

Auburn, Kentucky
Interim Wastewater Treatment Plant Expansion Project
Contracts 1, 2, and 3

ADDENDUM No. 2

February 5, 2026

This ADDENDUM to plans, specifications and bidding documents for the subject project modifies the referenced items to the extent described herein. Items not modified by this ADDENDUM remain unchanged and in full effect.

Bidders are required to acknowledge receipt of this ADDENDUM on the Bid Form.

Contract Time

The contract time is changed to 365 days for substantial completion and 400 days for final completion for Contract No. 1 (interim plant). Contract time for contracts 2 and 3 are not changed.

Erosion Control Plan

Contractor is responsible for preparing any required erosion and sediment control plans.

Geotechnical Report

A geotechnical report for the site of the future permanent wastewater treatment plant is provided as an attachment for reference.

END OF ADDENDUM NO. 2 TEXT

This addendum consists of 1 page of text and 42 pages of attachments.



EARTH SCIENCE ENGINEERING, LLC

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931-645-8008 Fax: 931-645-0180

December 13, 2024

Mr. Mike McGhee, P.E.
McGhee Engineering, Inc.
202 South Ewing Street
Guthrie KY 42234
mike.mcgee@mcgheengineering.com

**RE: Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
ESE Project No.: 48166**

Dear Mr. McGhee:

Earth Science Engineering, LLC (ESE) is pleased to submit these subsurface investigation results for the proposed Guthrie Wastewater Treatment Plant expansion project planned on Cypress Lane in Guthrie, Kentucky.

ESE's services were performed in general accordance with our October 30, 2024 proposal to your attention. Authorization was provided by you on November 04, 2024 via executed proposal. Included are the results of the exploration, boring logs, a boring location plan, and ESE's conclusions and recommendations.

Background: It is understood an expansion at the Guthrie Wastewater Treatment Plant on Cypress Lane in Guthrie, Kentucky is planned. The boring numbers, planned depth and other project information are outlined below:

Boring	Depth(FT)	Structure	Approximate Bearing Depth (FT)	Surface Elevation	Approximate Bearing Load (PSF)	
					Minimum	Maximum
B-1	20	Disinfection Basins	10	523.3	200	1,000
B-2	Refusal	Influent Lift Station	25	523.7	500	2,000
B-3	10	Administration Building	3	526.0	100	1,000
B-4	20	Sudge Holding	10	527.2	200	1,000
B-5	10	Sudge Processing	3	528.2	200	1,000
B-6	20	Headworks	10	525.0	200	1,000
B-7	20	Oxidation Ditch 1	10	523.9	500	1,500
B-8	20	Oxidation Ditch 2	10	525.6	500	1,500
B-9	20	Clarifier 1	12	524.3	300	1,200
B-10	20	Clarifier 2	12	524.2	300	1,200
B-11	20	Clarifier 3	12	525.4	300	1,200
B-12	Refusal	Clarifier 4	12	526.8	300	1,200
B-13	10	Road		526.6		
B-14	10	Road		523.5		
B-15	10	Road		525.5		
B-16	10	Road		527.0		

Final site grading requirements have not been established. However it is expected that minimal cuts and fills will be necessary to achieve design grade elevation between the new structures.

In addition to the proposed building construction, new access driveways and parking areas are planned. Traffic loading information has not been provided. It is understood that vehicle loading will be primarily automobile traffic and limited truck traffic.

Soil Sampling: As outlined in ESE's agreement with client, ESE performed 16 geotechnical soil borings at the site. Two borings were performed to an intended depth of auger refusal. Eight borings were performed to a depth of 20 feet and the remaining six borings to 10 feet each.

The borings were performed in locations marked in the field by representatives of McGhee Engineering. Limited access clearing vial land mulching techniques was required to access the boring locations.

The soil borings were performed with ESE's track-mounted rotary drill rig, Model STR-174, manufactured by TMG Manufacturing. The borings were advanced with 2.25 inch inside diameter hollow stem augers.

At preselected intervals throughout the boring depths, soil samples were recovered with a two inch O.D. split spoon sampler in accordance with the Standard Penetration Test (ASTM D 1586). The Standard Penetration Test consists of the measurement of the number of blows with a 140 pound hammer that is required to drive the split spoon sampler into the soil. Each test involves three 6 inch increments which comprise a total length of 18 inches. The values (blow counts) for the second and third increments are added together, designating the N-value for the respective soil sample.

One undisturbed Shelby tube sample was obtained in accordance with ASTM D 1587. A bulk sample of auger cuttings was obtained for moisture density relationship testing.

During the field exploration, each split spoon sample was monitored for organic vapors with a Minirae 3000 photoionization detector (pid). The pid readings are listed and attached to this report. No petroleum based odors were noted in any of the samples.

Upon completion of auguring, water level observations were made in all borings. After drilling, the borings were back filled with soil cuttings. It should be noted that, over time, the cuttings may settle and leave a void at the surface, requiring corrective measures by the Client.

Laboratory Testing: Soil samples recovered during the field exploration were transported to the ESE soils laboratory where they were examined and visually classified by an experienced laboratory technician under the direction of a registered professional engineer.

All soil samples were tested for natural moisture content (ASTM D 2216). Six select samples were tested for Atterberg limits (ASTM D 4318) and two samples were tested for percent of material passing a No. 200 sieve (ASTM D 422). Moisture-density relationship (standard Proctor) testing was performed in general accordance with ASTM D-698 from bulk sample of auger cuttings generated while drilling boring G-5. Unconfined compression strength testing (ASTM D 2166) was performed on an undisturbed Shelby tube sample obtained from boring G-6.

Additionally, unconfined compressive strengths were determined on several intact samples with the use of a RIMAC® field test device. The RIMAC® device consists of a calibrated spring apparatus which measures ultimate load to axial failure versus overall strain of the sample.

All descriptions and laboratory testing results are shown on the attached subsurface exploration logs. It should be noted that transitions between the soil types can be more gradual than shown on the logs. Those portions of the soil samples not altered by testing will be retained for 60 days after submittal of this report, at which time they will be discarded unless ESE is instructed otherwise.

Subsurface Description: Based on drill crew observations, the surficial material at the borings consist of over 12 inches of readily identifiable topsoil at the surface of the borings. It is noted the project area is wooded and limited clearing access was provided to ESE via land mulching techniques.

The soils encountered below the surficial material consists of predominately brown to dark brown, tan, brownish orange to brownish red, and brownish gray to gray low plasticity silty clay to highly plastic clay.

In boring G-7, brownish orange clayey sand is present at 6 to 10 feet and tan poorly graded sand is present in boring G-11 at 13.5 to 15 feet.

Soil strengths encountered in the borings are generally low to high. Lower soil strengths are summarized below:

Boring	Depth of SOFT/VERY SOFT Soils (ft)	Depth of Lower Strength (firm) Soils (ft)	Auger Refusal (ft / Elev.)	Delayed Water Level (ft / Elev.)
G-1	Upper 3 & 13.5 to 15	8.5 to 10	17 / +506	6 / +517
G-2	18.5 to 25	-	27.5 / +497	10 / +514
G-3	-	Upper 5.5	-	
G-4	18.5 to 20	Upper 3 & 13.5 to 15	21 / +506	
G-5	-	Upper 3	-	
G-6	18.5 to 20	13.5 to 15	-	
G-7	-	Upper 5.5 & 13.5 to 15	15.5 / +509	
G-8	Upper 3	6 to 10	-	
G-9	-	-	16.5 / +508	7 / +517
G-10	3.5 to 5	Upper 3 & 13.5 to 15	16 / +508	12 / +512
G-11	13.5 to 15	-	17 / +508	9 / +516
G-12	-	Upper 5.5 & 13.5 to 15	20 / +507	17 / +510
G-13	-	-	-	
G-14	Upper 3	6 to 10	-	
G-15	-	Upper 3	-	
G-16	-	Upper 3	5.5 / +522	

These soils are classified as CL (low plasticity silty clay), CL-CH (moderate plasticity clay), CH (highly plastic clay), SC (clayey sand), and SP (poorly graded sand) in general accordance with the Unified Soil Classification System (USCS).

Conclusions:

Sinkholes Bedrock in the general project area is susceptible to solutioning and sinkhole formation. Known as karst terrain, the bedrock is often very pinnacled and can be very weathered at the bedrock surface. Sinkholes typically occur due to collapse of subsoil caused by fluctuating groundwater levels in the bedrock and/or near the soil-bedrock interface. Groundwater can be influenced by a multitude of factors including precipitation variations and changes in surface drainage patterns. In many instances, modifications to surface drainage patterns at one site can affect subsurface drainage conditions at other properties. There are many publications about sinkholes and karst terrain. One excellent publication with numerous photographs and diagrams is *Building on Sinkholes* by George F. Sowers.

It is noted that, due to the characteristics of karst terrain, the risk of future sinkhole development is an inherent risk builders and owners assume when building in the general project area. This risk can be effectively eliminated through the use of structural slabs and foundations supported on micro piles which have been grouted into competent bedrock or caissons socketed into previously explored and verified sound bedrock. Other measures, including grouting programs can be effective in reducing future sinkhole risk. Such foundations and techniques are expensive and are typically cost-prohibitive for many developments. Therefore, Owners are often willing to tolerate this potential risk.

Review of available USGS topographical mapping does not indicate the presence of a closed depression (likely sinkhole) on or immediately adjacent to the subject property. No apparent voids or sudden drop of the drilling tools were noted during the field exploration. Some deeper soft soils were encountered. Based on the this information and the results of the subsurface investigation, it is ESE's opinion the VERY SOFT, SOFT, and lower strength soils encountered in the borings are due to subsurface water and not part of a karst condition. In our opinion, the site is at typical, but not elevated risk for sinkhole related conditions. A copy of the USGS topographical map is attached.

