Resource International, Inc.

WINCHESTER PIKE AT EBRIGHT ROAD AND SHANNON ROAD FRANKLIN COUNTY, OHIO

GEOTECHNICAL EXPLORATION REPORT (REV. 1)

Prepared For:
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Rii Project No. W-13-054

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December 18, 2013

Ms. Valerie Croasmun, P.E., AICP
ms consultants, inc.
2221 Schrock Road
Columbus, Ohio 43229

Re: Geotechnical Exploration Report (Rev. 1)
Winchester Pike at Ebright Road and Shannon Road
Franklin County, Ohio
Rii Project No. W-13-054

Ms. Croasmun:

Resource International, Inc. (Rii) is pleased to submit this revised geotechnical exploration report for the above-referenced project. Engineering logs have been prepared and are attached to this report along with the results of the laboratory testing. This report includes recommendations for the design and construction of the proposed improvements to the intersection of Winchester Pike with Shannon Road and Ebright Road, in Franklin County, Ohio. This document supersedes our previous submittal.

We appreciate having been given the opportunity to be of service to you on this project. If you have any questions concerning the geotechnical exploration or this report, do not hesitate to contact us.

Sincerely,

RESOURCE INTERNATIONAL, INC.

James R. Howdyshell, E.I.
Project Engineer

Jonathan P. Sterenberg, P.E.
Director of Geotechnical Services

Enclosure: Geotechnical Exploration Report

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EXECUTIVE SUMMARY

Resource International, Inc. (Rii) has completed a subgrade exploration report for the design and construction of the proposed roadway and intersection improvements at the intersection of Winchester Pike with Shannon Road and Ebright Road in Franklin County, Ohio. It is understood that the project will widen, for additional turn lanes, Winchester Pike along the north side of the roadway from approximately 1,200 feet west to 950 feet west of its intersection with Shannon Road and Ebright Road. Ebright Road will also be widened along the east side of the roadway to approximately 950 feet south of its intersection with Winchester Pike, and Shannon Road will be widened along the east side of the roadway to approximately 900 feet north of said intersection. In addition to the pavement widening, the existing bridge structure carrying Winchester Pike over Blacklick Creek will also be widened to the north. It is understood that the proposed structure modifications are considered to be rehabilitation, therefore, the design is to be performed in accordance with AASHTO Standard Specifications (LFD) and the 2004 ODOT Bridge Design Manual (BDM).

Exploration and Findings

During the period of July 8 through July 15, 2013, a total of sixteen (16) test borings, designated as borings B-001-0-13 through B-016-0-13, were drilled at the locations illustrated on the boring plan presented in Appendix II. In addition to the borings, five (5) pavement cores were also obtained from borings B-006, B-011, B-012, B-015 and B-016.

At the existing ground surface, nine (9) of the borings performed as part of this investigation were located outside of the existing pavement limits and encountered 3.0 to 10.0 inches of topsoil. The remaining seven (7) borings were located within the existing pavement and encountered 8.0 to 9.0 inches of asphalt at the existing ground surface, with the exception of boring B-008 which encountered 11.0 inches of concrete. Underlying the surficial asphalt, the borings performed within the existing pavement consistently encountered 4.0 inches of concrete, with the exception of boring B-014, which encountered 3.0 inches of aggregate base beneath the asphalt. Aggregate base was also encountered underlying the surficial concrete in boring B-008 with a thickness of 5.0 inches.

Underlying the surficial materials, existing fill was encountered in eight (8) of the sixteen (16) borings performed as part of this investigation. The existing fill material extended to depths ranging from 1.5 to 18.0 feet below existing grades, and consisted of both granular and cohesive soils. The granular fill soils encountered at the site were classified as gravel, gravel with sand and silt, gravel with sand, silt and clay, and sandy silt (ODOT A-1-a, A-2-4, A-2-6, A-4a). The cohesive fill soils were classified as sandy silt, silt and clay, and silty clay (ODOT A-4a, A-6a, A-6b). It should be noted that several of the recovered fill samples contained construction debris such as wood fibers and fragments in addition to asphalt, brick, concrete and slag fragments.

Underlying the surficial and existing fill materials, the borings encountered natural, primarily cohesive soils, underlain by deep deposits of granular soils in the structure borings. The natural cohesive soils encountered at the site consisted of sandy silt, silt, silt and clay, silty clay and clay (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6). The granular soils were described as gravel, gravel with sand, gravel with sand and silt, gravel with sand, silt and clay and sandy silt (ODOT A-1-a, A-1-b, A-2-4, A-2-6, A-4a).

Bedrock was not encountered in any of the borings performed as part of this investigation.

Analysis and Recommendations

The subgrade soils for the proposed roadway and intersection improvements at the intersection of Winchester Pike with Hannon and Ebright Roads consist predominantly of cohesive materials comprised of sandy silt, silt, silt and clay, silty clay and clay (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6). Some granular materials, comprised of gravel, gravel with sand, gravel with sand and silt, and gravel with sand, silt and clay (ODOT A-1-a, A-1-b, A-2-4, A-2-6) were also encountered within the uppermost 6.0 feet of the anticipated subgrade.

Based on the GB1, the overall average site parameters are noted as follows:

Overall Average Site Parameters

Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Design CBR
8	13	17	13	5.6	8

California Bearing Ratio (CBR) values for the entire project ranged from 4 to 12 with an average of 8. It is recommended that pavement design be based on the average CBR of 8 with a corresponding Subgrade Resilient Modulus, M_R, of 9,600 psi. Correlation charts indicate a Modulus of Subgrade Reaction (K) of 175 pci and a Soil Support Value (SSV) of 5.3.

It is understood that the existing structure carrying Winchester Pike over Blacklick Creek is currently a 3-span structure supported on 12-inch diameter cast-in-place (CIP) pipe piles (ODOT Item 507.07). Based on the information provided by ms, it is understood that driven CIP pipe piles will be utilized for support of the widened northern section of the existing structure. Rii understands that 12-inch diameter CIP piles will be utilized at the abutments, and 14-inch diameter CIP piles will be utilized at the intermediate piers. Anticipated scour depths are expected to range from 10 feet at the piers to 15 feet at the abutments. Based on the maximum pile loads provided, it is recommended that the proposed CIP piles be embedded as noted in the following table. It should be noted that the abutment and intermediate pier footings were considered to be at a depth of 10.0 feet below the existing ground surface.

CIP Pile Recommendations

Boring Number	Ground Elevation [1]	Pile Size	Pile Elevation		Embedment Depth [3] (feet)	Scour Depth [4] (feet)	Pile Capacity [4] (kips/pile)
			Top [2]	Tip			
B-004 (Rear Abutment)	754.5	12” CIP	744.5	697.5	47	15	79
B-005 (Pier 1)	746.1	14” CIP	736.1	694.1	42	10	120
B-008 (Pier 2)	744.0	14” CIP	734.0	691.0	43	10	120
B-009 (Forward Abutment)	754.7	12” CIP	744.7	687.7	57	15	79

1. *Ground elevation listed is the ground elevation at the boring location. The ground elevation at the pier locations is not the same as the elevations listed.*
2. *The top of pile elevation is at the proposed bottom of footing elevation at the abutment locations and at the bottom of the proposed pile cap at the pier locations.*
3. *Embedment depths represent the length of pile in contact with the soil.*
4. *Scour depth and maximum pile capacities were provided by ms consultants.*

NOTE: The top of pile elevation coincides with the bottom of footing elevations, and the estimated pile lengths reflect exclusively the length of the pile in contact with the soil. **Embedment length of the pile into the footing is not included.** Estimated pile lengths are rounded up to the nearest foot.

Please note that this executive summary does not contain all the information presented in the report. The unabridged subsurface exploration report should be read in its entirety to obtain a more complete understanding of the information presented.

1.0 INTRODUCTION

This report is a presentation of the geotechnical exploration performed for the design and construction of the proposed improvements to the intersection of Winchester Pike with Shannon Road and Ebright Road in Franklin County, Ohio. Resource International, Inc. (Rii) understands that the project will widen, for additional turn lanes, Winchester Pike along the north side of the roadway from approximately 1,200 feet west to 950 feet east of the intersection with Shannon Road and Ebright Road. Ebright Road will also be widened along the east side of the roadway to approximately 950 feet south of the intersection with Winchester Pike, and Shannon Road will be widened along the east side of the roadway to approximately 900 feet north of the intersection. Based on information provided by ms consultants (ms), it is anticipated that the proposed grade in the widened lanes will closely match the existing grade in the existing lanes. In addition to the pavement widening, the existing bridge structure carrying Winchester Pike over Blacklick Creek will also be widened to the north. The project area is shown on the vicinity map as part of the boring plan presented in Appendix II of this report.

2.0 GEOLOGY AND OBSERVATIONS OF THE PROJECT

2.1 Site Geology

Both the Illinoian and Wisconsinan glaciers advanced over two-thirds of the State of Ohio, leaving behind glacial features such as moraines, kame deposits, lacustrine deposits and outwash terraces. The glacial and non-glacial regions comprise five physiographic sections grouped by age, depositional process and geomorphic occurrence. Physiographically, the site lies within the Columbus Lowland of the Southern Ohio Loamy Till Plain. This region is characterized by relatively flat-lying silty loam till ground moraine, interspersed with end and recessional moraines, outwash and alluvial deposits. Ground moraines are deposited during the retreat of a glacier which results in an undifferentiated mixture of clay, silt, sand and gravel. End moraines are normally associated with ice melting that is neither advancing nor retreating for a period of time. Recessional moraines are deposited during the retreat of a glacial ice sheet. Both end and recessional moraines are commonly associated with boulder belts. Outwash deposits consist of undifferentiated sand and gravel deposited by meltwater in front of glacial ice and often occurs as valley terraces or low plains. Alluvium and alluvial terrace deposits range from silty clay to cobble sized particles, usually deposited in present and former floodplain areas, such as the Big Walnut Creek and Blacklick Creek river valleys.

Based on the Bedrock Geology and Topography Maps obtained from the Ohio Department of Natural Resources (ODNR), bedrock underlying the glacial deposits consists of the Devonian-aged Ohio Shale Formation. The Ohio Shale Formation consists of carbonaceous shale with carbonate/siderite concretions and ranges in color from brownish black to greenish gray. This formation contains laminated to thinly bedded shale and ranges from approximately 250 to 500 feet thick. According to be bedrock topography mapping, the bedrock surface forms a large, broad crest centered beneath the intersection of State Route 33 and South Hamilton Road. The edge of this crest slopes gradually downward beneath the site toward the northeast. The bedrock surface, at the intersection of Ebright Road and Winchester Pike, lies at an approximate elevation of 550 feet mean sea level (msl). Therefore, the depth to bedrock in the vicinity of the intersection is approximately 200 feet below the ground surface. Illustrations of the general geology of Ohio are included in Appendix I.

2.2 Existing Site Conditions

The intersection of Winchester Pike, Ebright Road and Shannon Road is located 0.9 miles north of U.S. Route 33, in Madison Township, Franklin County, Ohio. At the intersection, Winchester Road is aligned northwest and southeast, Ebright Road is aligned south, and Shannon Road heads northeast then to the east and intersects Gender Road. The existing roads all maintain two lanes of traffic, with Shannon Road having a right side turn lane at the intersection. The intersection services primarily agricultural properties and recreational facilities. Blacklick Trail runs along the northwest side of the intersection, crossing under Winchester Pike and running along Blacklick Creek. The intersection also contains many buried and overhead utilities that run adjacent to the roadways as well as through the intersection. The roadways are surfaced with asphalt and are generally in fair to good condition. The overall slope across the project area is to the north-northwest toward Blacklick Creek, which drains into Big Walnut Creek.

3.0 EXPLORATION

During the period of July 8 through July 15, 2013, a total of sixteen (16) test borings, designated as borings B-001-0-13 through B-016-0-13, were drilled at the locations illustrated on the boring plan presented in Appendix II, and summarized in Table 1. Six (6) of the borings were performed within the proposed widening area of Winchester Pike, six (6) borings were performed within the proposed widening areas of Ebright and Shannon Roads and four (4) borings were performed for the widening of the existing bridge structure carrying Winchester Pike over Blacklick Creek. Each of the twelve (12) pavement borings were sampled continuously beginning at either the existing ground surface, or at the bottom of the existing pavement section, to the boring termination depth. The structure borings were extended to depths ranging from 49.0 to 70.0 feet below the existing ground surface.

The boring locations were determined and located in the field by Rii representatives. Geographic latitude and longitude coordinates were collected using a handheld GPS device, and ground surface elevations at the boring locations were interpolated using topographic mapping information provided by ms.

Table 1. Test Boring Summary

Reference Alignment	Boring Number	Location				Ground Elevation (feet)	Boring Depth (feet)
		Station	Offset	Latitude	Longitude		
Winchester Pike	B-001-0-13	98+28.61	7.2' Lt.	39.892395028° N	82.867088240° W	750.9	7.0
	B-002-0-13	103+20.06	8.2' Lt.	39.891649918° N	82.865628480° W	752.2	7.0
	B-003-0-13	106+67.99	7.7' Lt.	39.891119702° N	82.864596961° W	755.8	7.0
	B-004-0-13	109+04.13	27.7' Lt.	39.890804549° N	82.863857051° W	754.5	70.0
	B-005-0-13	109+41.28	29.7' Lt.	39.890751273° N	82.863743295° W	746.1	65.0
Ebright Road	B-006-0-13	30+97.39	19.7' Rt.	39.887172020° N	82.863722579° W	749.7	6.0
	B-007-0-13	35+98.66	23.7' Rt.	39.888544310° N	82.863605264° W	747.8	6.0
Winchester Pike	B-008-0-13	110+47.84	26.6' Lt.	39.890575557° N	82.863437654° W	744.0	49.0
	B-009-0-13	110+88.05	31.2' Lt.	39.890521281° N	82.863311137° W	754.7	65.0
Ebright Road	B-010-0-13	41+11.77	19.4' Rt.	39.889851368° N	82.863104708° W	752.0	6.0
Winchester Pike	B-011-0-13	113+59.57	7.2' Lt.	39.890020140° N	82.862586414° W	754.8	7.0
Shannon Road	B-012-0-13	44+14.57	23.7' Rt.	39.890536819° N	82.862497086° W	752.7	6.0
	B-013-0-13	48+89.55	17.2' Rt.	39.891528700° N	82.861431508° W	746.0	6.0
Winchester Pike	B-014-0-13	117+55.23	6.5' Lt.	39.889326156° N	82.861500331° W	752.1	7.0
Shannon Road	B-015-0-13	52+83.79	21.8' Rt.	39.889326156° N	82.860255120° W	748.1	6.0
Winchester Pike	B-016-0-13	121+73.38	7.0' Lt.	39.888567975° N	82.860381430° W	750.5	7.0

In addition to the borings performed, five (5) pavement cores were also obtained from borings B-011 and B-016 along Winchester Pike, borings B-012 and B-015 along Shannon Road and from boring B-006 along Ebright Road to determine the existing pavement thickness, composition and condition where the proposed improvements will tie into the existing alignments. Photographs of the retained pavement cores are presented in Appendix IV immediately following the boring logs. The cores were retained with a portable, 4.0-inch diameter thin-walled, pavement coring machine.

