Exhibit E

June 19, 2018
C100490.019

McGarey Custom Homes
4242 Airport Road
Cincinnati, Ohio 45226
Atten: Mr. Peter McGarey

RE: REPORT OF GEOTECHNICAL STUDY FOR THE PROPOSED BROOKFIELD LANE DEVELOPMENT OFF DELTA AVENUE, CINCINNATI, OHIO

Dear Peter,

We have completed the geotechnical study for the proposed residential development at Brookfield Lane, Cincinnati, Ohio. The text of this report presents the project information, the scope of study, our findings, conclusions and design recommendations. You authorized this geotechnical study in May 2018.

The purpose of this investigation was to establish the subsurface conditions across the site to help provide geotechnical recommendations for the site design and general development of the site. The results of the test pits generally indicate that shallow basement foundations and the drilled pier foundations may be adopted for the proposed buildings and retaining walls following recommendations contained in this report.

We trust you will find the contents of this report are suitable for your needs. We appreciate the opportunity to provide our services to you and assure you of our best attention at all times. Please call the writer if you have any comments or questions.

Respectfully submitted,
ULTRA TECHNIC SERVICES, INC.

Olusegun G. Akomolede, PhD., MNSE, P.E.
President/Chief Geotechnical Engineer

Exhibit E

MCGAREY HOMES

PROPOSED BROOKFIELD LANE DEVELOPEMENT
OFF DELTA AVENUE, CINCINNATI, OHIO

REF: C100490.011/JUNE 19, 2018

REPORT OF GEOTECHNICAL STUDY

BY:

ULTRA TECHNIC SERVICES, INC.
6531 WEST CHESTER ROAD, WEST CHESTER, OHIO 45069
P.O. BOX 1533, WEST CHESTER, OH 45071

Exhibit E

TABLE OF CONTENTS

APPENDIX

Exhibit E

INTRODUCTION

As requested by Mr. Peter McGarey of McGarey Homes, Ultra Technic Services, Inc. (UTS) has completed the geotechnical study for the proposed Brookfield Lane Residential Development along the Brookfield Lane Paper Street at Hide Park, in Cincinnati, Ohio. The purpose of this study was to establish the subsurface conditions across the site to help provide geotechnical recommendations for the site design and general development of the site. Mr. Peter McGarey authorized this geotechnical study in May 2017.

The following sections present the project information, the scope of study, our findings, conclusions and design recommendations.

PROJECT DESCRIPTION

The site will be developed into a subdivision consisting of 6 residential lots. A 2 story, single-family homes with one to two basement levels is planned on each lot. The houses will typically measure approximately 30 ft. (9.0 m) by 45 ft. (13.5m) in maximum plan dimensions. The site will be accessed from Delta Street with a 25' wide access roadway winding around the uphill ends of the proposed houses and including a turning area near the mid-section of the street. The street will include a storm line that will drain into the existing inlet area of the existing pipe culvert draining the drainage swale. The street will also include a 6" diameter water main that will include two fire hydrants and will be tied to an existing mainline on Delta Avenue. A 6" diameter sanitary sewer line is planned immediately downhill from the proposed house locations at the toe of the slope. The approximate locations of the houses and these infrastructures are shown on the attached Site Plan, on Figure 1.

Topographically, the site is located on a fairly steep hillside with existing grades vary from between 533 and 557 along the bottom of the drainage swale on the north property line to between 664 and 700 along the uphill property line. To accommodate the hillside slopes, it is understood that the site and the buildings will be been designed to include a combination of deep basement foundation walls, retaining walls and drilled pier footings to achieve the general stability and grade separation across the site.

Details of the expected column and wall loadings have not been provided at the time of writing this report. However, based on our experience, we have assumed a maximum

Exhibit E

column load of 75 kips and wall load of 5 kips per linear foot for the buildings.

SCOPE OF GEOTECHNICAL STUDY

The work performed for this geotechnical study included fieldwork involving test pit excavation, engineering analysis and preparation of this geotechnical report. Details are presented as follows:

Fieldwork

Six Test Pits designated TP-1 to TP-6 were performed on May 16 and 17, 2018 to depths of 11 and 26 ft. (3.3 and 7.8m, respectively). The approximate test pits locations are shown on the Site Plan, presented as Figure 1 in the Appendix. The Test Pits were excavated with a track hoe. Each test pit was performed in the presence of and logged by the undersigned. The test pits locations were established in the field by the undersigned. The ground surface elevations at the test pits locations were established in the field by the project Surveyor- M.D Walker & Associates.

Engineering Analysis

The data developed from the test pits were used for the engineering analyses. The engineering analyses included:

- Bearing Capacity and Settlement Analyses
- Slope stability Analysis.
- Evaluation of the impact of the surrounding slopes on the stability of the proposed buildings.

The results of the engineering analysis are discussed under the Conclusions and Recommendations sections, which are presented later in this report.

EXISTING SITE CONDITIONS

Exhibit E

Surface Conditions

The site is entirely wooded with matured trees and limited ground cover. There is a major drainage swale along the north property line laden with large rock fragments of varying sizes. The swale is deeply incensed towards the north east end of the site but becoming broader and flowing into an existing pipe culvert near the north west end of the site. Existing grades vary from as low as 633 along the north west bottom of the drainage swale to 700 at the uphill south east end. Site reconnaissance performed revealed no noticeable evidence of active landslide, but some toe erosion of the creek is apparent in places.

Subsurface Conditions

Details of the subsoil strata encountered in the test pits are presented on the test pit logs as well as on the generalized subsurface cross sections (Figures 1 and 2) presented in the appendix. However, in summary, the test pits encountered a surface layer of topsoil underlain by glacial till clays to test pit termination.

The topsoil ranged in thickness from 8” to 18” and consisted of stiff lean clay with roots. The upper 6” of the topsoil is generally fibrous, becoming less fibrous with depth. The underlying glacial till deposits consisted brown grading brown and gray then gray glacial till clays. The upper brown till consisted of lean clay becoming sandy and gravelly lean clay with small to large (boulder sized) rock fragments. This material was stiff to very stiff in the top approximately 3’ becoming generally hard thereafter. The brown till typically occurred to between about 5’ and 10’ in depths towards the toe of the hill and as deep as 15’ uphill.

The underlying brown and gray till consisted of clay to fat clay and it was similarly sandy and gravelly and with rock fragments as the upper brown till. However, the soils often contain gray shale fragments and were generally stiff to very stiff except that there were also very moist to wet soft pockets or seams in the material. This brown and gray till typically transitioned into completely gray till with depth.

Due to the presence of weak zones in the underlying fat glacial till clay and the relatively steep slope of the surface of this layer, slope stability analysis was performed to determine the influence of the weak zones on the overall stability of the hillside. The analysis was performed based on computer program, Gstabl 7.0 developed by Garry H.Gregory. To simulate the worst-case scenario, the weak soil parameter was attributed to the entire brown and gray to gray fat glacial till clays. The results indicated that the hillside in its

Exhibit E

present condition should be generally stable under short term (undrained conditions) with a factor of safety of about 2.77 or more (See Sheet C-1 in the Appendix). The analysis further indicated that under long term (drained) conditions, if the weak zones in the glacial till clays should line up favorably for a slide to develop, the hillside will only be marginally stable with a factor of safety of only 1.21 ((See Sheet C-2 in the Appendix). However, when the analysis was performed under this same soil conditions as above but with the site shaped to the proposed final grades, the factor of safety for the long termed (undrained) condition reduced to 2.49 (See Sheet C-3 in the Appendix) while that for the long term was 1.26 which still indicate marginal stability (See Sheet C-3A in the Appendix).

To improve the long-term stability of the final site grades, drilled piers support were introduced to the retaining wall proposed along the north end of the site as well as the down slope ends of the houses to buttress the toe of the hill. The results yielded improved factors of safety for both the short term and long-term drainage conditions with factor of safety for the former increasing to 3.18 (See Sheet C-4 in the Appendix). For the latter, the factor of safety was increased to 1.52, with the hillside becoming stable.

Groundwater Conditions

Groundwater was not encountered in the test pits either during or upon completion of drilling. The test pits were too shallow to determine the equilibrium groundwater level. Seasonal variation in groundwater conditions due to rainfall and other weather conditions should be anticipated

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

As shown on the Subsurface Profiles Sections A-A to C-C, Figures 1 and 2, in the Appendix, the two-level basements proposed under the houses, will result in the basement levels falling within the upper very stiff to hard glacial till clay. This mode of construction will minimize or avoid any aggressive grading or disturbance of the hillside. This glacial till bearing material has adequate bearing capacity to support the buildings. However, the bearing capacity will not be the most critical factor determining suitable foundation solution for the proposed structures but the long-term stability of the hillside. As discussed earlier,

Exhibit E

the hillside will only be marginally stable under the long term (drained) soil and groundwater conditions under both the existing and proposed final site grades. The hillside stability was improved to stable conditions when drilled pier foundation supports were introduced as described earlier. Thus, based on the results of these analysis, foundations buttressed with drilled piers socketed well below the potential slip planes should be considered for the downslope ends of the houses while the upslope approximately 50% as well as the floor slab may bear directly on the hard brown glacial till clay. In addition to helping improve the overall stability of the hillside, the buttressing piers will also help transfer the building loads below the destabilizing zone of influence of the scouring creek flow during highwater, the toe erosion of the creek and the sanitary sewer line excavation and backfill. Similar drilled pier support should be considered for the proposed north retaining wall. The other infrastructures (water, storm and sanitary) can bear in the glacial till clays at the proposed bearing level. Detailed recommendations for the site preparation, foundation and floor slab design and construction recommendations are presented as follows:

Site Preparation Recommendations

The following site preparation recommendations are provided for the building construction:

1. The site preparation should commence by stripping the existing vegetation and topsoil within only the building, pavement, and other structural improvements areas. All the existing trees in the construction area should be up rooted. Where necessary, the hole created should be backfilled with suitable material, which is placed and compacted as recommended later in this report. Trees outside the construction areas should be preserved as much as practicable.

2. We recommend that the site be disturbed as little as possible with only limited grading outside of the building footprint. Any retaining walls that may be required for grade separation should be socketed adequately below the potential slip plane.