VERY SOFT and SOFT Soils As summarized in the previous table above, VERY SOFT and SOFT soils are present in 8 of the 16 borings drilled for this project. Low, marginal strength soils are present in all but two of the borings.

Where these soils are present at or near the ground surface, over excavation and replacement (undercutting) of these soils could be expected. It is noted the site is moderately wooded; therefore removal of much of these soils during site grubbing and stripping can be anticipated.

Attention should be to these soils at deeper depths as indicated at borings G-1, G-2, G-4, G-6, G-11, and to a lesser degree, G-7. These are noted in the up to 15 feet zones above the bedrock surface. The anticipated bearing depths of structures at these borings put foundations very close to these VERY SOFT and SOFT soils, creating an unacceptable risk for settlement.

In order to provide improved foundation support, several alternatives can be considered:

1. Over excavate the VERY SOFT and SOFT soils to a minimum depth of six feet below foundation level and back fill with at least four feet of aggregate rock fill wrapped in stabilization fabric. The balance can be capped with compacted structural fill as needed to facilitate piping excavations, etc.. (At boring G-2, planned cut of 25 feet is expected to encounter bedrock). With delayed free water levels as high as +517 during the field exploration, this approach can be expected to require considerable dewatering, especially at boring B-2.

2. Implement a grouting program to strengthen and stabilize these deep VERY SOFT and SOFT soils beneath the structures.

3. Support the structures on a system of helical piles screwed into the subgrade, driven steel piles, or auger cast piles where grout is pumped into the bore hole as the auger is removed can be considered. Each could be designed to bear on site bedrock. The base of each structure would be designed as a mat or “large pile cap” supported by the piles. Drilled cast in place caissons can also be considered, but installation would be complicated by the subsurface water.

4. Install rammed aggregate piers into the foundation subgrade soils to strengthen the foundation bearing zone. These would first be install from the point of bedrock up to a pre determined elevation then each structure designed as a mat foundation bearing on the aggregate piers.

While Item 1 could likely be performed by the project site grading contractor, Items 2-4 are typically performed on a design build basis by a specialty contractor. ESE is available to discuss any of these methods in more detail and suggest various specialty contractors for inquiry.

While the structures at borings G-1, G-2, G-4, G-6, G-7, and G-11 are at risk of settlement due to the deeper VERY SOFT and SOFT soils, deeper VERY SOFT and SOFT soil conditions are not indicated at the remaining borings. It appears as though these can be supported by shallow footing foundations with significantly less risk associated with deeper low strength soils.

Finally, the near surface soils at the borings, due to their more silty nature and sensitivity to increased moisture, can prove problematic during site grading activities. If site grading is performed during the wet season or after significant rainfall, some undercutting may be necessary. In general, the need for undercutting activities is reduced if site grading is performed during the dry season. Likewise, more undercutting can be expected if grading is performed during periods of wet weather (typically November through May)

Subsurface Water Free water was noted in seven of the borings. Free water was as shallow as six feet below the ground surface. Free water, after delayed open bore hole readings, was found to be as high as elevation +517. Subsurface water levels can fluctuate due to seasonal conditions and variations in rainfall and storm water runoff. It is very possible higher water level elevations may be present at certain times.

The contractor should be prepared to utilize dewatering techniques for excavations opened during construction.

Recommendations: Based on the information obtained from the soil borings performed at the site, the following recommendations are provided. As is the case of all construction projects, actual subsurface conditions can differ from that indicated by soil borings or other investigative methods during grading and foundation construction. If such different conditions become apparent, ESE should be notified so that our recommendations can be reviewed and revised, if necessary.

Shallow Foundations As discussed, the structures at borings G-1, G-2, G-4, G-6, G-7, and G-11 are at risk of settlement due to the deeper VERY SOFT and SOFT soils. It is not recommended to support these structures on the site soils in absence of remediation as mentioned on the previous page. The soil conditions at the remaining borings, however, do not indicate the presence of the deeper VERY SOFT and SOFT soils. It appears as though these can be supported by shallow footing foundations with significantly less risk associated with deeper low strength soils.

Foundations should be designed to bear at a minimum depth of 24 inches below exterior grade for frost protection. Interior footings may bear at depths of 18 inches provided the bearing soil is not disturbed by construction traffic.

Due to the potential for isolated soft soil zones, it is recommended that all footing excavations and slab subgrades be observed by a representative of the Project Geotechnical Engineer to verify the condition of the bearing soils. Any unstable pockets within the footings should be excavated to a depth and extent determined by the Engineer and back filled with Engineer recommended compacted structural fill, gravel, or concrete.

Foundations bearing on the site soils or compacted structural fill (not the VERY SOFT and SOFT soils noted in the table on Page 3) can be designed not to exceed the following:

Allowable Bearing Capacity

Columns (dead load and design live load)	2,275 psf
Strip (dead load and design live load)	1,900 psf
Maximum allowable passive resistance	1,100 psf
Friction coefficient (between soil and concrete)	0.35
Allowable side adhesion	500 psf

The values in the above table include a safety factor of 3 for allowable bearing capacity and a safety factor of 2 for allowable passive resistance. A safety factor of 1.5 has been applied to side adhesion.

The allowable bearing capacity values include dead load and design live load considerations. The top 18 inches, due to the potential for disturbance during construction, should be neglected when calculating passive resistance and side adhesion. All foundations should be sized and design by structural analysis. In order to reduce the potential for differential settlements, it is recommended that, as practically possible, all column footings be designed at the same allowable column bearing pressure and all wall footings be designed at the same allowable wall bearing pressure.

If it is necessary to leave footings open overnight, they should be covered and the ground surface along the sides of the footings sloped away from the inside of the footing excavation. Footings should not be placed in standing water or on frozen ground. The bearing surface of the footings should be cleaned of loose soil which may have been disturbed during excavation or sloughed during reinforcing steel placement.

Grading Based on the surface material measurements obtained by the drill crew and surface vegetation, stripping of at least 12 inches should be budgeted for the project.

After stripping, and before placement of any structural fill and prior to foundation construction, the entire building area (and drive/parking areas) should be proof rolled as practically possible with a fully loaded rubber tired dump truck under the direction and observation of a representative of the project Geotechnical Engineer. Based on these observations, it may become necessary to excavate several shallow back hoe test pits for additional observations or perform localized undercutting in which unsuitable soils are excavated from the subgrade and replaced with compacted structural fill.

After evaluation by a representative of ESE and completion of any recommended undercutting, the top nine inches of exposed subgrade, after cutting to desired subgrade elevation and/or before placement of fill, should be scarified and recompacted to the compaction requirements outlined in the table below*.

It is recommended that structural fill be placed in nine inch or thinner loose lifts and be compacted to no less than the following percentages shown below of the Standard Proctor maximum dry density (ASTM D 698) at moisture contents within two percent (+ or -) of the optimum value.

Area	Minimum Compaction, %
Beneath buildings (foundations and slabs)	95
Beneath Pavements and exterior concrete	95
Top 9" of existing subgrade beneath buildings, pavements, and exterior concrete (scarify & compact)*	95
Landscaping and other non essential areas	85

Structural fill should be free of organic or other deleterious materials and have a maximum particle size less than four inches. Fine-grained structural fill obtained from off-site sources should have a PI between 15 and 28. Variations of the structural fill properties may be permitted after review and approval by ESE.

Those on-site soils which are free of any debris or organics may be used as structural fill at the discretion of the Geotechnical Engineer. Generally, reddish soils can be expected to perform better than brownish silty soils. Due to the moisture contents of these soils being slightly higher than what would typically be the soils' optimum moisture content(s), aeration and/or additional compactive effort of the excavated soils will likely be required before the recommended compaction can be achieved.

Slopes Fill slopes should be designed for a 3H:1V or flatter slope angle unless a site specific slope stability analysis is performed. Fill should extend horizontally a minimum of four feet (or 3 x the adjacent wall footing width, whichever is greater) beyond the building/structure perimeter prior to sloping downward. Measures should be incorporated into project design to limit erosion of slopes; including adequate piping and structures for roof and/or pavement drainage.

Slabs Based on the soil encountered at the boring locations and our past experience, a subgrade modulus no greater than 90 pci should be used for soil-supported slab design. It is recommended that a layer of crushed stone (no. 57 or similar) be placed beneath the soil-supported floor slab to enhance drainage and provide a uniform bearing surface for the floor slab concrete.

The thickness of the crushed stone layer is dependent upon the anticipated slab loading conditions and preference of the structural designer. However, ESE recommends that the layer be no less than four inches in thickness. Polyethylene sheeting should be placed beneath the floor slab to act as a moisture vapor retarder. The floor slab should have an adequate number of expansion joints and, where practical, should not be rigidly connected to foundations, walls, or columns.

Seismic Site Class In order to determine seismic site class, ESE performed shear wave testing at the site via a refraction microtremor (referred to as ReMi).

ReMi provides an effective and efficient means to estimate shear wave velocity profiles and provide site-specific NEHRP and IBC Vs30 soil classification data. Testing is performed at the ground surface utilizing ambient seismic “noise” such as nearby roadways and foot traffic. It can be conducted in seismically noisy areas such as construction zones and urban environments. The data acquisition consists of setting up a linear array of geophones and recording ambient seismic “noise”. A shear-wave dispersion curve is derived and used to model subsurface shear-wave velocity. The effective depth of investigation is related to the length of the geophone array and the frequency response of the measurement system. More information can be found at: www.ce.memphis.edu/7137/PDFs/ReMi/satish.pdf .

ReMi testing results indicate the site can be classified as seismic site class C. The ReMi test results are attached to this report.

Additionally, project data was entered into The Applied Technology Council (ATC) site-specific hazard seismic load website: <https://hazards.atcouncil.org/>. Seismic design values were generated for a risk category II site. The ReMi test results and ATC generated seismic data are attached to this report.

