SUBSURFACE EXPLORATION RECOMMENDATIONS

PROPOSED STONEBRIDGE INDUSTRIAL DEVELOPMENT
Lafayette Center and Fogwell Drive
Fort Wayne (Allen County), Indiana

GME TESTING PROJECT NO.
G13-052421

PREPARED FOR:
ENGINEERING RESOURCES, INC.
Attn: Mr. Kurt Heidenreich, P.E.
9385 Auburn Road
Fort Wayne, IN 46825

May 29, 2013

GME TESTING

3517 Focus Drive ▪ P.O. Box 8358 ▪ Fort Wayne, Indiana 46898

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May 29, 2013
GME Ref: G13-052421

Engineering Resources, Inc.
9385 Auburn Road
Fort Wayne, IN 46825
ATTN: Mr. Kurt Heidenreich, P.E.

REF: Proposed Stonebridge Industrial Development
Lafayette Center and Fogwell Drive
Fort Wayne (Allen County), Indiana

Dear Kurt:

In compliance with your request, ***GME Testing*** is pleased to submit three copies of our subsurface exploration and recommendations report for the above referenced project. Our work was performed in accordance with our proposal (GMEP13-057359) dated May 17, 2013.

This report contains the results of our field and laboratory-testing program, an engineering interpretation of this data with respect to the available information, and subgrade recommendations to guide design and construction of this project. We wish to remind you that we will store the samples for 30 days after which time they will be discarded unless you request otherwise.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact us at your convenience.

Sincerely,
GME TESTING

Rami M. Anabtawi, P.E.

Robert McMichael, P.E.

RAMI M. ANABTAWI REGISTERED No. 920294 STATE OF INDIANA PROFESSIONAL ENGINEER

Enc.

PURPOSE OF STUDY

The purpose of this evaluation was to perform a subsurface exploration and develop geotechnical recommendations to guide the project design and construction team in preparing the site preparation plans for the proposed roadway and associated utilities.

SITE AND PROJECT DESCRIPTION

<u>Site Conditions</u>

The proposed industrial park will be constructed south of the Lafayette Center Road and Fogwell Drive intersection, between Zubrick Road and Aboite Road in Fort Wayne Indiana. At the time of our field exploration, the site was relatively level to gently sloping to the south and southwest with a maximum relief of approximately 20-feet (i.e., El. 857 to El. 836). The site is currently being used for agricultural purposes. The southernmost portion of the site was generally wooded with patches of wetland areas, according to a preliminary development plan provided. The project location is approximately shown in aerial map, Figure 1 below.

Figure 1: Aerial Map of Approximate Site Location

The surrounding areas are generally developed with commercial and industrial structures, roadways and above and below ground utilities.

Proposed Construction

It is our understanding that Allen County Redevelopment Commission is considering the development of approximately 192 acres into 12 industrial parcels ranging in sizes from about 8 to 14 acre each. Based on a preliminary development plan of the site, three detention ponds will be constructed along the approximately the southern boundary of the site as indicated in Figure 2, included in Appendix A of this report.

In order to accommodate access to the proposed industrial parcels, two entrances/exists are being proposed. One will be from the existing Lafayette Center Road and Fogwell drive intersection through a yet to be constructed Fogwell Parkway; while the second will be through the existing Zubrick Road in Fort Wayne, Indiana.

The proposed roadway is anticipated to be constructed in accordance with the Allen County Highway Department (ACHD) and the Indiana Department of Transportation (INDOT) Design Standards. Based on information provided, it is anticipated that the new pavement will consist of a flexible section over granular base, over a prepared soil subgrade. However, it is possible that rigid pavement (concrete section) may be used at certain locations within the proposed construction. The pavement section is expected to meet or exceed that which is specified in the ACHD standard specifications for the anticipated traffic volume. The data and recommendations outlined in this report may be used to guide design and construction of the proposed improvement.

Traffic criteria were not provided at this writing (i.e., projected annual average daily traffic, AADT); however, it is expected that the new pavement area will experience a combination of car and truck traffic of moderate frequency. Incidental improvements will also entail passing and right/left turning lanes along Fogwell Drive and Lafayette Center Road, drainage pipe installation and extensions, shoulder work, etc, although specific details regarding these construction elements were unavailable at this writing.

Final grading plans were not available at this writing. GME Testing should review the final grading plans prior to the onset of construction. GME Testing should also be consulted if our assumptions or our understanding of the project is incorrect.

FIELD EXPLORATION

Twelve (12) soil test borings were requested and drilled at the locations indicated on the approximate Boring Location Map, Figure 2 included in Appendix A of this report. Our borings were drilled to depths of 10 to 15-feet below the existing ground surface elevation.

Drilling and Sampling Procedures

The soil borings were performed with a truck mounted drill rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes and representative samples of the soils were obtained employing split-barrel sampling techniques in accordance with ASTM procedures D-1586. After completion of the borings and water level readings, the auger holes were backfilled with auger cuttings. The description and depths of soil strata encountered and levels at which samples were recovered are indicated on the accompanying borehole log sheets in the Appendix. In the column “Soil/Material Description” on the borehole log, the horizontal lines represent stratum changes.

An explanation of the symbols and terms used on the boring log sheets is given in Appendix B to this report.

Field Tests and Measurements

Standard Penetration Tests: During the sampling procedures, Standard Penetration Tests (SPT) was performed at regular intervals through the depth of the borings. The SPT value (“N”-value) is defined as the number of blows required to advance a 2-inch O.D., split-barrel sampler a distance of one foot by a 140-pound hammer falling 30-inches. These values provide a useful preliminary indication of the consistency or relative density of most soil deposits and are included on the Borehole Logs in Appendix B.

