December 26, 2018

Mr. Rich Heareth
Perfection Builders
P.O. Box 436494
Louisville, Kentucky 40253
rich@perfectionbuilders.com

Subject: Preliminary Slope Evaluation
Proposed South English Station Road Subdivision
1200 South English Station Road
Louisville, Kentucky 40299
ECS Project No. 61-1904

Dear Mr. Heareth:

A new residential subdivision is proposed for construction in Louisville, Jefferson County, Kentucky. The site is located in the southeast quadrant of the I-64/South English Station Road intersection. The approximate site location is shown on the attached Site Vicinity Map. The property generally consisted of wooded, rolling hills with surface drainage directed to the northern portion of the site by small swales and streams. Provided drawings indicated that existing surface elevations reportedly ranged from approximately ~EL 630 at low points along I-64, to ~El 725 in the southwest portion of the site near the bend in South English Station Road.

The "Preliminary Plan South English Station Property" (Plan) prepared by Mindel Scott, dated 10/15/2018 identified existing 20-30% slopes and >30% slopes on the property. A reduced copy of this drawing is attached. Item 12 of the General Notes included on this drawing stated that "No slopes >30% are expected to be impacted by this development." Some 20-30% slope areas shown on the plan could be disturbed by planned home construction, storm and sanitary sewer construction, detention/water quality basin construction, and road construction.

The current Metro Louisville Land Development Code (LDC) 4.7.5 includes requirements for land disturbing activities on slopes greater than 20%. Item B.3 of 4.7.5 states "Land disturbing activities on slopes greater than 20% and less than 30% shall be required to prepare a geotechnical survey report if the staff of the USDA Natural Resources Conservation Service (NRCS) determines such a study is warranted, given the site's soil and geologic characteristics. A geotechnical survey report shall be submitted for land disturbing activities on slopes greater than 30%.

We understand that at present the NRCS is not making the determination of the need for a geotechnical survey report. Accordingly, ECS Southeast, LLP (ECS) was retained to conduct a preliminary slope evaluation of the site and to determine if a geotechnical survey report would be required. Our evaluation consisted of the following tasks:

- Review the Plan
- Review USGS Geologic Quadrangle Map information
- Review USDA NRCS Soil Survey information
- Conduct a visual reconnaissance of selected slope areas
- Evaluate the reviewed information and prepare a report of our findings and recommendations

USGS Geologic Quadrangle Map Review

The "Geologic Map of the Fisherville Quadrangle, Jefferson County, Kentucky" published by the U. S. Geological Survey and shown on the Kentucky Geologic Map Information Service indicated that the far west and south west portions of the site along South English Station Road (roughly above EL710-EL720) are underlain by the Osgood and Brassfield Formations, with the remainder of the site underlain by the Drakes Formation. Slope stability problems have been associated with the Osgood Formation due to its tendency to lose strength when exposed. The referenced geologic map and reported surface elevations indicated that the contact between the base of the Saluda Dolomite Member and the top of the Bardstown Member (both parts the Drakes Formation) lies roughly between EL 665 to EL 683. Fill associated with I-64 embankments was shown to the far north. The mapped extent of the bedrock formations is shown on Figure 1.