The borings were drilled with an all-terrain-vehicle (ATV) mounted rotary drilling machine, utilizing a 4.5-inch outside diameter, solid flight auger to advance the pavement borings, and a 4.25-inch inside diameter hollow-stem auger to advance the structure borings. Standard penetration test (SPT) and split spoon sampling was performed continuously in the pavement borings to a depth of 6.0 feet below either the existing ground surface or the existing pavement section. In the structure borings performed for the proposed bridge widening, SPT and split spoon sampling were performed at 2.5-foot intervals to a depth of 20 feet below the proposed bottom of footing, and at 5.0-foot intervals thereafter until the boring termination depth. Continuous sampling was also performed for a 6.0-foot interval below the existing creek bed of Blacklick Creek in pier boring B-005. Due to the time constraints associated with closing the Blacklick Trail, continuous sampling was not performed below the creek bed in pier boring B-008.

The SPT, per the American Society for Testing and Materials (ASTM) designation D1586, is conducted using a 140-pound hammer falling 30.0 inches to drive a 2.0-inch outside diameter split spoon sampler 18.0 inches. Rii utilized an automatic drop hammer to generate consistent energy transfer to the sampler. Driving resistance is recorded on the boring logs in terms of blows per 6.0-inch interval of the driving distance. The second and third intervals are added to obtain the number of blows per foot (N). Standard penetration blow counts aid in determining soil properties applicable in pavement and foundation system design. The measured blow count (N) values were corrected to an equivalent (60%) energy ratio, N_{60}, by the following equation, and both values are represented on the boring logs in Appendix IV.

$$N_{60} = N_m*(ER/60)$$

Where:
N_m = measured N value
ER = drill rod energy ratio, expressed as a percent, for the system used

The hammer for the ATV-mounted drill rig used for this project was calibrated on April 26, 2013 and has a drill rod energy ratio of 77.7 percent.

Upon completion of drilling, the borings were backfilled with either soil cuttings generated during the drilling process, or a mixture of soil cuttings and bentonite chips. Where borings were located within the existing pavement, an equivalent thickness of cold patch asphalt was used to repair the pavement surface.

During drilling, field personnel prepared field logs showing the encountered subsurface conditions. Soil samples obtained from the drilling operation were preserved and sealed in glass jars and delivered to the soil laboratory. In the laboratory, the soil samples were visually classified and select samples were tested, as noted in Table 2.

Table 2. Laboratory Test Schedule

Laboratory Test	Test Designation	Number of Tests Performed
Natural Moisture Content	ASTM D2216	113
Plastic and Liquid Limits	AASHTO T89, T90	32
Hydrometers	AASHTO T88	33
Sulfate Content in Soils – Colorimetric Method	TEX-145-E	13
Loss By Ignition	ASTM D2974	1

These tests are necessary to classify the soil according to the Ohio Department of Transportation (ODOT) Classification System. The results are also used to infer engineering properties of importance in pavement and foundation design and soil related construction considerations. Results of the laboratory testing are presented on the boring logs in Appendix IV. A description of the soil terms used throughout this report is presented in Appendix III.

Hand penetrometer readings, which provide a rough estimate of the unconfined compressive strength of the soil, were reported on the boring logs in units of tons per square foot (tsf) and were utilized to classify the consistency of the cohesive soil in each layer. An indirect estimate of the unconfined compressive strength of the cohesive split spoon samples can also be made from a correlation with the blow counts (N_{60}). Please note that split-spoon samples are considered to be disturbed and the laboratory determination of their shear strengths may vary from undisturbed conditions.

4.0 FINDINGS

Interpreted engineering logs have been prepared from field logs, visual examination of samples, and laboratory testing. Classification follows the current version of the ODOT Specifications for Geotechnical Explorations (SGE). The following is a summary of what was found in the test borings and what is represented on the boring logs.

4.1 Surface Material

At the existing ground surface, nine (9) of the sixteen (16) borings performed as part of this investigation were located outside of the existing pavement limits and encountered 3.0 to 10.0 inches of topsoil, as identified by the significant presence of vegetation and organic materials. The remaining seven (7) borings were located within the existing pavement and encountered 8.0 to 9.0 inches of asphalt at the existing ground surface, with the exception of boring B-008 which encountered 11.0 inches of concrete within the limits of Winchester Pike. Underlying the surficial asphalt, the borings performed within the existing pavement consistently encountered 4.0 inches of concrete, with the exception of boring B-014 performed along Winchester Pike, which encountered 3.0 inches of aggregate base beneath the asphalt. Aggregate base was also encountered underlying the surficial concrete in boring B-008 with a thickness of 5.0 inches. In addition to the borings, it should also be noted that pavement cores were obtained at the locations of borings B-006, B-012, and B-015. While these borings were performed outside of the existing pavement, the corresponding adjacent pavement cores encountered 8.0 to 8.25 inches of asphalt at the ground surface. A detailed summary of the existing surface materials encountered at each boring location is provided in Table 3.

Table 3. Surface Material Thicknesses

Reference Alignment	Boring Number	Asphalt	Concrete	Aggregate Base	Topsoil
Winchester Pike	B-001-0-13	8.0	4.0	-	-
	B-002-0-13	8.0	4.0	-	-
	B-003-0-13	8.0	4.0	-	-
	B-004-0-13	-	-	-	8.0
	B-005-0-13	-	-	-	10.0
Ebright Road	B-006-0-13	-	-	-	4.0
	B-006 Core	8.0	-	-	-
	B-007-0-13	-	-	-	4.0
Winchester Pike	B-008-0-13	-	11.0	5.0	-
	B-009-0-13	-	-	-	3.0
Ebright Road	B-010-0-13	-	-	-	4.0
Winchester Pike	B-011-0-13	8.25	4.0	-	-
Shannon Road	B-012-0-13	-	-	-	5.0
	B-012 Core	8.0	-	-	-
	B-013-0-13	-	-	-	5.0
Winchester Pike	B-014-0-13	9.0	-	3.0	-
Shannon Road	B-015-0-13	-	-	-	8.0
	B-015 Core	8.25	-	-	-
Winchester Pike	B-016-0-13	8.25	4.0	-	-

4.2 Subsurface Soils

Underlying the surficial materials summarized in Table 3, material identified as existing fill was encountered in eight (8) of the sixteen (16) borings performed as part of this investigation. The existing fill material extended to depths ranging from 1.5 to 18.0 feet below existing grades, and several of the recovered samples were noted as containing construction debris such as wood fibers and fragments in addition to asphalt, brick, concrete and slag fragments.

Only one (1) of the three (3) borings performed along Ebright Road, boring B-006, encountered existing fill material. The existing fill material encountered in boring B-006 extended to a depth of 1.5 feet beneath the existing ground surface and consisted of stiff brown silt and clay (ODOT A-6a). Existing fill material was also encountered in the two (2) northernmost borings performed along Shannon Road, borings B-013 and B-015. Boring B-013 encountered existing fill material extending to a depth of 4.5 feet that consisted of medium dense, brownish gray gravel with sand, silt and clay (ODOT A-2-6) and gravel with sand and silt (ODOT A-2-4), which contained asphalt and slag fragments. The fill material encountered in boring B-015 extended to a depth of 1.5 feet and consisted of hard, light brown silt and clay (ODOT A-6a) containing Styrofoam fragments.

Along Winchester Pike, existing fill materials were encountered in each of the structure borings, but only one (1) of the pavement borings, B-011. The existing fill material encountered in boring B-011, performed near the existing intersection, extended the entire depth of the boring, a total of 7.0 feet below the ground surface, and consisted of medium dense, brown gravel (ODOT A-1-a) overlying very stiff, gray sandy silt and dense to very dense brownish gray gravel with sand, silt and clay (ODOT A-4a, A-2-6). It should be noted that asphalt and brick fragments were encountered throughout the fill material in boring B-011, and that sampler refusal was encountered at a depth of 5.9 feet.

Borings B-004 and B-005 were performed on the western side of Blacklick Creek for the proposed structure widening and encountered existing fill materials that extended to depths of 18.0 and 7.5 feet, respectively. The fill materials encountered in B-004 consisted of loose brown sandy silt (A-4a), stiff to very stiff brown and gray silt and clay and silty clay (ODOT A-6a, A-6b), and very loose gray gravel with sand and gravel with sand silt (ODOT A-1-a, A-2-4). The fill materials encountered in Boring B-005 consisted of brown and black sandy silt that ranged in consistency from soft to stiff. Wood fibers were noted throughout the fill material encountered on this side of the structure.

Borings B-008 and B-009 were performed on the eastern side of Blacklick Creek, and encountered existing fill materials to depths of 9.0 and 8.0 feet, respectively. The fill materials encountered in these borings was identified as medium dense to very dense gray gravel (ODOT A-1-a), and medium stiff to stiff gray, dark gray and black sandy silt

(ODOT A-4a). Wood fragments were noted throughout the fill material in both borings, and concrete fragments were noted in boring B-009.

Underlying the surficial and existing fill materials, the borings encountered natural, primarily cohesive, soils which were underlain by deep deposits of granular soils in the structure borings.

To the east of the intersection along Winchester Pike, pavement borings B-001 through B-003 encountered a consistent layer of medium dense granular soils extending to a depth of 2.5 feet. These granular soils consisted of brown and brownish gray gravel with sand and sandy silt (ODOT A-1-b, A-4a). Underlying the granular seam, borings B-001 and B-002 encountered brown, brownish gray, and black silt and clay (ODOT A-6a) with a medium stiff to very stiff consistency, while boring B-003 encountered medium dense to dense dark brown and dark gray gravel with sand, silt, and clay (ODOT A-2-6). On the western side of the intersection, borings B-014 and B-016 encountered a thin layer of medium dense brown, black and gray gravel (ODOT A-1-a) overlying medium stiff to very stiff brown and gray sandy silt and silty clay (ODOT A-4a, A-6b).

Borings B-006, B-007 and B-10 were performed along Ebright Road and encountered natural cohesive soils extending to the boring termination depths. These cohesive soils consisted of brown and brownish gray silt and clay, silty clay and clay (ODOT A-6a, A-6b, A-7-6) which ranged in consistency from stiff to very stiff. Along Shannon Road, boring B-012 encountered a thin seam of loose, brownish gray sandy silt (ODOT A-4a) overlying very stiff to hard brownish gray silt (ODOT A-4b), while borings B-013 and B-015 encountered very stiff to hard brown and gray sandy silt and silt and clay (ODOT A-4a, A-6a) underlying the existing fill materials.

In the structure borings, borings B-004, B-005 and B-008 encountered a similar stratigraphy, with a layer of medium dense to dense granular soils consisting of gravel, gravel with sand, and gravel with sand and silt (ODOT A-1-a, A-1-b, and A-2-4) overlying a continuous layer of sandy silt (ODOT A-4a) that ranged in consistency from medium stiff to hard. Underlying the cohesive layer, which ranged in thickness from 20.0 to 25.5 feet, the borings each encountered, and were terminated within, a layer of dense to very dense gravel and gravel with sand (ODOT A-1-a, A-1-b). Boring B-009, however, encountered primarily granular soils. Beneath a 6.0-foot thick layer of soft to medium stiff clay (ODOT A-7-6) that was encountered immediately underlying the fill materials, boring B-009 encountered and was terminated within granular soils consisting of loose to dense gravel with sand, gravel with sand and silt, gravel with sand, silt and clay, and sandy silt (ODOT A-1-b, A-2-4, A-2-6, A-4a), with the only exception being a 5.0-foot thick layer of hard silt and clay (ODOT A-6a) encountered at a depth of 27.0 feet.

The shear strength and consistency of the cohesive soils are primarily derived from the hand penetrometer values (HP). The cohesive soils encountered ranged from soft ($0.25 < HP \leq 0.5$ tsf) to hard ($HP > 4.0$ tsf). The unconfined compressive strength of the cohesive soil samples tested, obtained from the hand penetrometer, ranged from 0.25 tsf to over 4.5 tsf (limit of instrument). The relative density of granular soils is primarily derived from SPT blow counts (N_{60}). Based on the SPT blow counts obtained, the granular soils encountered ranged from very loose (N_{60} < 5 blows per foot [bpf]) to very dense (N_{60} > 50 bpf). Overall blow counts recorded from the SPT sampling ranged from 3 bpf to 80, generally increasing with depth.

Natural moisture contents of the soil samples tested ranged from 3 to 129 percent. The natural moisture contents of the soil samples tested for plasticity index ranged from 9 percent below to 39 percent above their corresponding plastic limits. In general, the soils exhibited natural moisture contents estimated to be significantly below to significantly above their corresponding optimum moisture levels.

4.3 Bedrock

Bedrock was not encountered in any of the borings performed as part of this investigation.

4.4 Groundwater

In the pavement borings performed as part of this investigation, groundwater seepage was encountered in boring B-013 at a depth of 4.0 feet, and more significant groundwater flow was encountered in boring B-006 at a depth of 5.2 feet. Both of these borings were noted as being dry at completion, meaning that no measurable amount of groundwater had accumulated in the borehole prior to backfilling. Groundwater was not encountered during drilling or at completion in any of the remaining ten (10) pavement borings.

Groundwater was encountered in each of the structure borings performed as part of this investigation, however. Groundwater seepage was encountered in each of the structure borings during drilling at depths ranging from 3.5 feet to 16.0 feet, with more significant groundwater flows encountered at depths ranging from 8.0 feet to 18.0 feet below the ground surface. Accurate groundwater level readings were not able to be obtained in the structure borings at the completion of drilling due to the introduction of drilling mud through the augers during drilling. The drilling mud was introduced to the boreholes in an effort to combat heaving sands.

Please note that short-term water level readings, especially in cohesive soils, are not necessarily an accurate indication of the actual groundwater conditions. In addition, groundwater levels or the presence of groundwater are considered to be dependent on seasonal fluctuations in precipitation.

A more comprehensive description of the groundwater conditions encountered in each of the borings during the drilling program can be found on the boring logs in Appendix IV.

5.0 ANALYSES AND RECOMMENDATIONS

Data obtained from the drilling and testing program have been used to determine pavement and foundation support capabilities for the soil encountered at the site. These parameters have been used to provide guidelines for the design of the pavement and structure foundation systems, as well as the construction specifications related to the placement of the pavement and structure foundation systems and general earthwork recommendations, all of which are discussed in the following paragraphs.