Wall Design Wall design should be performed in accordance with the Structural Designer’s recommendations and/or wall manufacturers guidelines. For the information below, soil conditions as encountered at boring G-2 have been utilized. The following soil ultimate design criteria are provided for wall design:

Parameter	Surface to (-)8'	(-)8' to (-)17'	(-)17' to (-)27.5'
Soil Classification	CL	CH	CH
Max. soil cohesion	2,250 psf	1,200 psf	135 psf
Soil unit weight (wet density)	125 pcf	120 pcf	112 pcf
Soil unit weight (submerged)	62.5 pcf	57.5 pcf	49.5 pcf
Active Earth Pressure, Ka	0.66	0.84	0.84
Passive Earth Pressure, Kp	1.5	1.2	1.2
At-rest Earth Pressure, Ko	0.79	0.91	0.91

In order to facilitate drainage behind subsurface walls and minimize potential disturbance due to over compaction of fine-grained back fill soil, a free draining granular material with minimal fines (less than 15%) should be utilized. For design purposes, the unit weight of the granular back fill material can be taken as 135 pounds per cubic foot (pcf) or as determined by laboratory testing.

As a minimum, the zone of back fill should extend from the bottom of the drainage zone and slope at an angle of 60 degrees from the horizontal. The upper two feet of back fill should consist of a relatively low permeability fine-grained soil to minimize surface water infiltration. The placement of a woven filter fabric between the fine-grained soil and the granular material to prevent segregation of the fine-grained particles into the granular back fill is advised. A perimeter drainage system, either gravity flow or a sump system with pumps is recommended. Surcharge loading, due to vehicles, construction equipment, etc., should be included in the design procedure as required.

Should the wall be constructed on a “design-build” basis, the contractor responsible for constructing the retaining wall must furnish shop drawings to the project Engineer of Record for review and approval that indicates the minimum following information:

- Plan view of the proposed excavation site,
- Locations of existing and proposed utilities (both above and below grade),
- Size and orientation of <each> excavation with required offset between temporary and finished wall section,
- Proposed bottom and top of excavation elevations,
- Design calculations certified by a qualified and Tennessee licensed Professional Engineer,
- Method of dewatering during construction.

The contractor is responsible for all site safety and must follow all applicable federal, state and local laws, rules, and regulations governing workplace, employee, personal, and public safety. Access to the work area by unauthorized personnel should be prohibited.

Initial Filling Procedure Upon completion of construction, the structures should be initially filled in increments of 25 percent or less with sufficient time between increments to allow the each structure and its foundation to stabilize. If excessive or non-uniform movement is observed, then filling operations should be stopped immediately and ESE contacted.

All piping should be provided with flexible connections where feasible. Furthermore, piping connections should be made after filling if practical.

Pavement Recommendations: Pavements for the project will be designed for automobile traffic with truck traffic in designated areas only. In the project area, both asphalt and Portland cement concrete pavements are used successfully. Asphalt pavements typically have a lower initial cost than concrete but require more routine maintenance over the life of the asphalt pavement and, depending upon factors such as the contractor's expertise and weather, can be more difficult to control during construction.

When parking and drive areas are proof rolled, it may become apparent that undercutting of soils observed to deflect and rut under the load of the dump truck will be necessary for successful use of the design pavement sections. The actual depth of undercutting, if necessary, will be dependent upon the condition of the soils at the time and the thickness of structural fill (if any) necessary to achieve design subgrade. The lower near surface soil strengths at borings G-3, G-12, G-15, and G-16 indicate the need for undercutting prior to pavement construction.

In entrance and exit ways, loading areas, trash dumpster areas, tight turn areas, docks, and any other high traffic areas, the use of Portland cement concrete pavements is recommended. The concrete pavements should be sufficiently large enough to cover the area beneath the front wheels of the vehicle, particularly in trash dumpster area(s). In the following sections, recommendations for both asphalt and Portland cement pavements are presented.

Asphalt Pavements Based on the soils encountered at the site, assumed traffic conditions, and past experience, the following minimum pavement section is provided for regular duty asphalt paving:

Wearing surface:	1 inch
Asphalt binder course:	2 inches
Compacted aggregate base course: (95% Standard Proctor)	6 inches
Compacted subgrade: (95% Standard Proctor)	9 inches

In any areas expected to receive more frequent passes and trucks, the following is recommended:

Wearing surface:	1.5 inches
Asphalt binder course:	3 inches
Compacted aggregate base course: (95% Standard Proctor)	8 inches
Compacted subgrade: (95% Standard Proctor)	9 inches

Concrete Pavements The following minimum section is provided for regular duty concrete paving:

Portland cement concrete:	4 inches
Aggregate base course: (95% Standard Proctor)	5 inches
Compacted subgrade (95% Standard Proctor)	9 inches

In areas to be frequented by trucks and designated for heavier traffic (including trucks), the regular duty concrete section above should be increased to:

Portland cement concrete:	6 inches
Aggregate base course: (95% Standard Proctor)	6 inches
Compacted subgrade (95% Standard Proctor)	9 inches

Pedestrian walks can be constructed as shown:

Portland cement concrete:	4 inches
Compacted subgrade (95% Standard Proctor)	9 inches

Design and Construction The provided asphalt and concrete sections are minimums derived from a subgrade California Bearing Ratio (CBR) assumed from similar projects and past experience. Additionally, pavement loading information has been assumed from similar projects. Regular duty traffic area loading has been assumed to be 500 automobiles per day and daily heavy duty traffic has been assumed as 4 (16 kips) five axle trucks, 12 (16 kips) two axle vans, and 30 automobiles.

All paving, regardless of asphalt or concrete should conform to applicable sections of the *Kentucky Standard Specifications for Road and Bridge Construction*. Dense Graded Aggregate (DGA) as defined by Section 805 of the *Kentucky Standard Specifications for Road and Bridge Construction* may be used as aggregate base course.

Only asphalt with Kentucky Transportation Cabinet approved mix designs should be utilized. These typically include the following properties:

Surface Course		Binder Course	
Marshall Stability:	1,200 lb.	Marshall Stability:	1,000 lb.
Percent Asphalt:	4-8 percent	Percent Asphalt:	3-7 percent
Voids Total Mix:	3-5 percent	Voids Total Mix:	3-7 percent

Concrete paving should be designed to attain a minimum compressive strength of 4000 psi at 28 days and be air entrained sufficiently (usually 4 to 6 percent) to improve durability. Concrete should be placed at slumps that will allow it to attain the recommended minimum strength.

Additionally, concrete pavements should be designed with adequate reinforcing steel and joint spacing to prevent potential cracking and provide proper load distribution. As a minimum, wire mesh or fiber mesh should be utilized. In areas where heavy traffic is expected and other areas where trucks will turn sharply back and forth (such as loading docks and dumpster pads), reinforcement consisting of No. 4 bars on 14 inches centers should be used as minimum reinforcement.

Proper drainage to eliminate water ponding in the pavement area is essential to long term pavement performance. Both the pavement surface and soil subgrade should be adequately sloped to prevent water from ponding on the pavement or ponding on the soil subgrade beneath the subgrade. Adequate drainage relief should be incorporated into the design to remove water from beneath the pavement area. In some cases, subsurface drains may be necessary.

Thicker pavement sections would reduce the potential for pavement cracking and deformation and may be required depending on the actual traffic loading conditions (or local building code requirements).

Closure The findings presented in this report are derived from the soils encountered in the borings and information provided by representatives of McGhee Engineering, Inc.. Should conditions during site development and construction activities differ from those discussed in this report, ESE should be contacted so that our recommendations can be reviewed and revised, if necessary.

All reports, drawings, specifications, computer files, field data, notes, and other documents and instruments prepared by ESE in the performance of this study are considered as instruments of service and remain the property of ESE. ESE retains all common law, statutory, and other reserved rights, including the copyright thereto.

ESE's scope of services did not include any environmental assessment for the presence or absence of hazardous or toxic materials in the soil or groundwater at or adjacent to the site studied. Additionally, ESE's services did not include the verification or delineation of any potential wetlands at the site. Any statements in this report or on the subsurface exploration logs concerning soil odors, colors, or other unusual conditions are strictly for the information of the client. Prior to purchase or development of this site, a thorough environmental assessment is recommended. ESE is available to assist with these services if desired.

Geotechnical recommendations cannot be considered complete until the Geotechnical Engineer has the opportunity to confirm the subsurface conditions via field observations during construction. It is critical that ESE's staff provide inspection during proof-rolling and foundation installations to confirm that the recommendations provided herein are properly interpreted and implemented. ESE is available to continue our assistance with the project continued geotechnical engineering oversight, construction materials testing, and special inspections during construction; and would be happy to provide a proposal for these services at the appropriate time.

This report may be distributed and relied upon by the Client. Reliance on the information and conclusions in this report by any other person or entity is not authorized without the written consent of Earth Science Engineering, LLC. Thank you for this opportunity to assist you with this project.

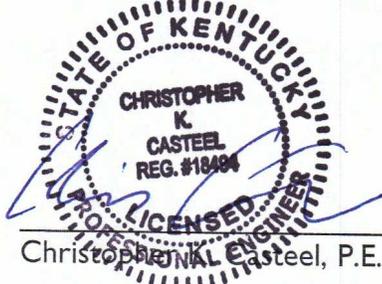
Thank you for this opportunity to assist you with this project. If you have any questions or if ESE may be of further service in any manner, please do not hesitate to call 931-645-8008 or e-mail alice@eseng.us.

