVC materials, the contractor should expect that separation, stockpiling, and double-handling of these materials should be expected. There may also be delays during construction to allow laboratory testing to confirm that the materials meet the LVC criteria.

Joints should be constructed in slabs at regular intervals as recommended by the American Concrete Institute (ACI) to help control the location of cracks. Joints or any cracks that develop in the floor slab should be sealed with a water-proof, non-extruding compressible compound.

Loads on footings that support structural walls and column loads are typically greater than floor slab loads. Consequently, footings should be expected to settle more than the adjacent floor slabs. The structural engineer should consider the potential for differential movement between foundations and grade-supported floor slabs.

Typically, some increase in the floor slab subgrade moisture content will occur because of gradual accumulation of capillary moisture, which would otherwise evaporate if the floor slab had not been constructed. The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

#### Floor Slab Construction Considerations

If LVC materials consist of clay, the subgrade should be maintained in a relatively moist condition until the floor slab is constructed. If the subgrade becomes desiccated prior to construction of the

Paragon Star Village 

Lee's Summit, Missouri

August 2, 2019 

Terracon Project No. 02195181



floor slab, the affected material should be removed or the materials should be scarified, moistened, and compacted. Upon completion of grading operations in the building area, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slab.

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall etc. As a result, the floor slab subgrade soils may not be sultable for placement of the granular course and/or concrete at the time of building construction, and corrective action may be required.

Terracon should evaluate the condition of the floor slab subgrades immediately prior to placement of the granular leveling course and construction of the slabs. Particular attention should be paid to areas containing backfilled trenches and high traffic areas that were previously disturbed during construction. Where unsuitable conditions are located within the floor slab subgrade soils, the subgrade should be improved by removing and replacing the affected material with properly compacted fill.

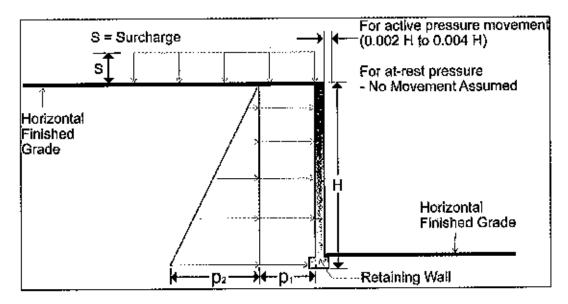
#### LATERAL EARTH PRESSURES

#### Lateral Earth Pressure Design Parameters

Below grade walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction, and/or compaction and the strength of materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls where wall movement is permitted. The at-rest condition considers no wall movement is permitted. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181





#### Lateral Earth Pressure Parameters

Earth Pressure ∰Conditions	Coefficient for Backfill Type		∦ Surcharge Pressure, p₁(psf)	
Active (K <sub>s</sub> )	Granular - 0.3	40	(0.3)\$	(40)H
	Clay - 0.42	50	(0.42)\$	(50)H
At-Rest (K₀)	Granular - 0.47	60	(0.47)S	(60)H
	Clay - 0.60	70	(0.60)S	(70)H
Passive (K <sub>p</sub> )	Granular - 3.3 Clay - 2.4	420 290		

#### Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 H to 0.004 H, where H is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- Clay soil backfill: unit weight = 120 pcf (maximum), and  $\phi$  = 24 degrees (minimum)
- Granular material backfill: unit weight = 130 pcf (maximum), and  $\phi$  = 32 degrees (minimum)
- Horizontal backfill, compacted as recommended in the report
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No loading from nearby footing or slabs
- No dynamic loading.
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

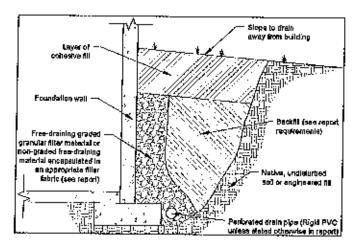
Paragon Star Village ■ Lee's Summit, Missourl August 2, 2019 ■ Terracon Project No. 02195181



Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active and at-rest cases, and at an angle of 60 degrees from vertical for the passive case. To calculate the resistance to sliding, a value of 0.3 should be used as the ultimate coefficient of friction where the footing bears on native day soils or engineered fill

#### Subsurface Drainage for Below Grade Walls

To prevent hydrostatic pressure on below-grade walls, we recommend drains be installed at the foundation level. Each drain line should be sloped to provide positive gravity drainage and should be surrounded by free-draining granular material graded to prevent the intrusion of fines, or an alternative free-draining granular material encapsulated with suitable filter fabric. At least a 2-foot wide section of free-draining granular fill should be used for backfill above the drain line and adjacent to the wall. The free-draining granular fill should extend to within 2 feet of final grade and should be capped with compacted cohesive fill to minimize infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

#### PRELIMINARY CONSIDERATIONS FOR FUTURE STRUCTURES

Deep foundations should be considered for the future structures due to the presence of very soft to medium stiff alluvial clays at the site. Future structures should be supported on drilled shaft foundations that extend to moderately weathered shale.

Paragon Star Village 
Lee's Summit, Missouri
August 2, 2019 
Terracon Project No. 02195181



As an alternative to deep foundations, the client could consider ground improvement as a means of improving the existing very soft to medium stiff native soils encountered at the site. A ground improvement system (such as rammed aggregate piers or stone columns) could be utilized to increase the bearing capacity of the on-site soils and decrease the potential settlement. A ground improvement system generally consists of aggregate-filled piers, which results in partial replacement of on-site soils and improves the foundation support capability of the adjacent remaining soils.

#### ADDITIONAL EXPLORATION FOR FUTURE STRUCTURES

The preliminary subsurface exploration program conducted for the planned future structures consisted of seven auger probes (i.e., borings where no soil or rock samples were obtained for laboratory testing) spread across the future development areas. Specific information about the anticipated building configuration, foundation loads, planned finish floor elevation(s) and site grading for these future structures was not available at the time of our exploration. Terracon should be retained to perform additional field exploration and laboratory testing and to prepare a design-phase geotechnical engineering report for each future building when more detailed information becomes available.

#### **GENERAL COMMENTS**

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between boring locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, cost estimating, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

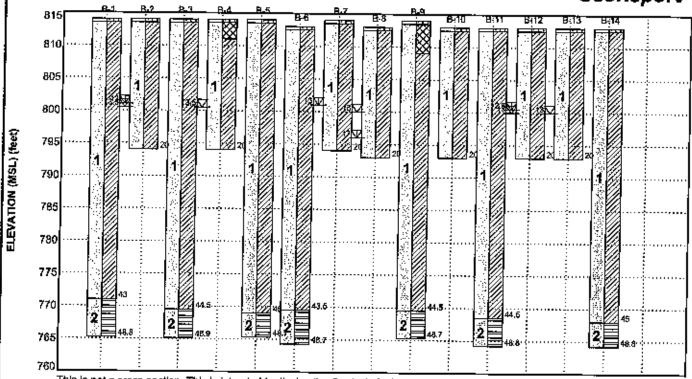
#### **FIGURES**

Contents:

GeoModel

## GEOMODEL. Paragon Star Village Lee's Summit, MO Terracon Project No. 02195181

### Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer Layer Name	General Description
1 Native Clay	Lean Clay (CL) - very soft to medium stiff
2 Shale	Shale - highly to moderately weathered

#### **LEGEND**

Topsoll

₩

Lean Clay

Shale

∇. First Water Observation

■ Second Water Observation

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

#### **ATTACHMENTS**

# Geotechnical Engineering Report Paragon Star Village Lee's Summit, Missouri August 2, 2019 Terracon Project No. 02195181



#### **EXPLORATION AND TESTING PROCEDURES**

#### Field Exploration

The borings were located in the field by Terracon personnel using a hand-held GPS unit with a horizontal accuracy of ±20 feet. Ground surface elevations indicated on the boring logs were estimated by interpolation from a site specific grading plan provided by GBA. Elevations are reported to the nearest 1 foot.

The borings were drilled with a track-mounted, rotary drill rig using solid-stem, continuous flight augers to advance the boreholes. Samples of the soil encountered in Borings B-1 through B-14 were obtained using thin-walled tube and split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outside diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value, The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. Borings B-15 through B-21 were drilled as auger probes, so no soil samples were obtained for laboratory testing.

The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. The drill crew backfilled the borings with auger cuttings after completion of drilling/sampling and prior to leaving the site.

The drill crew prepared a field log of each boring to record data including visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The final boring logs included with this report represent the engineer's interpretation of the subsurface conditions at the borings based on field and laboratory data and observation of the samples.

Paragon Star Village ■ Lee's Summit, Missouri August 2, 2019 ■ Terracon Project No. 02195181



#### Laboratory Testing

Representative soil samples were tested in the laboratory to measure their natural water content, dry unit weight, unconfined compressive strength, and Atterberg Ilmits. A pocket penetrometer was used to estimate the consistency of selected cohesive samples. The test results are provided on the boring logs included in Exploration Results.

The soil samples were classified in the laboratory based on visual observation, texture, plasticity, and the laboratory testing described above. The soil descriptions presented on the boring logs are in accordance with the enclosed General Notes and Unified Soil Classification System (USCS). The estimated USCS group symbols for native soils are shown on the boring logs, and a brief description of the USCS is included in this report.

The bedrock materials encountered in the borings were described in accordance with the appended Description of Rock Properties on the basis of drilling characteristics and visual classification of disturbed auger cuttings. Petrographic analysis and rock core may indicate other rock types.

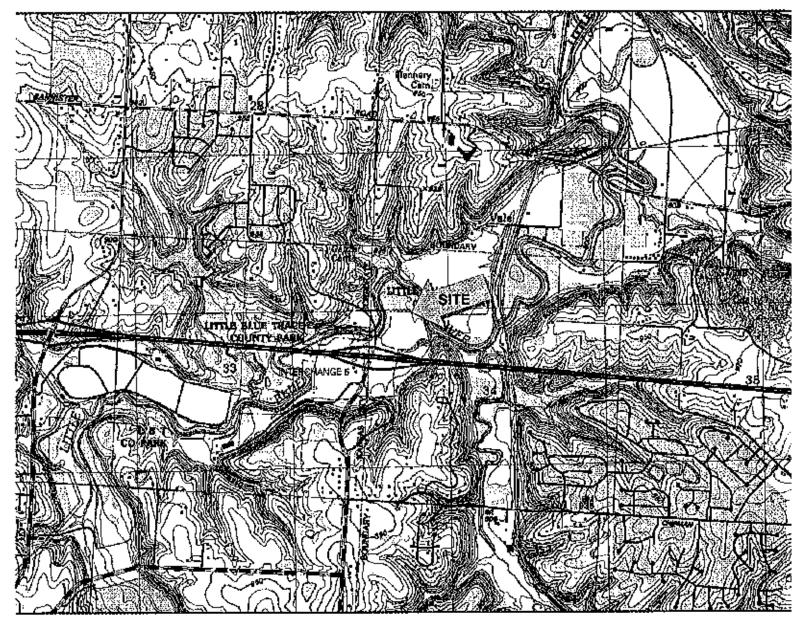
#### SITE LOCATION AND EXPLORATION PLANS

#### Contents:

Site Location Plan Exploration Plan

Note: All attachments are one page unless noted above.