5.1 Pavement Subgrade Recommendations

The subgrade soils for the proposed roadway and intersection improvements at the intersection of Winchester Pike with Shannon and Ebright Roads consist predominantly of cohesive materials comprised of sandy silt, silt, silt and clay, silty clay and clay (ODOT A-4a, A-4b, A-6a, A-6b, A-7-6). Some granular materials, comprised of gravel, gravel with sand, gravel with sand and silt, and gravel with sand, silt and clay (ODOT A-1-a, A-1-b, A-2-4, A-2-6) were also encountered within the uppermost 6.0 feet of the anticipated subgrade. Based on the soil conditions encountered during the drilling program, it is estimated that the subgrade soils within the upper portions of the proposed subgrade will require some level of stabilization under ODOT Geotechnical Bulletin GB1: Plan Subgrades. It is anticipated that proposed subgrade elevations will closely match the existing subgrade, with little change in the vertical alignment, requiring little to no site work to bring the site to the proposed final grading.

The moisture content of cohesive soil has a significant effect on the physical properties of the material. It must be noted that the moisture contents illustrated on the boring logs, and utilized in this analysis, represent the conditions during the drilling phase of the project. The referenced borings utilized in the subgrade analysis were performed on July 9th, 10th, and 15th, 2013. These soil conditions, especially in the uppermost soils, may not coincide with the soil conditions that will be encountered during construction. Consequently, the extent/need for subgrade improvement is entirely dependent on the subgrade conditions (i.e., moisture contents) encountered at the time of construction.

5.1.1 Station by Station Stabilization Recommendations

It is understood that specific, "station by station" recommendations for subgrade stabilization under GB1 are required for anticipated excavation and replacement quantities. Therefore, a summary of recommended excavation and replacement quantities, as well as chemical stabilization quantities, referencing the boring locations, are presented in Table 4. A complete analysis of each soil boring, presenting the proposed subgrade soils at each location, is presented in the GB1 spreadsheet included as Appendix VI. Please note that the stabilization depths presented in Table 4 were measured from the proposed roadway subgrade (bottom of proposed pavement section). If the final design subgrade elevation differs significantly, adjustments will be required to determine the subgrade treatment depth.

Table 4. Subgrade Treatment Summary

Alignment	From Station	To Station	Length (ft)	Representative Boring(s)	GB1 Subgrade Stabilization
Winchester Pike	98+00 (Est.)	100+74	274 (Est.)	B-001-0-13	Proof roll and perform cement stabilization to depth of 12 inches or excavate 12 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D.
Winchester Pike	100+74	107+86	712	B-002-0-13 and B-003-0-13	Proof roll area. No excavation or chemical stabilization anticipated.
Ebright Road	30+00 (Est.)	33+48	348	B-006-0-13	Proof roll and excavate 24 inches and replace with ODOT Item 703.16C granular material Type B or C, with 712.09 Geotextile Fabric Type D. Chemical stabilization not recommended due to low blow counts.
Ebright Road	33+48	42+50 (Est.)	902	B-007-0-13 and B-010-0-13	Proof roll and perform cement stabilization to depth of 16 inches or excavate 24 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D.
Shannon Road	42+50 (Est.)	46+52	402 (Est.)	B-012-0-13	Proof roll and perform cement stabilization to depth of 14 inches or excavate 36 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D.
Shannon Road	46+52	50+87	435	B-013-0-13	Proof roll area. No excavation or chemical stabilization anticipated.
Shannon Road	50+87	54+00 (Est.)	313 (Est.)	B-015-0-13	Proof roll and perform cement stabilization to depth of 14 inches or excavate 16 inches and replace with ODOT Item 703.16C granular material, Type B, C or D, with 712.09 Geotextile Fabric Type D.

Alignment	From Station	To Station	Length (ft)	Representative Boring(s)	GB1 Subgrade Stabilization
Winchester Pike	112+04	122+00 (Est.)	996 (Est.)	B-011-0-13, B-014-0-13 and B-016-0-13	Proof roll area. No excavation or chemical stabilization anticipated.

Note that the limits of the treatment areas are based upon the "Limitations of Study", defined in Section 6.0 of this subgrade exploration report.

Please note that the limits and depth of stabilization provided in the table above are estimated based on the soil conditions encountered in the borings performed during the field exploration. Actual limits and depth of stabilization may differ from the recommendations provided. Per ODOT GB1 requirements, if it is elected to perform station by station stabilization, the entire subgrade should be proof rolled to identify the actual limits of unstable subgrade and depth of stabilization required. Upon completion of the stabilization, areas that required stabilization should be proof rolled to verify that stability has been achieved.

5.1.2 Global Stabilization

Based on the ODOT GB1, when approximately 30 percent or more of the subgrade requires stabilization, consideration should be given to utilizing a global stabilization option. Per ODOT GB1, global stabilization recommendations are based upon the overall average site parameters, as noted in Table 5.

Table 5. Average Site Parameters

Average N_{60L}	Average PI	Average Moisture	Average Optimum Moisture	Average Group Index	Design CBR
8	13	17	13	5.6	8

Applying the averages in Table 5, GB1 recommends the following global stabilization options, which should be evaluated based upon a cost and constructability analysis:

Option 1. Chemically stabilize the entire subgrade with 14-inches of cement, as per ODOT Item 206. For estimating purposes, utilize a cement content of 6.0 percent by weight of soil. Actual application rates shall be verified by the contractor under Item 206.06 Mixture Design for Chemically Stabilized Soils.

Option 2. Stone stabilize the entire subgrade via a 1.5-foot undercut and replacement with ODOT Item 703.16C granular material, Type B, C or D installed over ODOT Item 712.09 Geotextile Fabric, Type D as detailed in accordance with ODOT Item 204.

As an alternate to cement, lime kiln dust (LKD) may be utilized for the chemical stabilization option and the depth of stabilization can still be maintained. LKD is typically cheaper than traditional cement stabilization and could present a significant cost savings for the stabilization, if it is elected to perform global stabilization. For estimating purposes, utilize an LKD content of 7.0 percent by weight of soil. Per ODOT GB1 requirements, if it is elected to perform global stabilization, the entire subgrade should be stabilized using one of the global stabilization options provided above. Upon completion of the stabilization, the entire subgrade should be proof rolled to verify that stability has been achieved.

5.1.3 Subgrade Design Considerations

California Bearing Ratio (CBR) values for the entire project ranged from 4 to 12 with an average of 8. It is recommended that pavement design be based on the average CBR of 8 with a corresponding Subgrade Resilient Modulus, M_R, of 9,600 psi. Correlation charts indicate a Modulus of Subgrade Reaction (K) of 175 pci and a Soil Support Value (SSV) of 5.3.

In addition, per ODOT GB1, soils with sulfate content in excess of 3,000 ppm cannot be chemically stabilized due to the potential for sulfate heave in the soil. Based on the results of the testing, the sulfate contents of the subgrade soils range from 13 to 53 parts per million (ppm or mg/kg of material). Soil with a sulfate content greater than 3,000 ppm was not encountered in the soil samples tested for this investigation.

Please note that the recommended CBR values consider that the materials utilized for the road subgrade in fill areas are equivalent to, or better than materials at the existing subgrade elevation. Sources of borrow material should be designated in advance of construction. The material should be tested in the laboratory to verify the soil exhibits a minimum design CBR value of 8.

Pavement design is dependent on the inclusion of adequate surface and subsurface drainage in order to maintain the compacted subgrade near optimum moisture conditions throughout the lifetime of the pavement. If underdrain systems are considered, they should be installed in accordance to the specifications presented in Item 204 of the ODOT Construction and Materials Specifications (CMS).

5.2 Pavement Thickness Evaluation

Based on the anticipated traffic loading information provided by ms via email on December 2, 2013, and summarized in Table 6, Rii evaluated both flexible and rigid pavement alternatives at the project site. The proposed minimum pavement section buildups are summarized in the following sections.

Table 6. Anticipated Traffic Loading Information

Intersection Leg	2017 ADT	2037 ADT	24-Hour Truck %	Functional Classification
North	5,220	5,320	3	Urban Collector
South	3,250	4,870	4	
East	8,590	12,270	1	Urban Minor Arterial
West	15,500	21,610	2	

5.2.1 Flexible Pavement

The flexible pavement alternative was evaluated in accordance with the procedures outlined in the current version of the ODOT Pavement Design Manual, Section 400 – Flexible Pavement Design. Based on the estimated traffic loading, the soil conditions encountered during the investigation, and consideration to the performance of pavement buildups for similar roadways, Rii proposes the following <u>minimum</u> flexible pavement buildup for each leg of the intersection:

Table 7. Flexible Pavement Alternative

Pavement Layer	Thickness
ODOT Item 448 Asphalt Concrete Surface Course, Type 1, PG64-22	1½ inch
ODOT Item 448 Asphalt Concrete Intermediate Course, Type 2, PG64-22	1¾ inch
ODOT Item 302 Asphalt Concrete Base Course	4 inches
ODOT Item 304 Aggregate Base	6 inches
Subgrade	Natural

5.2.2 Rigid Pavement

In addition to the flexible pavement, a rigid pavement alternative was also evaluated in accordance with the procedures outlined in the current version of the ODOT Pavement Design Manual, Section 300 – Rigid Pavement Design. Based on the estimated traffic loading, the soil conditions encountered during the investigation, and consideration to the performance of pavement buildups for similar roadways, Rii proposes the following <u>minimum</u> rigid pavement buildup for each leg of the intersection:

Table 8. Rigid Pavement Alternative

Pavement Layer	Thickness
ODOT Item 451 Reinforced Concrete Pavement	8¾ inch
ODOT Item 304 Aggregate Base	6 inches
Subgrade	Natural

5.3 Foundation Recommendations

It is understood that the existing structure carrying Winchester Pike over Blacklick Creek is currently a 3-span structure supported on 12-inch diameter cast-in-place (CIP) pipe piles (ODOT Item 507.07). Based on the information provided by ms, it is understood that driven CIP pipe piles will be utilized for support of the widened northern section of the existing structure. Rii understands that 12-inch diameter CIP piles will be utilized at the abutments, and 14-inch diameter CIP piles will be utilized at the intermediate piers. Anticipated scour depths are expected to range from 10 feet at the piers to 15 feet at the abutments. Based on the maximum pile loads provided, it is recommended that the proposed CIP piles be embedded as noted in the following table. It should be noted that the abutment and intermediate pier footings were considered to be at a depth of 10.0 feet below the existing ground surface.

Table 9. CIP Pile Recommendations

Boring Number	Ground Elevation [1]	Pile Size	Pile Elevation		Embedment Depth [3] (feet)	Scour Depth [4] (feet)	Pile Capacity [4] (kips/pile)
			Top [2]	Tip			
B-004 (Rear Abutment)	754.5	12” CIP	744.5	697.5	47	15	79
B-005 (Pier 1)	746.1	14” CIP	736.1	694.1	42	10	120
B-008 (Pier 2)	744.0	14” CIP	734.0	691.0	43	10	120
B-009 (Forward Abutment)	754.7	12” CIP	744.7	687.7	57	15	79

1. *Ground elevation listed is the ground elevation at the boring location. The ground elevation at the pier locations is not the same as the elevations listed.*
2. *The top of pile elevation is at the proposed bottom of footing elevation at the abutment locations and at the bottom of the proposed pile cap at the pier locations.*
3. *Embedment depths represent the length of pile in contact with the soil.*
4. *Scour depth and maximum pile capacities were provided by ms consultants.*

NOTE: The top of pile elevation coincides with the bottom of footing elevations, and the estimated pile lengths reflect exclusively the length of the pile in contact with the soil. **Embedment length of the pile into the footing is not included.** Estimated pile lengths are rounded up to the nearest foot.

The pile capacities listed in Table 9 are allowable values and were determined utilizing DRIVEN software (Appendix V) using allowable stress design (ASD) and a safety factor of 2.0. The pile capacity values listed were provided by ms. If the actual pile loads vary significantly from the design loads provided, Rii should be contacted in order to re-analyze the design. Settlement is estimated to be less than 1.0 inch for CIP piles.

We emphasize that the CIP pile lengths and load capacities presented above are estimates using empirical equations based on the derived characteristics of the soils encountered in the subject borings drilled. The most accurate method for determining pile capacities and lengths is to drive test piling at the site and perform either static or dynamic load testing in accordance with ASTM D1143 procedures.

5.3.1 Driven Pile Considerations

Proper pile installation is as important as pile design in order to obtain a cost effective and safe product. Driven piles must be installed to develop adequate soil resistance without structural damage. Because piles cannot be visually inspected after installation, direct quality control of the finished product is impossible. Consequently, substantial control must be exercised over peripheral operations leading to the pile placement within the foundation. It is essential that installation be considered during the design stage to insure that piles shown on the plans can be installed. Construction monitoring should be employed in (1) pile materials, (2) installation equipment, and (3) the estimation of the static load capacity.

It is recommended that the contractor submit a wave equation analysis (bearing graph) of his driving equipment, or the necessary pile driving and equipment data to perform the wave equation analysis, for hammer approval. A constant capacity wave equation analysis (inspector's chart) should also be performed to assist field personnel during inspection in accordance with the 2007 ODOT BDM.

5.4 Lateral Earth Pressure

For the soil types encountered in the borings, the "in-situ" unit weight (γ), cohesion (c), effective angle of friction (ϕ'), and lateral earth pressure coefficients for at-rest conditions (K_o), active conditions (K_a), and passive conditions (K_p) have been estimated and are provided in Table 10 and Table 11. These parameters are considered appropriate for the design of excavation support systems. The values in this table have been estimated from correlation charts based on minimum standards specified for compacted engineered fill materials.