Water Level Measurements: Groundwater level observations were made in the borings during and upon completion of the boring operations. The groundwater level measurements are noted on the boring logs presented herein.

All recovered samples were returned to GME Testing laboratory for visual examination and subsequent laboratory testing.

LABORATORY TESTING

Selected soil samples obtained from the drilling and sampling program were tested in the laboratory to develop additional pertinent engineering characteristics of the foundation materials necessary in estimating the engineering properties of these materials.

Soil Laboratory Tests and Measurements

Visual Classification: All samples were visually classified by a geotechnical engineer in general accordance with ASTM D-2488, and on the Borehole Logs, which are located in the Appendix of this report.

Moisture Content Tests: The natural moisture content of selected samples was determined by ASTM method D-2216 and is recorded on the Borehole Logs as a percentage of dry weight of soil under the “MC”.

Hand Penetration Tests: Samples of cohesive soils obtained from the split barrel sampler were tested with a calibrated hand penetrometer to aid in evaluating the soil strength characteristics. The results from this testing are tabulated on the Borehole Logs under the heading “Q_P”.

Unconfined Compressive Strength Test: The undrained shear strength of selected cohesive soil samples was evaluated utilizing unconfined compressive tests on specimens obtained from the split-barrel and/or thin wall tube sampler.

The values of strength tests performed on soil samples obtained from the split-barrel sampler are considered approximate recognizing that the sampler provides a representative but somewhat disturbed sample. These test results are tabulated on the Borehole Logs under the heading "Qu".

SUBSURFACE CONDITIONS

Descriptions of the subsurface conditions encountered at the test boring locations are shown on the Borehole Logs. The lines of demarcation shown on the logs represent an approximate boundary between the various classifications. The stratification of soils, as shown on the accompanying test borehole logs, represents the soil conditions at the actual borehole locations, and variations may occur between the boreholes. In-situ strata changes could occur gradually or at different levels. In addition, it should be noted that the boreholes depict conditions at the particular locations and times indicated.

Soil Conditions

Approximately 6 to 12 inches of dark brown and black clayey silty topsoil with fine roots were encountered on site in the borings. The site was previously a tilled farm field and the surficial topsoil layer was, in places, altered by farming activities.

Roadway Borings (B-1 through B-7; B-9 and B-10)

In summary, the materials disclosed in the borings, below existing topsoil, consisted of generally medium stiff brown and gray mottled silty clays to depths of about 2.5 to 4-feet beneath the existing ground surface elevation. The materials below consisted of medium stiff to very stiff brown silty clays, brown sandy silty clays and clayey sandy silt (i.e., in B-2 and B-6) underlain at about 12.5 to 13-feet by very stiff brown and gray and gray silty clays that extended to the terminal depths of the borings.

The consistencies and relative densities of the encountered materials were evaluated based on the results of the SPT, N-values according to ASTM D-1586.

In borings B-2 and B-9 below depths of about 4-feet, the clayey soils exhibited elevated moisture conditions with N-values of about 3 to 8 blows per foot (bpf), according to ASTM D-1586.

Interbedded seams of sands were also encountered as indicated on the boring logs.

Detention Pond Borings (B-8, B-11 and B-12)

The soils near the surface consisted of very soft to medium stiff brown silty clays over very stiff brown and gray silty clays to the terminal depths of the borings.

The forgoing discussions of soil conditions on this site represent a generalized soil profile as determined at the test boring locations. A more detailed description and data for each test boring can be found on the individual Borehole Logs in Appendix B of this report.

<u>Groundwater Conditions</u>

Groundwater measurements were taken during our field operations by noting the depth of water "on the rods" and in open boreholes following removal of the augers. No free water was encountered in the test borings during or following completion of our drilling operations. However, water may be trapped or "perched" within discontinuous sand seams.

It must be noted, however, that short term groundwater level observations made in test borings are not necessarily a reliable indication of the actual groundwater elevation. Fluctuations in the level of groundwater typically occur due to variations in rainfall and other factors. Shallow trapped water may become evident during wet periods of the year and within sand and silt lenses.

EVALUATION AND RECOMMENDATIONS

The following section have been developed in order to aid in the evaluation of the site for the proposed pavement improvement and to assist the project team in the planning and preparing the project design plans. They are intended for use with regard to the specific project discussed herein and any substantial changes in the project description, location, or assumed grades should be brought to our attention so that we may evaluate how such changes may affect our conclusions and recommendations.

Geotechnical Evaluation and Considerations

Proposed Roadways

Based on information provided to us, it is anticipated that a flexible pavement section over aggregate base may be used. In all new pavement areas, it is recommended that all existing topsoil, unsuitable materials, and quite moist and weak clayey subgrade materials be removed.

Based on the results of the test borings (i.e., B-2, B-3, B-4, B-7, B-9 and B-10), the near surface clayey soils moisture content were generally elevated (i.e., 20 to 24 percent). If at time of site preparation but prior to placement of aggregate base, these moisture content become significantly above optimum moisture content, it is anticipated that pumping and yielding of the existing subgrade will develop and improvements to these soils will be required. This improvement may necessitate removal of materials that become excessively moist, weak, and yielding and their replacement with suitable soils, aerating, conditioning, and/or chemical stabilization may be required.