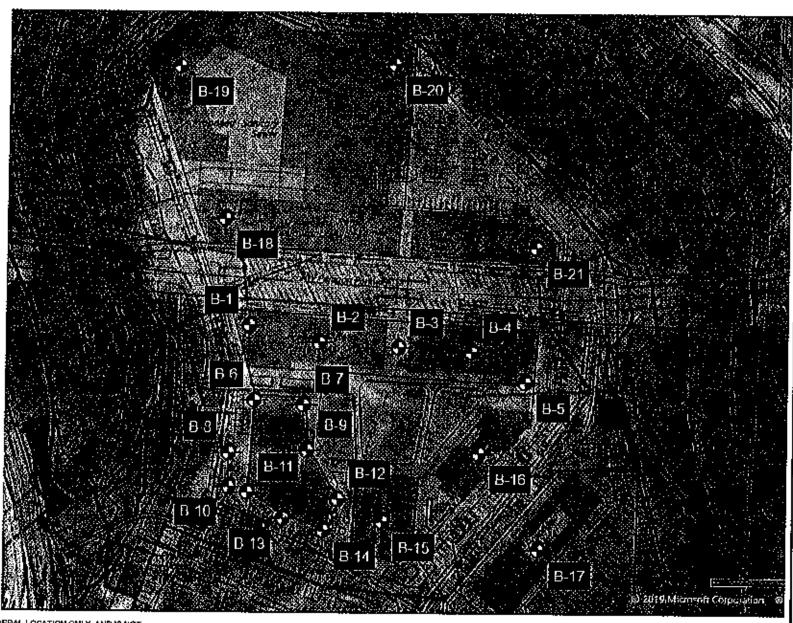


ENERAL LOCATION ONLY, AND IS NOT OR CONSTRUCTION PURPOSES TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEO QUADRANGLES INCLUDE: LEES SUMMIT, MO ( N PLAN

/illage a Lee's Summit, MO

I w Terracon Project No. 02195181





IERAL LOCATION ONLY, AND IS NOT CONSTRUCTION PURPOSES

AERIAL PHOTOGRAF MICROSOFT I

#### **EXPLORATION RESULTS**

#### Contents:

Boring Logs (B-1 through B-21)

Note: All attachments are one page unless noted above.

			BORING L	.00	<u>3 N</u>	10	. В	-1				Page	1 of 1
F	PRÓJ	ECT: Paragon Star Village		CI	ΙΕΝ	IT:	GB/ Len	4 exa, KS					
[5	SITE:	I-470 and View High Drive Lee's Summit, MO					Len	6AG, 110					
Æ	8	LOCATION See Exploration Plan		~	덕똜	Ä	(ji	F	HAND PENETROMETER (tsf)	a <b>z</b> §	3	ि	ATTERBER LIMITS
13	₫	Letitude: 38.9388° Longitude: -94.4484°		DEPTH (FL)	ATC.	ΕŢ	Š	ULTS	S S S S S S S S S S S S S S S S S S S	NESSE SESSE	Ě	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	
MODEL LAYER	GRAPHIC LOG	Approximate Surface	a Elev.: 814 (F1.) +/-	ОЕРІ	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	PIELD TEST RESULTS	를 보는 기계	UNCONFINED COMPRESSIVE STRENGTH (tsf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pdf)	LL-PL-PI
Ľ	13203	<b>ДЕРТИ</b>	ELEVATION (Ft.)		5₽	छ	<u> </u>		E	집당드	0		
.4 >4€		0.5 \(\Lambda_6"\) ROOT ZONE  LEAN CLAY (CL), brown to gray, mediun	813.5±0	_		$\vdash$	40	5-3-4	.			ļ	10.47.0
		and the state of t		_			18 8	N=7	4 1	1.09	20 31	95	43-17-26
			1	5 🕇		-	-			1.09	31	95	}
		- becoming very soft below 6.5 feet	1	$\exists$		X	18	0-0-0	1		27	i	
				$\lceil \cdot \rceil$		abla	12	N=0 0-0-0	í l		27	ı	
				10-				N=0	1 1			ľ	
			1	╡					]				
(4)			] .	15		$\bowtie$	9	0-0-0 N≃0	i '		31		
M				╡					]		i		
				亅		$\forall$	10	0-0-0		-	29		
				20-		$\cap$	'''	N=0		Ì	29		
10				Ь									
				<u>,</u> ]		X	18	0-0-0		ľ	35		
<b>%</b> :				25		Ī		N=0		Ī			
43.				7									
144. 432			1 3	30		$\times$	18	0-0-0 N=0			35		
							ĺ						
			ŀ			$\forall$	40	0-1-1			20		
			3	35	ł	4	16	N=2		-	35	ŀ	
7				$\exists$		Į	-				ŀ		
		- becoming sliff below 39.5 feet	i.	F.	į	X	18	3-5-9		ŀ	28		
			4	떡			$\Box$	N=14 ,		- [	$\neg$		
		SHALE, gray, moderately weathered	771+ <i>}</i> -	7						L			
		<u>эпиче.</u> gray, moderatery weathered	4	15	ſ	XĮ.	10	35-50/4"			18		
Á				$\exists$								ĺ	
<b>100</b>	=	8.8 Refusal et 48.8 Feet	785+/-	1	[-	-	2 4	50/2"		_	29	$\longrightarrow$	
		Refusal & 40.0 Feet				ſ			i	ĺ	<u></u>		
- 1	ļ		ľ	ſ		- 1	- 1			- 1		- 1	
							- [		- 1				
	Stra	lification lines are approximate. In-situ, the transition may	r be gradual.					Hammer Type: 7	- Sutometic			[	
_													
	ncemen eah Bor	Method:	See Exploration and Tas	ting Pr	acedi	urea (	or e.	Notes:					
			description of field and la used and edditional data	(If any	().			W.O.H.: WeigM o	f harnmer				
		1 Method:	See Supporting Informati symbols and abbreviation	ion for Ma.	ахріа	netici	n of						
Во	rin <b>g b</b> ed	kfilled with suger cuttings upon completion.	Elevations were Interpola					ļ					
		ATER LEVEL OBSERVATIONS	site olan					Boring Started: 07-	22-2019	Borton	Compl	leted: IV	7-22-2019
	Gno	undwater not encountered	llerra	36		)	ח	Drill Rig: 754		Driller:			
		ļ	15820 W	113th			•			LAMINET.	UIT	<del></del>	
			Lenexa	, KS				Project No.: 021851	81	1			

				BORING L	00	i N	O.	B-2	2			Р	age 1	lofi
Γ	PR	OJEC	T: Paragon Star Village		CI	JEN	T:	GBA	ka, KS					
$\mid$	S)T	E:	I-470 and View High Drive Lee's Summit, MO	<del></del> -				Lene	ka, K.a					
1000	MODEL DATER	GRAPHICLO	• • • • • • • • • • • • • • • • • • • •	, ,	DEPTH (PL)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (EX)	ONCONFINED COMPRESSIVE STRENGTH (Sf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pct)	ATTERBERG LIMITS LL-PL-PI
F			PTH √ <u>8" ROOT ZONE</u>	ELEVATION (FL)	_		<u> </u>				$\dashv$			
			LEAN CLAY (CL), brown to gray, medic stiff	ım sliff to	_ =		X	18 11	1-3-4 N=7	1.0		25 24	100	34-18-16
َ زام					5-		$\times$	18	1-4-5			25		
GDT 81/18			- becoming very soft below 8.5 feet		10_		Ø	18	N=9, D-0-1 N=1 _,			27		
TATEMPLATE					15	要	X	18	0-0-0 N=0			32		
NOON THE		20,	9	794+/-	20-		$\times$	18	0-0-0			33		
ER.			Boring Terminated at 20 Feet		20-				N=0					
SEPARATED FROM ORIGINAL REPORT, GEO SMART LOG-NO WELL IZCISSTBI PARAGON STAR VILLIGRUTERRACON, DATATEMPLATE GDT 		Stratifi Smootl f	cation lines are approximate. In-situ, the transition (			Broom		· ·	Hammer Type:	Automatic				
YALID IF	Cont	Sinvous (	illght Augera	See Exploration and fadescription of field and used and additional da  See Supporting Informs symbols and abbreviat	labora la (If a ation (i lions.	atory p irty). or expl	irocek Iánati	on of	W.O.H.: Weight o	of hammer				
<u> </u>			TER LEVEL OBSERVATIONS	Sievations were interpo	cialed	íram e	(opo	graphic	<del></del>	22 2040	lp	* C+	د مداهاد	17_22 2010
<u> </u>	Z	13.51	. while drilling	∣ 1[err	7	<b>C</b>	O	n	Boring Started: 07- Drill Rig: 754	23-2019	+	g Comp	neted: (	77-23-2019
	$\overline{\mathbf{V}}$	13 R.	upon completion	15620 V		th St	_		Project No.: 02195	161				

			BORING	LO	G I	10	. B	-3			Pag	e 1 of 1
PRO	OJE	CT: Paragon Star Village		C	LIE	VT:	GB/ Len	\ exa, KS				
SITI	E:	i-470 and View High Drive Lee's Summit, MO										
MODEL LAYER	2015	LOCATION   See Exploration Plan Latitude: 38.9367* Longitude: -94.4455*		(3)	WATER LEVEL	TYPE.	t' (ln.)	TS	HAND PENETROMETER (tsf)	CENT TOST TOST TOST TOST TOST TOST TOST TO	(%) LE	ATTERBA LIMITA
MODEL LAYER	ונים ליים ליים ליים ליים ליים ליים ליים ל	Approximate Surface	Elev.: 814 (FL) +/-	DEPTH (Ft.)	WIERL	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HANI NETRON	UNCONFINED COMPRESSIVE STRENGTH (%f) WATER	CONTENT (%)	
	ַ	DEPTH	ELEVATION (FL) 813.5±6		58	ß	æ		<u> </u>	2020		
		LEAN CLAY (CL), brown to gray, stiff		] :	1	Z	18	5-3-4		2	1	
				5-	1		15	N=7	2.0	2	_	4
		b		9-				0-0-0				7
		<ul> <li>becoming very soft below 6.5 feet</li> </ul>		-	}		18	N=0 0-0-0		2	=	
				10	}	×	18	0-0-0 N=0		3:	4	
				_	1							
				1 <del>5</del>	1	$\boxtimes$	18	0-0-0 N=0		3	1	
				'-	1			IV-U		Į		
				_	ļ	~	18	0-0-0		29	_	
				20_		$\cap$		N=0		2	+	
				_								
				25-		$\boxtimes$	18	0-0-0 N=0 J		32	2	
					1		ľ	11-0				
		- medium stiff from 28.5 to 20 feet		_	ļ	$\triangle$	18	1-4-5		3	$\dashv$	
				30_		Ĥ	<u> </u>	N=9		ا ا	`\	
				_								
				35		X	18	0-0-0 N=0	i	34		
				_			ľ					
				=		$\nabla$	18	0-0-0		38		
				40	ĺ	<u> </u>		N=0				
				∃		Ц						
	Z 44	SHALE, with limestone seams, gray, mode	769.5+/- rately	45		X	18	0-1-7 N=8	ı	33	4	
		weathered		7								
	48	.9 Refusal at 48.9 Feet	765+/-	7		<b>#</b>	3	50/3"			<u>-</u>	+-
		The form at 10,07 but			ĺ							1
							-					
\$	Stratif	ication lines are approximate. In-situ, the transition may t	be gradual.				<u>'</u>	Hammer Typa: A	utomatic	•		
		Melhod: 8	ee Exploration and	Testing F	Proced	lures I	for a	Notes:				
Wesh E	Вогв	dr.	escription of field en sed and additional d	d lebova	tary pr			W.O.H.: Weight o	hammer			
andonn	nent		ee Supporling Information		r expla	anatip	n <b>ợi</b>					
		filled with auger cultings upon completion.	evations were interp		rom e	topóg	raphic	]				
		ATER LEVEL OBSERVATIONS	le plan			_		Boring Started: 07-2	3-2019	Boring Cor	mpteled	: 07-23-2019
G	Prou	ndwater not encountered	llen	<b>'</b> 0			n	Drill Rig: 754		Driller: JW		
		į	15620	W 113th	ı\$t		_	Project No.: 021961	D1	1		