Table 10. Estimated Undrained (Short-term) Soil Parameters for Design

Soil Type	γ (pcf) [1]	C (psf)	ϕ	K_a	K_o	K_p
Soft to Medium Stiff Cohesive Soil	110	750	0°	1.0	1.0	1.0
Stiff Cohesive Soil	115	1,250	0°	1.0	1.0	1.0
Very Stiff to Hard Cohesive Soil	120	2,500	0°	1.0	1.0	1.0
Loose to Medium Dense Granular Soil	120	0	29°	0.35	0.48	2.88
Dense to Very Dense Granular Soil	130	0	34°	0.28	0.44	3.54
Compacted Cohesive Engineered Fill	125	1,500	0°	1.0	1.0	1.0
Compacted Granular Engineered Fill	135	0	33°	0.30	0.46	3.39

1. *When below groundwater table, use effective unit weight, $\gamma' = \gamma$ - 62.4 pcf and add hydrostatic water pressure.*

Table 11. Estimated Drained (Long-term) Soil Parameters for Design

Soil Type	γ (pcf) [1]	C (psf)	ϕ	K_a	K_o	K_p
Natural Cohesive Soil	115	0	26°	0.39	0..56	2.56
Loose to Medium Dense Granular Soil	120	0	29°	0.35	0.48	2.88
Dense to Very Dense Granular Soil	130	0	34°	0.28	0.44	3.54
Compacted Cohesive Engineered Fill	125	0	28°	0.36	0.53	2.77
Compacted Granular Engineered Fill	135	0	33°	0.30	0.46	3.39

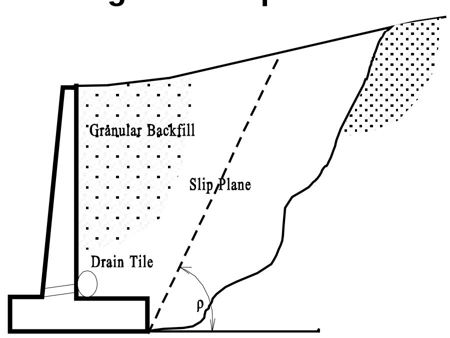
1. *When below groundwater table, use effective unit weight, $\gamma' = \gamma$ - 62.4 pcf and add hydrostatic water pressure.*

These parameters are considered appropriate for the design of subsurface walls and excavation support systems. It is recommended that the subsurface walls be designed based on at-rest conditions. The values in this table have been estimated from correlation charts based on minimum standards specified for compacted engineered fill materials. These recommendations do not take into consideration the effect of any surcharge loading or a sloped ground surface (a flat surface is considered). Earth pressures on excavation support systems will be dependent on the type of sheeting and method of bracing or anchorage.

In order to alleviate the build-up of hydrostatic pressure above the flow line of the stream behind the walls a minimum of 2.0 feet of clean free-draining granular fill (i.e., #57 gravel) should be placed full depth behind the walls along with a filter fabric placed between the granular fill and the natural soil. If granular fill other than #57 gravel is used, it should not have more than 8% (by weight) passing the #200 screen, and should be compacted to 95% of the maximum dry density. A perforated, corrugated drain tile, wrapped with filter fabric, should be placed along the perimeter at the base of the walls or at the design flow line/flood line for drainage purposes. A clay cap (minimum 1.0-foot thick) should be placed overtop the granular backfill to deter inflow of the surface water. The drainage system should properly outlet to a storm sewer, or to a properly sized sump pump system. Therefore, with a proper dewatering system, below grade walls should be designed for the undrained condition up to the design flood levels. Otherwise, below-grade walls should be designed for the undrained condition for the entire depth.

The 2.0 feet of free draining material placed behind the wall prevents the formation of hydrostatic pressures as noted above. However, unless this free-draining granular backfill is placed beyond the slip plane (see Figure 1), it has no influence on the equivalent fluid weight of the soil. If free-draining granular fill (meeting the requirements listed above) is to be placed beyond the slip plane (ρ=45^{o} for at-rest conditions; ρ=45+ϕ/2 for active conditions), the values presented in Table 7 for the compacted granular engineered fill can be employed, consequently, lowering the pressures on the wall.

Figure 1. Slip Plane



Backfill Rankine Zone with Select Backfill

5.5 Scour Data

Continuous sampling was performed for a 6.0-foot interval below the existing creek bed of Blacklick Creek in pier boring B-005 to determine the D_{50} of the riverbed soil. Due to the time constraints associated with closing the Blacklick Trail, continuous sampling was not performed below the creek bed in pier boring B-008. The creek bed soils encountered in this boring were classified as soft brown becoming black sandy silt (ODOT A-4a) overlying alternating layers of dense brown becoming gray gravel and gravel with sand (ODOT A-1-a, and A-1-b). Based upon the grain size analysis performed, the D_{50} of the granular materials (A-1-a, and A-1-b) ranged from 1.572 to 4.380 millimeters, and the D_{95} ranged from 15.506 to 21.484 millimeters. The D_{50} of the cohesive material (A-4a) was 0.096 millimeters, and the D_{95} was 1.334 millimeters. The results of the grain size analysis are summarized in the table below.

Table 12. Scour Sampling Summary

D_{50} and D_{95} Values				
Boring	**Sample No.**	**Depth (feet)**	**D_{50} Value (mm)**	**D_{95} Value (mm)**
B-005-0-13	SS-3	6.0 – 7.5	0.096	1.334
	SS-4	7.5 – 9.0	4.380	21.484
	SS-5	9.0 – 10.5	1.572	15.506

5.6 Construction Considerations

All site work shall conform to the latest ODOT CMS including the requirements that all excavation, embankment preparation and construction should follow ODOT Item 200 (Earthwork).

Prior to beginning excavation, grading and/or embankment operations across the site, all necessary clearing and grubbing shall be completed, including the complete removal of all topsoil and unsuitable fill materials (as determined by a geotechnical engineer or an experienced soil technician), vegetation, debris, saturated and/or soft/loose soils and/or existing pavement sections (where applicable) within the footprint of the proposed pavement and bridge areas.

Cohesive soil, primarily those containing silt, tend to become unstable (i.e., soft and flexing) under repeated loading from heavy rubber-tired vehicles. Therefore, heavy vehicle traffic on subgrades should be limited as much as possible during construction. The subgrade should be closely observed to determine if unstable conditions do develop which will require stabilization as determined by the geotechnical engineer.

The proposed subgrade surfaces should be proofrolled with sufficient proofrolling apparatus (preferably a fully-loaded tandem-axle dump truck), prior to placing engineered fill. A geotechnical engineer or an experienced soil technician should be present during proofrolling to determine if soft soil with inadequate stability exists. Subgrade instability encountered during a proofroll is indicated by deflection, cracking, or rutting of the surface. Soft soil is generally a result of the presence of very moist to wet cohesive soil. Deflecting subgrades may also be due to the presence of subsurface lenses of silt/fine sand, which typically contain water because the soil exhibits a higher porosity than the overlying and/or underlying cohesive soil. Based on the borings drilled, the moisture contents of the cohesive samples tested are considered to be significantly below to significantly above the corresponding optimum moisture contents. Soil in excess of the optimum moisture content creates the possibility of soft or unstable subgrades. It is likely that cohesive subgrade soil exhibiting natural moisture content in excess of its corresponding plastic limit will require some level of stabilization.

The extent/need for subgrade stabilization is entirely dependent on the subgrade conditions (i.e., moisture contents) encountered at the time of construction. If required, the method of stabilization employed is a function of the type of instability encountered, the location (i.e., depth) of the instability and the resources available.

Other stabilization options include 1) scarifying, drying and recompacting, 2) mixing wet soil with dry soil, 3) undercutting unsuitable surficial soil and replacing it with controlled density fill, and 4) a geogrid subgrade reinforcement system. Additional methods of subgrade stabilization are available and certainly may be effective (both physically and economically) in stabilizing the soil. The adequacy of any stabilization method should be verified through the construction of a test section. All proposed subgrade surfaces should be shaped to promote positive drainage, with a minimum slope of 2 percent or 0.25 inches per foot. Adequate drainage is necessary for maintaining the stability of the subgrade. Care should be taken during final grading so that no areas of potential ponding or standing water remain at the subgrade surface.

Generally, materials utilized for engineered fill should free of waste construction debris and other deleterious materials. Fill material utilized for embankment behind the proposed structures, or in areas where embankment fill is required to bring the site to the proposed profile grade should conform to ODOT Item 203, Section 203.02 embankment specifications. Fill material placed beneath pavement in areas where excavate and replacement are required should conform to ODOT Item 203, Section 203.02 granular embankment as specified in Section 5.1.

Most of the natural soils encountered on the site are considered suitable for reuse as structural fill for embankment and pavement support. However, the majority of the soil encountered had natural moisture contents that were well above their corresponding estimated optimum moisture content per ODOT GB1. These soils will likely require some form of moisture conditioning prior to reuse as structural fill. The final determination of whether a material is suitable for reuse as fill should be made by Rii or a field representative thereof.

Embankment construction should be performed in accordance with ODOT Item 203, Section 203.05. Per ODOT Item 203, Section 203.06, fill soil placed for foundation and pavement support should be placed in loose lifts not to exceed 8 inches. Fill soil placed under pavement or structures shall be compacted to not less than the maximum dry density required per ODOT Item 203, Section 203.07. Fill soil should not be placed in a frozen condition or on a frozen subgrade.

Per ODOT Item 203, Section 203.07, fill soil containing excess moisture shall be required to dry prior to or during compaction to a moisture content necessary to obtain the required density. However, for material that displays pronounced elasticity or deformation under the action of loaded rubber tire construction equipment, the moisture content shall be reduced to secure stability. Drying of wet soil shall be expedited by the use of plows, discs, or by other approved methods when so ordered by the site geotechnical engineer.

5.6.1 Excavation Considerations

All trenching and excavation procedures should follow applicable Occupational Safety and Health Administration (OSHA) standards, including adequate safety precautions conforming to OSHA standards for the personnel installing underground lines. During excavation, if slopes cannot be laid back to OSHA Standards due to adjacent structures or other obstructions, sheeting/trench boxes may be required.

The following table should be utilized as a general guide for implementing OSHA guidelines when estimating excavation back slopes at the various test boring locations. Actual excavation back slopes must be field verified by qualified personnel at the time of excavation in strict accordance with OSHA guidelines.

Table 13. Excavation Back Slopes

Soil	Maximum Back Slope	Notes
Soft to Medium Stiff Cohesive	1.5 : 1.0	Above Ground Water Table and No Seepage
Stiff Cohesive	1.0 : 1.0	Above Ground Water Table and No Seepage
Very Stiff to Hard Cohesive	0.75 : 1.0	Above Ground Water Table and No Seepage
All Granular & Cohesive Soil Below Ground Water Table or with Seepage	1.5 : 1.0	None
Rock to 3.0' +/- below Auger Refusal	0.75 : 1.0	Above Ground Water Table and No Seepage
Stable Rock	Vertical	Above Ground Water Table and No Seepage

The above recommendations are predicated upon construction monitoring and testing by a qualified soil technician under the direct supervision of a professional geotechnical engineer. Adequate testing and monitoring during construction are considered necessary to assure an adequate foundation system and are part of these recommendations.

5.6.2 Groundwater Considerations

Groundwater is anticipated to be encountered during construction of the proposed structure widening at a level near the normal water elevation in Blacklick Creek. Where encountered during construction, proper groundwater control should be employed and maintained to prevent disturbance to excavation bottoms consisting of cohesive soil, and to prevent the possible development of a quick or "boiling" condition if soft silts and/or fine sands are encountered. Any seepage or groundwater encountered at this site should be able to be controlled by pumping from temporary sumps. Additional measures may be required depending on seasonal fluctuations of the groundwater level and the level of the creek. Note that the determination of the groundwater table at construction is the responsibility of the contractor.

6.0 LIMITATIONS OF STUDY

The above recommendations are predicated upon construction inspection by a qualified soil technician under the direct supervision of a professional geotechnical engineer. Adequate testing and inspection during construction are considered necessary to assure an adequate foundation system and are part of our recommendations.

The recommendations for this project were developed utilizing soil information obtained from the test borings that were performed at the proposed site. At this time we would like to point out that soil borings only depict the soil conditions at the specific locations and time at which they were made. The conditions at other locations on the site may differ from those occurring at the boring locations.

The conclusions and recommendations herein have been based upon the available soil information and the preliminary design details furnished by a representative of the owner of the proposed project. Any revision in the plans for the proposed construction from those anticipated in this report should be brought to the attention of the geotechnical engineer to determine whether any changes in earthwork recommendations are necessary. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of the geotechnical engineer.

The scope of our services does not include any environmental assessment or exploration for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report or on the test boring logs regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted Geotechnical engineering principles and practices. Resource International is not responsible for the conclusions, opinions, or recommendations made by others based upon the data included.

APPENDIX I

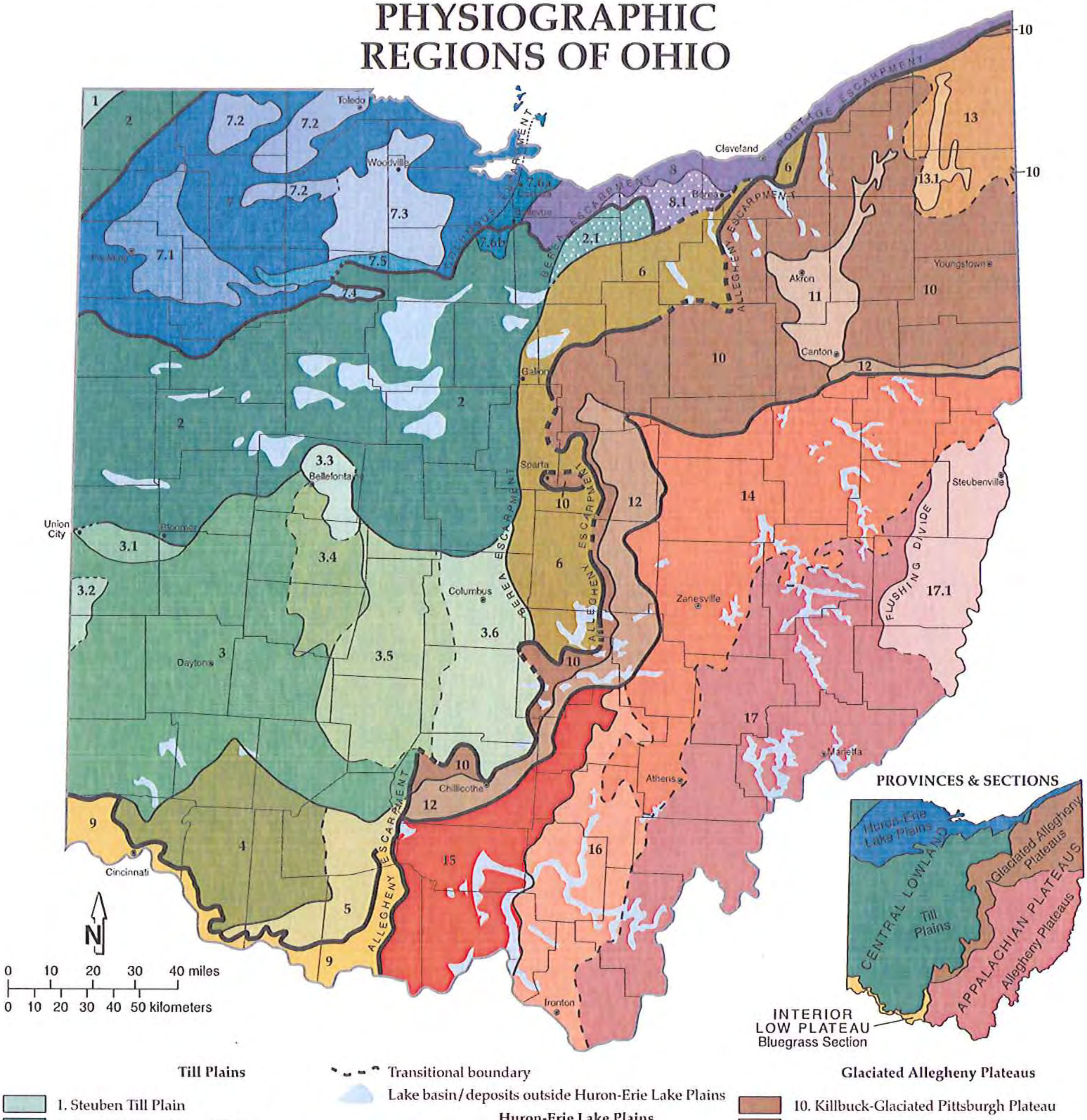
STATE GEOLOGY

STATE OF OHIO
Ted Strickland, Governor

DEPARTMENT OF NATURAL RESOURCES
Sean D. Logan, Director

DIVISION OF GEOLOGICAL SURVEY
Lawrence H. Wickstrom, Chief

PHYSIOGRAPHIC REGIONS OF OHIO



Till Plains

- 1. Steuben Till Plain
- 2. Central Ohio Clayey Till Plain
  - 2.1. Berea Headlands of the Till Plain
- 3. Southern Ohio Loamy Till Plain
  - 3.1. Union City-Bloomer Transitional Terrain
  - 3.2. Whitewater Interlobate Plain
  - 3.3. Bellefontaine Upland
  - 3.4. Mad River Interlobate Plain
  - 3.5. Darby Plain
  - 3.6. Columbus Lowland
- 4. Illinoian Till Plain
- 5. Dissected Illinoian Till Plain
- 6. Galion Glaciated Low Plateau