Respectfully submitted,

EARTH SCIENCE ENGINEERING, LLC



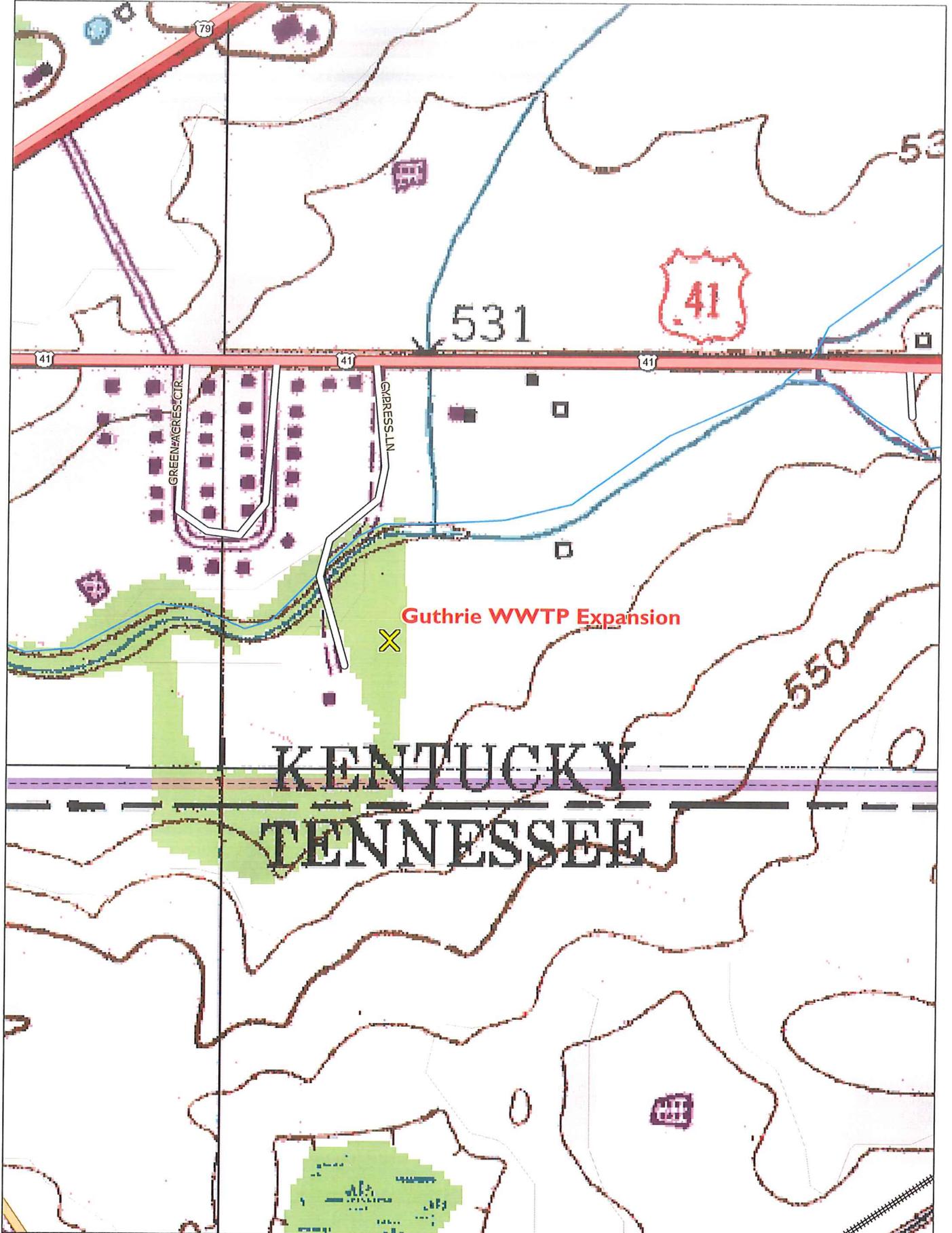
Shannon L. Medina



Christopher K. Casteel, P.E.

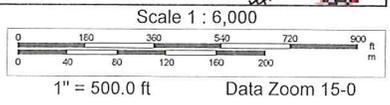
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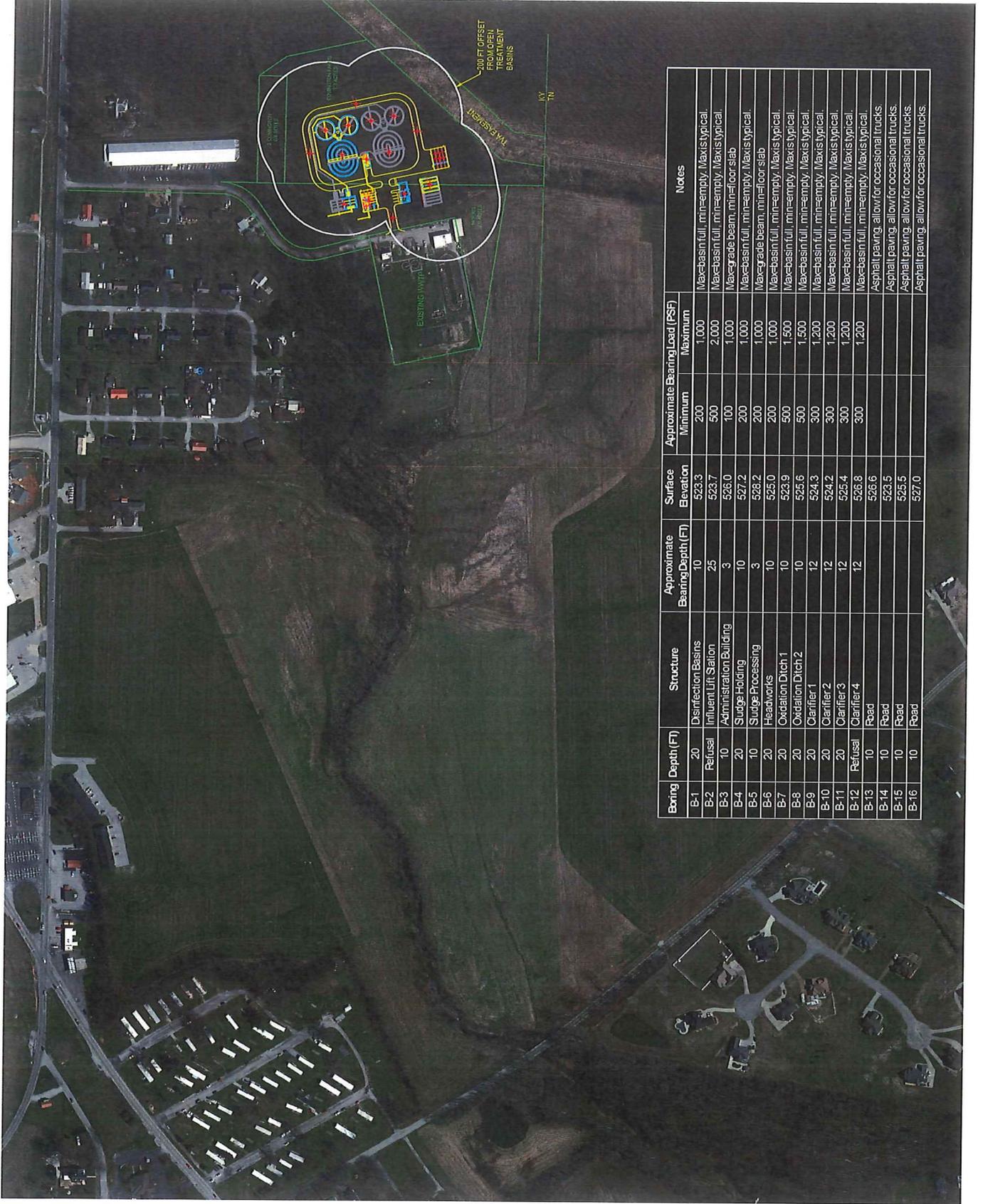
- Attachments:
- USGS Topographical Map (1 page)
 - Aerial Photograph (1 page)
 - Site Photographs (1 page)
 - Project Aerial Plan (1 page)
 - ReMi Testing Results (1 page)
 - Applied Technology Council Seismic Data (2 pages)
 - Standard Proctor (1 page)
 - Photoionization Detector Readings (3 pages)
 - Boring Location Plan (1 page)
 - Subsurface Exploration Log Key (1 page)
 - Subsurface Exploration Logs (16 pages)