ſ			BORING	3 L	00	3 N	Ю	B-	4			F	egs <sup>°</sup>	1 of 1	
Γ	PI	ROJI	ECT: Paragon Star Village		CI	JEN		GBA	xa, KS						
	S	ITE:	I-470 and View High Drive Lee's Summit, MO					LOILO	ixa, NG						
	MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 38,9387* Longiludo: -94,4451*		DEPTH (R.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	REŞULTS	HAND PENETROMETER (Ef)	UNCONFINED COMPRESSIVE STRENGTH (84)	WATER CONTENT (%)	DRY UNIT WEIGHT (pct)	ATTERBERG LIMITS	
	ş	_	Approximate Surface Elev.: 814 (Ft.)	²t.)	ä	WAT	SAM	RECC	문장	PENE	COMI	CON	ž Ž	LEFEVI	
ľ	٠.		0.5. \( \lambda \) FILL - LEAN CLAY, trace roots 813		_		$\sim$	18	10-13-11					42-18-24	
ŀ			LEAN CLAY (CL), brown, stiff to medium stiff	1+/-	5 -			13	N=24		3.02	24	103	42 10 24	
,   ,	 				_		$\geq$	18	3-4-5			22	103		
					- 10-		$\overline{\mathbb{Z}}$	18	N=9 0-1-4			26			
	•				' <b>-</b>	_			N=5,	i					
			- becoming very soft below 13.5 feet		_ 15—	Y	X	18	0-0-0 N=0			27			
					-	 			11-0						
	ं			4+1-		L	$\boxtimes$	18	0-0-0 N=0			24			
	-		Boring Terminated at 20 Feet					<u>ן</u>							
	١														
AGON STAR VILLION															
DI 66170															
3															
							li								
		Shra	atification lines are approximate. In-situ, the bansition may be gradual.				J		Hammer Type:	Automatic		L <u> </u>	L	!	
<b>;</b> },			nt Method: See Exploration	and Te	esling:	Proce	dures	for a	Notes:						
	Co	ากแกนอเ	s Fight Augers description of fis used and addition	id and nei dai	labore ba (If e	ny).	VOCAD	lurea	W.O.H.: Weight o	of hanvmer					
ŀ			nt Melhod: See Supporting aymbols and abb ckflilled with auger cuttings upon completion.	xevieli	ons.										
1			WATER LEVEL OBSERVATIONS							00 0045	B1		nlag - d. d	77 00 0040	
	V		5 tt. white drilling	rr	3	C		П	Boring Started: 07- Drill Rig: 754	23-2019	+		ieted: l	07-23-2019	
				5620 V	_	h St			Project No.: 02185181			Driller: JW			

	<u>,</u>	BORING L	OG	N	O. E	3-5			F	⊃age	1 of 1
	ECT: Paragon Star Village		CL	IENT	: GB Ler	A ıexa, KS					
S)TE:	I-470 and View High Drive Lee's Summit, MO										
MODEL LAYER GRAPHIC LOG	LOCATION See Exploration Plan		÷	WATER LEVEL OBSERVATIONS	<u>ਤ</u> ੋਂ ਤੌ	200	HAND PENETROMETER (ket)	SWE (SS)	(%)	<u>- 8</u>	ATTERB LIMIT
GRAPHIC LOG	Latitude: 36.9385° Longitude: -94.4448°		DEPTH (Ft.)	19.00 10 10 10 10 10 10 10 10 10 10 10 10 1	SAMPLE IYPE RECOVERY (In.)	RESULTS	HAND (ad)	UNCONFINED COMPRESSIVE STRENGTH (IS)	WATER CONTENT (%)	DRY UNIT WEIGHT (pct)	LL-PL
<b>_</b>	DEPTH	ce Elev.: 814 (Fl.) +/- ELEVATION (Fl.)	<u> </u>	Besi		₩	PEN	28.8 28.8	ិទ្ធ		
	0.5 ∧6" ROOT ZONE LEAN CLAY (CL), brown to gray, mediu	/813.5±L			18	2-2-4		-	- 20		46.46
			_ 🚽		20	N=6	1.0		28 27	96	46-19
			5 🖠			1-3-5		<u> </u>			
	- becoming very soft below 8.5 feet		=	Ŕ	12	N=8 0-1-1			30 29		
		'	10-	ľ	1"	N=2			28		
			=		<u> </u>	0-0-0					! I
		1	15_	1	18	N=0		.	29		
			4							ı	
		2	20-	2	18	0-0-2 N=2		-	30		
			=				! [				
		2	25_	⊳	18	0-0-0 N≂0			33		
			7				ı	ĺ		- 1	
		1		$\geq$	18	0-0-0 N=0			32	!	
		"	~=			14-0			1		
			_=	$\triangleright$	18	0-0-0		-	36		
		3	15			. N=0 .i	1				
			$\exists$	<u> </u>	18	0-0-0		-	38	ľ	
		4	억	K		N=0			<u> </u>		
			=		4.0	0-0-0		L			
4////	SHALE, gray, moderately weathered	<del></del>	5		18	N=0			35		
	6.7	765.5+/-	1								
	Refusal at 48.7 Feet	ĺ			۲	50/1"			16		
						i			!		
i I					1 1			-			
Strai	ification lines are approximate. In-stru, the transition ma	y be gradual.				Hammer Type: A	lutomatic				
rancement Vash Sore		See Exploration and Test	ing Pro	cedure	s for a	Notes:					
		description of field and lai used and additional data See Suppodice Informati	(If any).	-		W.O.H.: Weight of	( hemmer				
indonmeni Soring back	Method: filled with augar cultings upon completion.	See Supporting Information symbols and abbreviation	i9.								
		Elevations were interpolal site plan	led fron	n er tope	zgraphic	<del>                                     </del>		1			
	indwater not encountered	Jierra	<b>)</b> (		ח	Boring Started: 07-2	3-2019	Boring (		ated: 07	-23-20
		15620 W 1 Lanexa	13th Si		- 4	Orlil Rig: 754 Project No.: 021951	Q4	Driller: .	744		
		Lenexe,	. 14.39			project No., 021951	u I	1			

	ECT: Paragon Star Village		C1	.iEN	IT:	GBA Lene	xa, KS					
SITE:	I-470 and View High Drive Lee's Summit, MO											
5010	LOCATION See Exploration Plan Letitude: 98,9385° Longitude: -94,4463°		1 (Ft.)	LEVEL ATTONS	TYPE	RY (In.)	TEST	ND SMETER F)	IFINED ESSIVÉ (TH (ss)	TER NT (%)	EST Tegg	ATTERBI LIMITS
GRAPHIC LOG	Approximate Surfa	ice Elev.: 813 (Ft.) +/- ELEVATION (Ft.)	ОӨРТН (Ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	UNCONFINED COMPRESSIVE STRENGTH (ss)	WATER CONTENT (%)	DRY UNIT WEIGHT (pd)	LL-PL-
· 11/1	0.5.∧6" ROOT ZONE	/812.6±6										
	LEAN CLAY (CL), brown to gray, soft to	very soft	=		$\times$	18	2-3-1 N≃4			22		35-19
			5			24			1.03	27	98	
			=		$^{\times}$	18	1-3-5			27		
			,,=		$\overline{\nabla}$	18	N=8 0-1-1			28		
			10_			$\Box$	N=2				}	
							0-0-0					
			15		X	18	N=0			31	$\left\{ \right.$	
			=									
	- medium stiff from 18.5 to 20 feet		20-		$\boxtimes$	18	1-3-4 N=7			30	1	
			<b>2</b> 0_			1	N-t					
			_			40	0-0-0			24		
		ļ	25_		×	18	N=0			34	ł	
			_									
			30		$\boxtimes$	18	0-0-0 N=0	ĺ		33		
							11-0		İ			
			_		$\sim$	18	0-0-0			35	1	
			35_			╫	N=0				1	
			_									
			40-		$\boxtimes$	18	1-1-2 N=3			27		
			-									
	43.5 SHALE, gray, moderately weathered	769.5+/-	_		$\nabla$	8	40-50/2"			17	1	
	313.32 g/		45 <del>-</del>							<u> </u>	1	
	48.7	784.5+/-	=									
	Refusal at 48.7 Feet					╨	50/1"			20		
1		1										
	ratification lines are approximate. In-situ, the transition of	nau he oradijal			L		Hammer Type:	Automatic				
<b>5</b> 11	outposition in each approximate, in allow, the baseliness in	ia) no diagoni.					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	7 1214111-14				
ivanceme Wash Be	ant Method: pre	See Exploration and T description of field ex- used and additional de-	esting : I lebore ila (If a	Praco It <b>ory</b> p	dares	for a lunas	Notes: W.O.H.: Weight	of hammer				
		See Supporting Inform	nation fo		lanali	on of						
andonm Boring b	ant Malhod: ackfilled with auger cultings upon completion.	aymbols and abbrevia Elevations were interp		from e	1000	graphic	,					
	WATER LEVEL OBSERVATIONS	site plan					Boring Started: 07	-19-2019	Borle	ia Cami	o <b>le</b> teri-	07-19-2
	roundweter not encountered	7lerr	7	C	0	n	Orlii Rig: 754	10-2010	+	er: JYY	r	13-21
			W 113L		_							

•		BORING L	OG I	NO	. В	-7				Page	1 of 1
PRO.	JECT: Paragon Star VIIIage		CLIE	NT;	GB/ Len	A exa, KS					
SITE:	I-470 and View High Drive Lee's Summit, MO				- <u> </u>						
ž 8	LOCATION See Exploration Plan		다 <mark>현</mark> 중	Į Į	(llu.)	P 20	HAND PENETROMETER (tsf)		<u>8</u>	मू चू	ATTER
MODEL LAYER GRAPHIC LOG	Latitude: 38,9384* Longitude: -94,4461*		DEPTH (Ft.) WATER LEVEL	SAMPLE TYPE	RECOVERY (In.)	PIELD TEST	HAND ROME (ss)	NGTH NGTH	WATER CONTENT (%)	DRY UNIT WEIGHT (pct)	
\$ 8	1 ''			SAM	S S S	逆光	_ <u>~</u>	UNCONFINED COMPRESSIVE STRENGTH (IST)	Şŏ	E Š	LL-F
11//	05 6" ROOT ZONE	ELEVATION (Ft.)	+				<del>                                     </del>	+-			├
	LEAN CLAY (CL), brown, stiff		-	X	18 24	4-7-8 N=13		-	20		-
			5-		24		1.5	-	25	100	$\cdot$
	- becoming very soft below 6.5 feet	1		$\boxtimes$	18	0-0-1 <u>N</u> =1	1		26		
		-	10⊣	X	7	0-0-D N=0	1		27		
			$\exists^{\Psi}$				1			ĺ	i
		1.			18	0-0-1	·				
			15			N=1	1				
	20.0	704.1		W	1B	0-0-0	-		30		
1	Boring Terminated at 20 Feet		20	М		N=0	<del>  </del>		30		
			-								
					1						
									.		
										ı	
					ı						
				Ш					İ		
			1								
										ı	
1					- 1		J	·			
		i			-						
								ı			
1 1											
				- 1	- 1		 				
		1			1						
		!						Ì			
Strø	itification lines are approximate. In-situ, the transition	i may be gradual.				Hammer Type: /	Automatic				
vancemen Continuou	nt Melhod: s Flight Augere	See Exploration and Testi description of field and lat used and additional data (	coratory pr	wes fo	or a res	Notes: W.O.H.: Weight o	of harmmar	<u></u>			
andonnaer	it Method:	See Supporting Information symbols and abbreviation:	on for expla	ination	ı of						
	kfilled with auger cuttings upon completion.	I '				ļ					
		Efevations were interpolat	e mom pa	ropogi	abuse	I					
_	VATER LEVEL OBSERVATIONS	aite plan				Boring Started: 07-3	23-2019	Borina	Cample	eted: 07	7-23-20
Z 13 f		aibe plan				<b>-</b>	23-2019	Boring Driller:		ated: 07	7-23-20