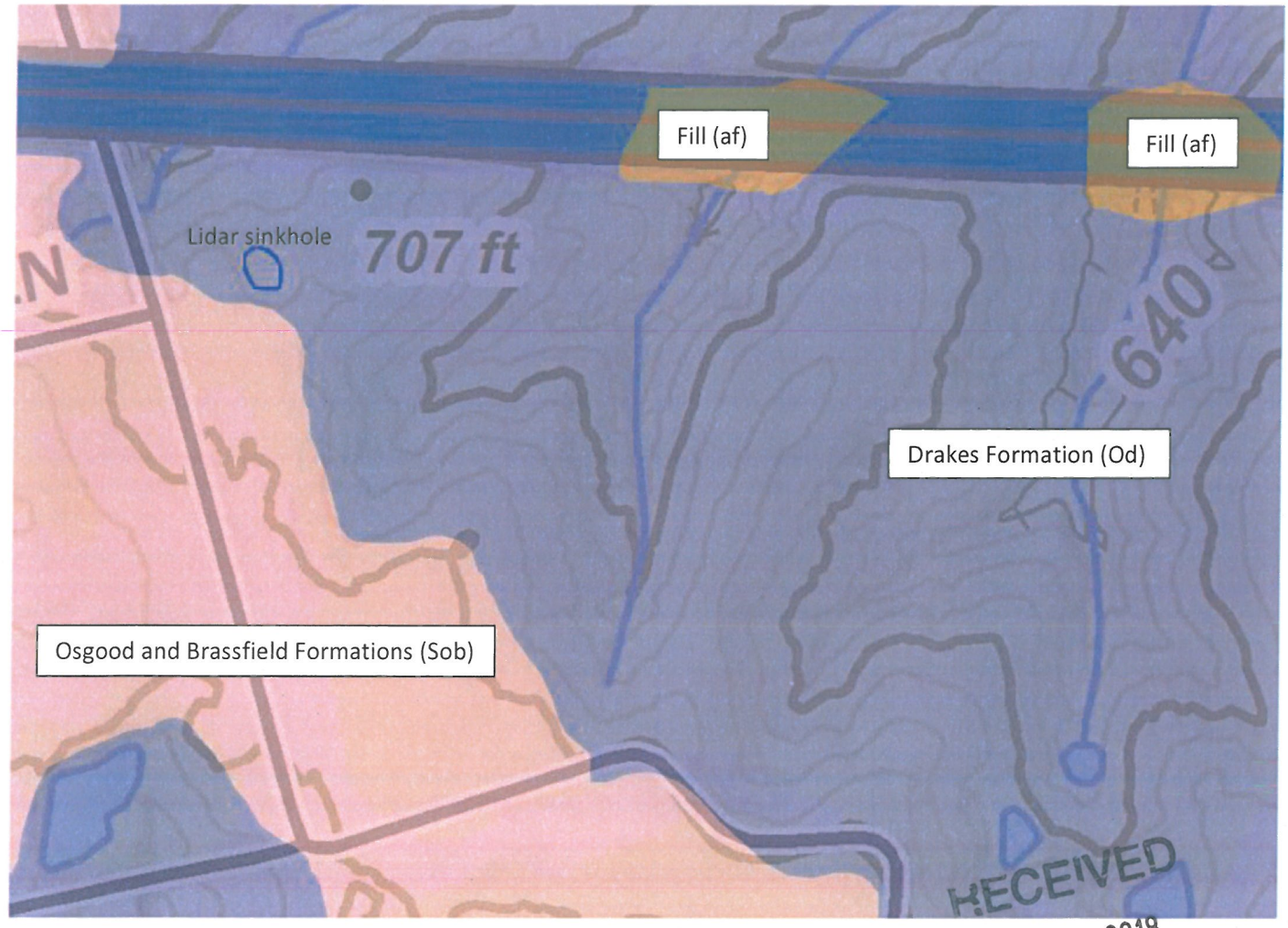


Figure 1: Reported Site Geology

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP

Osgood Formation

Primary Lithology: Shale, dolomitic mudstone, and dolomite.
Reported Thickness: 17' – 22'
Karst Potential: Non-karst.
Shale is light olive gray to greenish gray, with streaks of grayish red to dark reddish brown 5 to 9 feet above base; weathers same to grayish yellow. Interbedded with dolomitic mudstone and dolomite in uppermost and lowermost parts of unit. Dolomitic mudstone and dolomite are medium gray to greenish gray, weather same to dusky yellow and yellowish gray, locally reddish brown, mottled in part. Contact with underlying Brassfield Formation appears conformable but may be erosional where unit rests on Saluda Dolomite Member. Exposures sparse; description mainly from exposure at inter-change of Jefferson Freeway and Ky. Highway 155, about half a mile west of quadrangle.

Brassfield Formation

Primary Lithology: Limestone and dolomite.
Total Reported Thickness: 0' – 4'
Karst Potential: Non-karst.

Dominant limestone is grayish orange to pale yellowish brown, weathers yellowish gray to dark yellowish orange; coarsely crystalline, possibly recrystallized; contains whole and broken fossils and scattered thin lenses of porcelaneous chert. Less abundant limestone is light gray with greenish gray and pale reddish brown mottling, weathers same to dark yellowish orange; very finely crystalline; dolomitic; grades to dolosiltite of similar colors. Limestone types interbedded and intergraded; stylolitic; bedding is generally irregular, rubbly, and obscure; locally cross-bedded; bed thickness ranges from 0.1 to 2.5 feet. Glauconite locally abundant in topmost bed; bed near base contains pyrite and pellets, and clasts of limestone and dolomite from underlying unit. Mapped with overlying Osgood Formation. On some flat topped ridges the Brassfield is represented entirely by cherty red clay residue as much as 4 feet thick; absent locally due to non-deposition or pre Osgood erosion. Small sinkholes are common.