3. The indications are that up to about 13 ft. of cut and some nominal fill will be required to achieve the finial site grades. This fill will be placed at the swale crossing. The cut will be retained with retaining wall. The proposed fill should be placed as structural fill. The exposed ground surface following the stripping of the vegetation and topsoil and before fill placement should then be proof rolled to

Exhibit E

determine any area of soft ground. Any soft areas encountered should be undercut and then replaced with compacted structural fill (preferably ODOT 304 crushed limestone). The fill should be placed to final grades in maximum 8" loose lift and on horizontal benches cut into the natural overburden slopes. Each lift should be compacted to at least 98% Standard Proctor density (ASTM D 698) below all structural areas. The top 12" (30cm) below the finished pavement subgrade should be compacted to at least 100%. In non-structural areas, the degree of compaction may be reduced to 95%

4. All exposed ground surfaces should be mulched and seeded and landscaped as soon as possible to minimize soil erosion and infiltration of surface water into the subsoil. These conditions can lead to slope instability.

5. All site-grading operations will need to be witnessed and monitored in the field by geotechnical personnel.

6. It is reiterated that no structurally unsupported fill embankment be placed at this site.

Foundation Recommendations

As stated earlier, both shallow basement and drilled pier foundations are considered feasible at this site. The foundations must be designed not only to support the vertical building load but also the horizontal load from the overburden soils. This foundation system will provide stability of the building and help improve the overall stability of the hillside. However, it should be noted that this foundation system may not preclude continuous creep of the slope, downhill of the buildings. The following paragraphs provide recommendations concerning foundation design to be used in preparing the building design plans. We strongly recommend that we be allowed to review the plans and specifications to confirm compliance with recommendations in this report.

Shallow Basement Foundation Recommendations: Allowable bearing capacities of 4,000 psf (200 kN/m^2) for strip footings and 5,000 psf (250 kN/m^2) for spread footings should be available where footings bear at least 2 ft. into brown hard glacial till lean clay. The bearing surface should be closely inspected for loose or soft zones, soil or rock cuttings or debris, which if found must be removed and backfilled with concrete.

Exhibit E

Settlement of footings constructed to the depths, loading and standards stated above and supporting a maximum column load of 75 kips and wall load of 5 kips per linear foot should be less than 1". Differential settlement should be less than 0.5".

Geotechnical personnel should perform close inspection of the foundation excavation and construction. The inspection should include visual evaluation of the bearing material to confirm that the soils are consistent in quality and strength as encountered in the Test pits. The bearing material should also be probed at regular interval (maximum 10 ft or 3m intervals) to verify that no soft or unsuitable materials lie beneath the bearing surface. Pocket penetrometer readings of the bearing soils should also be obtained to verify that the above quoted bearing values are available.

Provision of adequate drainage facilities below the buildings is a critical aspect of this project. To this end, it is recommended that a minimum 4" (100 mm) diameter perforated drainage pipe should be installed along both the interior and exterior of the building foundation walls. The drainage pipes should be located on top of the footing and at the base of foundation walls where practical. The pipes should be sloped for positive drainage and should be discharged into a suitable outlet. Riprap should be placed at the pipe exit for erosion protection. The exterior pipe should be socked, bedded and backfilled with granular fill as recommended later in this report.

The soils encountered at this site are highly susceptible to loss of shear strength when disturbed say by construction traffic or exposed to weather or ingress of water. Care should therefore be taken during construction to avoid disturbance. Prolonged exposure of the foundation subgrade should be avoided. Footing concrete should be placed on the same day the excavation was made. Foundation excavation should not be left open overnight. If prolonged exposure of foundation subgrade is unavoidable, then the subgrade should be sealed with at least 3 to 4" (7.5 to10cm) lean concrete (at least 1500 psi or 10.8 MN/m^2) mud mat. It is also recommended that the foundation concrete be placed neat against the excavation wall to avoid the need for forming and backfilling.

The ground around the residence should be designed to drain adequately away from the foundations. The downspouts should be collected through non-perforated drainage pipes and be discharged at a suitable outlet. Drainage pipes should be watertight and should not be allowed to discharge onto the ground surrounding the buildings.

Exhibit E

Drilled Pier Option: For buttressing the rear of the houses and the toe of the hillside, drilled piers support may be considered. For preliminary design purposes, it is recommended that drilled piers be extended adequately below the potential slip plane. Based on the slope stability analysis, pier lengths of at least 20' are recommended for buttressing the downhill 50% of the houses and at least 30' for the retaining wall along the south end on the site. An allowable end bearing capacity of 10 ksf should be available for properly installed drilled pier design for axial compressive loads. It is recommended that minimum 24" diameter piers be utilized, to allow inspection of the pier bottom from the ground surface.

The basement walls of the building will be subjected to lateral loading from the soil retained. These walls should be designed as retaining walls. In addition, the piers will be subjected to lateral loads from the overburden soils due to the sloping hillside. The piers must therefore be designed to support lateral load from the overburden soils.

The piers must be adequately reinforced to support both the maximum shear and bending moments. The basement foundation walls should be strongly reinforced and cast rigidly together on top of the piers to develop a diaphragm action to resist lateral loads and reduce bending moment. Any deck posts supported on isolated drilled piers, which are not cast rigidly with the basement walls through grade beams, may require same length of piers as quoted above.

It is recommended that temporary steel casing be made available on site to be used as needed if water seepage is encountered during the drilling of the piers. The bearing surface of each pier should be thoroughly cleaned of any loose material prior to concrete placement. If water seepage is encountered during drilling, the specifications should state that no more than 2" of water should be allowed to collect at the bottom of the pier hole prior to concreting. If the water cannot be pumped out, then the concrete should be placed with a tremie. It is recommended that the number of piers drilled in a day be limited to those that can be concreted on the same day, and that no completed pier holes be left open overnight without being filled with concrete.

Design Recommendations for Basement and Other Retaining Walls:

We reiterate that the basement walls must be designed as reinforced concrete retaining walls, to retain the basement backfill and the sloping hillside.

Exhibit E

It is presumed that the proposed basement walls will be rigid and non-yielding due to their bracing support at the top and bottom. By contrast, the exterior retaining walls proposed to be used for grade separation will most likely be non-rigid and free to rotate. The following lateral earth pressure recommendations (for rigid and non-rigid) are provided for these two wall types. In both cases, it is assumed that the backfill will consist of free-draining granular soil and that positive drainage is provided. Much higher pressures than those given here will occur if cohesive soils are used as backfill and/or if drainage is not provided behind the walls and hydrostatic pressure is allowed to build up.

a. Basement Walls: Long-term pressure distribution behind the basement walls should be estimated based on at rest conditions using a rectangular loading distribution derived by the following:

P=30H (psf), where "H" is the wall height in feet.
P=5H (kN/m2), where "H" is the wall height in meters

These equations can also be used to estimate lateral load acting on the individual drilled piers in the overburden soils above potential slip plane. The term "H" in this case will represent the thickness of the affected overburden. An effective pier diameter equal to twice the actual pier diameter is recommended to take advantage of the effect of soil arching. An allowable passive resistance of 2,000 psf (100 kN/m2) can be adopted in the underlying glacial till bearing material in estimating resistance to lateral pressure.

Also, 50% of any surface surcharge loading applied adjacent to the wall should be included in the design pressure.

b. Non-Rigid (Cantilevered or modular) Retaining Wall: For any freestanding retaining wall that may be proposed for site grading or exterior landscaping purposes, a triangular pressure distribution can be used. A pressure distribution based on an equivalent fluid pressure of 50 pcf (8 kN/m^3), plus 40% of any surface surcharge loading is recommended. If other wall types are considered, the project geotechnical engineer should be contacted to evaluate potential impact on these pressure distribution recommendations.

Backfill behind the walls should consist of relatively well graded, free-draining granular material, having no more than 7% passing the No. 200 sieve. The granular backfill behind the walls should be at least 3 ft. (1m) wide and should be placed and compacted in 4" to 6" thick lifts. To avoid overstressing the walls, hand equipment should be utilized within 5 ft.

Exhibit E

of the wall. Foundation drains and/or weep holes should be included to provide drainage of the granular backfill. Each lift of wall backfill should be compacted to at least 98% of maximum Standard Proctor dry density.

It is recommended a minimum 4" diameter perforated or slotted drainage pipe, sloped for positive drainage be provided below the granular backfill. The pipe should be placed behind the retaining wall. The pipe should be bedded and backfilled with at least 6" thick of No. 57 stone before placing the granular fill. The entire drainage backfill material should be encapsulated in a non-woven geotextile (filter fabric) to prevent siltation and clogging of the pipe and wall backfill materials. The drainage pipe should be discharged into a storm sewer. Pipe outflow should not be allowed to spill onto the slope. A similar recommendation applies to roof gutter outlets.

To avoid surface runoff from directly penetrating the wall backfill, a 12" to 18" thick layer of cohesive soil should be placed to cap the surface of the backfill. This clay cap should be positively sloped to drain away from the buildings or walls.

Floor Slab Recommendations

The floor slab may be constructed as slab on grade following site preparation recommendations presented earlier. Where drilled pier foundations are used, they should be designed to effectively retain the soil beneath the building (that is, pier spacing should be within 3 pier diameters on center). If larger pier spacing is used in order to minimize the number of piers and thus minimize cost, structural slab supported on the piers may be used. Another advantage of using structural slab is that it helps to further tie the piers together, thereby increasing their rigidity and thus increasing their ability to resist lateral loading. However, if a slab on grade method is to be adopted, a design modulus of subgrade reaction of 125 pci is recommended. This design value is based on point loading conditions only.

It is recommended that a minimum 4" to 6" layer of free-draining, well-graded granular material, such as clean “bank run” sand and gravel or ODOT 304 material, be provided below the floor slab. This granular blanket will allow for a uniform slab thickness, more uniform load transfer, and aid in a more uniform curing of the concrete at the top and bottom of the slab.

Exhibit E

Seismic Considerations

The Ohio Basic Building Code (OBBC), 2013 Edition, recommends that every building and structure be designed and constructed to resist the effects of earthquake motions determined in accordance with Section 1612.1 of the Code. Based on the test pit results and the geology of the site, Site Classification C, may be adopted for the seismic design for foundations bearing entirely in the underlying shale and limestone bedrock.