			BOR	ING L	00	N	0	B-1	3			P	age 1	af 1
Γ	PR	OJE	ECT: Paragon Star Village		CL	IEN	T:	GBA	(a, K\$					
-	SIT	Œ:	I-470 and View High Drive Lee's Summit, MO					Lency	a, riu					
1	ž T	8	LOCATION See Exploretion Plan		<u>.</u>	EL NAS	문	[ln.}	<b>+</b>	F 4	25 25 25 25 26 26 26 26 26 26 26 26 26 26 26 26 26	38	_ 🕏	ATTERBĒRO LIMITS
	MODEL LAYER	GRAPHIC LOG	Letitude: 38.9382" Longitude: -94.4465"		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	COMPRESSIVE STRENGTH (SD)	WATER CONTENT (%)	DRY UNIT WEIGHT (pd)	
į		P. P. P. P. P. P. P. P. P. P. P. P. P. P	Approximate Surface Elev.: 81	3 (FL) •/-	DEPT	A HE	절	8	35. SES	F. F. C.	NA SE	<b>₹</b>	MEIG.	LL-PL-PI
ľ	<u> </u>		DEPTH ELEVAT	ION (Ft.)		×δ	o,	ř		뷥.	-ON		_	
F			4.5. A 6" ROOT ZONE	_B12.5±6	-			$\Box \bot$						
ı			LEAN CLAY (CL), brown to gray, medium stiff		_		$\times$	18	3-3-5 N=8	-		24		
1					5 -			22		-	1.20	24	100	
1	V				~ _		L	42	2-3-4			24		
	- Ø				-	l		18	N=7			24		
_ 10	. 1		- becoming soft to very soft below 8.5 feet		10-	ĺ	$\succeq$	18	0-1-3 N=4		- }	26		
DATATEMPLATEGO					_					ļ	1			
<u>.</u>					_	~	k->	<del>  </del>	0-0-0			28		
					15-	l		18	N=0					
<u>[</u> ]				1	_	$\nabla$	·							
<u>8</u>	୍ବାଞ୍ଚ		20.0	793+/-	=		∀	18	0-1-3			30		
FREACOIN	۳	-	Boring Terminated at 20 Feet	F80 11-	20-		r	┯-	N=4					
AR VILLGR														
PARAGOUN SI														
EPARATED FROM ORIGINAL REPORT, GEO SMART LOG-NO MELL. IZTESTBI PARAGUN STAR VILLGPJ.														
LKS-NAC WIEL														
EU SMART														
REPORT. 6										<b> </b> 				
N OFWEINAL														
3				,										
			eblication lines are approximate. In site, the transition may be grade	jel.					Hammer Type: .	Automatic				<u> </u>
	Çor	iceme itinuo	nt Method:  se Flight Augers  descriptic used and	oration and To on of field and additional da codina luloro	i labora da (If a	etory p iny).	жесв	dures	Notes: W.O.H.: Weight o	of hammer				
I SNSI SI	Aband Bori	ionme ing be	int Method: symbols included with augier symbols upon completion.	porting inform and abbreviat is were interp	tians.									
ğĘ.	_		WATER LEVEL OBSERVATIONS			_			Boring Started: 07	-20-2019	Borin	g Com	pleted:	07-20-2019
	<u>₩</u>	13	ft. upon completion		8			Π	Orill Rig: 754		Orille	nt JW		
計	_		и принтопирован	15820 V Lene	W 113 exa, K	th SI S			Project No.: 92195	181				

		ORING	LO	G N	10	. В	-9				Page	1 of 1
PROJ	ECT: Paragon Star VIIIage		C	LIEN			4 exa, KS		•			
SITE:	I-470 and View High Drive Lee's Summit, MO		7									
£ 8	LOCATION See Exploration Flan		÷	펵쭚	븶	(ji.)	F .	E E	記り返	<b>₩</b>	. <del>f</del> r	ATTERBER LIMITS
MODEL LAYER GRAPHIC LOG	Latifude: 38.9382° Longitude: -94.446°		ОЕРТН (#€∟)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (lst)	UNCONFINED COMPRESSIVE STRENGTH (IS)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	
98 S	Approximate Steface I	Elev.: 814 (Ft.) +/-	L H	SEE	AMP	Š	) 253 253	3 T T T	SET	₹.X	A PER COL	LL-PL-PI
ſ	DEPTH D5.46" ROOT ZÖNE	ELEVATION (Ft.)	ļ	>3	S	~		<u> </u>	700	٦	_	
▧	FILL - LEAN CLAY, frace roots		- 	1	X	18	17-22-15			20	}	46-18-26
ଃ	5.0	809+/-		1		13	. N=37	3.5	l i	23	101	10 10 2
	LEAN CLAY (CL), brown to gray, stiff to me stiff	edium	5-	ì					1			
			' -	1	X	18	3-5-9 N≃14			24		
			10-		M	18	1-2-4 N=6			24		
			_		!							
	- becoming very soft to soft below 13.5 feet		=		X	18	0-0-0			29		
			15 <u>-</u>				N=0 ,					
			_						i			
			20		$\bowtie$	18	0-0-0 N=0	- 1	[	29		
		Ī				ı		!		ı		
	- medium stiff from 23.5 to 25 feet		-		$\dashv$	18	0-0-5		}	-		
	The state of the s	i	25_	ŀ	$\curvearrowright$	<del>'</del>	N=5		ŀ	33	j	
			=						1		ļ	
			30	' į	X	18	0-0-0 N=0	ŀ		33		
			~~ <u>_</u>			ľ	IN-U					
			$\exists$	[	$\downarrow$		0.0.0		-		İ	
		ľ	35-	ŀ	4	18	0-0-u N=0	- 1		33		
			3	- 1	ı	- 1		ſ				
			,,]		a	18	0-0-1		ŀ	35		
			40	ĺ	Ť	┺	N=1 ,		Ī		i	
			7									
	SHALE, gray, moderately weathered	789.5+/-	45	Į.	×Ļ	<u>1B</u>	1-1-3 N=4			29	ĺ	
		i	目	1	ŀ					- 1		
+	8.7 Refusal at 48.8 Feet	765.5+/-		-	-	2 4	50/2"		<del></del>	23	$\rightarrow$	
	10.000.000		ľ					J				
] ]											1	
		1	ł	ſ	ľ	ſ			i			
Sirat	ification lines are approximate. In-situ, the transition may be	gradual.					Hammar Type: A	utomatic				
							<del></del>					_
lvancement Wash Bore	dea	Exploration and Tr cription of field end	Haborah	DIY DIG	res fo <b>ce</b> dur	F 8	Notes: W.O.H.: Weight of	hammer				
		d and additional da Supporting inform	-	-	nglive.	of	, Tradition	radion ( Hall				
andonment Boring back	Method: Asym Milled with sugar cultings upon completion.	ibola and abbreviat	lons.									
	Elen site	valions were interpo plan.	olated in	om e to	pogr	aphic						
	ATER LEVEL OBSERVATIONS  undwater not encountered	15	_				Boring Started: 07-1	9-2019	Boring	Comple	ate <b>3: 07</b>	-19-2019
J. 44		llerr			Jľ		Drift Rig: 754		Odller:	JW		
			V 113th xa, KS	81 			Project No.: 0219518	<u></u>				

			BORIN	NG LO	OG	N	Q.	B-1	0			F	age '	1 of <u>1</u>
ſ	PF	€O7I	ECT: Paragon Star Village		Ci	IEN	T:	GBA Lene:	xa, KS					
ľ	Sľ	TE:	1-476 and View High Drive Lee's Summit, MO				'							
Ī	5	90	LOCATION See Styloration Plan		<b>1</b>		먠	(ln.)	,	TER	明点を	(%)	_ ਨੂੰ	ATTERBERG LIMITS
	MODEL LAYER	GRAPHIC LOG	Latitude; 38.0381° Longitude: -94.4465°		оветн (Ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tsf)	UNCONFINED COMPRESSIVE STRENGTH (1st)	WATER CONTENT (%)	DRY UNIT WEIGHT (pd)	
		GRAP	Approximate Surface Elev.: 813	(Ft.) + <i>f</i> -	à	NATE OF THE PERSON NAMED IN COLUMN 1	AMP	ED O	<b>특</b> 뛌	ENET	STREETS TREETS	CON	WES	UL-PL-PI
Ė		<u>در زیل</u> ا	DEPTH ELEVATIONS SEEVATIONS OF A 6" ROOT ZONE	ON (FL) /812.5±6	<del></del>	-0	07	<u> </u>		<u> </u>				
- [ ;			LEAN CLAY (CL), brown to gray, stiff	/	Ξ		X	9	4-5-5			21		40-18-22
					5-	]		17	N=10 ,	2.0	'	23	101	
					Ŭ <u>-</u>		$\vdash$	18	2-5-6			26		
8			- becoming soft to very soft below 8.5 feet		_			18	N=11 0-1-2			27		
5	1				10		۷	<u> </u>	N=3					
DATATEMPLATE.GDT 81/19				-	_	1								
					15 <del>-</del>	}	×	18	0-0-0 N=0			27		
					_	}								
Ś			<sub>20.0</sub> - becaming medium stiff below 19.5 feet	793+/-	20-	_	$\boxtimes$	18	0-2-4 N=6			31	<u> </u>	
			Boring Terminated at 20 Feet					[						
3														
¥														
200														
Se Se Se Se Se Se Se Se Se Se Se Se Se S							1							
5 P														
2 2 3														
ş														
3														
8														
<u> </u>								1						
8														
3														
														]
<u>₹</u>														
		Sir	atification lines are approximate. In-situ, the transition may be gradua	<u> </u> 1.		<u> </u>			Hammor Type:	Automatic				
EPARATED FROM ORIGINAL REPORT, GEO SAART LOG-NO WELL, Q2195181 PARAGON STAR VILLIGRU TERBACON. The state of the state of the saart state of the stat									Luar					
ଅ ′			us Flight Augers description	ation and Ta of field and dditional da	l labori	etory p	soruža etopri	ofora.	Notes: W.O.H.: Weight	of hammer				
1 VALID			See Stype	rting Inform	ation (		lanat	ion of						
8 /			sckfilled with auger cuttings upon comptellors.	v3 abbreviat were interp		from e	a <b>1</b> 0pc	graphic						
뫒			WATER LEVEL OBSERVATIONS	E					Soring Started: 97	-19-2019	Borle	ng Com	plated:	07-19-2019
THIS BORBING LOG IS NOT		Gr	oundwater not encountered	275	6	C	0	N	Drill Rig: 754		+	r: JW		
				15620 \		lh St		-	Project No.: 02195	518 <b>1</b>				