If earthwork is expected to begin during a wet weather period, it may not be feasible to aerate existing upper soils and chemical stabilization may be required to expedite construction activities and reduce construction-related difficulties. It is recommended that GME Testing be on site during subgrade proofrolling evaluation as discussed in Site Preparation section of this report.

The repeated heavy construction traffic over the site subgrade could cause the subgrade to pump, yield and weak areas to develop and therefore should be avoided. Heavy construction traffic should use designated areas as directed.

PAVEMENT DESIGN AND SUBGRADE CONSIDERATIONS

The proposed pavement subgrade should be prepared as recommended in the Site Preparation requirements section of this report. Depending upon the time of the year the proposed roadway will be prepared, aerating and conditioning the existing moist clayey soils on site, as previously discussed will be required. If this method is considered ineffective to improve the existing subgrade, removal of materials that are excessively moist and/or weak and/or chemical stabilization may be required.

Final grading plans for these areas were not available. However, undercutting of existing soft silty clay or clayey silt soils should be expected near borings B-2 and B-4, B-9 and B-10 may be required if roadway subgrade is expected to be established at or below depths of about 2.5 to 4-feet beneath the existing ground surface elevation. **If field tiles are encountered at the anticipated pavement subgrade elevation or during mass site preparation, they must be abandoned and/or removed in accordance with good construction practice. Otherwise, surface drainage and/or subsurface seepage problems could result.**

Prior to pavement construction, the subgrade should be prepared as discussed in Site Preparation section of this report. It is assumed that a flexible pavement will be used. The pavement design thickness will be the responsibility of others. All pavement subgrade areas and new fill materials should be prepared and placed as recommended in the Site Preparation and Structural Fill sections of this report. The following minimum recommendations are offered.

A California Bearing Ratio (CBR) of about 3 is recommended for design of new pavement structure within the limits of the proposed construction, provided that all existing organic-containing and weak materials are removed and the subgrade is firm, non-yielding and compacted to 98 or more percent of ASTM D-698 (standard Proctor). Undercutting of weak materials may be required as discussed previously in this report.

During and following periods of wet weather, an increase in the moisture content of the soils can cause significant reduction in the soil strength and support capabilities. It is recommended to perform earthwork and site preparation activities during typical seasonally dry times of the year with little to no rain fall.

For localized unstable subgrade areas, undercutting and replacement with crushed limestone aggregate (e.g., INDOT No. 1 that is choked with INDOT No. 53) is generally the most cost-effective alternative. It is recommended that undistributed quantity of Geogrid (i.e., BX 1300 or Tensar® TX190L) be included in the contract document to mitigate yielding and pumping subgrade prior to placement of stone base, if needed, to reduce undercutting.

In any event, the selected method should be further evaluated by the site engineer prior to its use during construction. It is strongly recommended that GME Testing be retained on site to evaluate the subgrade condition.

All construction methods and materials should conform to the applicable and current INDOT Standards and Specifications.

Pavement Drainage

Water infiltration into pavement subgrade soils can reduce the service life of the pavement. Therefore, we recommended that adequate surface drainage be provided at the site to minimize any increase in moisture content of the pavement soils. The subgrade surface should be uniformly sloped to facilitate drainage through the granular base to the shoulders or inlets and to avoid any ponding of water beneath the pavement.

SITE PREPARATION

Wherever weak materials, existing soils containing organics and excessive moisture are encountered, they should also be removed and replaced with suitable, well-compacted new engineered fill in accordance with this report. All exposed subgrade must be evaluated by GME Testing geotechnical engineer or designee at the time of construction. If the existing site subgrade becomes very moist and yielding and pumping will be experienced, it is recommended that GME Testing evaluate possible remedial measures during construction.

It is recommended that, during grading operations, the surface of the site should always be sloped to promote immediate runoff of surface water. The exposed subgrade should then be evaluated by probing and testing by a GME Testing representative. Any unsuitable materials thus exposed should be removed. The exposed subgrade should then be proofrolled with suitable equipment. If the exposed subgrade is wet during construction, it is expected to fail the proof rolling evaluation; thus the proof rolling examination should be delayed.

The purpose of the proofrolling is to detect soft, yielding, or unstable areas under the influence of construction traffic. Any unsuitable or wet materials detected during this operation should be over-excavated or improved by appropriate preparation and stabilization techniques. GME Testing should evaluate the exposed subgrade. We recommend that site preparation activities be undertaken during dry weather to minimize an increase of moisture content and decrease in strength of the near-surface soils.

If any areas are scarified, conditioned, and aerated, they should be compacted to achieve a density of 100 percent as determined by ASTM D-698 (standard Proctor).

Backfill placed in utility excavations or against foundations should consist of a clean granular material which is generally more readily compacted to required densities than cohesive backfill in relatively confined areas.

The evaluation of the subgrade and selection of fill materials for various applications should be performed in consultation with a GME Testing representative. Similarly, the placement and compaction of fill for structural applications should be monitored and tested by a GME Testing representative to confirm the materials have been compacted to achieve a density of 100 percent as determined by ASTM D-698 (standard Proctor).

The foregoing recommendations for earthwork and site preparation were developed based on our understanding of the project and site conditions. All earthwork and site preparation should be performed under the observation of the geotechnical engineers' field representative. Additionally, the earthwork recommendations may require modifications based on the field observations during construction. The appropriate course of action should be determined by the geotechnical engineer at the time of construction.