Drakes Formation (4 Members: Hitz Limestone Bed, Saluda Dolomite Member, Bardstown Member, Rowland Member)

Total Reported Thickness: ±140'
Karst Potential: Low – Mapped Lidar sinkhole in northwest portion of the site is shown on Figure 1.

Hitz Limestone Bed of Saluda Dolomite Member
Primary Lithology: Limestone, dolomite, and shale
Total Reported Thickness: 0' – 7'

Limestone & dolomite are dark gray to olive gray, weather light gray to grayish orange, locally reddish brown cast; very fine to medium grained, silty, laminated in part; hackly to blocky fracture; inter--bedded and inter-tongued. Limestone and dolomite occur in at least four distinct alternating layers 0.2 to 0.4 foot thick with limestone at base. Pink calcite locally fills large fossil cavities. Shale is grayish black to dusky brown, carbonaceous, calcareous, and strongly fissile; commonly in two beds, one about 0.5 foot thick near base and one 0.2 foot thick near top. Small sinkholes are common.

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP

Saluda Dolomite Member
Primary Lithology: Dolomite, dolomudstone.
Total Reported Thickness: 37 – 45'

Dolomite, greenish gray, light to medium light gray, grayish yellowish green, & light olive gray in distinct color bands, weathers same to grayish orange & yellowish gray; mottled in part. Dolomite in upper three fourths of unit is laminated; calcareous; quartz silt and sand grains make up 0 to 3 percent; mud cracks and rip up clasts on some bedding planes; weathers blocky to massive in steep ravines, shaly to flaggy on weathered slopes. Lower one-fourth of unit is dolomudstone that lacks prominent lamination; fracture is subconchoidal; weathers shaly or to blocky prisms 1 to 2 inches across. Limestone is bluish gray, weathers olive gray to brownish gray; dense, micritic; conchoidal fracture; commonly as one or two beds 0.1 to 0.6 foot thick in lower part of laminated dolomite sequence. Shale, in same part of sequence, light gray to olive black, 0.1 to 1.0 foot thick. Basal 5 feet of unit locally contains very thin inter-beds of abundantly fossiliferous limestone characteristic of underlying Bardstown Member. Residuum thickest 3 to 7 feet on ridgetops. Water sufficient only for domestic and farm use is obtained from shallow wells in the Saluda Dolomite.

Bardstown Member
Primary Lithology: Limestone, mudstone, and shale.
Total Reported Thickness: 35 – 46'

Limestone, mudstone, and shale. Limestone in three types: Most common type is medium to dark gray, weathers yellowish brown; micritic to fine grained; beds very thin, laminated, continuous; fossils common. Second type is medium light gray to light olive gray, weathers light gray to dark yellowish orange; micritic to coarse grained; beds very thin, discontinuous; abundant whole fossils distinctive. Third type is muddy limestone, bluish to olive gray, weathers greenish gray to yellowish green, resembles limestone of underlying Rowland Member. Mudstone and shale, as inter-beds in limestone, are olive gray, somewhat calcareous, weather light olive gray to light gray. Near top and base shale is calcareous and carbonaceous, grayish to brownish black, weathers medium gray, in beds 0.1 foot to nearly 1 foot thick. All shale is fossiliferous.

Rowland Member
Primary Lithology: Limestone and shale.
Total Reported Thickness: ±140'

Limestone and shale. Dominant limestone is medium gray and greenish gray to medium bluish gray calcisiltite, weathers pale olive to yellowish gray; dolomitic and argillaceous; streaked with irregular burrows filled with dusky yellowish-green glauconitic material which weathers readily to form a pitted surface; thin to thick bedded in continuous planar beds; internal bedding laminations poorly preserved owing to bioturbation. Thin inter-beds of brownish black carbonaceous shale in this zone are similar to shale beds near base of overlying Bardstown Member. Dominant shale is olive gray, light olive gray, dark greenish gray, and greenish gray; weathers yellowish gray; calcareous, clayey; inter-beds higher in section are thinner and less prominent except near top of member where shale is locally dominant rock type in upper 5 feet. Basal shale contains locally cherty, laminated, thin bedded limestone in southern and central parts of quadrangle, and, in north central part along Floyds Fork between U.S. Highway 60 and Interstate Highway 64, a cross-bedded, fossil fragmental, mud supported limestone. Water sufficient only for domestic and farm use is obtained from shallow wells in the Rowland Members. Springs issue locally from limestone beds immediately above thick shale sections in the Rowland. Small sinkholes are common.