Pavement Design

The upper 12" of structural fill required to establish pavement subgrade level should be compacted to at least 100% Standard Proctor. The final subgrade should be established with lean clay. Based on this subgrade material, pavement design can be based on a CBR value of 3 for flexible pavement. Rigid concrete pavement may be designed based on a modulus of subgrade reaction of 125 pci based on point loading conditions.

Drainage

It is recommended that adequate drainage facilities be installed to promote positive drainage of surface and subsurface water around and below the pavement, as well as the building. The goal of such drainage should be to effectively collect surface water from the drives, and other paved areas, discharging the water at suitable outlets (e.g. storm sewer).

CONSTRUCTION MONITORING

It is recommended that close monitoring by the project geotechnical engineer or his representative be conducted during construction of all aspects of this project. Monitoring should include but not be limited to visual identification of soil conditions, inspection during basement excavation and all foundation (including drilled piers) installations, site and subgrade preparation, utility installation, testing of structural fill, granular base, and foundation backfill.

Exhibit E

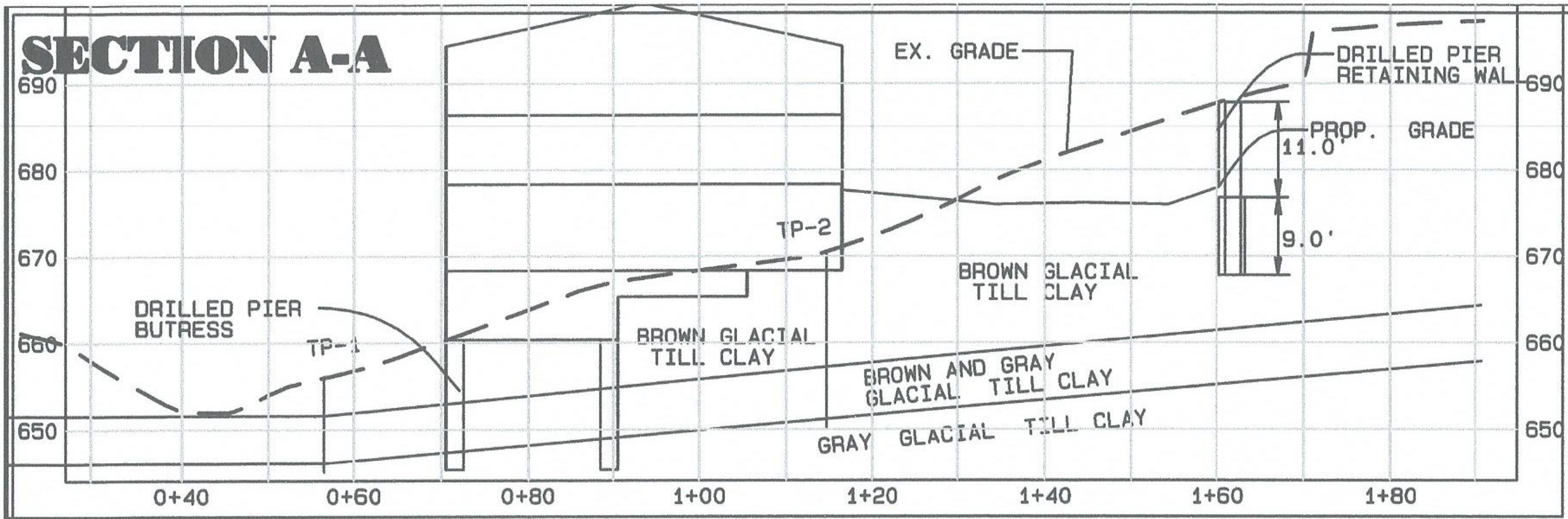
CLOSING REMARKS

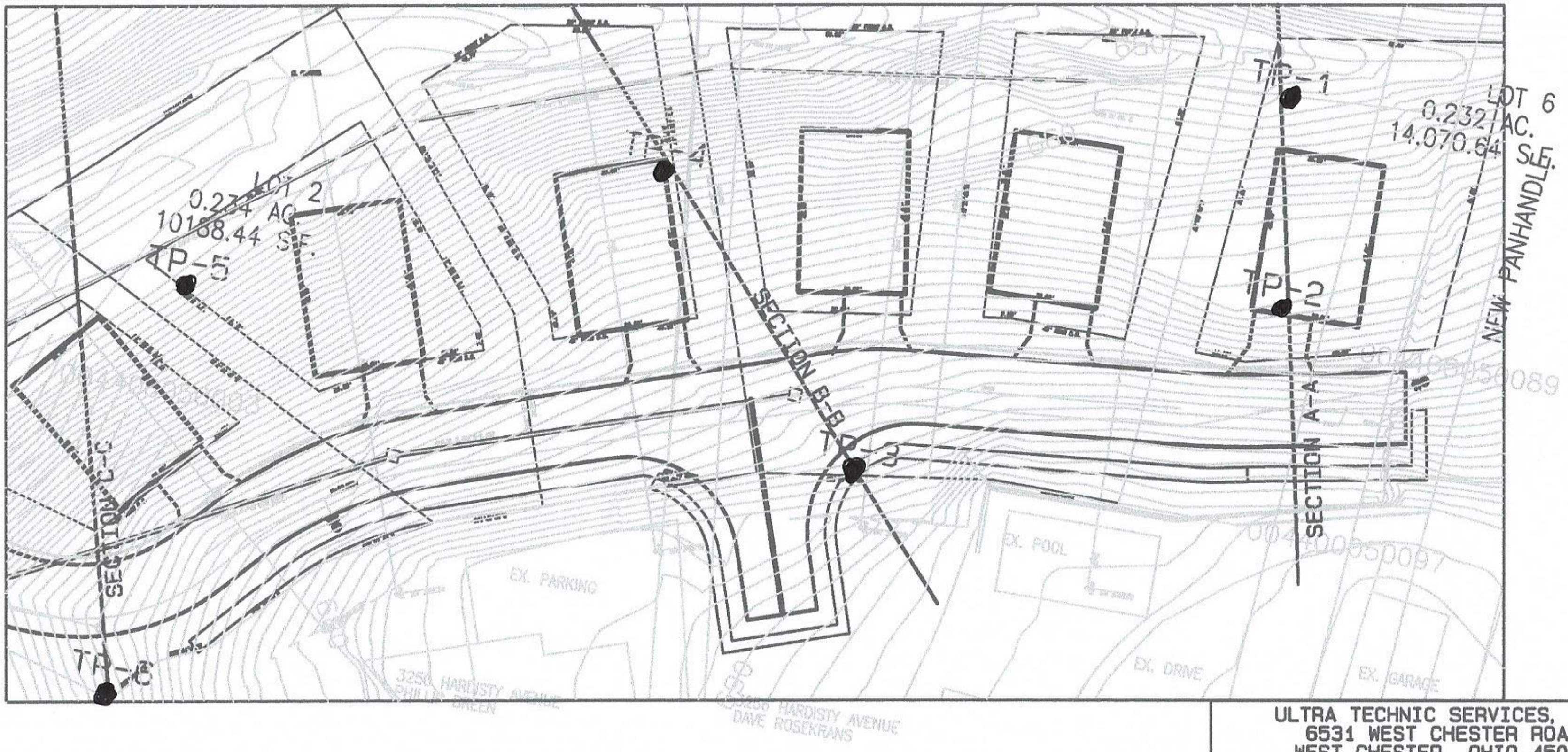
We trust that this geotechnical report has provided the information and data required for the design and cost estimate for this project. Additional analysis regarding design lateral load and the required embedment depth of drilled piers can be performed upon request, after site grading and preliminary foundation design drawings become available for review. We can provide additional review, consultation and design as an addendum contract under our standard unit rates.

Exhibit E

APPENDIX

Exhibit E


SECTION A-A



ULTRA TECHNIC SERVICES, INC
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WEST CHESTER, OHIO 45069
TEL.: 513-755-7879 FAX: 513-755-8923

PETER MCGAREY
AIRPORT RD, CINCINNATI OH 45211

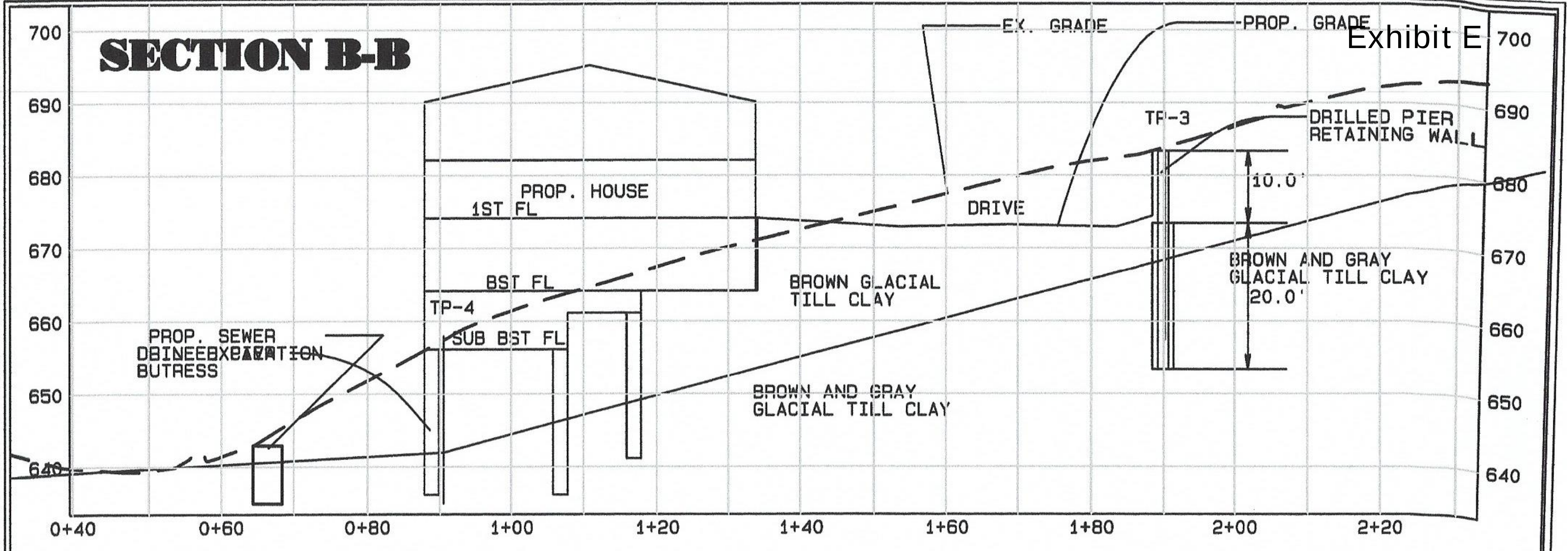
BROOKFIELD LANE DEVELOPMENT
CINCINNATI, OHIO