Guthrie WWTP Expansion

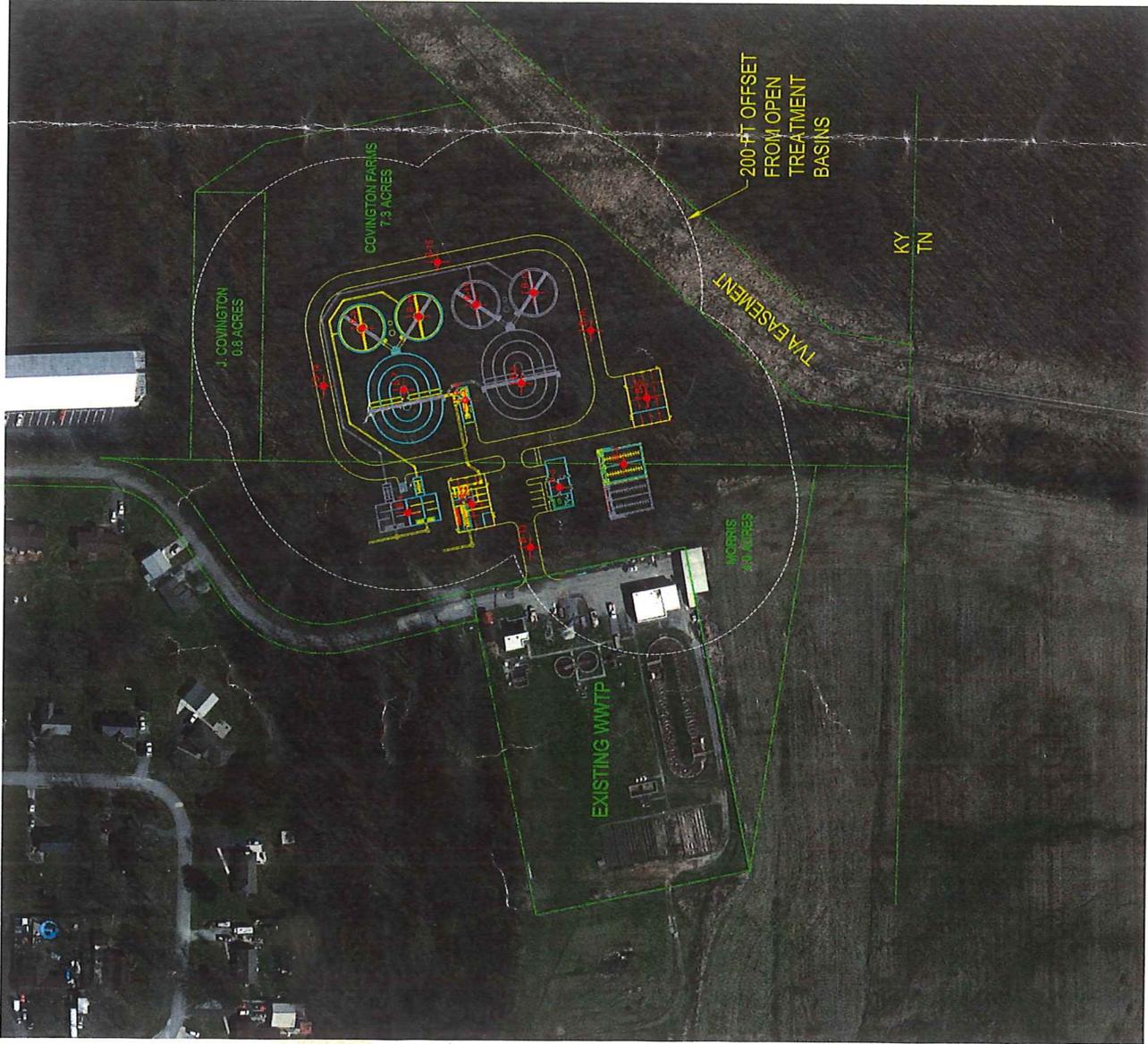
KENTUCKY
TENNESSEE





Boring	Depth (FT)	Structure	Approximate Bearing Depth (FT)	Surface Elevation	Approximate Bearing Load (PSF)		Notes
					Minimum	Maximum	
B-1	20	Disinfection Basins	10	523.3	200	1,000	Max-basin full, min-empty. Max is typical.
B-2	Petrusal	Influent Lift Station	25	523.7	500	2,000	Max-basin full, min-empty. Max is typical.
B-3	10	Administration Building	3	526.0	100	1,000	Max-grade beam, min-floor slab
B-4	20	Sludge Holding	10	527.2	200	1,000	Max-basin full, min-empty. Max is typical.
B-5	10	Sludge Processing	3	526.2	200	1,000	Max-grade beam, min-floor slab
B-6	20	Headworks	10	526.0	200	1,000	Max-basin full, min-empty. Max is typical.
B-7	20	Oxidation Ditch 1	10	523.9	500	1,500	Max-basin full, min-empty. Max is typical.
B-8	20	Oxidation Ditch 2	10	525.6	500	1,500	Max-basin full, min-empty. Max is typical.
B-9	20	Clarifier 1	12	524.3	300	1,200	Max-basin full, min-empty. Max is typical.
B-10	20	Clarifier 2	12	524.2	300	1,200	Max-basin full, min-empty. Max is typical.
B-11	20	Clarifier 3	12	525.4	300	1,200	Max-basin full, min-empty. Max is typical.
B-12	Petrusal	Clarifier 4	12	526.8	300	1,200	Max-basin full, min-empty. Max is typical.
B-13	10	Road		526.6			Asphalt paving, allow for occasional trucks.
B-14	10	Road		523.5			Asphalt paving, allow for occasional trucks.
B-15	10	Road		525.5			Asphalt paving, allow for occasional trucks.
B-16	10	Road		527.0			Asphalt paving, allow for occasional trucks.





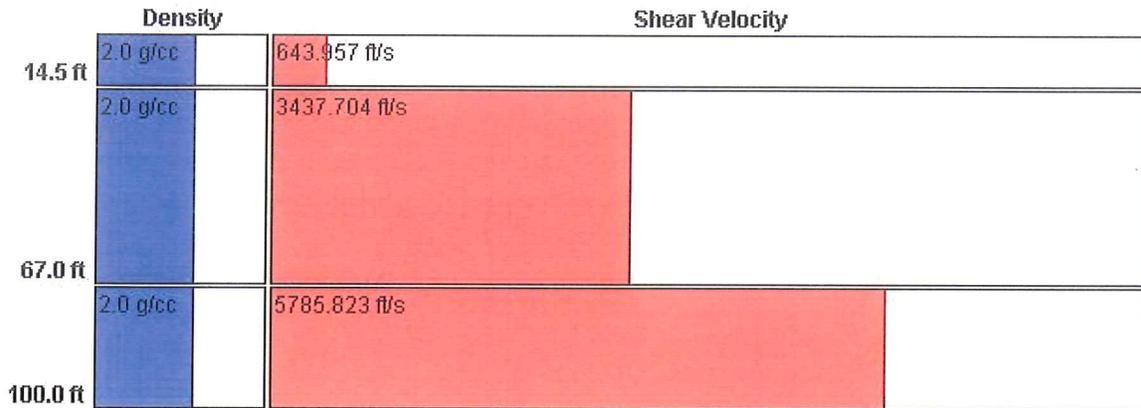
Boring	Depth (FT)	Structure
B-1	20	Disinfection Basins
B-2	Refusal	Influent Lift Station
B-3	10	Administration Building
B-4	20	Sludge Holding
B-5	10	Sludge Processing
B-6	20	Headworks
B-7	20	Oxidation Ditch 1
B-8	20	Oxidation Ditch 2
B-9	20	Clarifier 1
B-10	20	Clarifier 2
B-11	20	Clarifier 3
B-12	Refusal	Clarifier 4
B-13	10	Road
B-14	10	Road
B-15	10	Road
B-16	10	Road

GUTHRIE WWTP
 SOIL BORING LOCATIONS
 McGhee Engineering, Inc.
 10/22/24

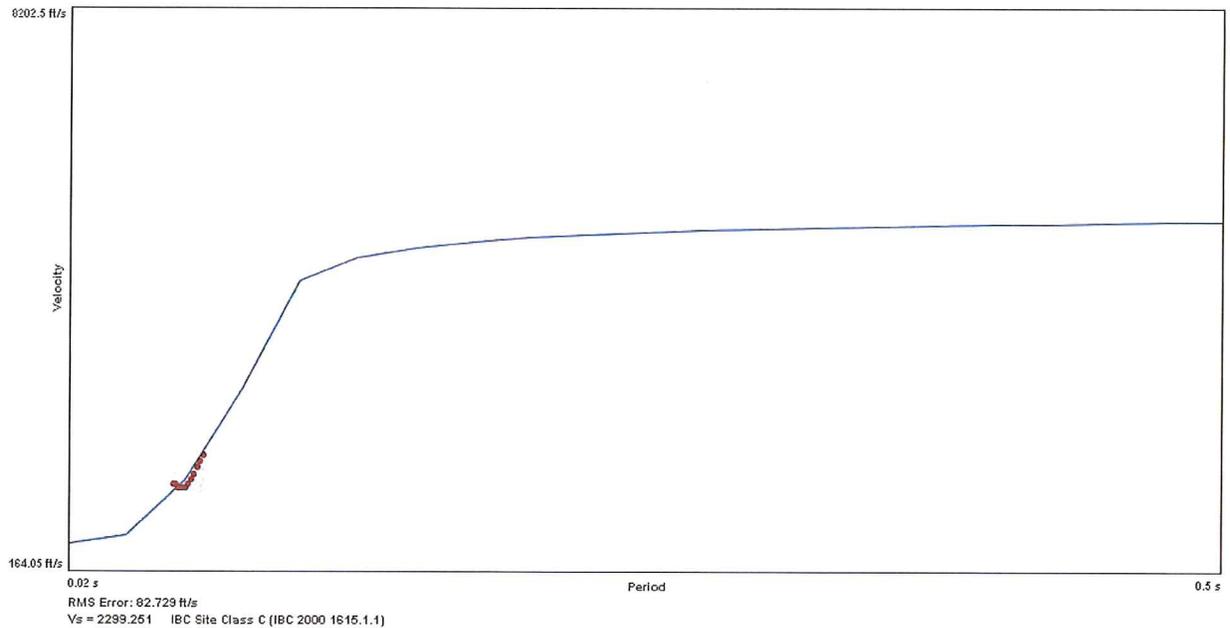
ReMi Testing Results

Project:	Guthrie WWTP Expansion	Date:	Nov 2024
Client:	McGhee Engineering	Project no.:	48166
Weather:	Cloudy, 51°	ESE Personnel:	AMM/SLM

Shear Velocity vs. Depth



Dispersion Curve



Calculated Avg. Shear Wave Velocity (feet/second):	2,299	Site Class (IBC):	C
--	-------	-------------------	---



The ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

ATC Hazards by Location site operations will discontinue at 11:59pm (PST) on December 31, 2024

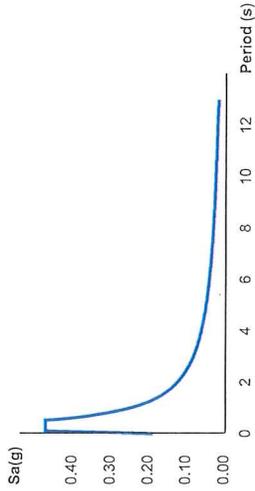
ATC Hazards by Location

Search Information

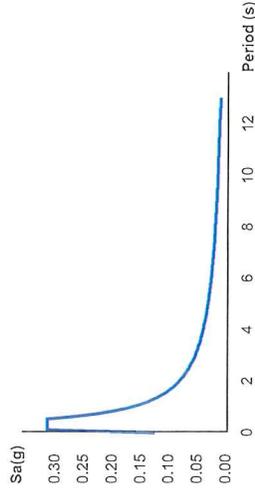
Coordinates: 36.643548, -87.187963
 Elevation: 538 ft
 Timestamp: 2024-12-11T19:37:59.397Z
 Hazard Type: Seismic
 Reference Document: ASCE7-16
 Risk Category: III
 Site Class: C



MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S _S	0.363	MCE _R ground motion (period=0.2s)
S ₁	0.166	MCE _R ground motion (period=1.0s)
S _{MS}	0.472	Site-modified spectral acceleration value
S _{M1}	0.249	Site-modified spectral acceleration value
S _{Ds}	0.315	Numeric seismic design value at 0.2s SA
S _{D1}	0.166	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	C	Seismic design category
F _a	1.3	Site amplification factor at 0.2s
F _v	1.5	Site amplification factor at 1.0s
CR _S	0.877	Coefficient of risk (0.2s)
CR ₁	0.858	Coefficient of risk (1.0s)
PGA	0.184	MCE _G peak ground acceleration

F _{PGA}	1.216	Site amplification factor at PGA
PGA _M	0.224	Site modified peak ground acceleration
T _L	12	Long-period transition period (s)
SsRT	0.363	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.414	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.166	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.194	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

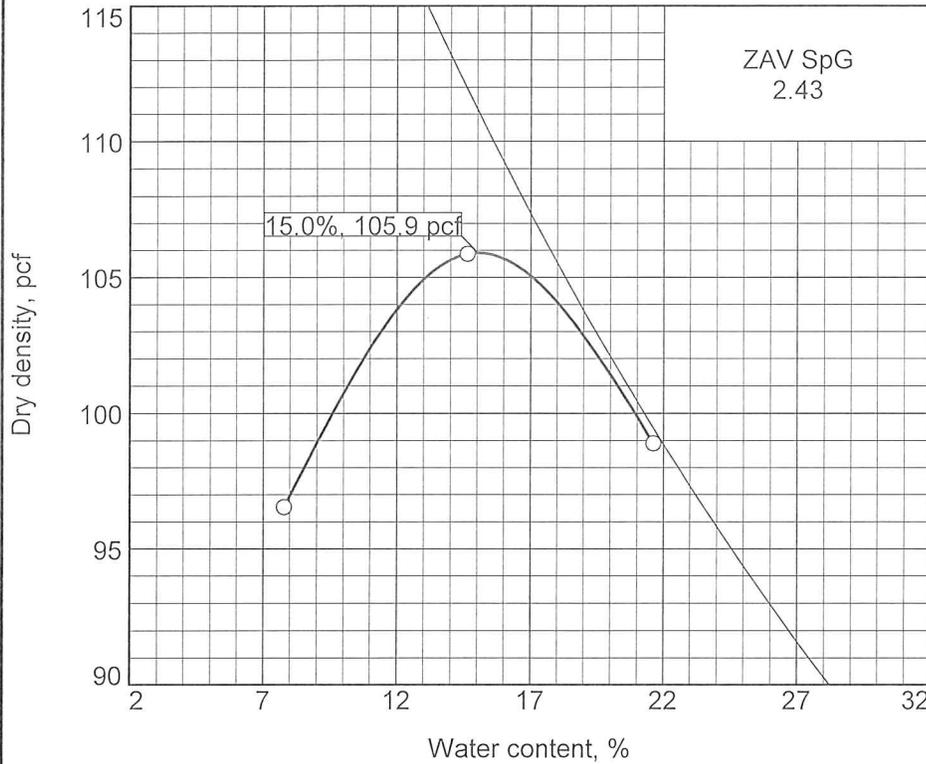
Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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COMPACTION TEST REPORT

Curve No.
1



Test Specification:
ASTM D 698-00a Method B Standard

Preparation Method Dry
 Hammer Wt. 5.5 lb.
 Hammer Drop 12 in.
 Number of Layers three
 Blows per Layer 25
 Mold Size 0.03333 cu. ft.

Test Performed on Material
 Passing 3/8 in. Sieve

NM 18.1 LL 41 PI 20
 Sp.G. (ASTM D 854) 2.43 (assumed)

%>3/8 in. %<No.200

USCS CL AASHTO -

Date Sampled 11/19/2024

Date Tested 12/03/2024

Tested By L. Pack

TESTING DATA

	1	2	3	4	5	6
WM + WS	3767.2	4028.7	4012.2			
WM	2194.0	2194.0	2194.0			
WW + T #1	265.5	273.1	242.4			
WD + T #1	246.8	239.1	200.5			
TARE #1	6.6	6.7	6.7			
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	7.8	14.6	21.6			
DRY DENSITY	96.5	105.9	98.9			

TEST RESULTS	Material Description
Maximum dry density = 105.9 pcf Optimum moisture = 15.0 %	Brown with tan and gray silty CLAY
Project No. 48166 Client: McGhee Engineering Project: Guthrie WWTP Expansion ○ Location: Boring G-5 at (-)2 to 6'	Remarks:
Earth Science Engineering, LLC	Checked by: S. Medina
Clarksville, TN	Title:
	Figure

Guthrie WWTP - Guthrie, KY

Boring	Depth	PID Reading
G-1	1-2.5	103.1
	3.5-5	54.6
	6-7.5	45.9
	8.5-10	25.1
	13.5-15	45.3

Boring	Depth	PID Reading
G-2	1-2.5	7.9
	3.5-5	5.3
	6-7.5	2.5
	8.5-10	10.7
	13.5-15	11
	18.5-20	5.7
	23.5-25	2.6

Boring	Depth	PID Reading
G-3	1-2.5	3.8
	3.5-5	5.8
	6-7.5	5.6
	8.5-10	4.6

Boring	Depth	PID Reading
G-4	1-2.5	4.8
	3.5-5	5.6
	6-7.5	5
	8.5-10	5.3
	13.5-15	4
	18.5-20	2.9

Boring	Depth	PID Reading
G-5	1-2.5	1.3
	3.5-5	1.5
	6-7.5	1.5
	8.5-10	1.5

Guthrie WWTP - Guthrie, KY

Boring	Depth	PID Reading
G-6	1-2.5	6.2
	3.5-5	7
Shelby	6-7.5	-
	8.5-10	3.6
	13.5-15	3.1
	18.5-20	3.1
	23.5-25	2.7

Boring	Depth	PID Reading
G-7	1-2.5	27.1
	3.5-5	12.4
	6-7.5	14
	8.5-10	8.4
	13.5-15	5.7

Boring	Depth	PID Reading
G-8	1-2.5	1.2
	3.5-5	1.7
	6-7.5	59.8
	8.5-10	48.1
	13.5-15	22.3
	18.5-20	20.2

Boring	Depth	PID Reading
G-9	1-2.5	102.9
	3.5-5	109.9
	6-7.5	77
	8.5-10	29.8
	13.5-15	5.4

Boring	Depth	PID Reading
G-10	1-2.5	11.7
	3.5-5	3.8
	6-7.5	6.4
	8.5-10	6.7
	13.5-15	11

Guthrie WWTP - Guthrie, KY

Boring	Depth	PID Reading
G-11	1-2.5	14.6
	3.5-5	8.1
	6-7.5	6
	8.5-10	9.2
	13.5-15	2.9

Boring	Depth	PID Reading
G-12	1-2.5	10.9
	3.5-5	7.3
	6-7.5	5.8
	8.5-10	4.2
	13.5-15	5.8
	18.5-20	4.7

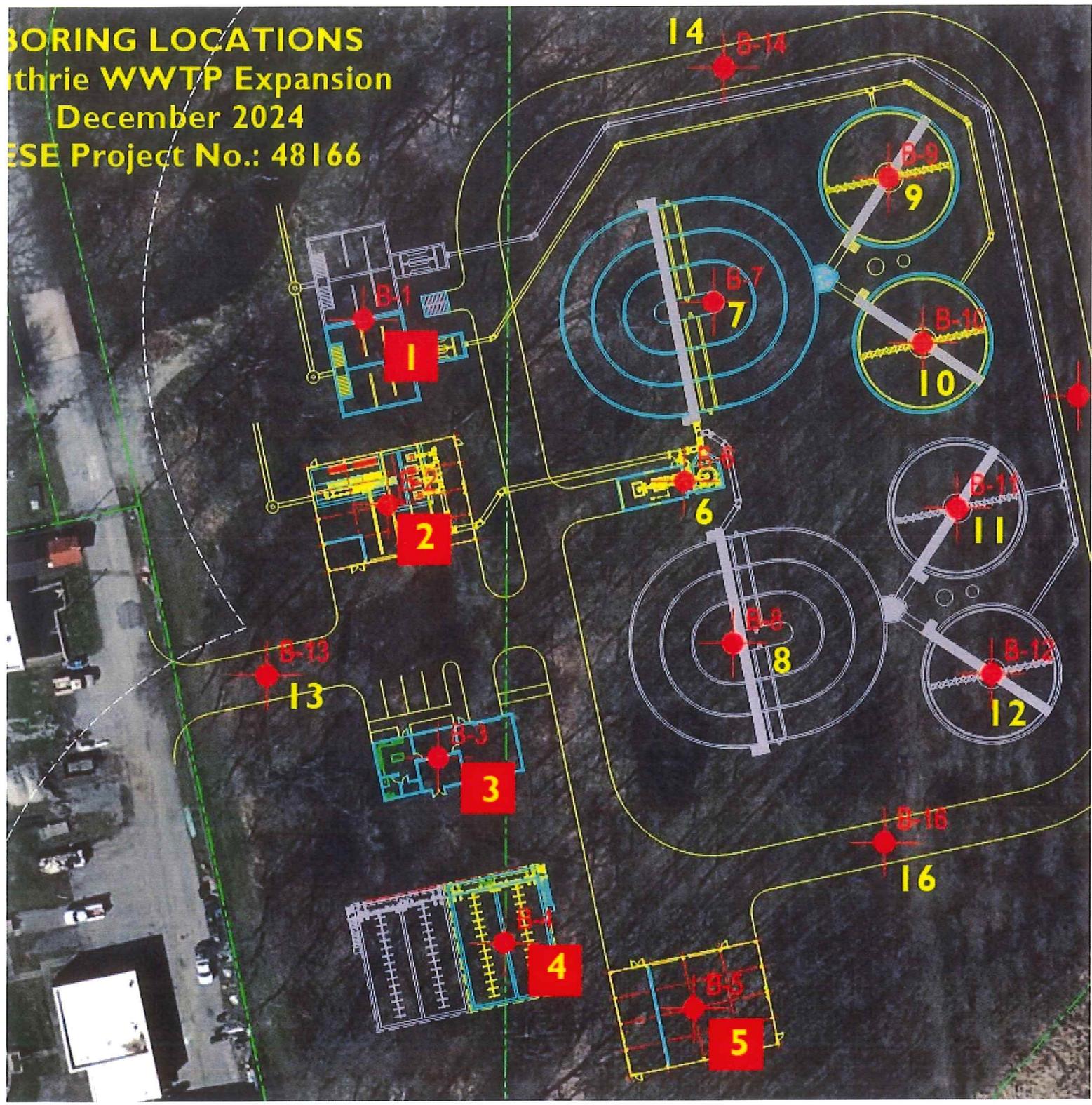
Boring	Depth	PID Reading
G-13	1-2.5	4.3
	3.5-5	2.4
	6-7.5	4.7
	8.5-10	3.6