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP

Soil Conservation Service Soil Survey

The USDA Natural Resources Conservation Service "Web Soil Survey" website indicated the 5 general soil types at the site as shown in Figure 2. Descriptions of these soil types are summarized below.

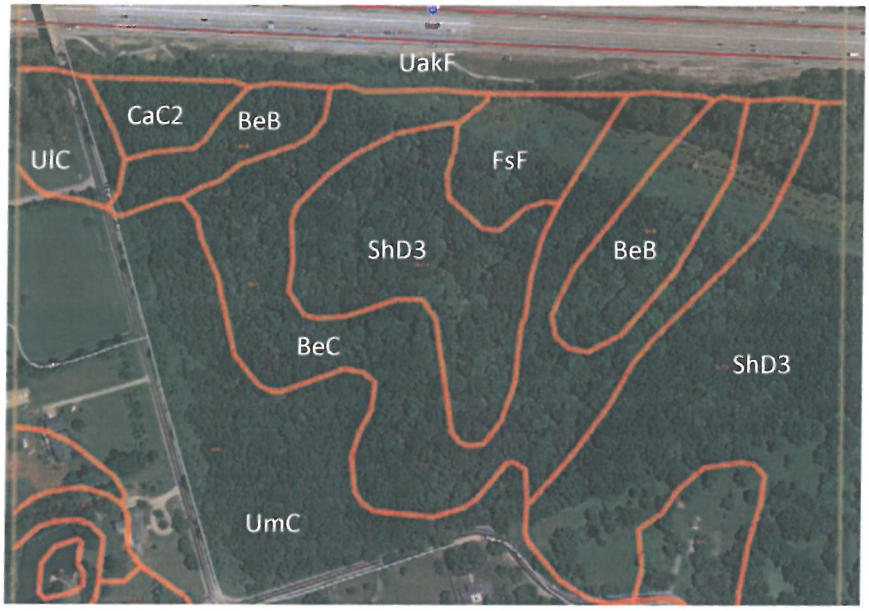


Figure 2: Reported Soil Data

UakF Urban land – Udorthents complex - 0 to 50 percent slope (embankment fill associated with I-64 at this site)
Parent material: not listed
Typical Profile: not listed

UlC Urban land – Alfic Udarents - Caneyville complex - 0 to 12 percent slopes
Parent material – clayey residuum weathered from limestone
Typical Profile
0 to 30 inches: silty clay
30 to 40 inches unweathered bedrock

UmC Urban land – Alfic Udarents - Crider complex 0 to 12 percent slopes
Parent material – thin fine-silty loess over clayey residuum weathered from limestone and dolomite
Typical Profile
0 to 24 inches: silt loam
24 to 100 inches: silty clay loam

CaC2 Caneyville silt loam – 6 to 12 percent slopes – eroded – very rocky
Parent material – clayey residuum weathered from limestone
Typical Profile
0 to 2 inches: silt loam
2 to 30 inches: silty clay
30 to 40 inches: unweathered bedrock

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP

BeB Beasley silt loam – 2 to 6 percent slopes
Parent material – clayey residuum weathered from calcareous shale
Typical Profile
0 to 7 inches: silt loam
7 to 29 inches: silty clay
29 to 50 inches silty clay
50 to 60 inches: bedrock

BeC Beasley silt loam – 6 to 12 percent slopes
Parent material – clayey residuum weathered from calcareous shale and/or calcareous siltstone
Typical Profile
0 to 6 inches: silt loam
6 to 48 inches: silty clay
48 to 58 inches: weathered bedrock

FsF Faywood-Shrouts-Beasley complex – 25 to 50 percent slopes
Parent material – clayey residuum weathered from limestone and shale
Typical Profile
0 to 7 inches: silt loam
7 to 29 inches: silty clay
29 to 39 inches: unweathered bedrock

ShD3 Shrouts silt loam – 12 to 25 percent slopes – severely eroded - very rocky
Parent material – clayey residuum weathered from calcareous shale and/or siltstone
Typical Profile
0 to 2 inches: silt loam
2 to 20 inches: silty clay
20 to 35 inches: silty clay
35 to 45 inches: weathered bedrock