SUBSURFACE CROSS SECTIONS

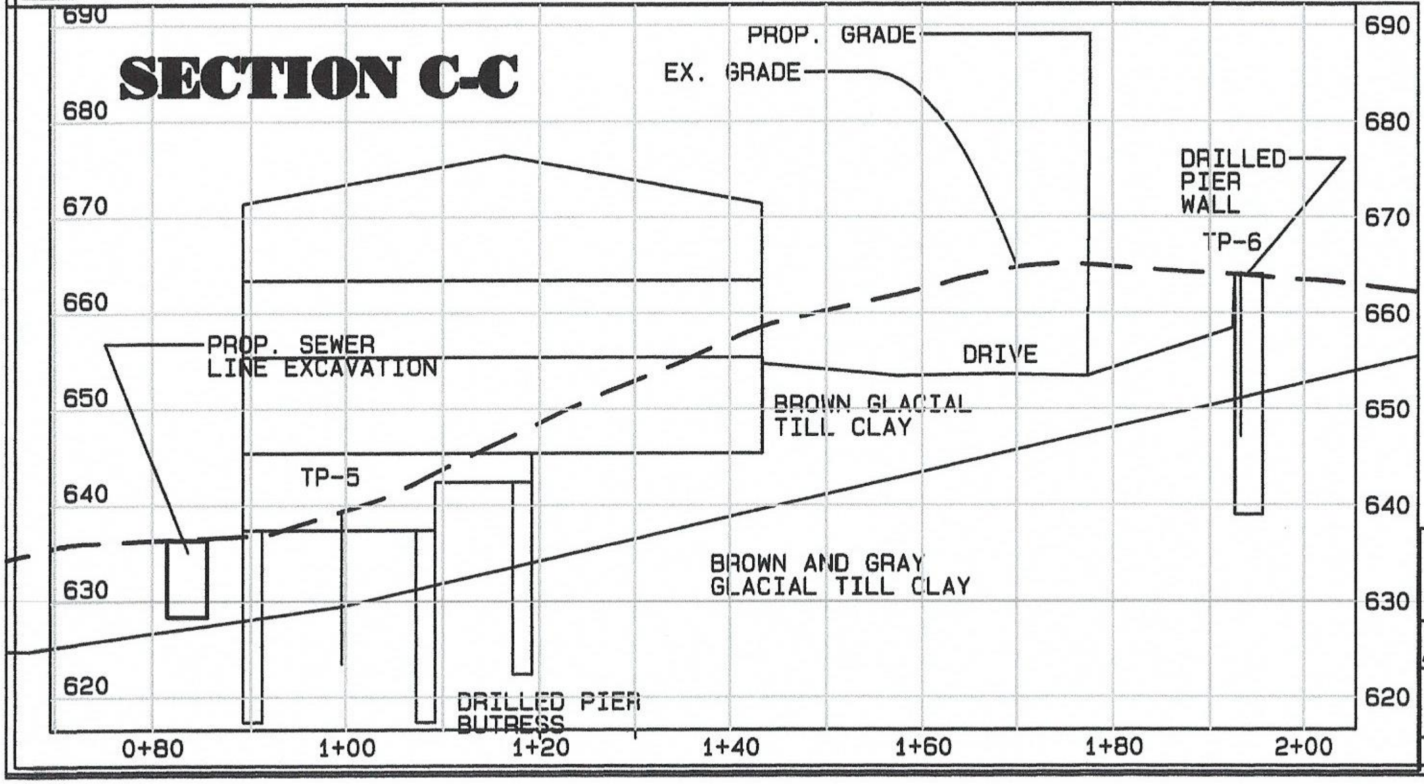
DATE: 06-18-18
REV.NO.: -
SCALE: N.T.S.
DRAWN BY: OGA
REV'D BY: -
FIGURE 1

Exhibit E

SECTION B-B



SECTION C-C



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BROOKFIELD LANE DEVELOPMENT
CINCINNATI, OHIO

SUBSURFACE CROSS SECTIONS

DATE: 06-18-18
REV.NO.: -
SCALE: N.T.S.
DRAWN BY: OGA
REV'D BY: -
FIGURE 2

Exhibit E

ULTRA TECHNIC SERVICES, INC.
6531 WEST CHESTER ROAD, WEST CHESTER, OHIO 45069
TEL.: 513-755-7879 FAX: 513-755-8923

TEST PIT LOG

CLIENT: MCGARY CUSTOM HOMES
Project: BROOKFIELD LANE RESIDENTIAL SUBDIVISION
BROOKFIELD LANE, CINCINNATI, OHIO
Boring Location: AS SHOWN ON PLAN
Reference Elevation: SITE TOPOGRAPHIC PLAN

Test Boring Number: TP-1
Date (Start) : 05/16/18
Date (End): 05/16/18

DEPTH ELEVATION FT.	M.	LEGEND	SAMPLE NUMBER	DESCRIPTION OF MATERIALS	N-VALUES BLOWS/FT. OR PER 0.3M	SAMPLE/ RECOVERY FROM SPOON	MOISTURE CONTENT(%)	LIQUID/ PLASTIC LIMITS(%)	POCKET PTR TSF/kPa
656.1	200.0	▨		Brown-moist stiff lean clay with roots (14" TOPSOIL)					
654.9	199.7								
2		☰		Brown-moist stiff sandy lean clay with gravel and rock fragments					
4									
651.6	198.7	▤		Gray and brown-moist very stiff to hard SANDY LEAN TO FAT CLAY with gravel and rock fragments (GLATIAL TILL)					
6									4.5+/ 450+
8									
10				Gray moist-stiff to hard CLAY TO FAT CLAY with gravel and rock fragments (GLACIAL TILL)					4.5+/ 450+
646.1	197.0								
645.1	196.7			Test pit terminated at 11' in depth					
12									
14									
16									
18									
20	6.0								
22									
24									
26									
28									
30	9.0								
32									
34									
36									
38									
40	12.0								

General Notes
ENGR: OGA
Rig No.:
Rig Type: TRACK HOE
Method: -

SYMBOL DESCRIPTION:
SS = Drive Split Spoon
ST= Pressed Shelby Tube
NX= Rock Core Size
PTR= Pocket Penetrometer Reading

GROUNDWATER CONDITIONS:		
First Noted at	NW	ft - m
At Completion:	NW	ft - m
After Hrs		ft - m
Caved Dry at		ft - m
Wet Seam at		ft - m

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ULTRA TECHNIC SERVICES, INC.
6531 WEST CHESTER ROAD, WEST CHESTER, OHIO 45069
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TEST PIT LOG

CLIENT: MCGARY CUSTOM HOMES
Project: BROOKFIELD LANE RESIDENTIAL SUBDIVISION
BROOKFIELD LANE, CINCINNATI, OHIO
Boring Location: AS SHOWN ON PLAN
Reference Elevation: SITE TOPOGRAPHIC PLAN

Test Boring Number: TP-2
Date (Start) : 05/16/18
Date (End): 05/16/18

DEPTH ELEVATION FT.	M.	LEGEND	SAMPLE NUMBER	DESCRIPTION OF MATERIALS	N-VALUES BLOWS/FT. OR PER 0.3M	SAMPLE/ RECOVERY FROM SPOON	MOISTURE CONTENT(%)	LIQUID/ PLASTIC LIMITS(%)	POCKET PTR TSF/kPa
670.2	204.3			Brown-moist stiff lean clay with roots (9" TOPSOIL)					
669.5	204.1								
2				Brown-moist stiff sandy lean clay with gravel and rock fragments					
4									
665.2 6	202.8			Brown hard SANDY LEAN CLAY with gravel and rock fragments (GLATIAL TILL)					4.5+/ 450+
8									
10									4.5+/ 450+
12									
657.2 14	200.4			Gray and brown moist-stiff to hard CLAY TO FAT CLAY with gravel, limestone and shale fragments (GLACIAL TILL)					
16									
18									
651.2 20	198.5 6.0			Gray moist stiff to hard CLAY with shale and limestone fragments (GLACIAL TILL)					
650.2	198.2			Test pit terminated at 20' in depth					
22									
24									
26									
28									
30	9.0								
32									
34									
36									
38									
40	12.0								

General Notes
ENGR: OGA
Rig No.:
Rig Type: TRACK HOE
Method: -

SYMBOL DESCRIPTION:
SS = Drive Split Spoon
ST= Pressed Shelby Tube
NX= Rock Core Size
PTR= Pocket Penetrometer Reading

GROUNDWATER CONDITIONS:
First Noted at NW ft - m
At Completion: NW ft - m
After Hrs ft - m
Caved Dry at ft - m
Wet Seam at ft - m

Exhibit E

ULTRA TECHNIC SERVICES, INC.
6531 WEST CHESTER ROAD, WEST CHESTER, OHIO 45069
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TEST PIT LOG

CLIENT: MCGARY CUSTOM HOMES
Project: BROOKFIELD LANE RESIDENTIAL SUBDIVISION
BROOKFIELD LANE, CINCINNATI, OHIO
Boring Location: AS SHOWN ON PLAN
Reference Elevation: SITE TOPOGRAPHIC PLAN

Test Boring Number: TP-3
Date (Start) : 05/16/18
Date (End): 05/16/18

DEPTH ELEVATION FT.	M.	LEGEND	SAMPLE NUMBER	DESCRIPTION OF MATERIALS	N-VALUES BLOWS/FT. OR PER 0.3M	SAMPLE% RECOVERY FROM SPOON	MOISTURE CONTENT(%)	LIQUID/ PLASTIC LIMITS(%)	POCKET PTR TSF/kPa
683.5	208.4			Brown-moist stiff lean clay with roots (8" TOPSOIL)					
682.8	208.2								
2									2.75/ 275
680.5	207.5			Brown-moist stiff sandy lean clay with gravel and rock fragments					
4									
6									4.5+/ 450+
8				Brown hard SANDY LEAN CLAY with gravel and rock fragments (GLATIAL TILL)					
10									4.5+/ 450+
12									
14									
668.5	203.8								
16									
18				Gray and brown moist-stiff to hard CLAY TO FAT CLAY with gravel, limestone and shale fragments (GLACIAL TILL)					
20	6.0								1.5/ 150
22									
24									
26									
657.5	200.5			Test pit terminated at 26 in depth					
28									
30	9.0								
32									
34									
36									
38									
40	12.0								