Engineered Fill

All engineered fill needed to replace undercut materials or as a grade-raise fill should consist of a non-organic, naturally occurring non-expansive soil compacted to 100 or more percent of the standard Proctor maximum dry density (ASTM D-698) or equivalent. The on-site materials that consist of very stiff brown silty clay with silt lenses may be used as general fill or grade-raise fill, if they do not contain excess moisture, and are otherwise approved by the GME Testing geotechnical engineer.

If aggregate is to be used to replace excavated materials or elevate new areas, this may consist of clean sand and gravel, INDOT No. 53's or 73's crushed limestone aggregate or processed concrete meeting INDOT No. 53 gradation requirements and must be free of debris. However, the choice to use either natural or processed concrete aggregate meeting INDOT No. 53 gradation should be determined by the engineer. Approved engineered fill should be compacted as described above at moisture content of between approximately one above optimum and two percent below optimum.

If fill construction takes place during the winter months, care should be taken so as not to place fill over frozen soil, nor should frozen materials be used within the fill.

The compaction should be accomplished in placing the fill in about 6 to 8-inch loose lifts and mechanically compacting each lift to the specified minimum dry density or greater.

Storm Detention Pond

It is our understanding that a detention pond will be constructed in the vicinity of borings B-8, B-11 and B-12. The pond invert elevation was not yet established at the time of this writing. The soil profile encountered in these borings should maintain water and any new materials should be compacted as described in this report. It is anticipated that storm-water percolation from the ponds will be at a low rate.

The existing silty clay soils encountered should have an estimated coefficient of permeability in the range of roughly 10^{-6} cm/sec or less. GME Testing should evaluate the pond materials to determine whether adequate soils are present after the proposed pond is excavated to desired depth. If organic-containing materials are encountered at the pond invert elevation, such materials should be removed and replaced with acceptable clayey soils. If granular materials are intercepted, a clay liner will be required in order to reduce seepage losses from the pond.

It is our opinion that some of the existing brown silty clays should generally be suitable as grade raise fill, pending evaluation by GME Testing at the time of construction.
In general, it is recommended that the excavated materials be allowed to aerate and dry. Discing and pulverization may be needed to achieve proper compaction.
Excessively moist and wet materials will require significant drying if they are desired to be used as fill.

Construction Dewatering

Groundwater was not encountered and is expected to be below the anticipated excavations for this project. Water seepage into excavations might be manageable using conventional sump pump methods; however, depending on the excavation method to be selected for construction of underground structures, the means and methods of dewatering should be determined by the contractor during construction. However, it is possible that seasonal variations will cause fluctuations in the water table.

Temporary Excavations

We recommend that trenches and excavations be designed and constructed in accordance with OSHA regulations. These regulations provide trench sloping and shoring design parameters for trenches up to 20-feet deep based on a description of the soil types encountered. If trenches/excavations greater than 20-feet deep are necessary, they should be designed by the Contractor’s professional engineer.

Temporary excavations that encounter water seepage may require shoring, bracing and/or lateral supports. Trench boxes may also be a suitable alternative to laying back the sidewalls. Localized to general sloughing may be experienced.

We have assumed that spoils from the excavation or other surcharge loads will not be placed above the excavation within a minimum of 1:1 (horizontal: vertical) plane extending up and back from the base of the excavations. If spoil piles are placed closer than this to the braced excavation, the resulting surcharge loads should be considered in the bracing or trench box design. The above recommendations should be considered as guidelines only, and an experienced design engineer should be contacted for further recommendations regarding design of the shoring system.

Excavations

All excavating operations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, “Excavations”, which deals with excavation and trench safety. Trenches and excavation for utilities and other construction activities are subject to caving sides, and can expose workers to engulfment hazards. All excavations should be monitored by a Competent Person, as defined by the OSHA standard, and appropriate shoring or sloping techniques used to prevent cave-ins.

Construction Monitoring

During fill placement and paving for the project, density tests, sampling and asphalt testing should be performed. A GME Testing technician should be retained to observe, test and evaluate the soils-connected phases of the project during construction to ensure compliance with the project specifications is achieved.

LIMITATIONS OF STUDY

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Additional subsurface evaluation will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. GME Testing should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request.

Although general constructibility issues have been considered in this report, the means, methods, techniques, sequences and operations of construction, safety precautions, and all items incidental thereto and consequences of, are the responsibility of parties to the Project other than GME Testing. This office should be contacted if additional guidance is needed in these matters.

Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials. Accordingly, their presence and/or absence is not implied, inferred or suggested by this report or the results of this study.

APPENDIX A

GME TESTING

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FIGURE NO 1- APPROXIMATE SITE VICINITY MAP

Project: Proposed Stonebridge Industrial Park
Allen County, Indiana

SCALE: NTS

GME PROJECT NO.	DATE:
G13-052421	May 2013

CLIENT: Engineering Resources, Inc.