Boring	Depth	PID Reading
G-14	1-2.5	2.9
	3.5-5	4.1
	6-7.5	4.2
	8.5-10	3.8

Boring	Depth	PID Reading
G-15	1-2.5	4.2
	3.5-5	3.9
	6-7.5	3.5
	8.5-10	4

Boring	Depth	PID Reading
G-16	1-2.5	4.3
	3.5-5	4

BORING LOCATIONS
Northrie WWTP Expansion
December 2024
ESE Project No.: 48166



KEY TO SUBSURFACE EXPLORATION LOG SYMBOLS

DRILLING AND SAMPLING SYMBOLS

SS: Split-spoon; 1 3/8" I.D., 2" O.D.

AU: Auger bag sample

ST: Shelby tube; 3" O.D.

DB: Diamond bit (rock coring)

SOIL PROPERTY SYMBOLS

Qp: Unconfined compressive strength, hand penetrometer, tsf

Qu: Unconfined compressive strength, Shelby tube sample

N: Blows per foot of a 140 lb hammer falling 30 inches on a 2" O.D. split spoon

QR: Unconfined compressive strength, RIMAC® field test device, tsf

mc: Percent of water in sample, %

LL: Liquid limit, %

Dd: Sample dry density, pcf

PI: Plasticity Index

-#200: Percent of sample passing a #200 sieve

-#4: Percent of sample passing a #4 sieve

RELATIVE DENSITY AND CONSISTENCY

COHESIVE SOILS (clays & silts)

<u>N</u>	<u>Consistency</u>	<u>Qu (tsf)</u>
0 - 2	Very soft	0 - 0.25
3 - 4	Soft	0.25 - 0.50
5 - 8	Firm	0.50 - 1.00
9 - 15	Stiff	1.00 - 2.00
16 - 30	Very stiff	2.00 - 4.00
> 30	Hard	> 4.00

NON-COHESIVE SOILS (sands & gravels)

<u>N</u>	<u>Relative Density</u>
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

PARTICLE SIZE

Boulders > 8"

Medium sand 0.2mm - 0.6mm

Cobbles 3" - 8"

Fine sand 0.074mm - 0.2mm

Gravel 5mm - 3"

Silt 0.005mm - 0.074mm

Coarse sand 0.6mm - 5mm

Clay < 0.005mm





Earth Science Engineering, LLC

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Clarksville, TN 37040
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LOG OF BORING G-1

(Page 1 of 1)

Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/20/2024
Date Completed : 11/20/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition	Water Levels	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	Water Level
			Split Spoon Shelby Tube Auger Cuttings Rock Core	Delayed Reading After 24 hours								
			DESCRIPTION									
0	523		VERY SOFT dark brown with orange and black silty CLAY (small sample recovery) with chert fragments		CL		2					
5	518		Very Stiff brown with tan, orange, and gray weathered cherty silty CLAY with sand	N = 26	CL		26			2.2	100	
			Stiff brown with tan, orange, and gray weathered cherty CLAY with sand		CL-CH		14					
10	513		Firm brown with tan, orange, black, and gray CLAY with weathered chert fragments		CH		7			1.5	97	
15	508		SOFT brownish red with black and tan with trace gray CLAY (moist) with sand		CH		4					
<p>Boring was terminated at (-)17' due to auger refusal.</p> <p>During drilling, no free water was encountered and the boring was observed with water at (-)6' after approximately 15 hours.</p>												
20												

12-12-2024 \\Ck-cp\esl\Word Processing\Other Files\MTECH Boring Log Files\2024 Projects\Guthrie WWTP Expansion\G-1.bo



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LOG OF BORING G-2

(Page 1 of 1)

Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/18/2024
Date Completed : 11/18/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev. 524	Samples	Sample Condition	Water Levels	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	Water Level
			Split Spoon Shelby Tube Auger Cuttings Rock Core	Delayed Reading During Drilling								
DESCRIPTION												
0	524		Stiff brown with tan, red, and gray silty CLAY		CL		12			3.0	106	
5	519		Very Stiff brownish orange with tan and gray silty CLAY with chert fragments		CL		20					
			Stiff gray with tan and brown silty CLAY		CL		11			2.5	116	
10	514		Stiff brown with orange with tan and gray silty CLAY with chert fragments and chunks		CL		14					
15	509		Stiff brown with gray and tan CLAY (slightly moist)		CH		9					
20	504		VERY SOFT brown and tan cherty CLAY (moist)		CH		2					
25	499		VERY SOFT brown with orange and black CLAY (saturated)		CH		0					
<p>Boring was terminated at (-)27.5' due to auger refusal.</p> <p>During drilling, free water was encountered at (-)12' and the boring was observed with water at (-)10' after approximately 7 hours.</p>												
30												



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LOG OF BORING G-3

(Page 1 of 1)

Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/18/2024
Date Completed : 11/18/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition				USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon	Shelby Tube	Auger Cuttings	Rock Core							
			DESCRIPTION										
0	526		Firm brownish gray with brown CLAY (moist)				CH		~10	~2.5	~25		
5	521		Very Stiff brownish red with gray and tan cherty silty CLAY				CL		~15	~3.5	~25	0.9	90
10			Stiff brownish red with gray and tan cherty silty CLAY				CL		~15	~3.5	~25		
<p>Boring was terminated at (-)10'.</p> <p>During drilling, no free water was encountered and the boring was dry at completion.</p>													



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LOG OF BORING G-4

(Page 1 of 1)

Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/18/2024
Date Completed : 11/18/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition		USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon Shelby Tube Auger Cuttings Rock Core	DESCRIPTION							
0	527			Firm dark brown with brownish gray with trace orange silty CLAY (slightly moist)	CL						
5	522			Stiff gray with brown silty CLAY	CL					3.4	102
				Very Stiff brownish orange with brown and gray cherty silty CLAY (small sample recovery)	CL						
10	517			Very Stiff brownish orange with gray and dark brown cherty silty CLAY	CL						
15	512			Firm brownish orange with tan CLAY (moist)	CL-CH						
20	507			VERY SOFT brownish orange with tan CLAY (moist)	CH						
<p>Boring was terminated at (-)21' due to auger refusal.</p> <p>During drilling, no free water was encountered.</p> <p>Cave in depth was encountered at (-)3'.</p>											
25											

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LOG OF BORING G-5

(Page 1 of 1)

Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/19/2024
Date Completed : 11/19/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition				USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon	Shelby Tube	Auger Cuttings	Rock Core							
			DESCRIPTION										
0	528		Firm dark brown with trace tan silty CLAY (slightly moist)				CL						
			LL = 44 PI = 23 at 3.5' Stiff gray with tan silty CLAY with roots				CL					5.3	114
5	523		Very Stiff brown with tan, orange, and black silty CLAY with weathered chert fragments				CL						
			Very Stiff brownish orange with tan cherty silty CLAY				CL		N = 26			2.1	113
10		Boring was terminated at (-)10'. During drilling, no free water was encountered and the boring was dry at completion.											



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LOG OF BORING G-6

(Page 1 of 1)

Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/18/2024
Date Completed : 11/18/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev. 525	Samples	Sample Condition	Water Levels	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	Water Level
			Split Spoon Shelby Tube Auger Cuttings Rock Core	Delayed Reading During Drilling								
DESCRIPTION												
0	525		Stiff brown with tan silty CLAY (slightly moist) with roots		CL		14					
5	520		Very Stiff brown with gray and tan silty CLAY with trace roots		CL		16			5.3	114	
			Brown with tan and gray silty CLAY with chert Qu: 1.8 tsf @ 8.6% strain		CL						115	
10	515		Stiff brownish orange with gray and tan silty CLAY with chert fragments and chunks		CL		15			2.1	110	
15	510		Firm brown with orange with trace black silty CLAY (slightly moist) with chert fragments		CL		6					
20	505		LL = 42 PI = 27 at 18.5' VERY SOFT tan with brown silty CLAY (moist) with chert fragments		CL		2					
25			Very Stiff tan with brown CLAY (moist) with chert fragments		CH		17					
Boring was terminated at (-)25'. During drilling, free water was encountered at (-)20'. Cave in depth was encountered at (-)1'.												