General Notes
ENGR: OGA
Rig No.:
Rig Type: TRACK HOE
Method: -

SYMBOL DESCRIPTION:

SS = Drive Split Spoon
ST= Pressed Shelby Tube
NX= Rock Core Size
PTR= Pocket Penetrometer Reading

GROUNDWATER CONDITIONS:

First Noted at	NW	ft - m
At Completion:	NW	ft - m
After Hrs		ft - m
Caved Dry at		ft - m
Wet Seam at		ft - m

Exhibit E

ULTRA TECHNIC SERVICES, INC.
6531 WEST CHESTER ROAD, WEST CHESTER, OHIO 45069
TEL.: 513-755-7879 FAX: 513-755-8923

TEST PIT LOG

CLIENT: MCGARY CUSTOM HOMES
Project: BROOKFIELD LANE RESIDENTIAL SUBDIVISION
BROOKFIELD LANE, CINCINNATI, OHIO
Boring Location: AS SHOWN ON PLAN
Reference Elevation: SITE TOPOGRAPHIC PLAN

Test Boring Number: TP-4
Date (Start) : 05/16/18
Date (End): 05/16/18

DEPTH ELEVATION FT.	M.	LEGEND	SAMPLE NUMBER	DESCRIPTION OF MATERIALS	N-VALUES BLOWS/FT. OR PER 0.3M	SAMPLE% RECOVERY FROM SPOON	MOISTURE CONTENT(%)	LIQUID/ PLASTIC LIMITS(%)	POCKET PTR TSF/kPa
658.0	200.6			Brown-moist stiff lean clay with roots (8" TOPSOIL)					
657.33	200.4								
2									2.50/ 250
655.0	199.7			Brown-moist stiff sandy lean clay with gravel and rock fragments					
4									
6									4.5+/ 450+
				Brown hard SANDY LEAN CLAY with gravel and rock fragments (GLATIAL TILL)					
8									
10									4.5+/ 450+
12									
14									
16									
642.0	195.7			Gray and brown moist-stiff to hard CLAY TO FAT CLAY with gravel, limestone and shale fragments (GLACIAL TILL)					
18									
20	6.0								
22									
635.0	193.6			Test pit terminated at 23' in depth					
24									
26									
28									
30	9.0								
32									
34									
36									
38									
40	12.0								

General Notes
ENGR: OGA
Rig No.:
Rig Type: TRACK HOE
Method: -

SYMBOL DESCRIPTION:
SS = Drive Split Spoon
ST= Pressed Shelby Tube
NX= Rock Core Size
PTR= Pocket Penetrometer Reading

GROUNDWATER CONDITIONS:
First Noted at NW ft - m
At Completion: NW ft - m
After Hrs ft - m
Caved Dry at ft - m
Wet Seam at ft - m

Exhibit E

ULTRA TECHNIC SERVICES, INC.
6531 WEST CHESTER ROAD, WEST CHESTER, OHIO 45069
TEL.: 513-755-7879 FAX: 513-755-8923

TEST PIT LOG

CLIENT: MCGARY CUSTOM HOMES

Project: BROOKFIELD LANE RESIDENTIAL SUBDIVISION

BROOKFIELD LANE, CINCINNATI, OHIO

Boring Location: AS SHOWN ON PLAN

Reference Elevation: SITE TOPOGRAPHIC PLAN

Test Boring Number: TP-5

Date (Start) : 05/17/18

Date (End): 05/17/18

DEPTH ELEVATION FT.	M.	LEGEND	SAMPLE NUMBER	DESCRIPTION OF MATERIALS	N-VALUES BLOWS/FT. OR PER 0.3M	SAMPLE% RECOVERY FROM SPOON	MOISTURE CONTENT(%)	LIQUID/ PLASTIC LIMITS(%)	POCKET PTR TSF/kPa
639.6	195.0			Brown-moist stiff lean clay with roots (18" TOPSOIL)					
638.1	194.5								
2				Brown-moist stiff sandy lean clay with gravel and rock fragments					4.5/ 450
4									
634.6	193.5								
6				Brown hard SANDY LEAN CLAY with gravel and rock fragments (GLATIAL TILL)					
8									4.5+/ 450+
10									
629.6	192.0			Gray and brown moist-stiff to hard CLAY TO FAT CLAY with gravel, limestone and shale fragments (GLACIAL TILL)					
12									
14									
16									
623.6	190.1			Test pit terminated at 16' in depth					
18									
20	6.0								
22									
24									
26									
28									
30	9.0								
32									
34									
36									
38									
40	12.0								

General Notes
ENGR: OGA
Rig No.:
Rig Type: TRACK HOE
Method: -

SYMBOL DESCRIPTION:
SS = Drive Split Spoon
ST= Pressed Shelby Tube
NX= Rock Core Size
PTR= Pocket Penetrometer Reading

GROUNDWATER CONDITIONS:
First Noted at NW ft - m
At Completion: NW ft - m
After Hrs ft - m
Caved Dry at ft - m
Wet Seam at ft - m

Exhibit E

ULTRA TECHNIC SERVICES, INC.
6531 WEST CHESTER ROAD, WEST CHESTER, OHIO 45069
TEL.: 513-755-7879 FAX: 513-755-8923

TEST PIT LOG

CLIENT: MCGARY CUSTOM HOMES
Project: BROOKFIELD LANE RESIDENTIAL SUBDIVISION
BROOKFIELD LANE, CINCINNATI, OHIO
Boring Location: AS SHOWN ON PLAN
Reference Elevation: SITE TOPOGRAPHIC PLAN

Test Boring Number: TP-6
Date (Start) : 05/17/18
Date (End): 05/17/18

DEPTH ELEVATION FT.	M.	LEGEND	SAMPLE NUMBER	DESCRIPTION OF MATERIALS	N-VALUES BLOWS/FT. OR PER 0.3M	SAMPLE/ RECOVERY FROM SPOON	MOISTURE CONTENT(%)	LIQUID/ PLASTIC LIMITS(%)	POCKET PTR TSF/kPa
664.2	202.5	▨		Brown-moist stiff lean clay with roots (18" TOPSOIL)					
662.7	202.0	▤		Brown-moist stiff sandy lean clay with gravel and rock fragments					
2									
4									
659.2	201.0	▤		Brown hard SANDY LEAN CLAY with gravel and rock fragments (GLATIAL TILL)					4.5+/ 450+
6									
8									
10									
12									
651.2	198.5	☰		Gray and brown moist-stiff to hard CLAY TO FAT CLAY with gravel, limestone and shale fragments (GLACIAL TILL) becoming gray below 16.5' in depth					
14									
16									
18									
646.2	197.0			Test pit terminated at 18' in depth					
20	6.0								
22									
24									
26									
28									
30	9.0								
32									
34									
36									
38									
40	12.0								

General Notes
ENGR: OGA
Rig No.:
Rig Type: TRACK HOE
Method: -

SYMBOL DESCRIPTION:
SS = Drive Split Spoon
ST= Pressed Shelby Tube
NX= Rock Core Size
PTR= Pocket Penetrometer Reading

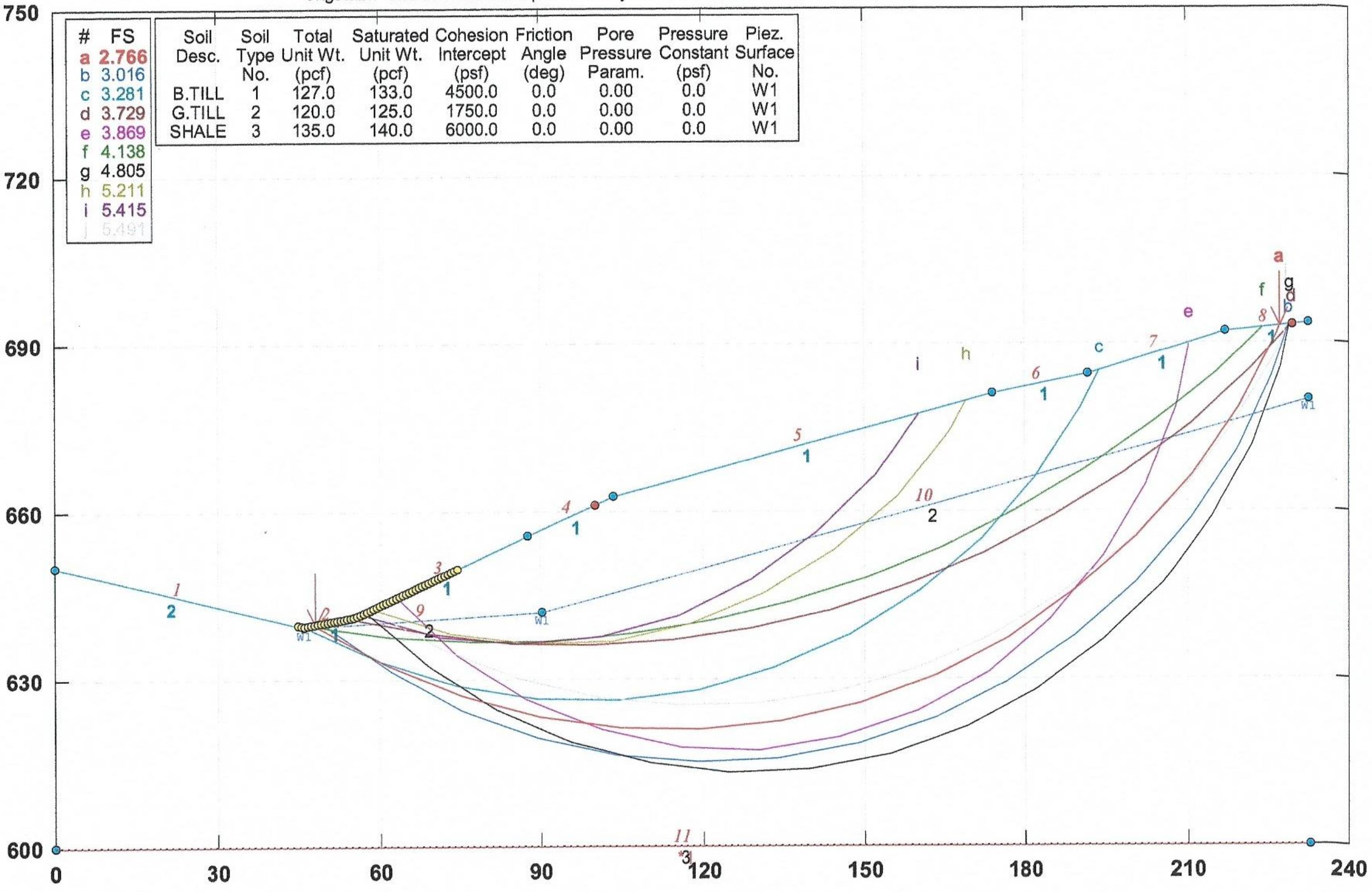
GROUNDWATER CONDITIONS:
First Noted at NW ft - m
At Completion: NW ft - m
After Hrs ft - m
Caved Dry at ft - m
Wet Seam at ft - m