Transitional boundary

Lake basin/deposits outside Huron-Erie Lake Plains

Huron-Erie Lake Plains

- 7. Maumee Lake Plains
  - 7.1. Paulding Clay Basin
  - 7.2. Maumee Sand Plains
  - 7.3. Woodville Lake-Plain Reefs
  - 7.4. Findlay Embayment
  - 7.5. Fostoria Lake-Plain Shoals
  - 7.6a and 7.6b. Bellevue-Castalia Karst Plain
- 8. Erie Lake Plain
  - 8.1. Berea Headlands of the Erie Lake Plain

Bluegrass Section

- 9. Outer Bluegrass Region

Glaciated Allegheny Plateaus

- 10. Killbuck-Glaciated Pittsburgh Plateau
- 11. Akron-Canton Interlobate Plateau
- 12. Illinoian Glaciated Allegheny Plateau
- 13. Grand River Low Plateau
  - 13.1 Grand River Finger-Lake Plain

Allegheny Plateaus

- 14. Muskingum-Pittsburgh Plateau
- 15. Shawnee-Mississippian Plateau
- 16. Ironton Plateau
- 17. Marietta Plateau
  - 17.1. Little Switzerland Plateau

4/98

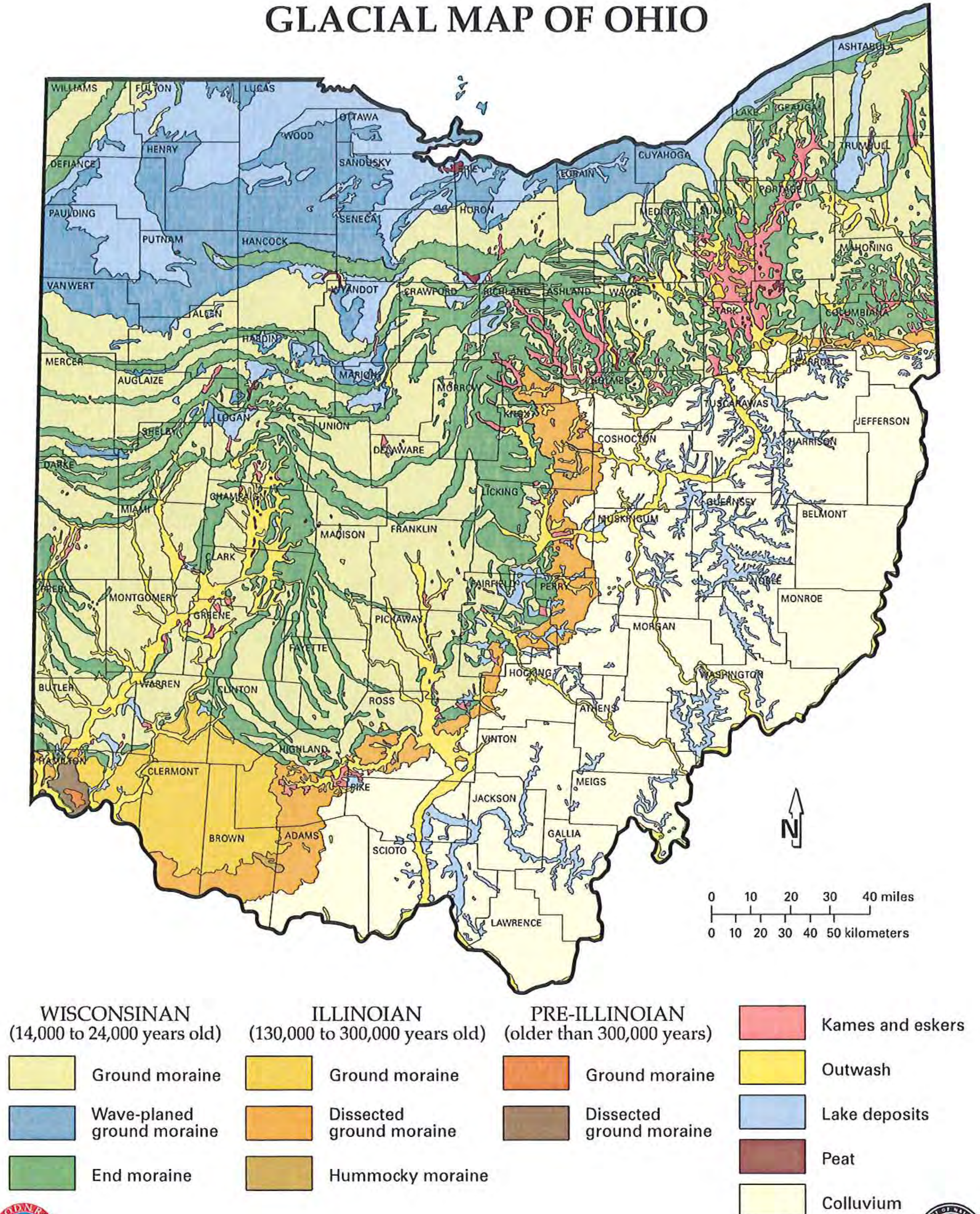
Recommended citation: Ohio Division of Geological Survey, 1998, Physiographic regions of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,100,00.

STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GLACIAL MAP OF OHIO

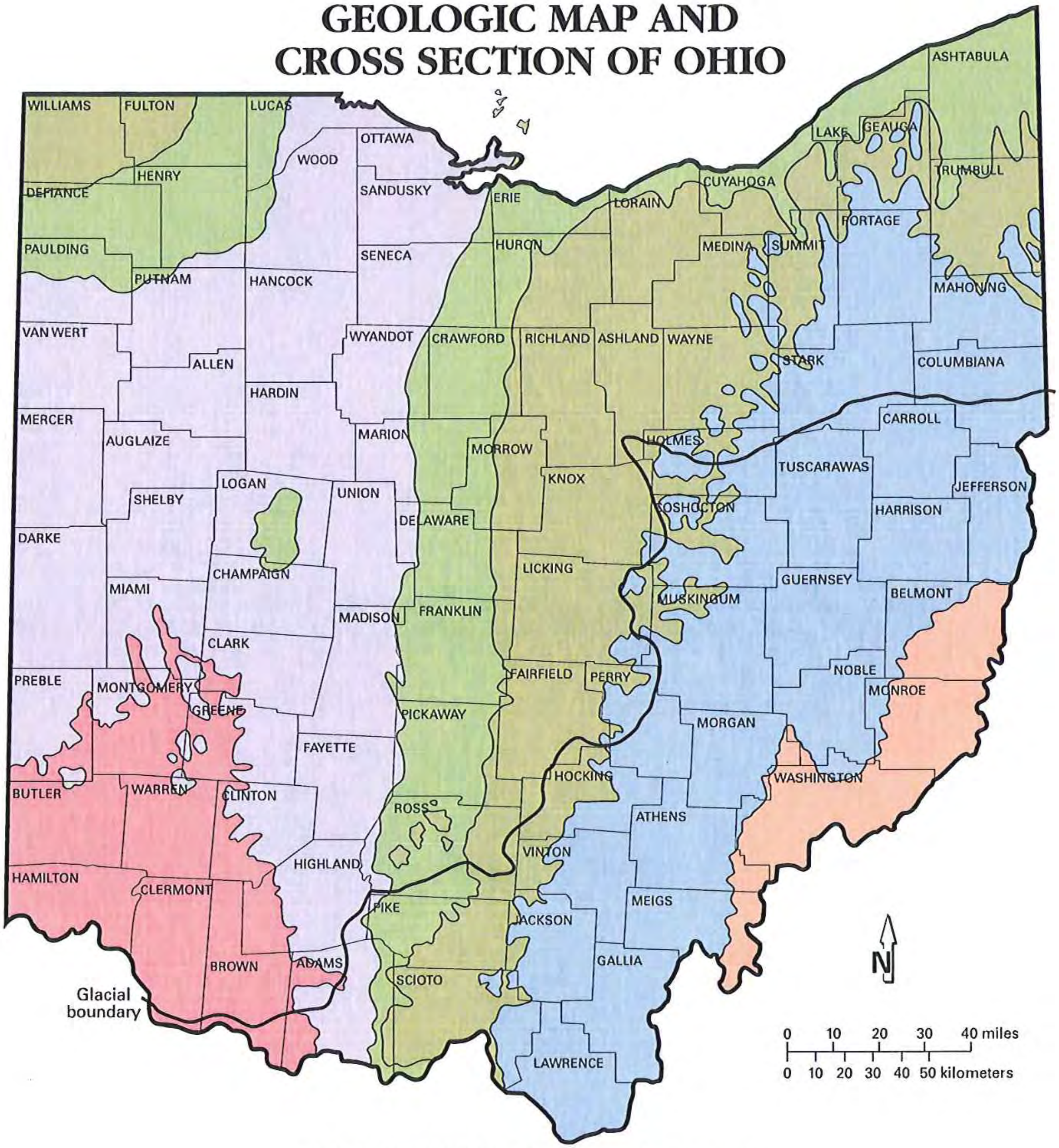


STATE OF OHIO
Bob Taft, Governor

DEPARTMENT OF NATURAL RESOURCES
Samuel W. Speck, Director

DIVISION OF GEOLOGICAL SURVEY
Thomas M. Berg, Chief

GEOLOGIC MAP AND CROSS SECTION OF OHIO



GEOLOGIC SYSTEM (million years before present)

Permian (286-245)

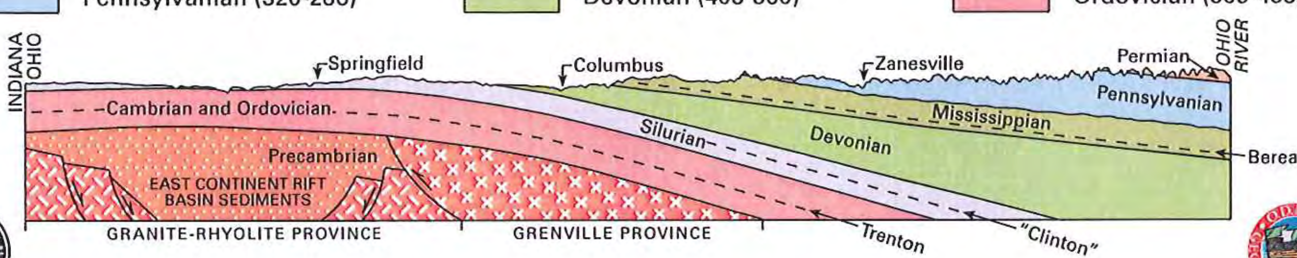
Pennsylvanian (320-286)

Mississippian (360-320)

Devonian (408-360)

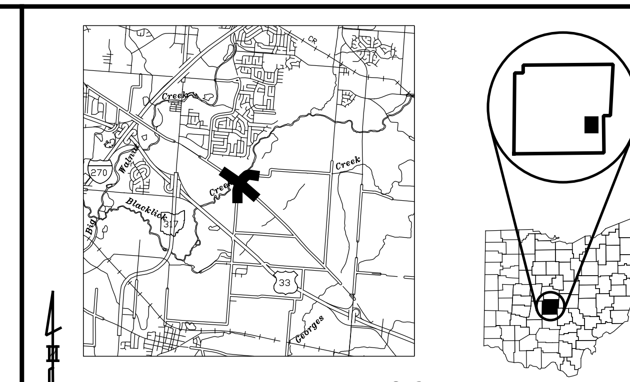
Silurian (438-408)

Ordovician (505-438)

