Appendix A
Preliminary Soils Report

Shaffer Soil Services, Inc.
685 Sanford Road
Pittsboro, NC 27312
919-542-5803
shaffersoils@gmail.com

December 13, 2013

Walter Lewis, President
The Extra Garage
25 Bob Horton Road
Apex, NC 27523

Subject: Soil Evaluation – Jones Property- Parcel No. 74879
41 W. H. Jones Road off of Pea Ridge Road
Chatham County, NC

On December 13, 2013 Shaffer Soil Services, Inc. conducted a site evaluation of a specific section of this parcel for purpose of reviewing the soils for a possible stormwater attenuation site. The specific location and criteria were established by the site engineer and include determination of soil type, seasonal high water table, and estimated soil permeability. The general location is found on attached Site Map 1 and is defined by locations B1, B2, and B3. As the soils in this geology are sometimes highly variable, Shaffer Soil Services performed 8 soil borings in this area to better define the site and possible soil variability. The relative location of these 8 borings can be found on attached Site Map 2. Each soil boring is field flagged with a numbered orange ribbon according to Site Map 2.

The soils mostly classify in the Brickhaven soil series with minor variations. These soils have moderate permeability in the upper 12 to 18 inches and slow permeability below. The topsoil is generally fine sandy loam to a depth of 8 to 14 inches, and underlain by subsoil of silty clay loam to silty clay. Seasonal high water occurs from 12 inches to 28 inches across the area evaluated. Depth to bedrock exceeds 6 feet, but depth to soft, weathered bedrock occurs from 40 to 60 inches typically. These soils are not expansive nor do they have a high shrink-swell potential like the nearby Creedmoor soils. Brickhaven soils are friable to firm with a low to moderate shrink-swell potential (moderate where the subsoil has clay and silty clay textures). Silt content exceeds 30% in these soils. The parent material is highly weathered siltstone and mudstone with a high silt and very fine sand content. Parent material textures are silt loam to loam, and range to silty clay loam. One soil boring had loamy very fine sand in the parent material. The parent rock is very fine grained and although friable remains slowly permeable due to the tight grain patterns. Soft parent rock was encountered in 2 deep borings at 58 inches and 66 inches. No hard rock was encountered within 6 feet of the soil surface. Gravel content in all soil borings was less than 5% by volume.

The following table shows the characteristics from each soil boring. Soil borings 2, 3, and 4 were on a sideslope with a westerly aspect. The other borings are in or near a subtle headslope which is the head of a shallow drainageway which drains to the northwest. The seasonal high water table in the headslope

area is from 12 to 18 inches, whereas the seasonal high water table in borings 2 through 4 (sideslope) ranges from 22 to 28 inches.

Soil boring #	Topsoil texture	Subsoil texture	Subsoil depth (in)	Seasonal high water table depth (in)	Permeability in subsoil *	Slope	Landscape position
1	Fine sandy loam	Clay	40	16	Slow	2	Headslope
2	Fine sandy loam	Silty clay	>50	22	Slow	6	Sideslope
3	Fine sandy loam	Silty clay loam	46	26	Moderately slow	6	Sideslope
4	Fine sandy loam	Silty clay loam	48	28	Moderately slow	7	Sideslope
5	Fine sandy loam	Silty clay	42	20	Slow	5	Lower sideslope
6	Fine sandy loam	Silty clay	58	17	Slow	4	Lower sideslope
7	Fine sandy loam	Silty clay loam	>40	12	Moderately slow	2	toeslope
8	Fine sandy loam	Silty clay	47	18	Slow	3	Lower sideslope

*Permeability terms:
a) Permeability in the topsoil from 12 to 18 inches classified as moderate: 0.6. to 1.5 inches per hour
b) Subsoil permeability: moderately slow is 0.2 to 0.6 inches per hour; slow is 0.06 to 0.2 inches per hour
These terms define native, undisturbed soil permeability. Compaction of these soils can result in soil permeability well below 0.02 inches per hour, and indeed can often result in meeting a compaction standard required of wastewater lagoons of 1×10^{-7} cm/sec.

The soil material is good fill material and easily compacted. It does not have a high predominance of coarse sands nor does it have expansive clays which would hinder its use for fill material. The subsoil is consistently deeper than 40 inches. Underlying the subsoil are soft weathered bedrock layers of loam and silt loam, which appear also to be slowly permeable. *However, occasionally in this bedrock type the parent rock is fractured with quartz or diabase dikes. While none of these were noted during this evaluation, there is always a chance they may occur. For this reason, I recommend no excavations deeper than 40 inches if the goal is to maintain a relatively impervious structure.*

If a pond is chosen as a control structure, then the dam design should include a core which is excavated well into the parent rock and backfilled with the silty clay subsoil material found on site. Storage volume can be obtained by excavating the native soil out not to exceed 40 inches.