Visual Reconnaissance of Selected Slope Areas

Based on our review of the Plan, 15 areas shown to be 20-30% slopes that may be disturbed were identified. See attached Visual Slope Reconnaissance Plan for approximate locations. The visual reconnaissance of these areas was conducted on December 19, 2018. Selected photos of the conditions observed at these areas, as well as bank conditions along existing streams and swales, are shown below. In general, similar conditions were observed in most areas. The site primarily was wooded with numerous small to large trees. Some brush, vines, and other low vegetation also was present. Evidence of past tree mowing to create relatively open strips was observed in several areas. No rock outcrops were observed along the hillsides with the exception of occasional, small, isolated outcrops and flag stones along the bottom and banks of swales and small streams on the site. Some indications of erosion were observed including occasional patches of bare soil and small gullies, primarily along the swales and small streams at the site. No indications of large scale erosion were noted. No visual indications of slope instability were observed. In particular, none of the following were noted: unusual tilting or fallen trees, tension cracks, scarps, displaced soil, or mounds of soil in lower areas.

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP

Steep slope looking east at Area 01

Steep stream bank at Area 01

Area 02

Area 05

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP


Area 09


Area 15


Erosion and flag rock at stream near Area 03


Erosion and flag rock at stream near Area 10

Based on our review of the above reference information and on our past experience with construction under similar conditions in Jefferson County, our opinion is that the on-site slopes (excluding small, localized erosion features along swales and streams) in the observed areas were stable at the time of our reconnaissance. Slope stability problems have been associated with the Osgood Formation due to its tendency to lose strength when exposed. However, it appears that the Osgood Formation only is present in the in the higher, flatter, south and southwest portion of the property as shown in Figure 1. The current, on-site slope stability likely is related to the following factors:

- Relatively thin depths of soil in slope areas
- Cohesive (clayey) soil matrix
- Rocky soil texture
- Limestone bedrock in many areas
- Numerous trees and other vegetation

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP

In our opinion, a geotechnical survey report including soil/rock test borings/coring, shear strength testing of soils, etc. is not required, so long as the planned subdivision configuration does not involve disturbance significantly greater that what was indicated on the Plan.

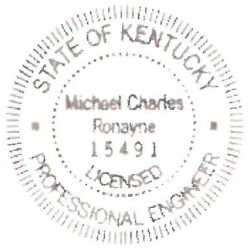
Several measures may be considered to help maintain the stability of the existing and planned slopes during construction of the new subdivision and over the life of the new homes. These measures include:

- Plan grading to minimize changes to existing topography along slopes.
- Minimize disturbance to slopes and vegetation outside new construction areas.
- Avoid significant transverse cuts along or at the toe of existing slopes.
- Avoid significant embankments along or at the crest of existing slopes.
- Maintain the following limits for new embankments without additional geotechnical exploration and analysis:
  - 3:1 (horizontal:vertical) or flatter slopes.
  - Properly strip all vegetation, topsoil, etc. where fill will be placed.
  - Construct embankments with controlled fill compacted to at least 98 percent standard Proctor maximum dry density and within 2 percent of the optimum moisture content.
  - Maximum fill embankment height – 5 feet.
  - Horizontally bench new fill into existing slopes.
- Maintain the following limits for new cuts in soil without additional geotechnical exploration and analysis:
  - 3:1 (horizontal:vertical) or flatter slopes.
  - Maximum cut height – 5 feet.
- Provide adequate erosion and surface water drainage control during construction and over the life of the subdivision.
- Establish permanent vegetative cover as soon as practical.

We appreciate the opportunity to work with you on this project. If you have any questions about this evaluation, or if you need any further assistance, please call us at any time.

Cordially,
ECS Southeast, LLP

Michael C. Ronayne, P.E.
Chief Engineer



Jeremy R. Hudson, P.E.
Senior Project Engineer

Attachments: Site Vicinity Map
Preliminary Plan South English Station Property
Visual Slope Reconnaissance Plan

1762 Watterson Trail, Louisville, KY 40299 • T: 502.493.7100 • F: 502.493.8190 • ecslimited.com
ECS Capitol Services, PLLC • ECS Florida, LLC • ECS Mid-Atlantic, LLC • ECS Midwest, LLC • ECS Southeast, LLP • ECS Southwest, LLP