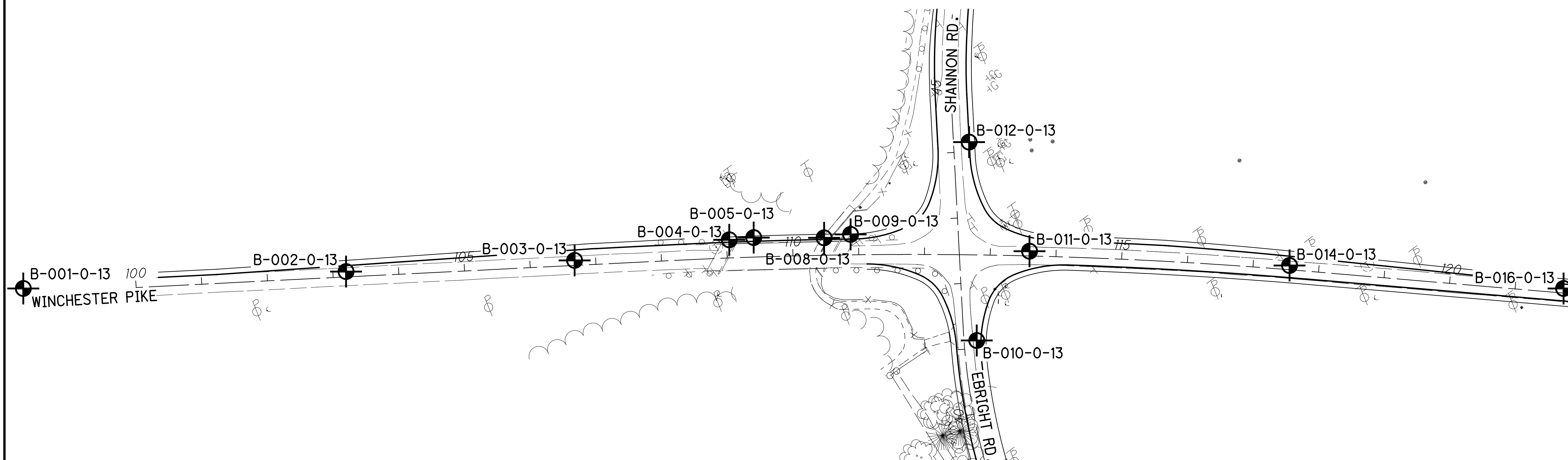


APPENDIX II

VICINITY MAP AND BORING PLAN



VICINITY MAP

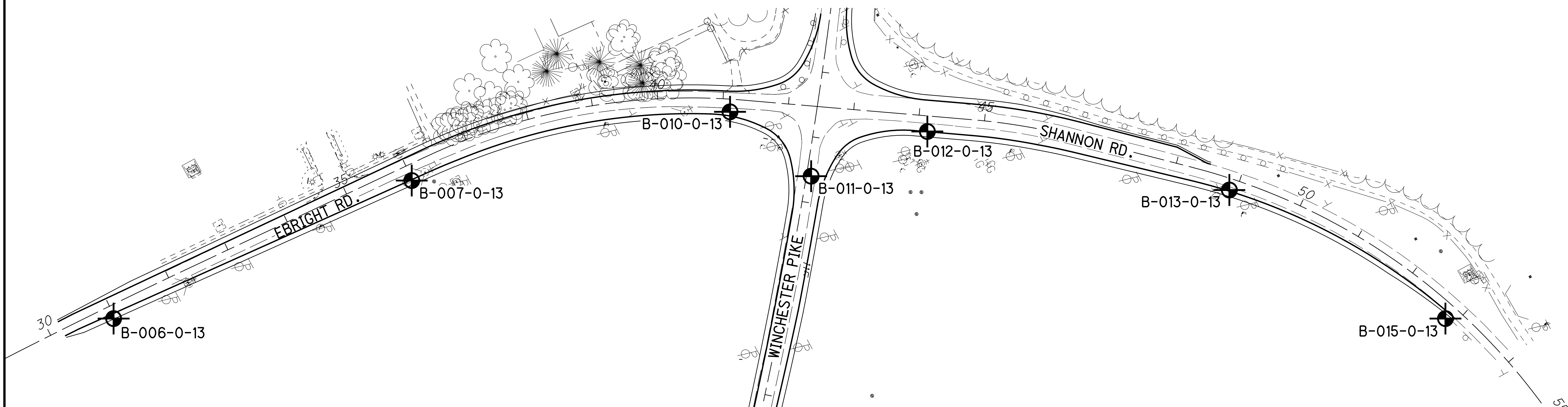


BORING PLAN

WINCHESTER PIKE & SHANNON ROAD INTERSECTION IMPROVEMENTS

FRANKLIN COUNTY, OHIO

PROJECT NO. Rii W-13-054	DRAWN RRM	RESOURCE INTERNATIONAL, INC.
SCALE: 1"=150' (0 75 150)	REVIEWED JRH	
	DATE 9-18-13	



BORING PLAN

WINCHESTER PIKE & SHANNON ROAD INTERSECTION IMPROVEMENTS

FRANKLIN COUNTY, OHIO

PROJECT NO.
Rii W-13-054

SCALE: 1"=150'
0 75 150

DRAWN RRM
REVIEWED JRH
DATE 9-18-13

RESOURCE INTERNATIONAL, INC.

APPENDIX III

DESCRIPTION OF SOIL TERMS

DESCRIPTION OF SOIL TERMS

The following terminology was used to describe soils throughout this report and is generally adapted from ASTM 2487/2488 and ODOT Specifications for Geotechnical Explorations.

Granular Soils - The relative compactness of granular soils is described as:
ODOT A-1, A-2, A-3, A-4 (non-plastic) or USCS GW, GP, GM, GC, SW, SP, SM, SC, ML (non-plastic)

Description	Blows per foot – SPT (N_{60})		
Very Loose	Below		5
Loose	5	-	10
Medium Dense	11	-	30
Dense	31	-	50
Very Dense	Over		50

Cohesive Soils - The relative consistency of cohesive soils is described as:
ODOT A-4, A-5, A-6, A-7, A-8 or USCS ML, CL, OL, MH, CH, OH, PT

Description	Unconfined Compression (tsf)		
Very Soft	Less than		0.25
Soft	0.25	-	0.5
Medium Stiff	0.5	-	1.0
Stiff	1.0	-	2.0
Very Stiff	2.0	-	4.0
Hard	Over		4.0

Gradation - The following size-related denominations are used to describe soils:

Soil Fraction		USCS Size	ODOT Size
Boulders		Larger than 12”	Larger than 12”
Cobbles		12” to 3”	12” to 3”
Gravel	coarse	3” to ¾”	3” to ¾“
	fine	¾” to 4.75 mm (¾” to #4 Sieve)	¾” to 2.0 mm (¾” to #10 Sieve)
Sand	coarse	4.75 mm to 2.0 mm (#4 to #10 Sieve)	2.0 mm to 0.42 mm (#10 to #40 Sieve)
	medium	2.0 mm to 0.42 mm (#10 to #40 Sieve)	-
	fine	0.42 mm to 0.074 mm (#40 to #200 Sieve)	0.42 mm to 0.074 mm (#40 to #200 Sieve)
Silt		0.074 mm to 0.005 mm (#200 to 0.005 mm)	0.074 mm to 0.005 mm (#200 to 0.005 mm)
Clay		Smaller than 0.005 mm	Smaller than 0.005 mm

Modifiers of Components - Modifiers of components are as follows:

Term	Range		
Trace	0%	-	10%
Little	10%	-	20%
Some	20%	-	35%
And	35%	-	50%

Moisture Table - The following moisture-related denominations are used to describe cohesive soils:

Term	Range - USCS	Range - ODOT
Dry	0% to 10%	Well below Plastic Limit
Damp	>2% below Plastic Limit	Below Plastic Limit
Moist	2% below to 2% above Plastic Limit	Above PL to 3% below LL
Very Moist	>2% above Plastic Limit	
Wet	≥ Liquid Limit	3% below LL to above LL

Organic Content – The following terms are used to describe organic soils:

Term	Organic Content (%)
Slightly organic	2-4
Moderately organic	4-10
Highly organic	>10

Bedrock – The following terms are used to describe the relative strength of bedrock:

Description	Field Parameter
Very Weak	Can be carved with knife and scratched by fingernail. Pieces 1 in. thick can be broken by finger pressure.
Weak	Can be grooved or gouged with knife readily. Small, thin pieces can be broken by finger pressure.
Slightly Strong	Can be grooved or gouged 0.05 in deep with knife. 1 in. size pieces from hard blows of geologist hammer.
Moderately Strong	Can be scratched with knife or pick. 1/4 in. size grooves or gouges from blows of geologist hammer.
Strong	Can be scratched with knife or pick with difficulty. Hard hammer blows to detach hand specimen.
Very Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to detach hand specimen.
Extremely Strong	Cannot be scratched by knife or pick. Hard repeated blows of geologist hammer to chip hand specimen.

APPENDIX IV

BORING LOGS:

B-001-0-13 through B-016-0-13

Definitions of Abbreviations for Boring Logs

A	=	Adhesion (pounds per square foot)
AS	=	Auger Sample
BCP	=	Bentonite Chips or Pellets
C	=	Cohesion (pounds per square foot)
CB	=	Cased (Concentric) Boring
C/B	=	Neat Cement/Bentonite Grout
Cl^-	=	Chloride Ion Concentration (parts per million)
FA	=	Angle of Internal Friction (degrees)
FF	=	Friction Factor
GS	=	Geoprobe Sample
HSA	=	Hollow Stem Auger
HSB	=	High Solids Content Bentonite Grout
K	=	Modulus of Horizontal Subgrade Reaction (kips per cubic foot)
LOI	=	Percent Organic Content (by weight) as determined by ASTM D-2974 (loss on ignition test)
MD	=	Rotary Mud Drilling
NQ	=	Wireline Method (1.875-inch diameter rock core)
NX	=	Conventional Method (2.126-inch diameter rock core)
PC	=	Neat Portland Cement Grout
PID	=	Photo-Ionization Detector Reading (parts per million)
qh	=	Unconfined Compressive Strength of Soil as determined by a hand penetrometer (tons per square foot)
qr	=	Unconfined Compressive Strength of Intact Rock Core as determined by ASTM D-2938 (pounds per square inch)
qu	=	Unconfined Compressive Strength of Soil as determined by ASTM D-2166 (tons per square foot)
quu	=	Unconsolidated-Undrained Triaxial Compressive Strength as determined by ASTM D-2850 (pounds per square foot)
RC	=	Rock Coring
SO^{4-}	=	Sulfate Concentration
SFA	=	Solid Flight Auger
SS	=	Split Spoon Sample
3S	=	For instances of no recovery from standard SS interval, a 3.0 inch O.D. split spoon is driven the full length of the standard SS interval plus an additional 6.0 inches to obtain a representative sample. Only the final 6.0 inches of sample is retained. Blow counts from 3S sampling are not correlated with N_{60} values.
ss	=	Soluble Salts (conductivity)
ST	=	Thin-walled (Shelby) Tube Sample
uw	=	"In-Situ" Unit Weight of Soil (pounds per cubic foot)
VIS	=	Visual classification only, no testing performed
W	=	Weight of Hammer and Drill Rods "pushed" split spoon sampler 6-inches.
WD	=	Rotary Wash Drilling

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / T.F.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 98+28.61 / 7.2' Lt
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / A.D.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 750.9 (MSL) EOB: 7.0 ft.
START: 7/15/13 END: 7/15/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.892395028 ° N / 82.86708824 ° W

EXPLORATION ID B-001-0-13

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 750.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.7' - ASPHALT (8.0")	750.2																	
0.3' - CONCRETE (4.0")	749.9																	
MEDIUM DENSE, BROWN **SANDY SILT**, AND FINE GRAVEL, LITTLE CLAY, MOIST. -SAMPLE SS-1: SULFATE CONTENT = 47 PPM	748.4	1–2.5	6 4 5	12	56	SS-1	-	37	3	16	31	13	NP	NP	NP	19	A-4a (2)	
STIFF TO VERY STIFF, BROWN **SILT AND CLAY**, SOME COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		2.5–4	6 7 7	18	56	SS-2	2.50	4	15	15	43	23	29	17	12	15	A-6a (7)	
		4–5.5	5 6 7	17	56	SS-3	1.50	-	-	-	-	-	-	-	-	18	A-6a (V)	
	743.9	5.5–7 EOB	5 5 5	13	67	SS-4	1.00	-	-	-	-	-	-	-	-	20	A-6a (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 6.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / T.F.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 103+20.06 / 8.2' Lt	EXPLORATION ID B-002-0-13
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / A.D.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE	PAGE 1 OF 1
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 752.2 (MSL) EOB: 7.0 ft.	
START: 7/15/13 END: 7/15/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.891649918 ° N / 82.86562848 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 752.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.7' - ASPHALT (8.0")	751.5																	
0.3' - CONCRETE (4.0")	751.2	1																
MEDIUM DENSE, BROWN **GRAVEL AND SAND**, SOME SILT, TRACE CLAY, MOIST.	749.7	2	21 7 7	18	33	SS-1	-	39	23	13	24	1	NP	NP	NP	10	A-1-b (0)	
MEDIUM STIFF TO STIFF, BROWNISH GRAY AND BLACK **SILT AND CLAY**, LITTLE FINE GRAVEL, TRACE FINE SAND, MOIST TO WET. -SAMPLE SS-2: SULFATE CONTENT = 53 PPM -ORGANIC ODOR PRESENT IN SS-3		3	6 4 6	13	56	SS-2	2.00	11	0	5	49	35	33	21	12	22	A-6a (9)	
		4-5	2 2 2	5	56	SS-3	1.50	-	-	-	-	-	-	-	-	28	A-6a (V)	
	745.2	6	4 4 4	10	56	SS-4	1.00	-	-	-	-	-	-	-	-	30	A-6a (V)	
		EOB 7																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 5.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / T.F.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 106+67.99 / 7.7' Lt	EXPLORATION ID B-003-0-13
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / A.D.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE	
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 755.8 (MSL) EOB: 7.0 ft.	PAGE 1 OF 1
START: 7/15/13 END: 7/15/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.891119702 ° N / 82.864596961 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 755.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.7' - ASPHALT (8.0")	755.1																	
0.3' - CONCRETE (4.0")	754.8	1																
MEDIUM DENSE, BROWNISH GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, DAMP. -SAMPLE SS-1: SULFATE CONTENT = 47 PPM	753.3	2	21 7 7	18	33	SS-1	-	20	20	20	25	15	NP	NP	NP	10	A-4a (1)	
MEDIUM DENSE TO DENSE, DARK BROWN TO DARK GRAY **GRAVEL WITH SAND, SILT, AND CLAY**, DAMP TO MOIST.		3	8 8 9	22	56	SS-2	-	28	24	16	31	1	29	17	12	8	A-2-6 (0)	
		4, 5	10 12 13	32	67	SS-3	-	-	-	-	-	-	-	-	-	11	A-2-6 (V)	
		6	12 19 13	41	67	SS-4	-	-	-	-	-	-	-	-	-	8	A-2-6 (V)	
	748.8	EOB 7																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 109+04.13 / 27.7' Lt
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 4/26/13	ELEVATION: 754.5 (MSL) EOB: 70.0 ft.
START: 7/10/13 END: 7/11/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.890804549 ° N / 82.863857051 ° W