The soils throughout this area typically have a seasonal high water table from 12 to 30 inches in depth. With that in mind, any upslope areas above a storage structure such as a pond or stormwater

containment system are susceptible to receiving surface water runoff and shallow subsurface water runoff. This excessive water can be controlled by surface water diversions and/or shallow subsurface water diversions. These shallow systems should be designed at approximately 12-15 inches below the seasonal high water table and outleted below the stormwater storage structure.

Summary: the soils are Brickhaven soils and closely related variants. Seasonal high water table averages about 18 inches from the surface, and ranges from 12 to 28 inches. Permeability is moderately slow to slow in the subsoil. Permeability rates are estimated, but can be measured if requested. The subsoil material to 40 inches is free from bedrock and weathered bedrock and also serves well as fill material which may be compacted to standards which allow the use of the material as a pond or lagoon liner without supplemental materials being added.

This report and recommendations therein represent my professional opinion. This does not imply any guarantee that any given type of stormwater containment system will automatically function in the area evaluated. Proper function of these systems is based on siting, design, and operational factors. The attached maps are not to be separated from this report as the use may be misinterpreted.
I appreciate the opportunity to perform this service for you. Please contact me if you have any questions on this report.

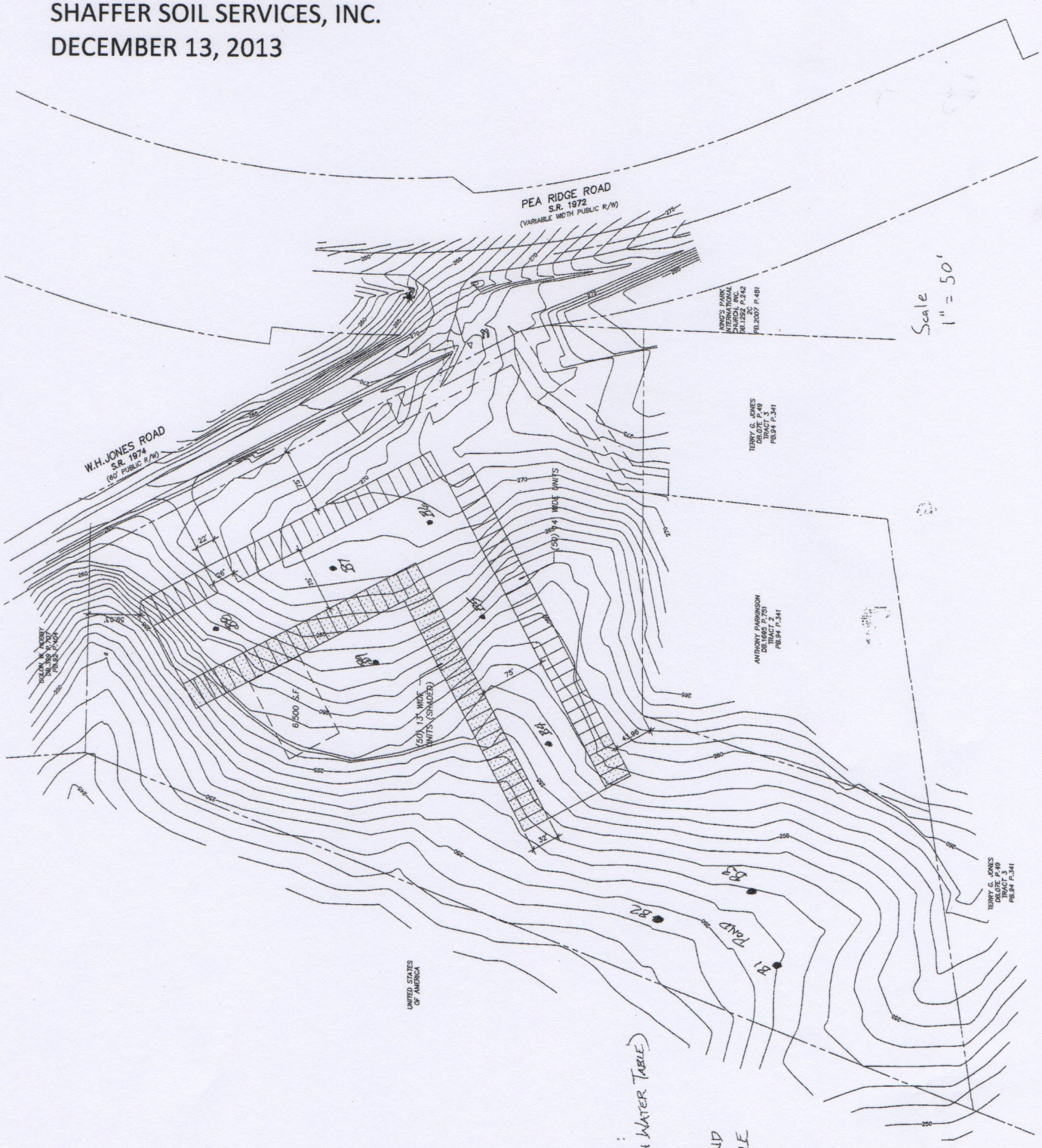
Sincerely,

Karl A. Shaffer, L.S.S.
President-Shaffer Soil Services, Inc.