		<u>.                                    </u>	BORING LO	OG I	NO.	В.	-11			J	Page	1 of 1
-	PRC	JECT: Paragon Star Village		CLIE	NT:	GB.	A lexa, KS					
	SITE	I-470 and View High Drive Lee's Summit, MO				Ler	exa, No					
į	¥ 8	LOCATION See Exploration Plan		그 년 년		(J.)	E.n	- A	a <b>y</b> S	E	. 5	ATTERBER LIMITS
STORY BUILDING	GRAPHIC LOS	Latilude: 36.938" Longilude: -94,4464"		DEPTH (FL) WATER LEVEL	OBSERVATIONS SAMPLE TYPE	RECOVERY (In.)	PIELD TEST RESULTS	HAND PENETROMETER (tsf)	UNCONFINED COMPRESSIVE STRENGTH (M)	WATER CONTENT (%)	DRY UNIT WEIGHT (pct)	
Ş	\$   §	I	' '	WATE	SAMP SAMP	ÉCO	퍨뾦	36.7	SEE	W CO	YES.	LL-PL-PI
H	177	DEPTH 0.5. \6" ROOT ZONE	ELEVATION (FL)	<del>-  </del> -	U 40	<del>  "-</del>	•	i ii	- 0%			
1		LEAN CLAY (CL), brown to gray, med	llum stiff	-	$\boxtimes$	18	2-2-3 N=5	<u> </u>	]	22		!
			] ;	5 🗍		15	<u> </u>	0.5		25	102	
<u>.</u>		- becoming very soft to soft below 6.5	feet	7	X	18	0-0-0		<b> </b>	28		
THE REPORT OF THE PROPERTY LEGISLE BANKS				0	$\overline{\mathbb{R}}$	18	N=0 0-0-1	1	İ	29		
			1 '	Ϋ]			N⊐1					
				=		18	0-0-0			-	ĺ	
			1	5닉		-	<u>N=0</u>		'	30		
				7					Ĺ		l	
			2	0-	X	14	0-0-1 N=1		-	31		
្ទ				]	11							
			2:	5	$\boxtimes$	14	0-D-1 N=1			30	ĺ	
16 1.5			-	<u>"</u>		1			- 1	ĺ		
					$\forall$	9	1-1-1		-	35		
災			30	թ⊒		┪	N=2	i	-	<u> </u>		
				=								
Ş			35	5_	M	18	0-1-1 N=2		 	29		
Ý			1	_	H	-				ļ		
		<ul> <li>becoming stiff to hard below 38.5 feet</li> </ul>	40	<u>,</u>	X	18	1-3-8 N=11			28	1	
Ž				╡		ſ						
() 33		64.5	768.5+/-	<u>,</u>	X	11	11-18-19	- 1	-	-		
2		SHALE, gray, moderately weathered	45	$\Xi$		┺	N=35				İ	
ð.		46.8 Refusal at 48.8 Feet	764+ <u>/-</u>	1_	╼┩	2 4	50/2"			-		
		Merusa) at 40.8 Pael			▎▝		50/2		<u> </u>	21		
1				1								
Ī												
•	Sin	adfication lines are approximate, in-situ, the transition of	nay be gyadual.				Hammer Type: Ar	utomatic		Щ.		
		nt Method:	See Exploration and Testin	in Proces	lures fo	v P	Notes:					
W.	ssh Bor	7	description of field and late used and edditional data (II	oratory o	rocedur	9B	W.O.H.: Weight of	hammer				
ban	donne	ni Method:	See Supporting Information symbols and abbreviations	ı far expl	enetion	of						1
Во		ckfilled with auger cutlings upon completion.	Elevations were interpolate		topogra	phic						
		VATER LEVEL OBSERVATIONS undwater not encountered				╗	Boring Started: 07-20	D-2019	Boring C	comple)	ed: 07-	20-2019
	GIL	erreneda lini alionnikalan	llerra			1	Orill R/g; 754		Driller: J			
			15620 W 11 Lenexa, i			- 1	Project No.: 0219518	91	ľ			

Γ		BOR	ING L	og	N	ე.	<b>B-1</b>	2			P	age 1	of 1
L	PRO.	ECT: Paragon Star Village		CL	IEN	T: (	GBA Lenex	ca, KS					
[	SITE:	I-470 and View High Drive Lee's Summit, MO											/Tree-
AVER	9010	LOCATION See Exploration Plans Letitude: 38,938" Longfuide: -94,4459"		1(Ft.)	1EVEL ATIONS	= TYPE	RY (In.)	TEST	HAND PENETROMETER (tsf)	UNCOMPINED COMPRESSIVE STRENGTH (151)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS
MODEL LAYER	GRAPHIC LOG	Approximate Surface Elev.: 6	· · · I	рветн (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HA 함	COMPR	CONTE	WEIGH	LL-PL-PI
F		DEPTH ELEVA 0.5. 6" ROOT ZONE LEAN CLAY (CL), brown to gray, medium etilf	812.5±6			Ž	18	2-3-4 N=7			23		
				5	-		13	N=7	3.0	[	24	103	ı
				10	1	X	18 18	2-4-4 N=8 2-2-4		İ	24 25		
1				10-	蚕		-	N=6 ,					
		- becoming very soft below 13.5 feet		15	1	$\boxtimes$	18	0-0-0 N=0			30		
		20.0	793+/-	20-	_	$\times$	18	0-0-0 N=0			29		
		Boring Terminated at 20 Fast					[						
										i			
3													
200												!	<b> </b> 
												i	
3									]	!			
5													
200				l									
SEPARATED PROM ORIGINAL REPORT, 640 SMSS LOGGES													
		Stratification lines are approximate. In-situ, the transition may be gre	kávaľ.	_	<u>_</u>	Щ		Hemmer Type:	Automatic	<u></u> _		1	<u> </u>
		uous Filight Augers descrip	ploration and tion of field ar nd additional c	nd laiber	ratory	proce	s for a dures	Notes: W.O.H.: Weight	of hammer				
I A A A A A A A A A A A A A A A A A A A	bandon Borino	ment Method: symbol	pporting information and abbrevious were inter-	mations.	For exp								
š -		WATER LEVEL OBSERVATIONS						Boring Started: 07	7-22-2019	Rook	ъ Спе	pletod:	07-22-2019
		13 ft. while drilling	eri	7	1	O	П	Drill Rig: 754		<del>-1-</del>	er: JW	,	
ág	$\overline{V}$	12.5 ft. upon completion	15620	D W 113 enexa, K	3th SI	_		Project No.: 0218	5181				

		BORII	NG LO	OG	N	0.	B-1	4			P	age '	of 1
Γ	PROJ	ECT: Paragon Star Village		CI	IEN	T: ·	GBA	xa, KS					
r	SITE:	I-470 and View High Drive Lee's Summit, MO		1			LOI IG	xa, 130					
ŀ	T g	LOCATION See Exploration Plan		_	피Ŝ	핊	(F)	<b>-</b>	EH II	n y G	<u>%</u>	. 官	ATTERBERO LIMITS
MODEL LAYER	GRAPHIC LOG	Lebitude: 38.9379° Longitude: -94.4458°		DEPTH (R.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	RESULTS	HAND PENETROMETER (tsf)	UNCONFINED COMPRESSIVE STRENGTH (IST)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	
Į	1 \$	Approximate Surface Elév.: 813	1567 F/F	Ë	EEEE SEE	MPL	Š	0.15 1.65 1.65 1.65 1.65 1.65 1.65 1.65 1	로투 등		¥ĕ	滥	LL-PL-PI
1	<u>ق</u> ا	DEPTH ELEVATI	ON (FL)	_	şģ	δŖ	<u>#</u>		Ø	⊃ გ 2⁄2	Ö		
Г		0.5 A6" ROOT ZONE	812.5+/	-	$\top$			0.56"		ļ			<u></u>
ľ		LEAN CLAY (CL), brown to gray, stiff		=	-	X	18	3-5-8 N=13			23		47-19-28
				5-	1		В		1.5	-	31	88	
		- becoming soft to very soft below 6.5 feet		_	1	$\geq$	18	1-1-2			27		
				10-	1	$\stackrel{>}{ ightarrow}$	18	N=3 0-1-3		F	27		
				10-	1		H	N=4					
				=	1						凵		
				15 <u>-</u>	}	X	18	0-0-0 N=0 ,			28		
			-	_	1		<u> </u>						
1				_	1		18	0-0-0		ŀ	35		
3				20-	}		<u> </u>	<u>N=0</u>		ŀ	30		
!				-	1								
֓֞֜֞֜֜֓֓֓֓֓֓֜֜֜֜֓֓֓֓֜֜֜֜֡֓֓֓֓֓֡֜֜֜֡֡֓֜֜֜֡֡֓֡֓֜֜֡֡֡֡֓֜֡֓֡֓֡֡֡֡֡				25 <del>-</del>	-	$\mathbb{X}$	18	0-0-0	1	į	35		
[]				20-	}		│	N=0		1			İ
				Ξ	}	L.,		0.00		-			
\$  ·				30-	7	X	18	0-0-0 N=0 ,		}	35		
CK SOLEN PERCENTAL SOLEN VILLEGES DESKALLON DE L'ARTENITORI DE				=	7								
ة   <u>آ</u>				35	7	$\times$	18	0-0-0		ŀ	34		
				35	7	<u></u>		N=0 ,					
				=	7	L							1
<b>[</b> ]				40-	1	×	18	0-0-0 N=0		-	35		
[				-	1								
5  °			768+/-	=	1	岗	18	0-0-0		ŀ	32		
<u>"</u>		45.0 SHALE, gray, highly to moderately weathered	70077-	45	1	۳.		N=0,		Ī	_		
\$   1 5   1		48.B	7/84+/-	_	1	L							
3		Refusal at 48.8 Feet					-2-1	50/2"			16		
										ļ	ļ		
							Ш						
SEPARATED FROM ORIGINAL REPORT, SEO SMART LOGINO MELL	\$	tratification lines are approximate. In-situ, the transition may be gradui	BI.					Hemmer Type:	Automatic				
			ration and T					Notes:					<u> </u>
	Wash B		n of fiold and additional da			100:00	onut	W.O.H.: Weight	of herrymer				
┋┝	andona	ent Mathod: swnbols 8:	eršing Inform nd ebbreviai	rstlan I Vans.	for exp	lanat	ion of						
֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓	Boring I	eackfilled with suger cuttings upon completion. Elevations	were interp		from	a topo	graphic						
ŧ		WATER LEVEL OBSERVATIONS						Boring Started: 07	-22-2019	Boring	Comp	želed:	07-22-2019
	G	roundwaler not encountered	GLL	3		0	n	Orill Rig: 754		Driller	"		
INIS BURNANCELUGE IS NOT VALED IF			15620 (		Nh St		<b>-</b>	Project No.: 02195	i181				