EXPLORATION ID B-004-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 754.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.7' - TOPSOIL (8.0")	753.8																	
FILL: LOOSE, BROWN **SANDY SILT**, LITTLE CLAY, TRACE FINE GRAVEL, MOIST. -TRACE ROOT FIBERS PRESENT IN SS-1 -SAMPLE SS-1: SULFATE CONTENT = 53 PPM	751.5	1–2	2 3 4	9	61	SS-1	-	3	16	24	44	13	NP	NP	NP	15	A-4a (4)	
FILL: STIFF TO VERY STIFF, BROWN TO GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, MOIST.		4–5	3 3 5	10	100	SS-2	2.50	0	2	31	40	27	28	17	11	19	A-6a (7)	
-WOOD AND ROOT FIBERS PRESENT IN SS-3	746.5	6–7	5 5 6	14	100	SS-3	3.50	-	-	-	-	-	-	-	-	17	A-6a (V)	
FILL: STIFF, DARK BROWNISH GRAY TO GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.		8.5–10	3 3 3	8	78	SS-4	1.75	11	9	14	20	46	35	15	20	18	A-6b (10)	
-COBBLES PRESENT THROUGHOUT	741.5	11–12.5	2 2 4	8	100	SS-5	1.75	-	-	-	-	-	-	-	-	28	A-6b (V)	
FILL: VERY LOOSE, GRAY **GRAVEL WITH SAND AND SILT**, WET.	739.0	W 13.5; 13.5–15	2 1 2	4	100	SS-6	-	-	-	-	-	-	-	-	-	27	A-2-4 (V)	
FILL: VERY LOOSE, GRAY **GRAVEL AND SAND**, LITTLE SILT, WET. -WOOD AND ROOT FIBERS PRESENT IN SS-7	736.5	16–17.5	1 1 3	5	67	SS-7	-	-	-	-	-	-	-	-	-	30	A-1-b (V)	
MEDIUM DENSE, GRAY **GRAVEL AND SAND**, TRACE TO LITTLE SILT, TRACE CLAY, MOIST TO WET.		W 18; 18.5–20	2 4 5	12	67	SS-8	-	30	39	15	9	7	NP	NP	NP	18	A-1-b (0)	

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 109+04.13 / 27.7' Lt	START: 7/10/13	END: 7/11/13	PG 2 OF 4	B-004-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 732.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
MEDIUM DENSE, GRAY **GRAVEL AND SAND**, TRACE TO LITTLE SILT, TRACE CLAY, MOIST TO WET. *(same as above)*		23																
		24–25	6 9 10	25	78	SS-9	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		26–28																
		29–30	7 9 12	27	100	SS-10	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
	722.5	31																
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE COARSE TO FINE GRAVEL, MOIST.		32–33																
		34–35	4 9 9	23	78	SS-11	4.50	-	-	-	-	-	-	-	-	11	A-4a (V)	
-COBBLES PRESENT THROUGHOUT		36–38																
		39–40	3 7 4	14	100	SS-12	3.25	-	-	-	-	-	-	-	-	11	A-4a (V)	
		41–43																
		44–45	3 5 7	16	89	SS-13	2.00	14	14	19	26	27	20	12	8	11	A-4a (4)	

MATERIAL DESCRIPTION AND NOTES	ELEV. 708.9	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
VERY STIFF TO HARD, GRAY **SANDY SILT**, SOME CLAY, LITTLE COARSE TO FINE GRAVEL, MOIST. *(same as above)*		46 – 49																
		49 – 50	17 47 30	100	67	SS-14	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
-COBBLES PRESENT THROUGHOUT	702.5	50 – 52																
VERY DENSE, GRAY **GRAVEL**, SOME COARSE TO FINE SAND, WET.		52 – 54																
		54 – 55	26 23 31	70	100	SS-15	-	-	-	-	-	-	-	-	-	12	A-1-a (V)	
		55 – 59																
		59 – 60	12 26 26	67	83	SS-16	-	-	-	-	-	-	-	-	-	9	A-1-a (V)	
	692.5	60 – 62																
DENSE TO VERY DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, TRACE CLAY, WET.		62 – 64																
-STONE FRAGMENTS PRESENT THROUGHOUT		64 – 65	20 20 23	56	100	SS-17	-	33	36	19	5	7	NP	NP	NP	15	A-1-b (0)	
		65 – 68																
		68.5 –	2															

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 109+04.13 / 27.7' Lt	START: 7/10/13	END: 7/11/13	PG 4 OF 4	B-004-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 685.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
	684.5	EOB 70	14 16	39	89	SS-18	-	-	-	-	-	-	-	-	-	20	A-1-b (V)	

NOTES: SEEPAGE ENCOUNTERED @ 13.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 18.0'; DRILLING MUD ADDED TO AUGERS @ 20.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE
TYPE: ROADWAY
PID: BR ID:
START: 7/11/13 END: 7/11/13

DRILLING FIRM / OPERATOR: RII / R.B.
SAMPLING FIRM / LOGGER: RII / S.T.
DRILLING METHOD: 4.25" HSA
SAMPLING METHOD: SPT

DRILL RIG: CME-750X (SN 310218)
HAMMER: CME AUTOMATIC
CALIBRATION DATE: 4/26/13
ENERGY RATIO (%): 77.7

STATION / OFFSET: 109+41.28 / 29.7' Lt
ALIGNMENT: WINCHESTER PIKE
ELEVATION: 746.1 (MSL) EOB: 65.0 ft.
LAT / LONG : 39.890751273 ° N / 82.863743295 ° W

EXPLORATION ID
B-005-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 746.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.8' - TOPSOIL (10.0")	745.3																	
FILL: STIFF, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. -ROOT FIBERS PRESENT IN SS-1	743.1	1–2	WOH 2 2	5	72	SS-1	1.50	-	-	-	-	-	-	-	-	21	A-4a (V)	
FILL: SOFT, BROWN TO BLACK **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST TO WET.		3 (W)																
		4–5	2 4 5	12	33	SS-2	0.25	-	-	-	-	-	-	-	-	22	A-4a (V)	
-WOOD FIBERS PRESENT IN SS-3	738.6	6–7	1 2 3	6	100	SS-3	0.25	2	11	43	23	21	26	24	2	63	A-4a (2)	
DENSE, BROWN **GRAVEL**, SOME FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, MOIST. -STONE FRAGMENTS PRESENT IN SS-4	737.1	8 (W)	7 14 18	41	100	SS-4	-	62	15	12	6	5	NP	NP	NP	9	A-1-a (0)	
DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, TRACE CLAY, MOIST.	735.6	9–10	12 14 17	40	83	SS-5	-	47	23	15	7	8	NP	NP	NP	9	A-1-b (0)	
DENSE, GRAY **GRAVEL**, SOME COARSE TO FINE SAND, TRACE SILT, WET.	733.1	11–12	9 12 15	35	100	SS-6	-	-	-	-	-	-	-	-	-	13	A-1-a (V)	
MEDIUM DENSE TO DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, WET.		14–15	5 17 10	35	83	SS-7	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
	728.1	16–17	10 10 8	23	72	SS-8	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	
STIFF TO VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, SOME COARSE TO FINE GRAVEL, MOIST.		19–20	2 3 4	9	61	SS-9	3.25	-	-	-	-	-	-	-	-	14	A-4a (V)	
-COBBLES PRESENT THROUGHOUT		21																

GRADATION (%): GR, CS, FS, SI, CL; ATTERBERG: LL, PL, PI

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 109+41.28 / 29.7' Lt	START: 7/11/13	END: 7/11/13	PG 2 OF 3	B-005-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 724.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
STIFF TO VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, SOME COARSE TO FINE GRAVEL, MOIST. *(same as above)*		23																
		24	1 3 4	9	61	SS-10	1.00	-	-	-	-	-	-	-	-	14	A-4a (V)	
-COBBLES PRESENT THROUGHOUT		25																
	719.1	26																
MEDIUM STIFF, GRAY **SANDY SILT**, SOME CLAY, SOME COARSE TO FINE GRAVEL, MOIST.		27																
		28																
		29	3 5 7	16	50	SS-11	0.50	21	13	13	27	26	22	13	9	14	A-4a (4)	
		30																
	714.1	31																
HARD, GRAY **SANDY SILT**, SOME CLAY, SOME COARSE TO FINE GRAVEL, MOIST.		32																
		33																
		34	4 8 15	30	100	SS-12	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		35																
-COBBLES PRESENT THROUGHOUT		36																
		37																
		38																
		39	8 20 42	80	89	SS-13	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		40																
	704.1	41																
DENSE TO VERY DENSE, GRAY **GRAVEL AND SAND**, LITTLE SILT, TRACE CLAY, WET.		42																
		43																
-STONE FRAGMENTS PRESENT IN SS-14		44	17 13 16	38	67	SS-14	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		45																

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 109+41.28 / 29.7' Lt	START: 7/11/13	END: 7/11/13	PG 3 OF 3	B-005-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 700.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
DENSE TO VERY DENSE, GRAY **GRAVEL AND SAND**, LITTLE SILT, TRACE CLAY, WET. *(same as above)*		46–48																
		49–50	17 17 20	48	78	SS-15	-	-	-	-	-	-	-	-	-	15	A-1-b (V)	
		51–53																
		54–55	17 20 24	57	83	SS-16	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		56–58																
		59–60	8 14 16	39	94	SS-17	-	16	40	30	13	1	NP	NP	NP	17	A-1-b (0)	
		61–63																
	681.1	64–65 EOB	14 12 12	31	100	SS-18	-	-	-	-	-	-	-	-	-	21	A-1-b (V)	

NOTES: SEEPAGE ENCOUNTERED @ 3.5'; GROUNDWATER ENCOUNTERED INITIALLY @ 8.0'; DRILLING MUD ADDED TO AUGERS @ 10.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 100 LBS BENTONITE CHIPS AND SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 30+97.39 / 19.7' Rt	EXPLORATION ID B-006-0-13
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: EBRIGHT ROAD	
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 749.7 (MSL) EOB: 6.0 ft.	PAGE 1 OF 1
START: 7/9/13 END: 7/9/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.88717202 ° N / 82.863722579 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 749.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.3' - TOPSOIL (4.0")	749.4																	
FILL: STIFF, BROWN **SILT AND CLAY**, AND FINE TO COARSE SAND, LITTLE FINE GRAVEL, MOIST. -TRACE GRASS AND ROOT FIBERS PRESENT IN SS-1 -SAMPLE SS-1: SULFATE CONTENT = 33 PPM	748.2	1	1 2 3	6	50	SS-1	2.00	13	27	12	35	13	31	17	14	18	A-6a (4)	
STIFF, BROWN **SILTY CLAY**, AND FINE TO COARSE SAND, LITTLE FINE GRAVEL, MOIST.		2	1 1 1	3	67	SS-2	1.75	15	32	14	26	13	38	18	20	19	A-6b (3)	
		3–4	2 3 4	9	56	SS-3	1.00	-	-	-	-	-	-	-	-	23	A-6b (V)	
	743.7	5 (W) – 6 EOB	4 4 6	13	78	SS-4	1.50	-	-	-	-	-	-	-	-	16	A-6b (V)	

NOTES: GROUNDWATER INITIALLY ENCOUNTERED @ 5.2'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 35+98.66 / 23.7' Rt
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: EBRIGHT ROAD
PID: BR ID:	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 747.8 (MSL) EOB: 6.0 ft.
START: 7/9/13 END: 7/9/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.88854431 ° N / 82.863605264 ° W

EXPLORATION ID B-007-0-13

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 747.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.3' - TOPSOIL (4.0")	747.5																	
VERY STIFF, BROWN **CLAY**, SOME TO AND FINE TO COARSE SAND, SOME TO AND SILT, TRACE FINE GRAVEL, DAMP TO MOIST.		1	1 2 3	6	78	SS-1	2.75	6	19	11	43	21	45	24	21	18	A-7-6 (11)	
-SAMPLE SS-1: SULFATE CONTENT = 13 PPM		2	3 3 5	10	67	SS-2	3.75	5	24	14	36	21	44	19	25	18	A-7-6 (11)	
		3, 4	4 7 10	22	67	SS-3	3.00	-	-	-	-	-	-	-	-	12	A-7-6 (V)	
	741.8	5	7 10 14	31	28	SS-4	-	-	-	-	-	-	-	-	-	13	A-7-6 (V)	
		EOB 6																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 110+47.84 / 26.6' Lt	EXPLORATION ID B-008-0-13
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.B.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE	
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 4/26/13	ELEVATION: 744.0 (MSL) EOB: 49.0 ft.	PAGE 1 OF 3
START: 7/12/13 END: 7/12/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.890575557 ° N / 82.863437654 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 744.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.9' - CONCRETE (11.0")	743.1																	
0.4' - GRANULAR BASE (5.0")	742.7																	
FILL: MEDIUM STIFF, DARK GRAY AND BLACK **SANDY SILT**, LITTLE CLAY, WET. -WOOD FRAGMENTS AND SLIGHT ORGANIC ODOR PRESENT IN SS-1	738.5		1 1 2	4	94	SS-1	0.50	-	-	-	-	-	-	-	-	32	A-4a (V)	
FILL: MEDIUM DENSE, GRAY **GRAVEL**, SOME COARSE TO FINE SAND, TRACE SILT, TRACE CLAY, MOIST. -STONE FRAGMENTS FROM 7.5' TO 8.0' -WET WOOD FRAGMENTS FROM 8.0' TO 9.0' -ORGANIC MATTER = 92.9% FROM 8.0' TO 9.0'	735.0	W	8 11 12	30	78	SS-2	-	56	22	11	10	1	17	13	4	10	A-1-a (0)	
							-	-	-	-	-	-	-	-	-	129	A-1-a (V)	
MEDIUM DENSE, GRAY **GRAVEL WITH SAND AND SILT**, WET.	729.0	W	5 6 7	17	67	SS-3	-	30	45	19	6	0	20	13	7	18	A-2-4 (0)	
STIFF TO VERY STIFF, GRAY **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE FINE GRAVEL, MOIST.			4 6 8	18	78	SS-4	1.00	-	-	-	-	-	-	-	-	14	A-4a (V)	

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 110+47.84 / 26.6' Lt	START: 7/12/13	END: 7/12/13	PG 2 OF 3	B-008-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 722.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
STIFF TO VERY STIFF, GRAY **SANDY SILT**, LITTLE TO SOME CLAY, LITTLE FINE GRAVEL, MOIST. *(same as above)*		23 - 24	2 7 12	25	50	SS-5	4.00	18	14	15	42	11	NP	NP	NP	12	A-4a (4)	
		28 - 29	5 5 9	18	72	SS-6	2.50	-	-	-	-	-	-	-	-	15	A-4a (V)	
		33 - 34	14 8 8	21	72	SS-7	2.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		38 - 39	20 24 26	65	94	SS-8	3.50	11	12	15	39	23	24	16	8	13	A-4a (5)	
	703.5	40																
DENSE TO VERY DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, MOIST.		43 - 44	15 17 19	47	94	SS-9	-	-	-	-	-	-	-	-	-	13	A-1-b (V)	
		45																

2013 ODOT BORING LOG 8X11 -RII- LAT/LONG - OH DOT.GDT - 12/17/13 17:10 - U:\GI8\PROJECTS\2013\W-13-054.GPJ

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 110+47.84 / 26.6' Lt	START: 7/12/13	END: 7/12/13	PG 3 OF 3	B-008-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 698.4	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
DENSE TO VERY DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, MOIST. *(same as above)*		46																
		47																
		48	15 20 20	52	100	SS-10	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
	695.0	EOB 49																

NOTES: SEEPAGE ENCOUNTERED @ 9.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 12.0'; DRILLING MUD ADDED TO AUGERS @ 17.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 150 LBS BENTONITE CHIPS AND SOIL CUTTINGS; CONCRETE

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 110+88.05 / 31.2' Lt	EXPLORATION ID B-009-0-13
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE	
PID: BR ID:	DRILLING METHOD: 4.25" HSA	CALIBRATION DATE: 4/26/13	ELEVATION: 754.7 (MSL) EOB: 65.0 ft.	PAGE 1 OF 3
START: 7/8/13 END: 7/8/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.890521281 ° N / 82.863311137 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 754.7
0.3' - TOPSOIL (3.0")	754.4
FILL: MEDIUM DENSE, GRAY **GRAVEL**, SOME COARSE TO FINE SAND, TRACE SILT, TRACE CLAY, MOIST. -ASPHALT FRAGMENTS PRESENT IN SS-1 -SIMILAR TO BASE MATERIAL	751.7
FILL: STIFF, GRAY **SANDY SILT**, SOME FINE GRAVEL, LITTLE CLAY, MOIST. -SAMPLE SS-2: SULFATE CONTENT = 47 PPM	749.2
FILL: VERY DENSE, GRAY **GRAVEL**, MOIST (CONCRETE FRAGMENTS).	746.7
SOFT TO MEDIUM STIFF, GRAY TO BROWN **CLAY**, AND SILT, LITTLE FINE TO COARSE SAND, TRACE FINE GRAVEL, MOIST.	740.7
LOOSE, BROWN **GRAVEL WITH SAND AND SILT**, TRACE CLAY, WET.	739.2
MEDIUM DENSE TO DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, WET.	