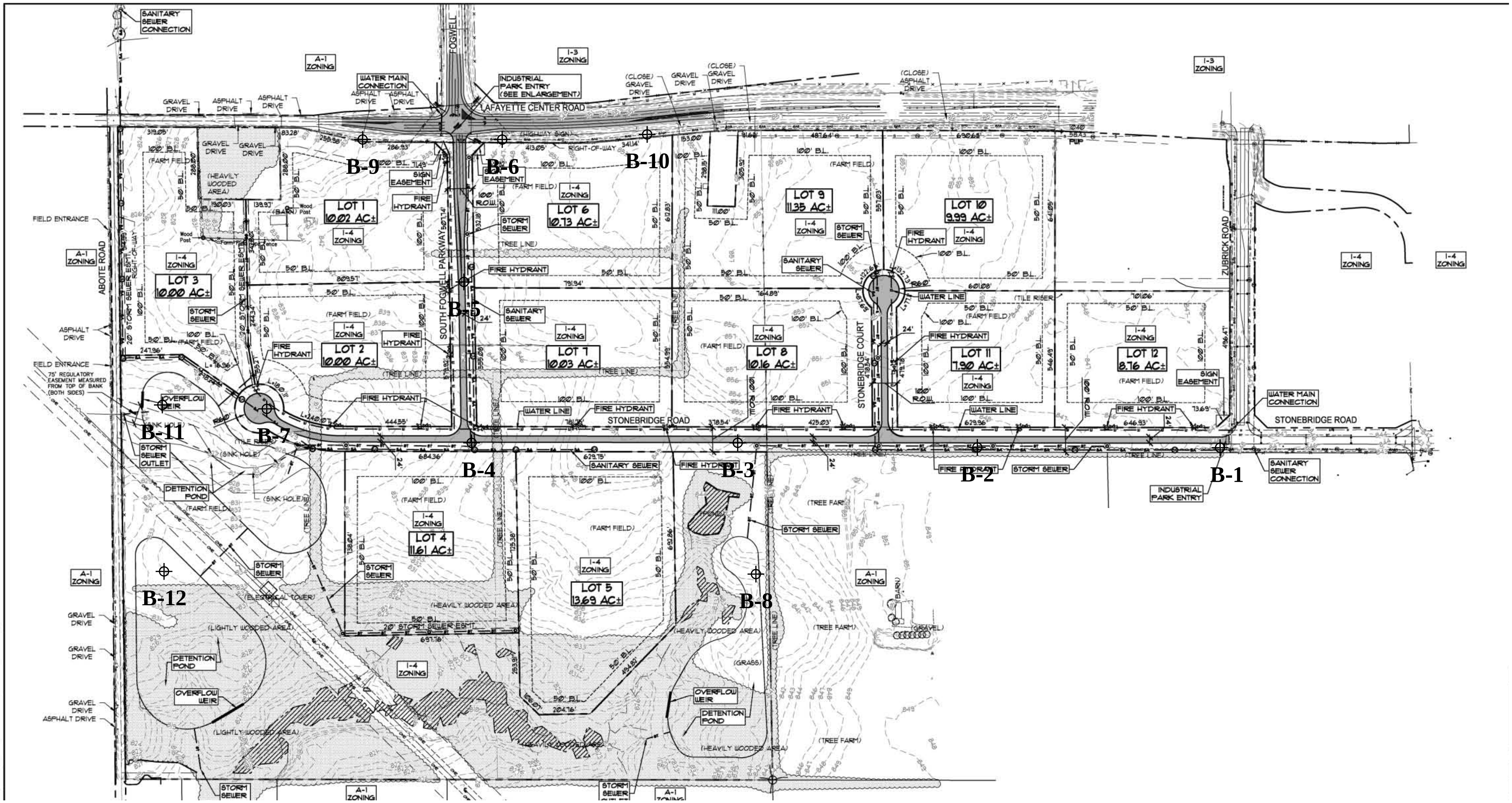

FIGURE 2-Approximate Boring Location Map

Project: Proposed Stonebridge Industrial Park
Allen County, Indiana

Scale: NTS

GME TESTING

GME Project No.	Date:	CLIENT: Engineering Resources, Inc.
G13-052421	May 2013	

APPENDIX B

GME TESTING

TEST BORING LOG

BORING NO.: B-1
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 847.0	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 10.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry; At completion Dry; Caved in at 6.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
846.0		±12" Dark Brown, Clayey Silty Topsoil with Fine Roots. 1.0										
844.5	2.5	Medium Stiff, Brown, Mottled SILTY CLAY. 2.5	SS 1	3-2-5 (7)	25	16.5		3.0				
	5.0		SS 2	7-9-12 (21)	100	14.0		4.5+				
	7.5	Very Stiff, Brown, SILTY CLAY with Silt Lenses.	SS 3	7-11-12 (23)	100	14.0		4.5+				
837.0	10.0	10.0	SS 4	6-12-14 (26)	80	15.3		4.5+				
		Bottom of Boring at 10.0 ft										
	12.5											
	15.0											
	17.5											
	20.0											
	22.5											
	25.0											

GME TESTING

TEST BORING LOG

BORING NO.: **B-2**
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 848.0	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 10.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry — At completion Dry — Caved in at 4.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION		SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
847.4		±7" Dark Brown, Clayey Topsoil and Very Fine Roots	0.6										
	2.5	Soft, Brown, Mottled SILTY CLAY, traces of Fine Sand.		SS 1	2-2-3 (5)	100	21.8		3.0				
844.0			4.0										
	5.0	Very Soft, Brown, Quite Moist SILTY CLAY.		SS 2	2-1-2 (3)	100	19.9		0.25				
842.0			6.0										
	7.5	Stiff, Brown, Moist, CLAYEY SILT, traces of Fine Sand and Gravel.		SS 3	3-6-7 (13)	100	17.3						
839.5			8.5										
		Very Stiff, Brown, SILTY CLAY, traces of Gravel.		SS 4	5-10-12 (22)	100	16.1		4.5+				
838.0	10.0		10.0										
		Bottom of Boring at 10.0 ft											
	12.5												
	15.0												
	17.5												
	20.0												
	22.5												
	25.0												