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LOG OF BORING G-7

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Guthrie WWTP Expansion
 Guthrie, Todd County, Kentucky
 McGhee Engineering, Inc.

Date Started : 11/20/2024
 Date Completed : 11/20/2024
 Hole Diameter : 2.25 in.
 Drilling Method : Hollow Stem Auger
 Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
 Helper : B. Spain
 Drill Equipment : STR-174
 Est. surface material : +12" topsoil
 Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev. 524	Samples	Sample Condition		USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon Shelby Tube Auger Cuttings Rock Core	DESCRIPTION							
0	524										
			Firm		CH						
			dark brown with tan and black								
			CLAY (slightly moist) with roots and organic debris								
5	519		Firm		CL						
			brown and tan with orange with trace black								
			weathered cherty silty CLAY with roots								
			#200: 41.9% passing at 6' Medium Dense		SC						
			brownish orange with tan with trace black								
			clayey SAND (slightly moist) with weathered chert fragments								
10	514		Medium Dense		SC						
			brownish orange with tan with trace black								
			clayey SAND (slightly moist; small sample recovery) with weathered chert fragments								
15			Firm		CH						
			brownish red with tan and gray								
			CLAY (moist)								
<p>Boring was terminated at (-)15.5' due to auger refusal.</p> <p>During drilling, no free water was encountered and the boring was dry at completion.</p> <p>Cave in depth was encountered at (-)3'.</p>											

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LOG OF BORING G-8

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Guthrie WWTP Expansion
 Guthrie, Todd County, Kentucky
 McGhee Engineering, Inc.

Date Started : 11/19/2024
 Date Completed : 11/19/2024
 Hole Diameter : 2.25 in.
 Drilling Method : Hollow Stem Auger
 Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
 Helper : B. Spain
 Drill Equipment : STR-174
 Est. surface material : +12" topsoil
 Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev. 526	Samples	Sample Condition				USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon	Shelby Tube	Auger Cuttings	Rock Core							
0	526												
		Split Spoon	VERY SOFT			CH					0.4	82	
			brownish gray with brown										
			CLAY (moist) with roots										
5	521	Split Spoon	Very Stiff			CH							
			brownish orange with black and tan										
			CLAY (slightly moist)										
		Split Spoon	Firm			CH							
			brownish orange with gray with trace black										
			CLAY										
			LL = 51 PI = 33 at 7'										
10	516	Split Spoon	Firm			CL					1.0	110	
			tan with gray										
			sandy silty CLAY										
		Split Spoon	Stiff			CL							
			tan with gray										
			sandy silty CLAY (slightly moist) with chert										
			fragments										
15	511	Split Spoon	Very Stiff			CL							
			brown with tan and gray										
			sandy silty CLAY (moist; small sample										
			recovery) with chert										
20	506		Boring was terminated at (-)20'.										
			During drilling, no free water was encountered and the boring was dry at completion.										
			Cave in depth was encountered at (-)2'.										
25													



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LOG OF BORING G-9

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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/21/2024
Date Completed : 11/21/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition	Water Levels	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	Water Level
			Split Spoon Shelby Tube Auger Cuttings Rock Core	Delayed Reading During Drilling								
DESCRIPTION												
0	524		Stiff brownish gray with tan and black silty CLAY with sand and weathered chert/sandstone		CL		16					
5	519		Very Stiff brownish orange and brown with trace black cherty silt CLAY (small sample recovery)		CL		21					
			Stiff brownish orange with black and gray CLAY (slightly moist) with sand		CH		9			2.5	106	
10	514		Medium Dense brownish orange with tan clayey SAND #200: 33.2% passing at 10'		SC		17					
15	509		Medium Dense gray with brown clayey SAND (slightly moist)		SC		14					
<p>Boring was terminated at (-)16.5' due to auger refusal.</p> <p>During drilling, free water was encountered at (-)10' and the boring was observed with water at (-)7' after approximately 25 hours.</p>												
20												

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LOG OF BORING G-10

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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/21/2024
Date Completed : 11/21/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition	Water Levels	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	Water Level
			Split Spoon Shelby Tube Auger Cuttings Rock Core	Delayed Reading After 24 hours								
			DESCRIPTION									
0	524		Firm dark brown with trace tan CLAY		CH		6					
			LL = 55 PI = 34 ay 3.5' SOFT		CH		4					
5	519		dark brown with trace tan and orange CLAY with chert fragments		CH							
			Hard brown with tan, orange, and black cherty silty CLAY (small sample recovery)		CL		36					
10	514		Stiff brown with tan, orange, and black cherty silty CLAY (small sample recovery)		CL		10					
15	509		Firm brown with tan and orange with trace black CLAY with chert fragments		CH		7					
<p>Boring was terminated at (-)16' due to auger refusal.</p> <p>During drilling, no free water was encountered and the boring was observed with water at (-)12' after approximately 23 hours.</p>												
20												

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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/21/2024
Date Completed : 11/21/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition	Water Levels	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	Water Level
			Split Spoon Shelby Tube Auger Cuttings Rock Core	Delayed Reading During Drilling								
DESCRIPTION												
0	525		Stiff brownish gray with tan CLAY		CH		10			1.6	97	
			Stiff brownish orange with tan and brown silty CLAY		CL		10			3.5	103	
5	520		Very Stiff tan with orange and gray with trace black cherty silty CLAY with sand		CL		20					
			Stiff brownish orange with tan sandy CLAY (small sample recovery)		CL		11					
10	515		VERY LOOSE tan with brownish red and orange poorly graded SAND (saturated) with clay clumps		SP		4					
<p>Boring was terminated at (-)17' due to auger refusal.</p> <p>During drilling, free water was encountered at (-)10' and the boring was observed with water at (-)9' after approximately 20 hours.</p>												
15	510											
20												

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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/21/2024
Date Completed : 11/21/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition	Water Levels	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	Water Level
			Split Spoon Shelby Tube Auger Cuttings Rock Core	Delayed Reading After 24 hours								
DESCRIPTION												
0	527		Firm brownish orange with brown and red silty CLAY (slightly moist) with trace roots		CL		6					
			Firm gray with brownish gray silty CLAY		CL		7			1.3	98	
5	522		Very Stiff brown with tan and orange cherty silty CLAY (small sample recovery)		CL		19					
			LL = 46 PI = 31 at 8.5' Stiff brown with tan silty CLAY (small sample recovery)		CL		12					
10	517		Firm brownish red with tan and black CLAY with chert fragments and chunks		CH		7					
15	512		Hard brownish red CLAY with chert fragments		CH		60					
20	507		Boring was terminated at (-)20' due to auger refusal. During drilling, no free water was encountered and the boring was observed with water at (-)17' after approximately 17 hours.									
25												

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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/18/2024
Date Completed : 11/18/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev.	Samples	Sample Condition				USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon	Shelby Tube	Auger Cuttings	Rock Core							
			DESCRIPTION										
0	527		Stiff brown with tan and gray with trace orange silty CLAY (moist)			CL							
			Hard brown with orange silty CLAY (small sample recovery)	N = 48		CL							
5	522		Very Stiff brown with tan and orange silty CLAY with weathered chert fragments and chunks			CL							
			Stiff brown and gray with orange and tan CLAY			CH						2.0	91
10		Boring was terminated at (-)10'. During drilling, no free water was encountered and the boring was dry at completion.											



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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/21/2024
Date Completed : 11/21/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev. 524	Samples	Sample Condition				USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon	Shelby Tube	Auger Cuttings	Rock Core							
0	524		VERY SOFT brownish gray with brown silty CLAY (slightly moist; small sample recovery) LL = 38 PI = 19 at 2.5'				CL						
5	519		Stiff brown with orange, tan, and black cherty silty CLAY				CL					4.3	100
			Firm brown with tan, gray, and orange CLAY with chert fragments				CL-CH						
10			Firm brown with gray, black, and orange CLAY with sand				CH						
<p>Boring was terminated at (-)10'.</p> <p>During drilling, no free water was encountered.</p> <p>Cave in depth was encountered at (-)4'.</p>													



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LOG OF BORING G-15

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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/22/2024
Date Completed : 11/22/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev. 526	Samples	Sample Condition	USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)	
			Split Spoon Shelby Tube Auger Cuttings Rock Core								
			DESCRIPTION								
0	526		Firm brownish gray with brown CLAY (slightly moist) with trace roots	CH							
			Stiff brownish gray with brown CLAY (slightly moist) with organic debris	CH							
5	521		Very Stiff brownish orange with tan sandy cherty CLAY	CH							
			Very Stiff brownish orange with tan cherty CLAY	CH							
10		Boring was terminated at (-)10'. During drilling, no free water was encountered and the boring was dry at completion.									

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Guthrie WWTP Expansion
Guthrie, Todd County, Kentucky
McGhee Engineering, Inc.

Date Started : 11/22/2024
Date Completed : 11/22/2024
Hole Diameter : 2.25 in.
Drilling Method : Hollow Stem Auger
Sampling Method : SPT; automatic hammer

Driller : D. Hendrix
Helper : B. Spain
Drill Equipment : STR-174
Est. surface material : +12" topsoil
Surface elevations are approximate

ESE Project no: 48166

Depth in Feet	Surf. Elev. 527	Samples	Sample Condition		USCS	GRAPHIC	N-value (blows per foot)	Qp (tsf)	mc (%)	Qr (tsf)	Dd (pcf)
			Split Spoon	Shelby Tube							
0	527										
					CH						
			Firm								
			brownish gray with tan with trace black								
			CLAY (slightly moist)								
					CH						
			Very Stiff	N = 29							
			dark brown with black with trace tan								
			CLAY with organic debris								
5			Boring was terminated at (-)5.5' due to auger refusal.								
			Boring was offset 5 feet towards the north and was terminated at (-)4.5' due to auger refusal.								
			During drilling, no free water was encountered and the boring was dry at completion.								