Ĺ			BORING I	LOG	N	Q.	B	·15			ı	Page	1 of 1
P	ľRÓJ	IECT: Paragon Star Village		C	LIE	ŧΤ:	GB/	A exa, KS					
s	ITE:	I-470 and View High Lee's Summit, MO	Drive				LU.						
Ę,	8	LOCATION See Exploration Plan		-	¤SS SS	Æ	દુ	F-10	HAND PENETROMETER (tsf)	8 2	8	្ឌ	ATTERBE LIMITS
MODEL LAYER	GRAPHIC LOG	Latitude: 38.9379° Longhude; -84.4456°		OSPTH (FL)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (IA.)	PIELD TEST RESULTS	AND ROME (st.)	UNCONFINED COMPRESSIVE STRENGTH (M)	WATER CONTENT (%)	DRY UNIT WEIGHT (pct)	
MOD	38	App	oximate Surface Elev.: 814 (Ft.) +/-	þ	WATE	AMP	ECO	퍨ӝ		NO.	₹500   ₹500		I ԼԼ-₱Լ-Բ
$\vdash$	17777	OEPTH 05-√6" ROOT ZONE	ELEVATION (FL) ,813.5±/		-0	63	E .		*	-0%	Ť		
40		LEAN CLAY (CL), brown to g	ray					:					
				5-									
				_					ı				
				10_	ĺ				!	!			
				' <u>-</u>							i		
				1 <del>5</del>	١.		ĺ		١.				
									1				
				=		' '							
				20-									
7				Ⅎ			- 1		] ]				
				25			ļ						
ľ						' [				ļ			
				30			i						
				╛			ļ		İ 1	- 1	ļ		
				35					ļ ļ				
				╛									
				╡		ı	ı				i	ļ	
				40	Ì			j	i	i			
				ゴ	ľ						ľ		
		<b>46</b> .0	749.4	45								i	
% <b>E</b>		SHALE, gray	766+/-			- 1							
<b>₹</b>		50.0	. 784+/-	╡	- 1					- 1	- 1	ľ	
		Boring Terminated at 50 Fee		50	7		寸				$\dashv$		
			ĺ	- 1						ſ			
						1							
	Stra	ibilication lines are approximate. In-situ, the	transition may be greduel.		L			Hammor Type:	Aulomatic				
\dven	cemer	n Method:	Con Evelonica and T	untine C	en card	11. m s s		Notes:					
	sh Bon		See Exploration and T description of field and used and additional de	laborati	жу рес	cedu res (0	res	W.O.H.: Weight of	ıf hammer				
h		ak bilantha di	See Supporting Inform	iation for		ration	rof						
		nt Method: skilled with euger cuttings upon completion	symbols and abbrevial Elevations were interp		gym er k	onoa:	anhin.						
	٧	VATER LEVEL OBSERVATIONS	alte plan				_	<del></del>	D.4 B.C.1.2	T			
		undwaler not encountered	7 Terr	<b>'</b>		76	7	Boring Started: 07-	24-2019	+		e1ed: 07	-24-2018
			15620 \	W 113th			Ħ	Drill Rfg: 754		Drillen	JW		
			Lane	xa,KS				Project No.: 02195	181	1			

			ВО	RING LO	)G	N	0.	B-1	6			P	'age '	of 1
	P	ROJI	ECT: Paragon Star Village		CL	IEN	T:	GBA Lenes	ca, KS					
Ì	S	TE:	I-470 and View High Drive Lee's Summit, MO					Lene	ka, Ko					
	MODEL LAYER	GRAPHIC LOG		v.: B14 (Ft.) +/- EVATION (Ft.) A33.5ev	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	HELD TEST RESULT'S	HAND PENETROMETER (tsf)	UNCONFINED COMPRESSIVE STRENGTH (SD	WAYER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
TVALID IF SEPARATED FROM ORIGINAL R	W Abau	enceme ash Bo ndonma bring bi	ont Method: See sym ackfilled with auger cultings open completion.  Elev WATER LEVEL OBSERVATIONS	788.5+/- 784+/- gradual.  Exploration and Tealpton of field and and additional data Supporting Informations and abbreviati adding were Interportant.	labora ta (If 8 ation R ions, alated	atory p vy). or expl from e	rocex Iamail I topo	Avres Ion of Ographic	Hammer Typo: .  Notes: W.O.H.: Weight of	of hammer	Borio	g ¢omin	pleted:	07-24-2019
		•••	oundwater not encountered	llerr	8	C		Π	Orill Rig: 754		+	r. ₩		_,
200				15620 V		h St	_	<b>-</b>	Project No.: 02195	181				

PROJECT: Paragnor Start Willage  SITE: L470 and View High Drive Lee's Summit, MO  Approximate Surface Elex; 813 (FL) + F. Latitude: 38 6078* Longitude: 44.4447  Approximate Surface Elex; 813 (FL) + F. Latitude: 38 6078* Longitude: 44.4447  Approximate Surface Elex; 813 (FL) + F. Latitude: 38 6078* Longitude: 44.4447  Approximate Surface Elex; 813 (FL) + F. Latitude: 38 6078* Longitude: 44.4447  Approximate Surface Elex; 813 (FL) + F. Latitude: 38 6078* Longitude: 44.4447  Approximate Surface Elex; 813 (FL) + F. Latitude: 44.4447  Approximate Surface Elex; 813 (FL) + F. Latitude: 44.4447  Approximate Machine: 814 (FL) + F. Latitude: 44.4447  Approximate Machine: 914 (FL) + F. Latitude: 914 (FL)	<u> </u>		BORING L	00	N	0.	В	-17				Page	1 of 1
SITE: L470 and Viow High Drive Log's Summit, MO    Solid See September 1   See September 2   See Septe	PROJI	ECT: Paragon Star Village		Ç	LIEN	T:	GB	A NAVA KE					,
Approximate Merical Energy State Constitution in merical super curring s	SITE:	I-470 and View High Drive Lee's Summit, MO	;	-			LOI	ieza, NJ					
LEAN GLAY.(G.L.) brown to gray  10  10  15  10  20  25  30  30  35  35  36  36  36  36  36  36  36  36	HH 83	LOCATION See Expforation Plan	,	•	길었	띮	(ln.)		T E	ម្រីគីម	- F	£	ATTERBĘ LIMITA
LEAN GLAY.(G.L.) brown to gray  10  10  15  10  20  25  30  30  35  35  36  36  36  36  36  36  36  36	[필 ]	Lalilude: 38.9378° Longilude: -94.4447°	1	Ē	VATIC	띩	ERY (	STES.	20gg	PESSINA PESSIN	E 5	불	
LEAN GLAY.(G.L.) brown to gray  10  10  15  10  20  25  30  30  35  35  36  36  36  36  36  36  36  36	MOD SEA	Approximati	9 Surface Elev.: 813 (Ft) +/-		WATE	1	8		1 5 A S	S S S S S S S S S S S S S S S S S S S	N N		LUPLP
LEAN GLAY ICIL brown to gray  10  10  15  20  25  30  30  35  36  40  40  45  36  Build gray  35  Build gray  35  Build gray  35  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  Build gray  TRSH:  50  Build gray  TRSH:  50  Build gray  Build g					>ŏ	ъĵ	ũ	<u> </u>	<u> </u>	-282	٥		
Stratification times are approximate. In-aidu, the transition may be gradual.  Stratification times are approximate. In-aidu, the transition may be gradual.  Stratification times are approximate. In-aidu, the transition may be gradual.  Advancement Method:  Wash Bore  See Espicialition and Texting Procedures for a description of hold and charactery procedures for a description of hold and charactery procedures for a description of hold and charactery procedures.  See Espicialition and Texting Procedures for a description of hold and charactery procedures for a description of hold and charactery procedures.  Wash Bore  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Technology Startist: 07-24-2019 Boring Completed: 07-24-20 Dail Fig. 754 Dottler: JVV				_		-							
Stratification times are approximate. In-aidu, the transition may be gradual.  Stratification times are approximate. In-aidu, the transition may be gradual.  Stratification times are approximate. In-aidu, the transition may be gradual.  Advancement Method:  Wash Bore  See Espicialition and Texting Procedures for a description of hold and charactery procedures for a description of hold and charactery procedures for a description of hold and charactery procedures.  See Espicialition and Texting Procedures for a description of hold and charactery procedures for a description of hold and charactery procedures.  Wash Bore  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Technology Startist: 07-24-2019 Boring Completed: 07-24-20 Dail Fig. 754 Dottler: JVV				_ =					1				
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional disk (if any).  See Buptorting Information for explanation of explanation of explanation of explanation of explanation of explanation of explanation of explanation for explanation of explanation explanation of explanation of explanation explanation of explanation				5-		1							
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of teld and faboratory procedures used an additional data (if any).  See Buptorting Information for explanation of explanati				╡	-	ſ			1				
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of teld and faboratory procedures used an additional data (if any).  See Buptorting Information for explanation of explanati				10┦		1							
SHALE, gray  SHALE, gray  So D  Borling Terminated at 50 Fast  See Exploration and Testing Procedures for a description of field and faboratory procedures used an additional data (if any).  See Supporting information for explanation of symbols and additional data (if any).  See Supporting information for explanation of explanation of symbols and abbroviations.  Elevations were interpolated from a topographic alle, plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  TESTACON  Borling Started: 07-24-2018  Borling Started: 07-24-2018  Borling Started: 07-24-2018  Borling Started: 07-24-2019  Drill Rig: 754  Drill Rig: 754				╡		1				i i			
SHALE, gray  SHALE, gray  So D  Borling Terminated at 50 Fast  See Exploration and Testing Procedures for a description of field and faboratory procedures used an additional data (if any).  See Supporting information for explanation of symbols and additional data (if any).  See Supporting information for explanation of explanation of symbols and abbroviations.  Elevations were interpolated from a topographic alle, plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  TESTACON  Borling Started: 07-24-2018  Borling Started: 07-24-2018  Borling Started: 07-24-2018  Borling Started: 07-24-2019  Drill Rig: 754  Drill Rig: 754			1	. I					1	' '			
SHALE, gray  SHALE, gray  Solution times are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used an additional data (if any).  See Supporting Information for explanation of symbols and additional data (if any).  See Supporting Information for explanation of explanation of symbols and abbreviations.  Elevations were Interpolated from a topographic alle, plan.  See Supporting Information for explanation of explanation of symbols and abbreviations.  Elevations were Interpolated from a topographic alle, plan.  See Supporting Information for explanation of explanat			[ 1	15-		-			] .				
SHALE, gray  SHALE, gray  Solution times are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used an additional data (if any).  See Supporting Information for explanation of symbols and additional data (if any).  See Supporting Information for explanation of explanation of symbols and abbreviations.  Elevations were Interpolated from a topographic alle, plan.  See Supporting Information for explanation of explanation of symbols and abbreviations.  Elevations were Interpolated from a topographic alle, plan.  See Supporting Information for explanation of explanat				╡	-								
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional disk (if any).  See Buptorting Information for explanation of explanation of explanation of explanation of explanation of explanation of explanation of explanation for explanation of explanation explanation of explanation of explanation explanation of explanation			1 2	20-			- 1						
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of teld and faboratory procedures used an additional data (if any).  See Buptorting Information for explanation of explanati					- 1	-							
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional disk (if any).  See Buptorting Information for explanation of explanation of explanation of explanation of explanation of explanation of explanation of explanation for explanation of explanation explanation of explanation of explanation explanation of explanation				∄	ĺ					' <b>'</b>			
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of teld and faboratory procedures used an additional data (if any).  See Buptorting Information for explanation of explanati			2	25-		İ	-				- 1		
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional disk (if any).  See Buptorting Information for explanation of explanation of explanation of explanation of explanation of explanation of explanation of explanation for explanation of explanation explanation of explanation of explanation explanation of explanation				Ⅎ					ĺ		ľ		
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of teld and faboratory procedures used an additional data (if any).  See Buptorting Information for explanation of explanati			1 2	ᆟ			1		·				
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of teld and faboratory procedures used an additional data (if any).  See Buptorting Information for explanation of explanati			١	<b>"</b>		1	1			i			
Stretification lines are approximate. In-situ, the transition may be gradual.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional data (if any).  See Buptorting Information for explanation of symbols and additional data (if any).  See Supporting Information for explanation of symbols and abbreviations.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Terracon  Boring Started: 07-24-2018  Boring Completed: 07-24-2.  Datil Rig: 754  Datilier: JW			1	$\exists$	1								
Streetfication lines are approximate. In-situ, the transition may be gradual.  Streetfication lines are approximate. In-situ, the transition may be gradual.  Advancement Method:  Wash 6 ore  See Exploration and Testing Procedures used and additional data (if any).  See Supporting information for explanation of symbols and abbreviations.  Elevations were interpolated from a topographic site plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Terracon  16620 W 113th 5t.  Drill Rig: 754  Drill Rig: 754			3	5-		ı						ļ	
Stratification lines are approximate. In-situ, the transition may be graduel.  Stratification lines are approximate. In-situ, the transition may be graduel.  Advencement Method:  Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional data (if any).  See Supporting information for explanation of ex				7		1			ı				
SHALE, gray  Shale, gray  Shale, gray  Shale, gray  Street/ficetion times are epproximate. In-situ, the transition may be graduel.  Advencement Method:  Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional data (if any).  See Supporting information for explanation of explanation o				_ 📫					ļ	ĺ		ı	
SHALE, gray  SHALE, gray  Shale, gray  Stratification lines are approximate. In-situ, the transition may be graduel.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Supporting information for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic alter plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Terration  Boring Started: 07-24-2019  Boring Completed: 07-24-20  Drill Rig: 754  Driller: JW			4	먹							1		
SHALE, gray  SHALE, gray  Shale, gray  Stratification lines are approximate. In-situ, the transition may be graduel.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Supporting information for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic alter plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Terration  Boring Started: 07-24-2019  Boring Completed: 07-24-20  Drill Rig: 754  Driller: JW				4				i			-		
SHALE, gray  SHALE, gray  Shale, gray  Stratification lines are approximate. In-situ, the transition may be graduel.  Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Supporting information for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic alter plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Terration  Boring Started: 07-24-2019  Boring Completed: 07-24-20  Drill Rig: 754  Driller: JW			4	5-1			1		ľ			- 1	
Stratification lines are approximate. In-situ, the transition may be graduel.  Advancement Method: Wash Bore Wash Bore Wash Boring backfilled with sugar cuttings upon completion.  WATER LEVEL OBSERVATIONS Groundwater not encountered  Testing Procedures to a description of field and laboratory procedures used and additional data (if any).  See Supporting information for explanation of explanation of symbols and abbreviations.  Elevations were interpolated from a topographic situation.  Boxing Started: 07-24-2018 Boxing Completed: 07-24-2018 Drill Rig: 754  Drill Rig: 754  Drill Rig: 754	46.		766.5+/-		1	1	1				1	-	
Stretification times are approximate. In-situ, the transition may be graduel.  Advencement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any). See Supporting information for explanation of symbols and abbreviations.  Elevations were interpolated from a topographic site plan.  Boring Started: 07-24-2019  Boring Started: 07-24-2019  Drill Rig: 754  Drill Rig: 754  Drill Rig: 754				4					- 1		1		
Advancement Method: Wash Bore  Wash Bore  See Exploration and Testing Procedures for a description of fletd and laboratory procedures used and addition of fletd and laboratory procedures used and addition of fletd and laboratory procedures used and addition of fletd and laboratory procedures used and addition of symbols and abbreviations.  See Exploration and Testing Procedures for a description of fletd and laboratory procedures used and additional addition for explanation of symbols and abbreviations.  Elevations were Interpolated from a topographic site plan.  Boring Started: 07-24-2019  Boring Completed: 07-24-20  Drill Rig: 754  Driller: JW			<del></del>	+	+	┿	+		<u> </u>	$\dashv$	+	$\dashv$	
Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Index of the procedures  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  See Exploration and Index of the procedures  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of h										- 1	- 1	Ī	
Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures for a description of field and laboratory procedures.  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Testing Procedures  W.C.H.: Weight of hammer  See Exploration and Index of the procedures  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  See Exploration and Index of the procedures  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of hammer  W.C.H.: Weight of h	] [								ļ		ľ		
Advancement Method: Wash Bore  See Exploration and Testing Procedures for a description of field and faboratory procedures used and additional data (if any).  See Supporting information for explanation of symbols and abbreviations.  See Supporting information for explanation of symbols and abbreviations.  Elevations were interpolated from a topographic site plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  See Exploration and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description and Testing Procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of field and faboratory procedures to a description of faboratory procedures to a description of faboratory procedures to a description of faboratory procedures to a description of faboratory procedures to a desc	Stratifi	cation tines are approximate. In-situ, the transition	n may be graduel.			L	<u> </u>	Hammer Tuce: A	utometic				
Wash flore  See Exposition and Testing Procedures to a description of field and faboratory procedures used and additional data (if any).  See Supporting information for explanation of symbols and abbreviations.  See Supporting information for explanation of symbols and abbreviations.  Elevations were interpolated from a topographic site plan.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Boring Started: 07-24-2019  Boring Completed: 07-24-20  Drill Rig: 754  Driller: JW	A	<u> </u>											
Abandonment Method: Boring backfilled with auger cuttings upon completion.  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Used and additional data (if any).  See Supporting information for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic alternation for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic alternation for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic alternation for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic alternation for explanation of symbols and abbreviations.  Efevations were interpolated from a topographic point of the plan.  Boring Started: 07-24-2019  Boring Completed: 07-24-20  Drill Rig: 754  Drill Rig: 754		sernod:	description of field and lab	xxator	V Droce	s for dure	8 5						
Soring backfilled with suger cuttings upon completion.  Elevations were interpolated from a topographic  WATER LEVEL OBSERVATIONS  Groundwater not encountered  Boring Started: 07-24-2019  Boring Completed: 07-24-20  Drill Rig: 754  Driller: JW			used and additional data (i	lf eny)				w.o.H.: Weight of	nammer				
WATER LEVEL OBSERVATIONS Groundwater not encountered  Elevations were interpolated from a topographic  Boding Started: 07-24-2019 Boding Started: 07-24-2019 Boding Started: 07-24-2019 Drill Rig: 754  Drill Rig: 754	bandonment M Boring backfl	fethod:   66 with suger cuttings upon respective	symbols and abbreviations	11 far e 9.	xpianal	ièn c	of						
WATER LEVEL OBSERVATIONS Groundwater not encountered  Terracon  Boding Started: 07-24-2019  Boding Completed: 07-24-20  Drill Rig: 754  Driller: JW			Elevations were interpolate	ed from	п в Сорс	ograp	anic						
IICITACON Drill Rig: 754 Driller: JW	Group	TER LEVEL OBSERVATIONS				_	$\Box$	Boring Started: 07-2	4-2018	Boring C	Complet	ted: 07-	24-2019
16620 W 113th St	5,000	and the outpoint of	IIGLLS	)C	.O	П		Drill Rig: 754		<del>-</del>			
				13th \$1			_ }	Project No.: 0219518	 B1	T			