GME TESTING

TEST BORING LOG

BORING NO.: B-3
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION	: 849.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	:	RIG TYPE	: Truck	DRILLER/INSP	: DCA/GJ
OFFSET	:	CASING DIA.	: 3.3 in	TEMPERATURE	: °F
LINE	:				
DEPTH	: 10.0 ft	CORE SIZE	:	WEATHER	: Sunny

GROUNDWATER: Encountered at Dry   At completion Dry   Caved in at 4.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
848.4		±7" Dark Brown, Clayey Silty Topsoil and Fine Roots 0.6										
846.0	2.5	Stiff, Brown, Mottled SILTY CLAY, traces of Fine Sand and Gravel. 3.0	SS 1	3-5-6 (11)	80	20.3		2.5				
	5.0	Very Stiff, Brown, SILTY CLAY with Silt Lenses, traces of Gravel.	SS 2	7-11-14 (25)	100	14.4		4.5+				
840.5	7.5	8.5	SS 3	6-12-15 (27)	100	14.1		4.5+				
839.0	10.0	Very Stiff, Brown and Gravel, SILTY CLAY. 10.0	SS 4	5-10-15 (25)	100	14.0		4.5+				
		Bottom of Boring at 10.0 ft										
	12.5											
	15.0											
	17.5											
	20.0											
	22.5											
	25.0											

GME TESTING

TEST BORING LOG

BORING NO.: B-4
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 839.0	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 10.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry   At completion Dry   Caved in at 5.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
838.4		±7" Dark Brown, Clayey Silty Topsoil and Fine Roots 0.6										
836.5	2.5	Soft, Dark Brown and Gray, Moist, Mottled SILTY CLAY. 2.5	SS 1	2-2-3 (5)	70	19.7		1.5				
	5.0	Medium Stiff to Very Stiff, Brown, SILTY CLAY, traces of Fine Sand and Gravel.	SS 2	2-3-5 (8)	90	16.7		4.5+				
830.5	7.5	8.5	SS 3	6-9-12 (21)	100	14.0		4.5+				
829.0	10.0	Very Stiff, Brown and Gray, SILTY CLAY. 10.0	SS 4	4-7-11 (18)	100	16.7		4.5+				
	12.5	Bottom of Boring at 10.0 ft										
	15.0											
	17.5											
	20.0											
	22.5											
	25.0											

TEST BORING LOG

GME TESTING

BORING NO.: **B-5**
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION	: 846.0	BORING METHOD	: HSA	HAMMER	: Auto
STATION	:	RIG TYPE	: Truck	DRILLER/INSP	: DCA/GJ
OFFSET	:	CASING DIA.	: 3.3 in	TEMPERATURE	: °F
LINE	:				
DEPTH	: 10.0 ft	CORE SIZE	:	WEATHER	: Sunny

GROUNDWATER: Encountered at Dry — At completion Dry — Caved in at 4.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION		SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
845.5		±6" Dark Brown, Clayey Topsoil.	0.5										
843.0	2.5	Medium Stiff, Brown, SANDY SILTY CLAY, traces of Gravel.	3.0	SS 1	2-3-6 (9)	70	15.1		1.5				
	5.0	Very Stiff, Brown, SILTY CLAY, traces of Fine Sand.		SS 2	7-10-12 (22)	100	14.3		4.5+				
	7.5			SS 3	5-9-13 (22)	100	14.9		4.5+				
836.0	10.0		10.0	SS 4	7-11-15 (26)	100	15.3		4.5+				
		Bottom of Boring at 10.0 ft											
	12.5												
	15.0												
	17.5												
	20.0												
	22.5												
	25.0												

GME
GME TESTING

TEST BORING LOG

BORING NO.: B-6
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-21-13
DATE COMPLETED : 05-21-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 844.0
STATION :
OFFSET :
LINE :
DEPTH : 10.0 ft

BORING METHOD : HSA
RIG TYPE : Truck
CASING DIA. : 3.3 in
CORE SIZE :

HAMMER : Auto
DRILLER/INSP : DCA/GJ
TEMPERATURE : °F
WEATHER : Sunny

GROUNDWATER: Encountered at Dry | At completion Dry | Caved in at 4.5 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION		SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
843.4		±7" Dark Brown, Clayey Silty Topsoil.	0.6										
	2.5	Stiff, Brown, SILTY CLAY, traces of Fine Sand and Gravel.		SS 1	2-4-7 (11)	100	13.7		4.5+				
841.0			3.0										
839.0	5.0	Medium Dense, Brown, Quite Moist, CLAYEY SANDY SILT.	5.0	SS 2	4-6-6 (12)	100	17.6						
	7.5	Very Stiff, Brown, SILTY CLAY, traces of Fine Sand and Gravel.		SS 3	6-9-12 (21)	100	14.8		4.5+				
834.0	10.0		10.0	SS 4	5-8-12 (20)	100	17.2		4.5+				
		Bottom of Boring at 10.0 ft											
	12.5												
	15.0												
	17.5												
	20.0												
	22.5												
	25.0												

GME TESTING

TEST BORING LOG

BORING NO.: **B-7**
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 831.5	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 10.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry — At completion Dry — Caved in at 4.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
830.9	0.6	±7" Clayey Topsoil.										
	2.5	Medium Stiff, Brown, Mottled SILTY CLAY, traces of Fine Sand.	SS 1	2-2-4 (6)	80	20.1		1.5				
	5.0		SS 2	3-3-4 (7)	90	19.2		2.0				
826.0	5.5											
	7.5	Very Stiff, Brown, SILTY SANDY CLAY, traces of Gravel.	SS 3	7-12-17 (29)	100	14.9		4.5+				
821.5	10.0		SS 4	5-11-16 (27)	100	14.8		4.5+				