G-1

Exhibit E

BROOKFIELD LANE RESIDENTIAL DEVELOPMENT SHORT TERM WITHOUT PIERS

c:\gstabl7 data\brookfieldb-b.pl2 Run By: ULTRA TECHNIC SERVICES, INC 6/18/2018 05:49PM



#	FS
a	2.766
b	3.016
c	3.281
d	3.729
e	3.869
f	4.138
g	4.805
h	5.211
i	5.415
j	5.491

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
B.TILL	1	127.0	133.0	4500.0	0.0	0.00	0.0	W1
G.TILL	2	120.0	125.0	1750.0	0.0	0.00	0.0	W1
SHALE	3	135.0	140.0	6000.0	0.0	0.00	0.0	W1

GSTABL7 v.2 FSmin=2.766

Safety Factors Are Calculated by GLE (Morgenstern-Price) Method (1-2)

GSTABL7

C-2
Exhibit E

BROOKFIELD LANE RESIDENTIAL DEVELOPMENT LONG TERM WITHOUT PIERS

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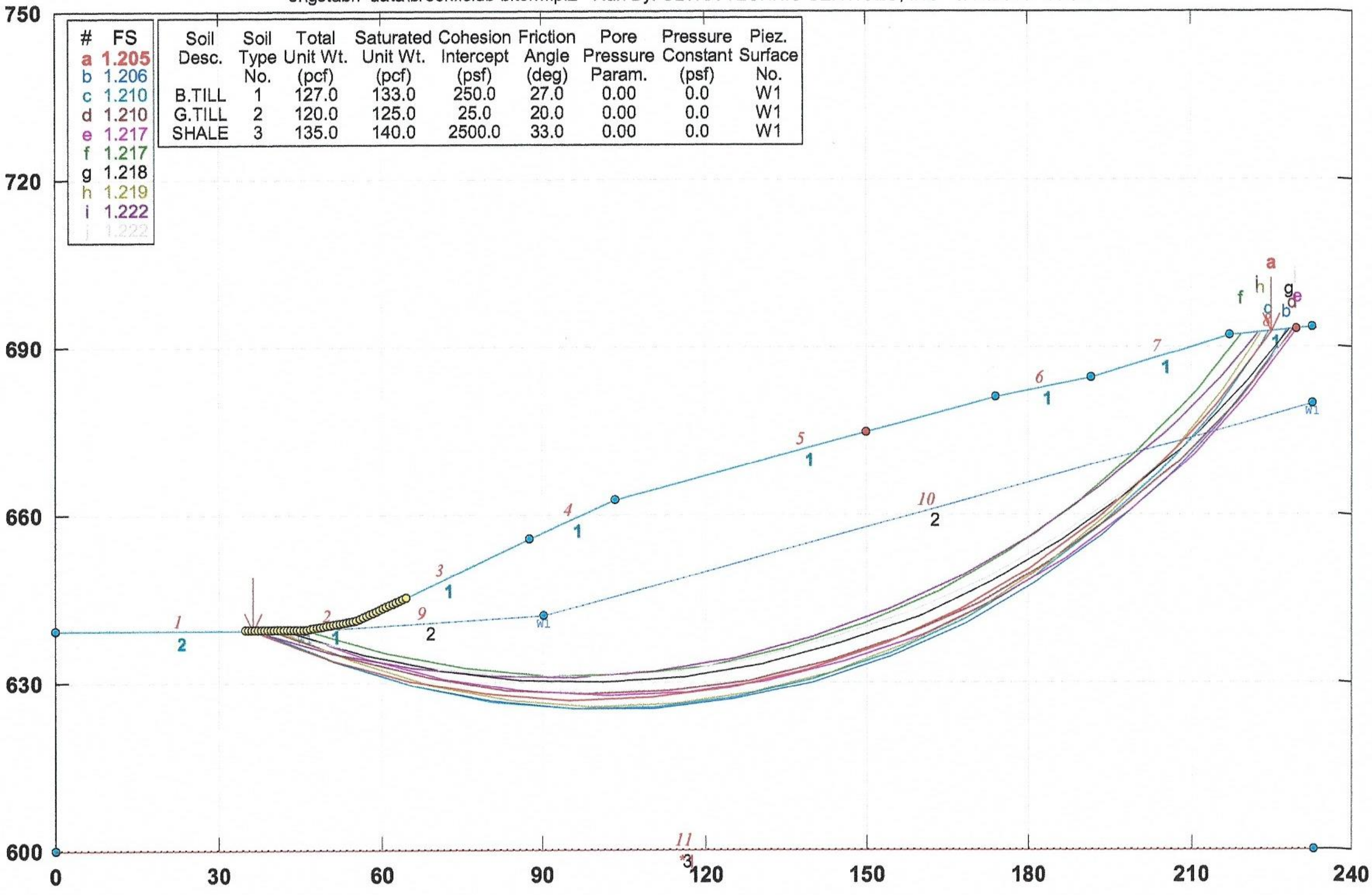


#	FS
a	1.205
b	1.206
c	1.210
d	1.210
e	1.217
f	1.217
g	1.218
h	1.219
i	1.222
j	1.222

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
B.TILL	1	127.0	133.0	250.0	27.0	0.00	0.0	W1
G.TILL	2	120.0	125.0	25.0	20.0	0.00	0.0	W1
SHALE	3	135.0	140.0	2500.0	33.0	0.00	0.0	W1

GSTABL7 v.2 FSmin=1.205

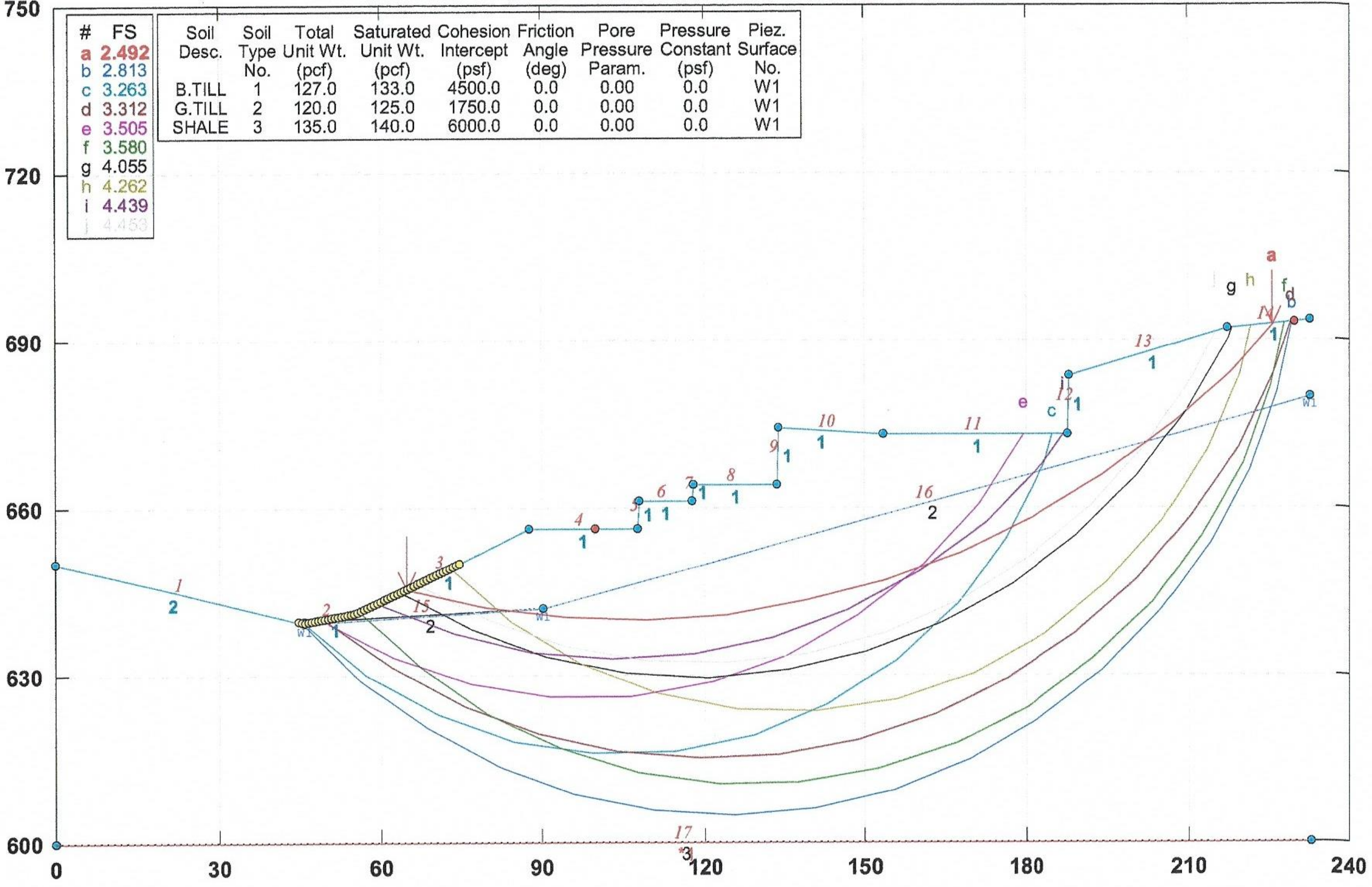
Safety Factors Are Calculated by GLE (Morgenstern-Price) Method (1-2)