				BORING LO	OG	N	<u>).</u>	B-1	8			P	age 1	of 1
ļ	PF	ROJE	ECT: Paragon Star Village		CL	IEN	T: (	GBA Lenex	(a, K\$		_			
-	SI	TE:	I-470 and View High Drive Lee's Summit, MO										-	NTCODE OF
	MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan  Latitude: 36,9393" Longituda: -94,4465"  Approximate Surfa	· ·	DEPTH (PL)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	HAND PENETROMETER (IST)	COMPRESSIVE STRENGTH (187)	WATER CONTENT (%)	DRY UNIT WEIGHT (pd)	ATTERBERG LIMITS LL-PL-PI
HIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT, GEO SMART LOG-NO WELL 02195191 PARAGON STAR VILLIGEJ DATATEMITIALE, GLI 1 WW19	Adv Manual Adv Manua	Si Si Sancari.	A1.0  SHALE. gray  Boring Terminated at 50 Feat  Fatification lines are approximate. In-situ, the transition of the mathematical states are approximated at 50 Feat  Mathematical states	772+/- 763+/- 76	10—15—15—15—15—15—15—15—15—15—15—15—15—15—	p Procuratory any).	odure proces plane a top	s for s durea tion of ographic	Hammer Type: Notes: W.O.H.: Weight	Autometic of heremor			Iplahed	07-23-2019
OF INTER	$\vdash$	G	roundwater not encountered	1 Nerr	9			n	Drill Rig: 754	,-za- <b>z</b> u18	<del></del>	ar: JW		
HS B				15620		34h \$t			Project No.: 0219	5181				

ļ		BORING L	OG	N	Ο.	В	-19				Paga	1 of 1
PROJE	CT: Paragon Star Village		CL	IEN	T:	GB.	A nexa, KS					
SITE:	I-470 and View High Drive Lee's Summit, MO	3				TĆ!	ieza, No					
YER LOG	OCATION See Exploration Plan	<u>.                                      </u>	3	면 왕	7E	(jg)	F	Ę	e R.B	2	. £	ATTERI LIMI
MODEL LAYER GRAPHIC LOG	alitude: 38.9399° Longitude: -94.4468°		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (Isf)	UNCONFINED COMPRESSIVE STRENGTH (M)	WATER CONTENT (%)	DRY UNIT WEIGHT (pct)	
		9 Surface Elev.: 606 (Ft.) +/-		WATE BSE	SAMP	ĞΕĞ	<u> </u>	1 3 F	SEA	35	WEG.	LL-PI
	5-A <u>6" ROOT ZONE</u>	ELEVATION (Ft.)		-0	17)		-	<u> </u>	-0%			
	LEAN CLAY (CL), brown to gray		4									
			5-									
		ļ			ı							
			🕇	1	ľ							
			10-									
			7	-	J							
			15-					,				
			7		1	- [						
		l .		-	-	ľ	l					
		11	20-									
			$\exists$		1				ľ		-	
		2	25	-	1					ļ		
		1	3								ı	
			305		1	-						
			"-	1					- 1	-		
			_			1			ļ		ı	
		3	15	1		1						
			4	ľ				'	ł			
40.4		766+/- A	٦		ı			- 1	- 1			
	SHALE, gray	'	_		1			ĺ				
		1	4									
		4	5_		1			ĺ	ľ			
			7					ĺ				
50.0	Boring Terminated at 50 Feet		0+	+	+	+	<u>,,_,</u>			$\dashv$	$\dashv$	
1 ]							i		ĺ	ľ		
\$tratific	ation lines are approximate. In-situ, the translit	on may be gradual.		J			Hammer Type: A	Lutomatic		Ц.		
yancement M	ethad:	See Evolutation and Torr	P				Notes:					
Wash Bore		See Exploration and Tosli description of field and lat used and additional data (	poretory	proc	edwe edwe	<b>8</b>	Notes: W.O.H.: Weight of	f hämmer				
 Indonment M	alhod:	See Supporting Informatio	on for ex	ıçlana	المالة	φľ						
Boring backfill	ed with suger cultings upon completion.	symbols and abbreviation Elevations were interpolet		a hon	יייטוו	nble	1					
WAT	FER LEVEL OBSERVATIONS	ste plan	IFWIII		-cyra		Bad 81-1 1 45-1	d no.	Ī			
	tweler not encountered	] ][erra	)[		ľ	1	Boring Started: 07-2	4-2019	Boring (		ted: 07	24-20
		16620 W 1	13lh St			- 1	Drill Rig: 754		Oritier: .	JW		
		Lenosa,	KS				Project No.: 021951	81	ł			