Bottom of Boring at 10.0 ft

Depth scale: 2.5, 5.0, 7.5, 10.0, 12.5, 15.0, 17.5, 20.0, 22.5, 25.0

GME
GME TESTING

TEST BORING LOG

BORING NO.: B-8
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-21-13
DATE COMPLETED : 05-21-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 839.0	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 15.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry | At completion Dry | Caved in at 7.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
838.3		±8" Dark Brown, Clayey Silty Topsoil with Fine Roots 0.7										
	2.5	Soft , Dark Brown and Gray, Mottled SILTY CLAY, traces of Fine Sand.	SS 1	1-2-3 (5)	80	19.6						
835.5		3.5										
	5.0	Stiff to Very Stiff, Brown, SILTY CLAY.	SS 2	3-6-6 (12)	80	13.1		4.5+				
	7.5		SS 3	5-12-16 (28)	100	13.5		4.5+				
	10.0		SS 4	6-10-12 (22)	100	12.8		4.5+				
	12.5											
826.0		13.0										
824.0	15.0	Very Stiff, Gray, SILTY CLAY, traces of Fine Sand. 15.0	SS 5	9-12-12 (24)	40	16.7		3.5				
		Bottom of Boring at 15.0 ft										
	17.5											
	20.0											
	22.5											
	25.0											

TEST BORING LOG

GME TESTING

BORING NO.: B-9
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-21-13
DATE COMPLETED : 05-21-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 834.0
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : HSA
RIG TYPE : Truck
CASING DIA. : 3.3 in
CORE SIZE :

HAMMER : Auto
DRILLER/INSP : DCA/GJ
TEMPERATURE : °F
WEATHER : Sunny

GROUNDWATER: Encountered at Dry; At completion Dry; Caved in at 5.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
833.4	0.6	±7" Dark Brown, Clayey Topsoil.										
	2.5	Medium Stiff, Brown, Quite Moist, SANDY SILTY CLAY, Occasional Sand Seams.	SS 1	2-3-4 (7)	100	20.3		1.0				
829.5	4.5		SS 2	1-2-6 (8)	100	21.7		0.75				
	5.0											
	7.5	Very Stiff, Brown, SILTY CLAY, traces of Fine Sand.	SS 3	5-9-13 (22)	100	16.0		4.5+				
	10.0		SS 4	6-9-12 (21)	40	17.6		4.5+				
	12.5											
819.0	15.0		SS 5	6-10-12 (22)	70	17.5		4.5+				
		Bottom of Boring at 15.0 ft										

17.5
20.0
22.5
25.0

GME TESTING

TEST BORING LOG

BORING NO.: **B-10**
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-21-13
DATE COMPLETED : 05-21-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 853.0	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 10.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry At completion Dry Caved in at 4.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION		SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
852.3		±9" Dark Brown, Clayey Topsoil with Roots.	0.8										
850.0	2.5	Soft, Dark Brown, Moist, Mottled SILTY CLAY.	3.0	SS 1	1-2-2 (4)		24.5						
847.0	5.0	Medium Stiff, Brown and Gray, Moist, SILTY CLAY.	6.0	SS 2	2-3-3 (6)	100	22.2		1.5				
844.5	7.5	Stiff, Brown, SILTY CLAY, traces of Fine Sand.	8.5	SS 3	3-5-6 (11)	80	16.5		4.5+				
843.0	10.0	Very Stiff, Grayish Brown, SILTY CLAY.	10.0	SS 4	6-10-12 (22)	100	15.3		4.5+				
		Bottom of Boring at 10.0 ft											

Depth scale: 12.5, 15.0, 17.5, 20.0, 22.5, 25.0

GME TESTING

TEST BORING LOG

BORING NO.: **B-11**
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 826.0	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 15.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry — At completion Dry — Caved in at 6.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
825.3		±8" Dark Brown, Clayey Silty Topsoil. 0.7										
823.0	2.5	Medium Stiff, Brown, Mottled SILTY CLAY. 3.0	SS 1	2-2-5 (7)	100	20.1		1.5				
	5.0		SS 2	6-10-13 (23)	100	15.0		4.5+				
	7.5		SS 3	5-10-11 (21)	100	16.5		4.5+				
812.5	10.0	Very Stiff, Brown, SILTY SANDY CLAY, traces of Gravel. 13.5	SS 4	5-7-11 (18)	80	15.3		4.5+				
811.0	15.0	Very Stiff, Brown and Gray, SILTY CLAY, traces of Gravel. 15.0	SS 5	5-9-12 (21)	100	15.7		4.5+				
		Bottom of Boring at 15.0 ft										

GME TESTING

TEST BORING LOG

BORING NO.: B-12
SHEET 1 OF 1
GME PROJECT NO: G13-052421
STRUCTURE
DATUM :
DATE STARTED : 05-20-13
DATE COMPLETED : 05-20-13

CLIENT: Engineering Resources, Inc.
PROJECT TYPE: Proposed Stonebridge Industrial Park
LOCATION : Lafayette Center And Fogwell Drive, Fort Wayne (Allen County), Indiana

ELEVATION : 834.0	BORING METHOD : HSA	HAMMER : Auto
STATION :	RIG TYPE : Truck	DRILLER/INSP : DCA/GJ
OFFSET :	CASING DIA. : 3.3 in	TEMPERATURE : °F
LINE :		
DEPTH : 15.0 ft	CORE SIZE :	WEATHER : Sunny