Attachments:

1) Site Map 1
2) Site Map 2
3) Invoice

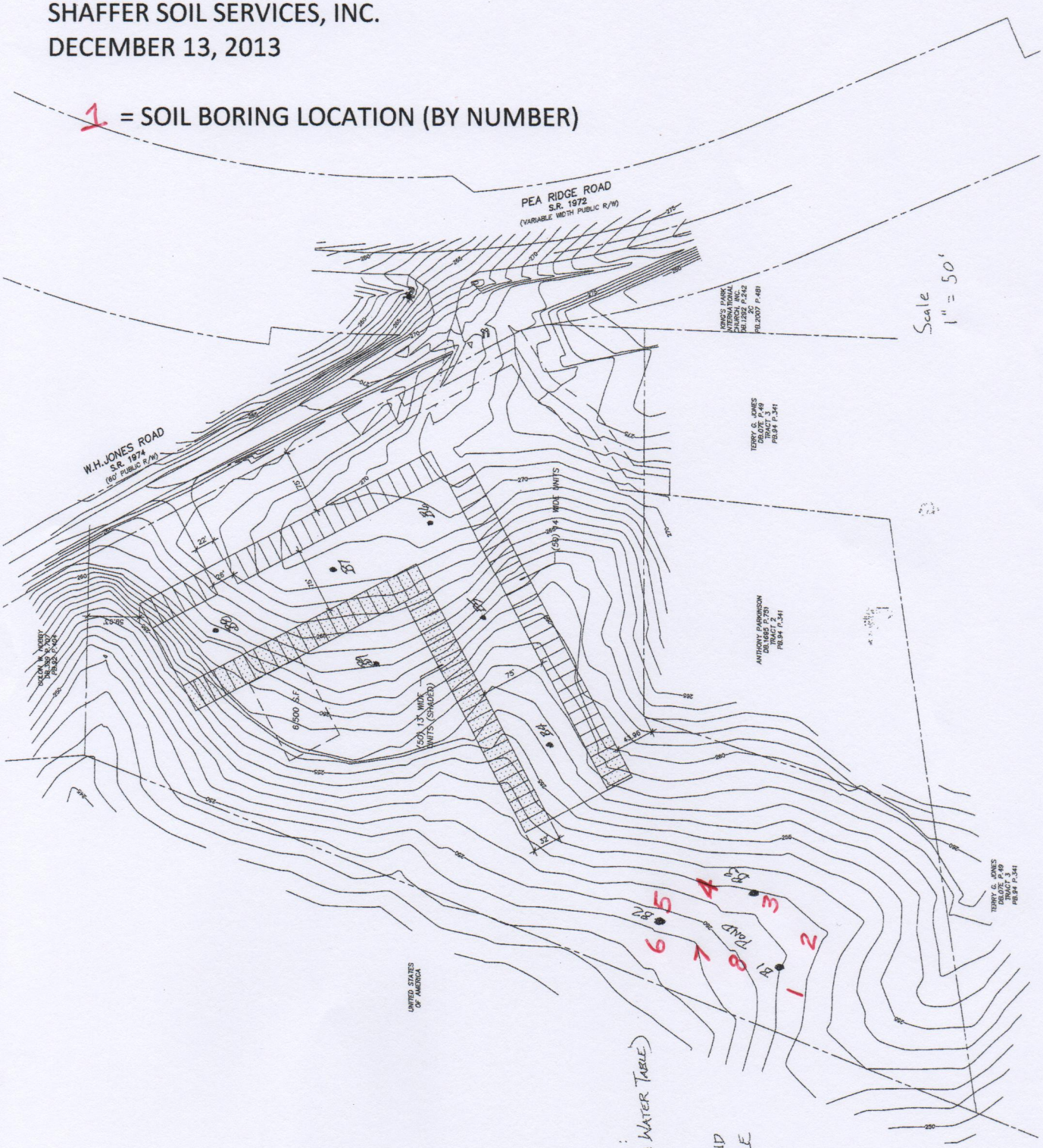
SITE MAP 1
JONES PROPERTY- PARCEL 74879
CHATHAM COUNTY, NC
SHAFFER SOIL SERVICES, INC.
DECEMBER 13, 2013



1. Soils/Boring Info Required:
   a: SHWT (Seasonal High Water Table)
   b: Soil Type
   c: Permeability
B1-B3 for Pond/Wetland
B4-B9 Gravel/Permeable Pavement

SITE MAP 2
JONES PROPERTY- PARCEL 74879
CHATHAM COUNTY, NC
SHAFFER SOIL SERVICES, INC.
DECEMBER 13, 2013

1 = SOIL BORING LOCATION (BY NUMBER)



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