GSTABL7

C-3
Exhibit E

BROOKFIELD LANE RESIDENTIAL DEVELOPMENT SHORT TERM WITHOUT PIERS

c:\gstabl7 data\brookfieldb-bprop.pl2 Run By: ULTRA TECHNIC SERVICES, INC 6/19/2018 02:56AM



#	FS
a	2.492
b	2.813
c	3.263
d	3.312
e	3.505
f	3.580
g	4.055
h	4.262
i	4.439
j	4.453

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
B.TILL	1	127.0	133.0	4500.0	0.0	0.00	0.0	W1
G.TILL	2	120.0	125.0	1750.0	0.0	0.00	0.0	W1
SHALE	3	135.0	140.0	6000.0	0.0	0.00	0.0	W1

GSTABL7 v.2 FSmin=2.492

Safety Factors Are Calculated by GLE (Morgenstern-Price) Method (1-2)

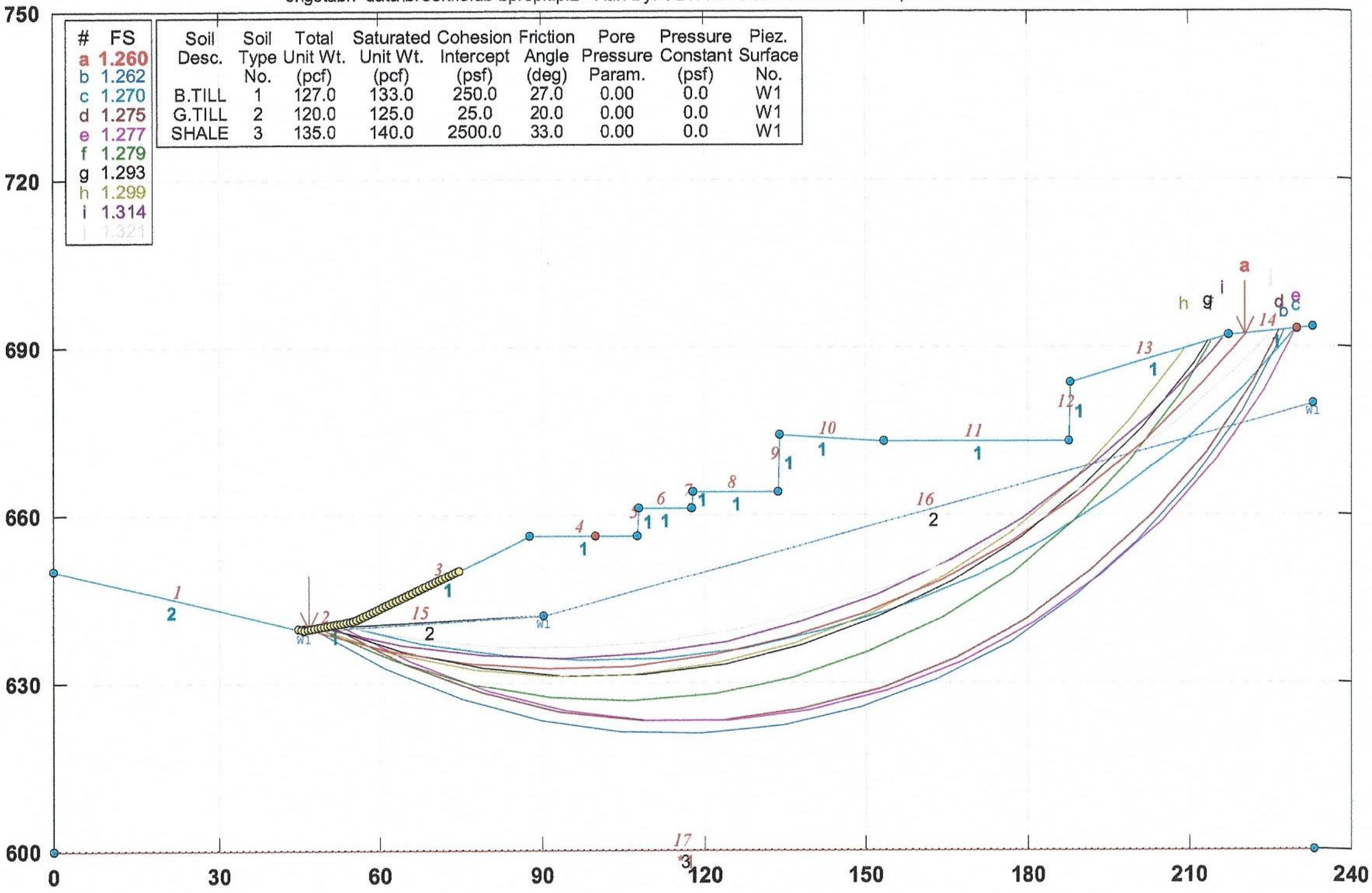
GSTABL7

C-3A

Exhibit E

BROOKFIELD LANE RESIDENTIAL DEVELOPMENT SHORT TERM WITHOUT PIERS

c:\gstabl7 data\brookfieldb-bproplt.pl2   Run By: ULTRA TECHNIC SERVICES, INC   6/19/2018   02:44AM



#	FS
a	1.260
b	1.262
c	1.270
d	1.275
e	1.277
f	1.279
g	1.293
h	1.299
i	1.314
j	1.321

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
B.TILL	1	127.0	133.0	250.0	27.0	0.00	0.0	W1
G.TILL	2	120.0	125.0	25.0	20.0	0.00	0.0	W1
SHALE	3	135.0	140.0	2500.0	33.0	0.00	0.0	W1

GSTABL7 v.2 FSmin=1.260

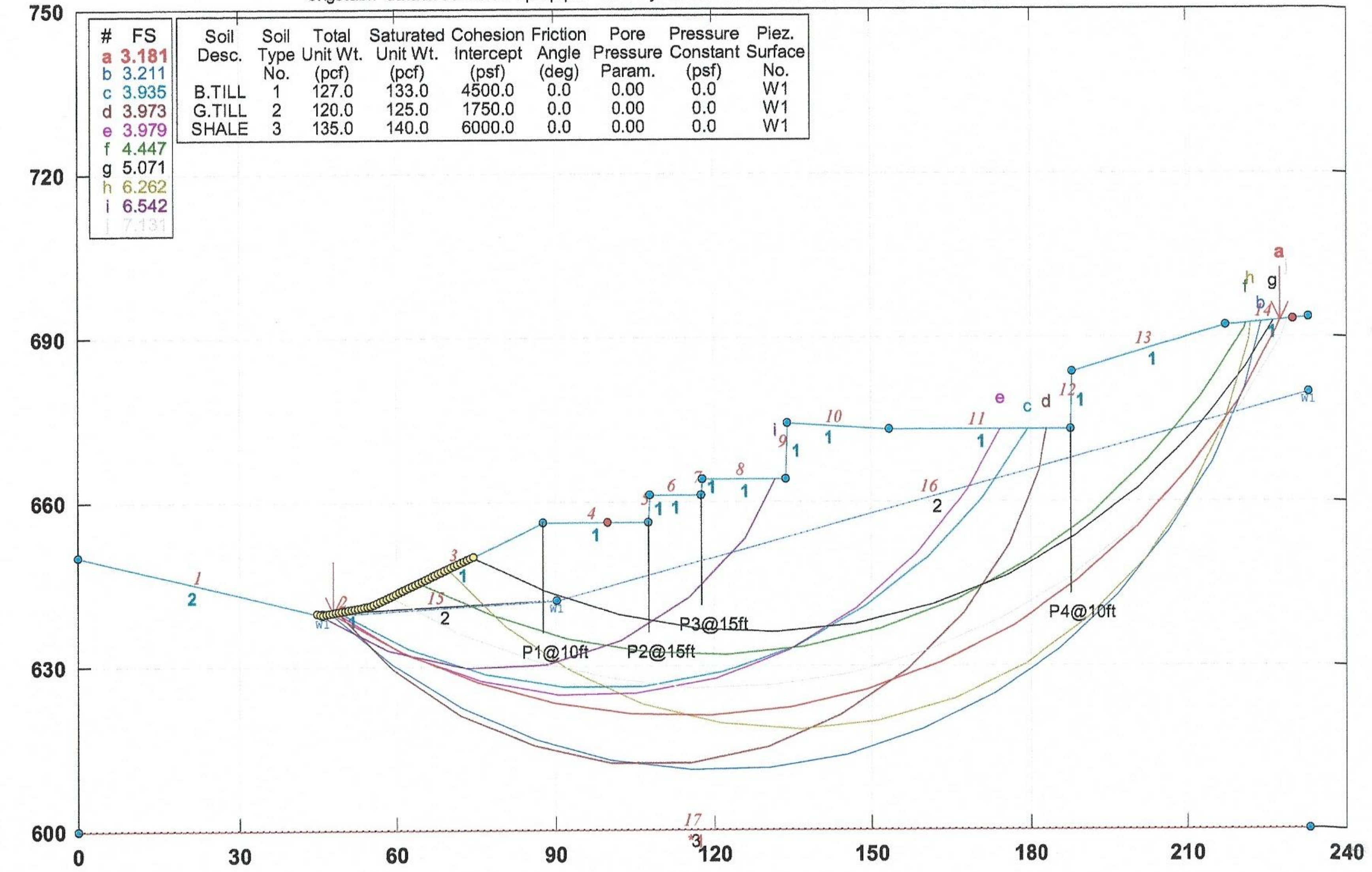
Safety Factors Are Calculated by GLE (Morgenstern-Price) Method (1-2)

GSTABL7

Exhibit ~~E~~ 4

BROOKFIELD LANE RESIDENTIAL DEVELOPMENT SHORT TERM WITHOUT PIERS

c:\gstabl7 data\brookfieldb-bprop.pl2 Run By: ULTRA TECHNIC SERVICES, INC 6/18/2018 06:18PM