GROUNDWATER: Encountered at Dry | At completion Dry | Caved in at 8.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	ATTERBERG LIMITS LL	PL	PI	REMARKS
833.3		±9" Clayey Topsoil. 0.8										
830.5	2.5	Medium Stiff, Brown and Gray, Mottled SILTY CLAY, traces of Fine Sand and Gravel. 3.5	SS 1	2-3-6 (9)	100	23.1		1.5				
	5.0	Very Stiff, Brown, SILTY CLAY, traces of Gravel and Fine Sand.	SS 2	5-8-10 (18)	100	14.7		4.5+				
	7.5		SS 3	7-12-13 (25)	100	15.3		4.5+				
	10.0		SS 4	7-10-15 (25)	100	17.7		4.5+				
821.0	12.5	13.0										
819.0	15.0	Very Stiff, Brown and Gray, SILTY CLAY, traces of Gravel. 15.0	SS 5	6-11-13 (24)	40	16.2		4.5+				
	17.5	Bottom of Boring at 15.0 ft										
	20.0											
	22.5											
	25.0											

GENERAL NOTES

SAMPLE IDENTIFICATION

Visual soil classifications are made in general accordance with the United States Soil Classification System on the basis of textural and particle size categorization, and various soil behavior and characteristics. Visual classifications should be made by appropriate laboratory testing when more exact soil identification is required to satisfy specific project applications criteria.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Term	Defining Range by % of Weight
Trace	1-10 %
Little	11-20 %
Some	21-35 %
And	36-50 %

WATER LEVEL MEASUREMENT

NE	No Water Encountered
BF	Backfilled upon Completion

ORGANIC CONTENT BY COMUSTION METHOD

Soil Description	LOI
w/traces organic matter	1-6 %
w/little organic matter	7-12 %
w/some organic matter	13-18 %
Organic Soil (A-8)	19-30 %
Peat (A-8)	More than 30 %

LABORATORY TESTS

Qp	Penetrometer Reading, tsf
Qu	Unconfined Strength, tsf
MC	Moisture Content, %
LL	Liquid Limit, %
PL	Plastic Limit, %
PI	Plastic Index
SL	Shrinkage Limit, %
pH	Measure of Soil Alkalinity/Acidity
γ	Dry Unit Weight, pcf
LOI	Loss of Ignition, %

DRILLING AND SAMPLING SYMBOLS

AS	Auger Sample
BS	Bag Sample
PID	Photo ionization Detector (Hnu meter) volatile vapor level,(PPM)
COA	Clean-Out Auger
CS	Continuous Sampling
FA	Flight Auger
HA	Hand Auger
HAS	Hollow Stem Auger
NR	No Recovery
PT	3" O.D. Piston Tube Sample
RB	Rock Bit
RC	Rock Coring
REC	Recovery
RQD	Rock Quality Designation
RS	Rock Sounding
S	Soil Sounding
SS	2"O.D. Split-Barrel Sample
2ST	2"O.D. Tin-Walled Tube Sample
3ST	3" O.D. Thin-Walled Tube Sample
VS	Vane Shear Test
DB	Diamond Bit
WS	Wash Sample
RB	Roller Bit
ST	Shelby Tube, 2" O.D. or 3" O.D.
CB	Carbide Bit

GRAIN SIZE TERMINOLOGY

Soil fraction	Particle size	Us standard sieve size
Boulders	larger than 75 mm	Larger than 3"
Gravel	2mm to 75 mm	#10 to 75 mm
Coarse Sand	0.425 mm to 2 mm	#40 to #10
Fine Sand	0.075mm to 0.425 mm	#200 to #40
Silt	0.002 mm to 0.075 mm	Smaller than #200
Clay	Smaller than 0.002 mm	Smaller than #200

RELATIVE DENSITY

Term	"N" Value
Very Loose	0-5
Loose	6-10
Medium Dense	11-30
Dense	31-50
Very Dense	51+

CONSISTENCY

Term	"N" Value
Very Soft	0-3
Soft	4-5
Medium Stiff	6-10
Stiff	11-15
Very Stiff	16-30
Hard	31+

PLASTICITY

Term	Plastic Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High/Very High	Over 22

Note(s):
The penetration resistance, "N" Value, is the summation of the number of blows required to effect two successive 6-inch penetrations of the 2-inch split-barrel sampler. The sampler is driven with a 140-lb. weight falling 30-inches and is seated to a depth of 6-inches before commencing the standard penetration test.
Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils

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GME TESTING

SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
	Clean Gravels (Less than 5% fines)	
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
	Clean Sands (Less than 5% fines)	
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

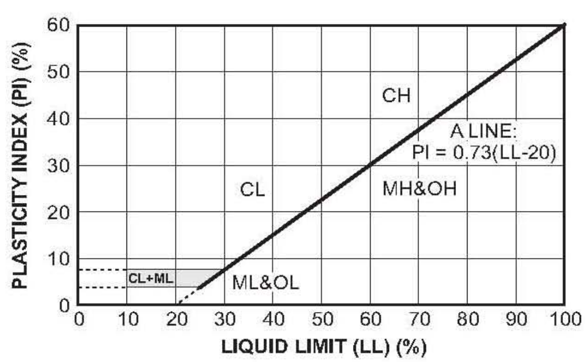
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

PLASTICITY CHART



Note: Dual Symbols are used to Indicate Borderline Soil Classifications

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