	BORING LOG NO. B-20 Page 1 of 1												
F	PROJECT: Paragon Star Village			CL	IEN	T: (	GBA	ca, KS					
s	SITE: I-470 and View High Drive Lee's Summit, MO						AU 167						M-TEODERS
ä	ģ	LOCATION See Exploration Plan		÷	되었 SVS	Æ	(lu.)	₩.	£		<u>\$</u>		ATTERBERG LIMITS
MODEL LAYER	GRAPHICLOG	Letitude: 38.9399" Longilude: -94.4456"		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (tel)	UNCONFINED COMPRESSIVE STRENGTH (ISD	WATER CONTENT (%)	DRY UNIT WEIGHT (pd)	LL-PL-PI
MOOM	GRAF	Approximate Surface	I .	DEF	WATE	SAME	868	핕벋		SPE	≥S.	\$ E	PP-\L C_L
F	11/1/	DEPTH DE_G" ROOT ZONE	ELEVATION (FL)	_	٣	Н							
		LEAN CLAY (CL), brown to gray		_									
ि				5-								, ]	
					1								
				- -	1								
;[:				10_	1								
				=	1								
				15	}								
				=	}								
֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓				20-	}	ĺ							
1				- -	1								İ
				_	1	1							
				25-	1								
UZJSJAT PARAGON SI AK VILLOF				_	1								
5			ļ	30-	1							i	
				=	1								
				35	1								
				35	}								
T AM ON				-	}								
3		40.0 SHALE, with timestone lenses, gray	<u>763+/-</u>	40	-								!
				-	1				ļ				
្ន				45-	1					I			
3 2 2 3			•	-T-J	1								
2				-	1								
		50.0 Boring Terminated et 50 Feet		50-	╁╸	T		<u>., .,</u>		<u> </u>			
5		1									-		
Ž													
	\$	 tratification lines are approximate, in-stru, the fransition ma	ky be gradual.			1		Hammer Type:	Automatic		-		•
<u>.</u>	k.m ·	and Malhad	Can Eurice · · ·	Taker	Dece -	of in-	a for -	Notea:					
<u>"</u>	Wash 8	nent Melhod: Hore	See Exploration and description of field actually used and additional descriptions.	<b>XV</b> i labol	ratory (	BLOCE SZUE	dures	W.O.H.: Weight	of hammer				
<u></u>			See Supporting Infan	mallon		danai	lion of						
S H		nent Melhod; backfilled with euger cuttings upon completion.	symbols and abbravional Elevations were infor		i from	a top	ographic	,					
8		WATER LEVEL OBSERVATIONS	alta nian					Boring Started: 0	7-24-2019	Borle	ng Çarı	preted:	07-24-2019
	G	roundweter not encountered	Ner	2		0	ח	Drill Rig: 764			er: JW		
HIS BORING LOG IS NOT VALID IF SEPARATED FROM CARGINAL REPORT, CACO SALAST LOG-NO	16820			W 113 nexa, ƙ	ath St	_	_ =	Project No.: 0219	5181	+			

	BORING LOG NO. B-21 Page 1 of 1													
	P	ROJ	ECT: Paragon Star Village		CI	LIEN	IT:	GB.	A A					
	SITE: J-470 and View High Drive Lee's Summit, MO			Lenex		exa, KS								
ļ	MODEL LAYER	GRAPHIC LOG	LOCATION See Expression Plan Latitude: 38.8391° Longitude: -94.4447°		DEPTH (PL)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HAND PENETROMETER (191)	UNCONFINED COMPRESSIVE STRENGTH (ISI)	WATER CONTENT (%)	DRY UNIT WEIGHT (pd)	LU-PE-PI
	ž	ু কুল্	Approximate S  DEPTH  D.5. \( \lambda 6'' \) ROOT ZONE	urface Elev.: 804 (Ft.) +/- ELEVATION (Ft.)	•	¥8	SA	Ä	<u> </u>	<u> </u>	38%	8		
OT VALID IF	Gont	Strati	LEAN CLAY (CL), brown to gray	763.5+/- 4	ting Probotato (If any on for	y pro	cedur	res	Hammer Type: A					
SLOG IS	- CTIE		ATER LEVEL OBSERVATIONS	Elevations were interpola site plan	ted fro	on a to	pogra	aphic	<b>.</b>		<u> </u>			
		13 fL	while drilling	- 7lerra	)ſ	-6	)[	1	Boring Started: 07-23-2019 Boring Completed: 07-23-201				-23-2019	
	<u> </u>	3 ft. c	pon completian	16820 W 1	113ሁነ 8		-		Drill Rig: 754		Drillèr:	344		
- ا				Lenexa	ia, KS Project No.: 92195181									

# SUPPORTING INFORMATION

### Contents:

General Notes Unified Soil Classification System Description of Rock Properties

Note: All attachments are one page unless noted above.

## **GENERAL NOTES**

**DESCRIPTION OF SYMBOLS AND ABBREVIATIONS** 

Paragon Star Village 👼 Lee's Summit, MO

Terracon Project No. 02195181



SA	MPLING	WATER LEVEL		FIELD TESTS
		Water Initially Encountered	N	Standard Penetralion Test Resistance (Blows/Ft.)
Shelby	Split Spaan	Water Level After a Specified Period of Time	(HP)	Hand Penetromater
Tube	M-4	Water Level After a Specified Period of Time	m	Torvane
		Water levels indicated on the soil boring logs are the levels measured in the borehole at the times	(DCP)	Dynamic Cone Penetrometer
		indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not	uc	Unconfined Compressive Strength
		possible with short term water level observations.	(PID)	Photo-ionization Datactor
			(OVA)	Organic Vapor Analyzar

### DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

### LOCATION AND ELEVATION NOTES

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

(More Uran 50%	OF COARSE GRAINED SOILS fetained on No. 200 sleve ( Standard Penetration Resistance	Consideracy de	MS CONSISTENCY OF FINE GRAINED (50% or more passing the No. 200) lemaned by laboratory phear strength to procedures or standard penetration re	sieve sating field visual manual
Descriptive Term (Density)	Stendard Penetration or N-Value Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu. (tef)	Standard Penetration or N-Value Blows/Ft.
Very Loose	0-3	Very Soft	less than 0.25	0 - 1
Loosa	4-9	Soft	0.25 to 0.50	2-4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4-8
Dense	80 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

	S OF SAND AND GRAVEL	RELATIVE PROPOF	RTIONS OF FINES
Descriptive Term(s) of a cliner constituents	Percent of 342 Dry.Welght	Descriptive Term(s) of ✓ other constituents	Percent of an Dry Weight
Тласв	<15	Trace	<5
With	15-29	With	5-12
Modifier	>30	Modifier	>12
GRAIN BIZE T	ERMINOLOGY		SCRIPTION
Mejor Component of Sample	Part cle Size	Term Starte	Plasticity Index
Boulders	Over 12 in. (300 mm)	Non-plastic	0
Cobbles	12 in. to 3 in. (300mm to 76mm)	Low	1 - 10
Gravel	3 in. to #4 sleve (75mm to 4.75 mm)	Medium	11 - 30
Sand	#4 to #200 sleve (4.75mm to 0.075mm	High	> 30
Sill or Clay	Passing #200 sieve (0.075mm)		



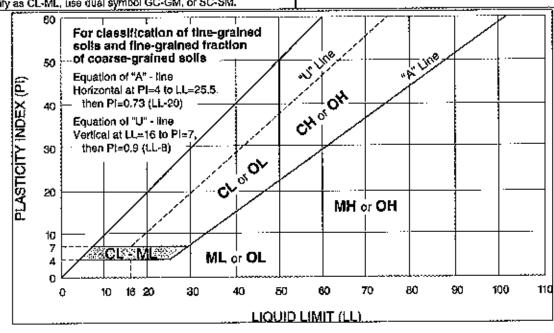
				8 Group	oli Classification
Criteria for Assigni	ng Group Symbols	and Group Names	Using Laboratory Tests A	Symbol	Group Name <sup>g</sup>
		Clean Gravels:	Cu ≥ 4 and 1 ≤ Cc ≤ 3 <sup>E</sup>	G₩	Well-graded gravel F
	Gravels: More than 50% of	Less than 5% lines <sup>c</sup>	Cu < 4 and/or [Cc<1 or Cc>3.0] E	GP	Poorly graded gravel <sup>F</sup>
	coarse fraction	Gravels with Fines:	Fines classify as ML or MH	GM	Slity gravel P, G, H
Coarse-Grained Soils:	relained on No. 4 eleve	More than 12% fines <sup>c</sup>	Fines classify as CL or CH	GC	Clayey gravel F. G. H
More than 50% retained on No. 200 sieve		Clean Sands:	Cu ≥ 6 and 1 ≤ Cc ≤ 3 <sup>g</sup>	SW	Well-graded sand <sup>I</sup>
di 140. 200 31040	Sands: 50% or more of coarse fraction passes No. 4 sleve	Less than 5% fines p	Qu < 6 and/or [Cc<1 or Cc>3.0] €	SP	Poorly graded eand !
		Sande with Fines: More than 12% fines <sup>D</sup>	Fines classify as ML or MH	\$M	Silty eand G, H, I
			Fines classify as CL or CH	sc	Clayey sand 6, H. I
	Silis and Clays: Liquid limit less than 50		PI > 7 and plots on or above "A"	CL	Lean clay K. L. M
		Inorganic:	PI < 4 or plots below "A" line "	ML	Silt K, L, M
			Liquid limit - oven dried < 0.75	OL.	Organic clay K, L, M, N
Fine-Grained Solls:		Organic:	Liquid limit - not dried	J 5	Organic silt K, L, M, o
50% or more passes the No. 200 sieve			Pl plots on or above "A" line	CH	Fat clay K, L, M
110. 200 albvo	Silts and Clays:	Inorganic:	Pl plots below "A" line	МН	Elastic Slit K, L, M
	Uquid limit 50 or more		Liquid limit - oven dried < 0.75	ОН	Organic clay K, L, M, P
		Organic:	Liquid limit - not dried < 0.75	Un.	Organic silt K, L, M, Q
Highly organic soils:	Primarily	organic matter, dark in c	otor, and organic odor	PΥ	Peat

- ABased on the material passing the 3-inch (75-mm) sleve.
- B if field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- <sup>c</sup> Gravels with 5 to 12% fines require dual symbols: GW-GM wall-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
- O Sands with 5 to 12% (Ines require dual symbols: SW-SM well-graded send with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

$$\epsilon_{Cu} = D_{cc}/D_{10} \quad \ Cc = \frac{\left(D_{30}^{}\right)^2}{D_{10}^{} \times D_{60}^{}}$$

- F if soil contains ≥ 15% sand, add "with sand" to group name.
- 6 If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

- Hif fines are organic, add "with organic fines" to group name.
- If f soil contains ≥ 15% gravel, add "with gravel" to group name.
- J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
- Kiff soil contains 15 to 29% plus No. 200, add "with sand" or "with grayel," whichever is predominant.
- If soil contains > 30% plus No. 200 predominantly sand, add "sandy" to group name.
- Mff soil contains  $\geq$  30% plus No. 200, predominantly gravel, add "gravelly" to group name.
- NPI ≥ 4 and plots on or above "A" line.
- PPI < 4 or plots below "A" line.
- PPI plots on or above "A" line.
- PI plots below "A" line.



#### DESCRIPTION OF ROCK PROPERTIES



Term	WEATHERING Description
	a <b>мирок ними</b> торож 1960 г. на выстрания выправности и под настрания и выправности и выправности и выправности и
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Nesizazi açıı	All rock material is converted to soll. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

	STRENGTH OR HARDNESS	
Description	Field Identification	Unjaxial Compressive Strength, psi (MPa)
Extremely weak	Indented by thumbnell	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strang rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

	DISCONTINUIT	DESCRIPTION	
Fracture Spacing (Joints	, Faults, Other Fractures) 🔍 🔻	Bedding Spacing (May	include Foliation or Banding) 🞏 🗸
Description	Spacing S	Description	Spacing
Extremely close	< ¾ in (<19 mm)	Lam/nated	< ½ in (<12 mm)
Very close	% in 2-1/2 in (19 - 60 mm)	Very thin	½ in − 2 in (12 − 50 mm)
Close	2-1/2 in - 8 in (60 - 200 mm)	Thin	2 in = 1 ft. (50 = 300 mm)
Moderate	8 in 2 ft. (200 600 mm)	Medium	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	Thick	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	Massive	> 10 ft. (3 m)

<u>Discontinuity Orientation (Angle)</u>: Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DE	SIGNATION (RQD)
Description	RQD Value (%)
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

The combined length of all sound and Intact core segments equal to or greater than 4 (notes in length, expressed as a
percentage of the total core run length.

Reference:

U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009 <u>Technical Manual for Design and Construction of Road Tunnels – Civil Elements</u>