#	FS
a	3.181
b	3.211
c	3.935
d	3.973
e	3.979
f	4.447
g	5.071
h	6.262
i	6.542
j	7.131

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
B.TILL	1	127.0	133.0	4500.0	0.0	0.00	0.0	W1
G.TILL	2	120.0	125.0	1750.0	0.0	0.00	0.0	W1
SHALE	3	135.0	140.0	6000.0	0.0	0.00	0.0	W1

GSTABL7 v.2 FSmin=3.181

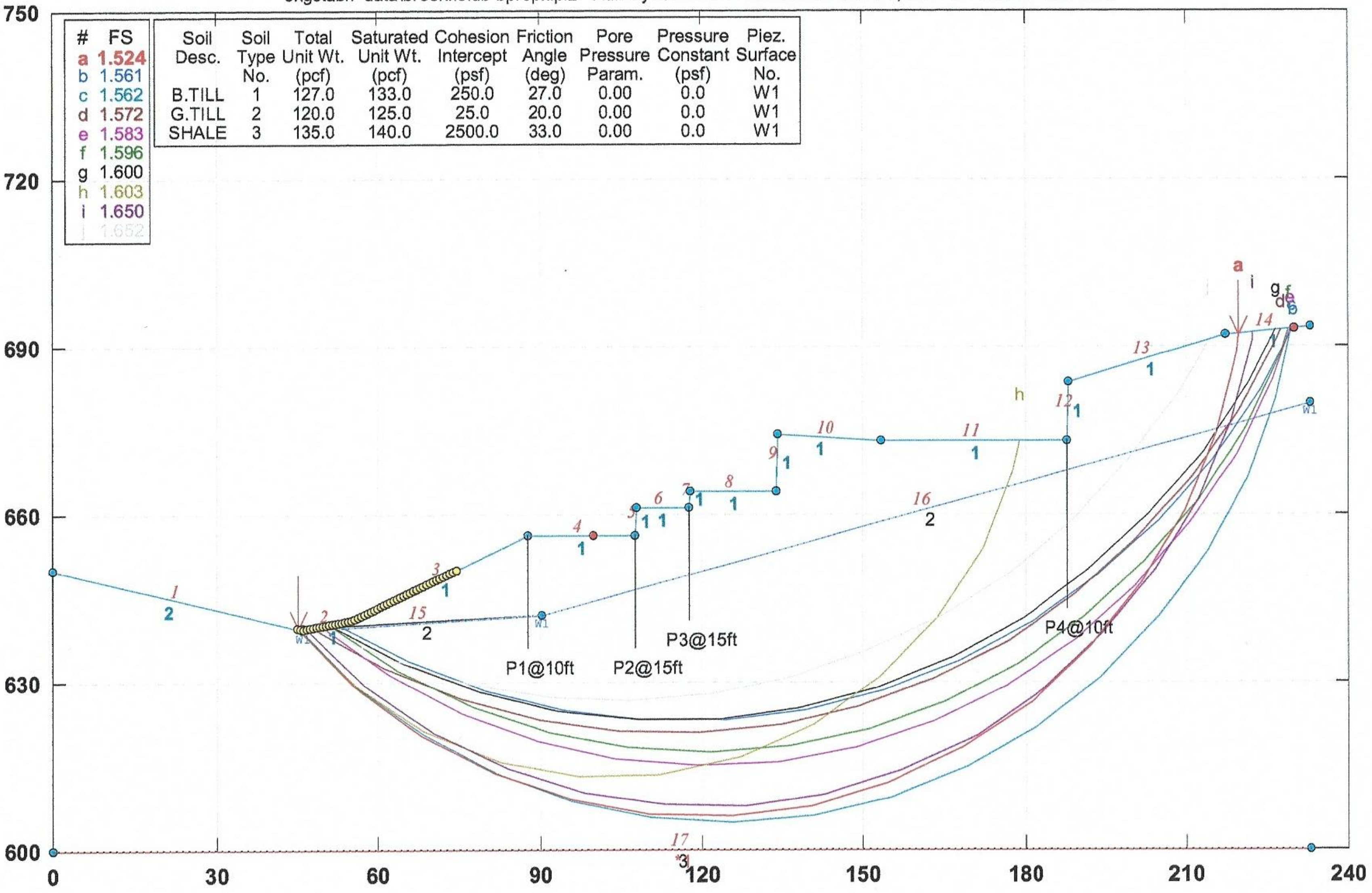
Safety Factors Are Calculated by GLE (Morgenstern-Price) Method (1-2)

GSTABL7

C-5
Exhibit E

BROOKFIELD LANE RESIDENTIAL DEVELOPMENT SHORT TERM WITHOUT PIERS

c:\gstabl7 data\brookfieldb-bproplt.pl2 Run By: ULTRA TECHNIC SERVICES, INC 6/18/2018 06:22PM



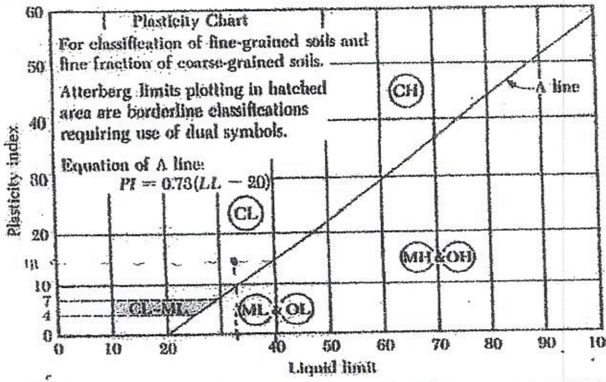
#	FS
a	1.524
b	1.561
c	1.562
d	1.572
e	1.583
f	1.596
g	1.600
h	1.603
i	1.650
j	1.652

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
B.TILL	1	127.0	133.0	250.0	27.0	0.00	0.0	W1
G.TILL	2	120.0	125.0	25.0	20.0	0.00	0.0	W1
SHALE	3	135.0	140.0	2500.0	33.0	0.00	0.0	W1

GSTABL7 v.2 FSmin=1.524
Safety Factors Are Calculated by GLE (Morgenstern-Price) Method (1-2)

Exhibit E

Table 1.6 Unified System of Classification[a]

Major divisions			Group symbols	Typical names	Classification criteria		
Coarse-Grained Soils More than 50% retained on No. 200 sieve[b]	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve GW, GP, SW, SP More than 12% pass No. 200 sieve GM, GC, SM, SC 5% to 12% pass No. 200 sieve Borderline classification requiring use of dual symbols	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		Sands with Fines	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7	
Fine-Grained Soils 50% or more passes No. 200 sieve[b]	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	 		
			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 greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity			
Highly Organic Soils			PT	Peat, muck, and other highly organic soils	Visual-manual identification, see ASTM Designation D2488.		

Guide for Consistency of Fine-Grained Soils

SFT Penetration (blows/foot)	Estimated Consistency	Estimated Range of Unconfined Compressive Strength tons/sq.ft.
< 2	Very soft (extruded between fingers when squeezed)	<0.25
2-4	Soft (molded by light finger pressure)	0.25-0.50
4-8	Medium Imolded by strong finger pressure)	0.50-1.00
8-15	Stiff (readily indented by thumb but penetrated with great effort	1.00-2.00
15-30	Very Stiff (readily indented by thumbnail)	2.00-4.00
>30	Hard (indented with difficulty by *thumbnail)*	*>4.00*

SANDS & COARSE SILTS				
Standard Penetration Test (blows/ft)	Cone Resistance (hg/cm2)	Relative Density %	Angle of Internal Friction (Degrees)	Consistency
<4	<20	<20	25-30	Very Loose
4-10	20-40	20-40	30-35	Loose
10-30	40-120	40-60	35-40	Medium Density
30-50	120-200	60-80	40-45	Dense
>50	>200	>80	>45	Very Dense

Exhibit E

HARDNESS CLASSIFICATION OF INTACT ROCK

CLASS	HARDNESS	FIELD TEST	APPROXIMATE RANGE OF UNIAXIAL COMPRESSIVE STRENGTH Kg/cm^2 or Tons/ft^2 (MN/m^2)
I	Extremely hard (extremely strong)	Many blows geologic hammer required breaking intact specimen	**>2000 (200)**
II	Very Hard (Very strong)	Hand held specimen breaks with hammer end of pick under more than one blow	**2000-1000 (200-100)**
III	Hard (strong)	Cannot be scraped or peeled with knife, hand held specimen can be broken with single moderate blow with pick	**1000-500 (100-50)**
IV	Soft (weak)	Can just be scraped or peeled with knife. Indentations 1mm to 3mm show in specimen with moderate blow with pick	**500-250 (50-25)**
V	Very soft (very weak)	Material crumbles under moderate blow with sharp end of pick and can be peeled with a knife, but is too hard to hand-trim for Triaxial test specimen	**250-10 (25-1)**

Exhibit E

VISUAL IDENTIFICATION OF SAMPLES

DEFINITIONS OF SOIL COMPONENTS AND FRACTIONS

1. GRAIN SIZE

MATERIAL	**FRACTION**	**SIEVE SIZE**
BOULDERS		12"+
COBBLES		3" - 12"
GRAVEL	COARSE	3/4" - 3"
	FINE	No. 4 to 3/4"
SAND	COARSE	No. 10 to No. 4
	MEDIUM	No. 40 to No. 10
	FINE	No. 200 to No. 40
FINES (SILT & CLAY)		PASSING No. 200

2. COARSE AND FINE GRAINED SOILS

DESCRIPTIVE ADJECTIVE	**PERCENTAGE REQUIREMENT**
TRACE	1 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%

3. Fine-Grained Soils. Identify in accordance with plasticity characteristics, dry strength, and toughness as described in Table 3.

	DESCRIPTIVE TERM	**THICKNESS**
Stratified Soils	alternating	
	thick	
	thin	
	parting	- 0 to 1/16" thickness
	seam	- 1/16 to 1/2" thickness
	layer	- 1/2 to 12" thickness
	stratum	- greater than 12" thickness
	varved Clay	- alternating seams or layers of sand, silt and clay
	pocket	- small, erratic deposit, usually less than 1 foot
	lens	- lenticular deposit
	occasional	- one or less per foot of thickness
	frequent	- more than one per foot of thickness

Exhibit E

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size of configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to the adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions their likely reaction to proposed construction activity and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or ground-water fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. Unless indicated otherwise this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

Exhibit E

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are not exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be please to discuss other techniques, which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials, which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

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