DEPTHS: W (approx. 16 ft), W (approx. 18 ft)

DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GR	CS	FS	SI	CL	LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
1–2.5	35 9 4	17	83	SS-1	-	68	18	6	7	1	NP	NP	NP	12	A-1-a (0)	
3.5–5	2 3 2	6	94	SS-2	1.25	28	8	7	38	19	28	19	9	17	A-4a (4)	
6–7.5	40 35 4	51	44	SS-3	-	-	-	-	-	-	-	-	-	8	A-1-a (V)	
8.5–10	1 1 1	3	72	SS-4	1.00	4	4	11	54	27	42	21	21	31	A-7-6 (13)	
11–12.5	2 2 3	6	100	SS-5	1.00	-	-	-	-	-	-	-	-	25	A-7-6 (V)	
13.5–15	1 3 4	9	100	SS-6	0.25	-	-	-	-	-	-	-	-	30	A-7-6 (V)	
					-	37	19	11	27	6	30	22	8	20	A-2-4 (0)	
16–17.5	6 8 4	16	61	SS-7	-	-	-	-	-	-	-	-	-	12	A-1b (V)	
18.5–20	9 9 11	26	89	SS-8	-	-	-	-	-	-	-	-	-	10	A-1-b (V)	

2013 ODOT BORING LOG 8X11 -RII- LAT/LONG - OH DOT.GDT - 12/17/13 17:10 - U:\GI8\PROJECTS\2013\W-13-054.GPJ

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 110+88.05 / 31.2' Lt	START: 7/8/13	END: 7/8/13	PG 2 OF 3	B-009-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 732.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
MEDIUM DENSE TO DENSE, GRAY **GRAVEL AND SAND**, TRACE SILT, WET. *(same as above)*		23																
-STONE FRAGMENTS PRESENT IN SS-9		24	8 9 16	32	78	SS-9	-	-	-	-	-	-	-	-	-	12	A-1-b (V)	
	727.7	25–27																
HARD, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.		28																
-COBBLES PRESENT THROUGHOUT		29	5 6 6	16	83	SS-10	4.50	-	-	-	-	-	-	-	-	16	A-6a (V)	
	722.7	30–32																
LOOSE TO MEDIUM DENSE, GRAY **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST TO WET.		33																
-COBBLES PRESENT THROUGHOUT		34	8 9 13	28	31	SS-11	-	-	-	-	-	-	-	-	-	13	A-2-6 (V)	
		35–38																
		39	6 8 10	23	44	SS-12	-	16	52	18	5	9	25	12	13	18	A-2-6 (0)	
		40–43																
		44	1 2 3	6	39	SS-13	-	-	-	-	-	-	-	-	-	13	A-2-6 (V)	
		45																

PID:	BR ID:	PROJECT: WINCHESTER PIKE	STATION / OFFSET: 110+88.05 / 31.2' Lt	START: 7/8/13	END: 7/8/13	PG 3 OF 3	B-009-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 709.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
LOOSE TO MEDIUM DENSE, GRAY **GRAVEL WITH SAND, SILT, AND CLAY**, MOIST TO WET. *(same as above)*	707.7	46 – 47																
DENSE TO VERY DENSE, GRAY **SANDY SILT**, AND FINE GRAVEL, LITTLE CLAY, DAMP TO MOIST.		48 – 50	14 34 28	80	72	SS-14	-	-	-	-	-	-	-	-	-	11	A-4a (V)	
		51 – 55	20 20 24	57	72	SS-15	-	-	-	-	-	-	-	-	-	7	A-4a (V)	
	692.7	56 – 62	15 14 15	38	89	SS-16	-	39	9	9	31	12	NP	NP	NP	12	A-4a (2)	
MEDIUM DENSE, GRAY **SANDY SILT**, AND FINE GRAVEL, LITTLE CLAY, MOIST.	689.7	63 – 65 EOB	3 8 10	23	83	SS-17	-	-	-	-	-	-	-	-	-	15	A-4a (V)	

NOTES: SEEPAGE ENCOUNTERED @ 16.0'; GROUNDWATER ENCOUNTERED INITIALLY @ 18.0'; DRILLING MUD ADDED TO AUGERS AT 20.0'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER 50 LBS BENTONITE CHIPS AND SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 41+11.77 / 19.4' Rt
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: EBRIGHT ROAD
PID: BR ID:	DRILLING METHOD: 4.5" CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 752.0 (MSL) EOB: 6.0 ft.
START: 7/9/13 END: 7/9/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.889851368 ° N / 82.863104708 ° W

EXPLORATION ID B-010-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 752.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.3' - TOPSOIL (4.0")	751.7																	
VERY STIFF, BROWNISH GRAY **SILT AND CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST. -SAMPLE SS-1: SULFATE CONTENT = 20 PPM	750.5	1	2 2 3	6	50	SS-1	2.50	17	14	16	30	23	28	15	13	19	A-6a (5)	
VERY STIFF, BROWNISH GRAY **SILTY CLAY**, SOME COARSE TO FINE SAND, LITTLE FINE GRAVEL, MOIST.		2	4 4 5	12	78	SS-2	3.50	18	13	18	25	26	29	13	16	16	A-6b (5)	
		3, 4	4 4 6	13	78	SS-3	4.00	-	-	-	-	-	-	-	-	17	A-6b (V)	
	746.0	5, 6 EOB	6 8 8	21	100	SS-4	3.50	-	-	-	-	-	-	-	-	18	A-6b (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / T.F.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 113+59.57 / 7.2' Lt	EXPLORATION ID **B-011-0-13**
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / A.D.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE	
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 754.8 (MSL) EOB: 7.0 ft.	PAGE 1 OF 1
START: 7/15/13 END: 7/15/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.89002014 ° N / 82.862586414 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 754.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.7' - ASPHALT (8.25")	754.1																	
0.3' - AGGREGATE BASE (4.0")	753.8	1																
FILL: MEDIUM DENSE, BROWN **GRAVEL**, SOME FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, MOIST.	752.3	2	21 7 9	21	56	SS-1	-	59	23	8	9	1	NP	NP	NP	8	A-1-a (0)	
FILL: VERY STIFF, GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. -SAMPLE SS-2: SULFATE CONTENT = 27 PPM	750.8	3	8 5 7	16	56	SS-2	3.00	3	7	27	40	23	23	18	5	19	A-4a (6)	
FILL: DENSE TO VERY DENSE, BROWNISH GRAY **GRAVEL WITH SAND, SILT, AND CLAY**, DRY TO DAMP. -ASPHALT AND BRICK FRAGMENTS PRESENT THROUGHOUT		4 5	8 5 27	41	56	SS-3	-	-	-	-	-	-	-	-	-	9	A-2-6 (V)	
			50/5"	-	100	SS-4	-	-	-	-	-	-	-	-	-	3	A-2-6 (V)	
	747.8	6 EOB 7																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 6.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 44+14.57 / 23.7' Rt
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: SHANNON ROAD
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 752.7 (MSL) EOB: 6.0 ft.
START: 7/10/13 END: 7/10/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.890536819 ° N / 82.862497086 ° W

EXPLORATION ID B-012-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 752.7	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.4' - TOPSOIL (5.0")	752.3																	
LOOSE, BROWNISH GRAY **SANDY SILT**, LITTLE CLAY, LITTLE FINE GRAVEL, MOIST. -SAMPLE SS-1: SULFATE CONTENT = 47 PPM	751.2	1	3 3 3	8	56	SS-1	-	16	4	22	40	18	NP	NP	NP	16	A-4a (5)	
VERY STIFF TO HARD, BROWNISH GRAY TO GRAY **SILT**, SOME COARSE TO FINE SAND, LITTLE CLAY, TRACE FINE GRAVEL, MOIST.		2	3 4 4	10	94	SS-2	2.00	1	6	27	52	14	25	17	8	18	A-4b (6)	
		3	4 5 5	13	83	SS-3	4.25	-	-	-	-	-	-	-	-	17	A-4b (V)	
		4																
		5	6 7 8	19	94	SS-4	2.75	-	-	-	-	-	-	-	-	20	A-4b (V)	
	746.7	EOB 6																

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER SOIL CUTTINGS

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 48+89.55 / 17.2' Rt
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: SHANNON ROAD
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 746.0 (MSL) EOB: 6.0 ft.
START: 7/10/13 END: 7/10/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.8915287 ° N / 82.861431508 ° W

EXPLORATION ID **B-013-0-13**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 746.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.4' - TOPSOIL (5.0")	745.6																	
FILL: MEDIUM DENSE, BROWNISH GRAY **GRAVEL WITH SAND, SILT, AND CLAY**, DAMP. -STONE FRAGMENTS PRESENT IN SS-1	744.5	1	3 4 5	12	78	SS-1	-	48	14	11	22	5	31	15	16	7	A-2-6 (1)	
FILL: MEDIUM DENSE, DARK BROWNISH GRAY **GRAVEL WITH SAND AND SILT**, TRACE CLAY, DAMP.		2	7 9 7	21	67	SS-2	-	40	15	13	24	8	29	19	10	12	A-2-4 (0)	
-ASPHALT FRAGMENTS AND SLAG PRESENT IN SS-3	741.5	3, W 4	3 5 4	12	83	SS-3	-	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
VERY STIFF, GRAY **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	740.0	5, EOB 6	3 5 5	13	78	SS-4	3.50	-	-	-	-	-	-	-	-	22	A-6a (V)	

NOTES: SEEPAGE ENCOUNTERED @ 4.0'; CAVE-IN DEPTH @ 5.8'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER SOIL CUTTINGS

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / T.F.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 117+55.23 / 6.5' Lt	EXPLORATION ID B-014-0-13
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / A.D.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE	
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 752.1 (MSL) EOB: 7.0 ft.	PAGE 1 OF 1
START: 7/15/13 END: 7/15/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.889326156 ° N / 82.861500331 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 752.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.8' - ASPHALT (9.0")	751.3																	
0.2' - AGGREGATE BASE (3.0")	751.1																	
MEDIUM DENSE, BROWNISH GRAY **GRAVEL**, SOME FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, DAMP.	749.6	1–2	10 5 4	12	56	SS-1	-	59	23	8	9	1	NP	NP	NP	7	A-1-a (0)	
STIFF, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. -SAMPLE SS-2: SULFATE CONTENT = 20 PPM		3	8 7 6	17	56	SS-2	2.00	5	15	20	37	23	27	21	6	18	A-4a (5)	
	746.6	4–5	3 2 3	6	67	SS-3	1.50	-	-	-	-	-	-	-	-	20	A-4a (V)	
VERY STIFF, BROWN **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	745.1	6–7 EOB	5 6 7	17	78	SS-4	3.00	-	-	-	-	-	-	-	-	22	A-6b (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 5.5'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; COMPACTED WITH THE AUGER SOIL CUTTINGS

2013 ODOT BORING LOG 8X11 -RII- LAT/LONG - OH DOT.GDT - 12/17/13 17:10 - U:\GI8\PROJECTS\2013\W-13-054.GPJ

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / R.B.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 52+83.79 / 21.8' Rt	EXPLORATION ID B-015-0-13
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / S.T.	HAMMER: CME AUTOMATIC	ALIGNMENT: SHANNON ROAD	
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 748.1 (MSL) EOB: 6.0 ft.	PAGE 1 OF 1
START: 7/10/13 END: 7/10/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.889326156 ° N / 82.86025512 ° W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 748.1	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.7' - TOPSOIL (8.0")	747.4																	
FILL: HARD, LIGHT BROWN **SILT AND CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST. -STYROFOAM FRAGMENTS AND ROOT FIBERS PRESENT IN SS-1	746.6	1	3 3 4	9	44	SS-1	4.50	8	7	17	49	19	32	19	13	17	A-6a (8)	
VERY STIFF TO HARD, BROWN **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. -SAMPLE SS-2: SULFATE CONTENT = 40 PPM		2	4 4 7	14	67	SS-2	4.50	2	7	24	42	25	NP	NP	NP	16	A-4a (6)	
-STONE FRAGMENTS PRESENT IN SS-3		3–4	2 2 4	8	83	SS-3	2.00	-	-	-	-	-	-	-	-	21	A-4a (V)	
	742.1	5 / EOB 6	5 5 6	14	94	SS-4	2.00	-	-	-	-	-	-	-	-	21	A-4a (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING

ABANDONMENT METHODS, MATERIALS, QUANTITIES: COMPACTED WITH THE AUGER SOIL CUTTINGS

RESOURCE INTERNATIONAL, INC.

PROJECT: WINCHESTER PIKE	DRILLING FIRM / OPERATOR: RII / T.F.	DRILL RIG: CME-750X (SN 310218)	STATION / OFFSET: 121+73.38 / 7.0' Lt
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: RII / A.D.	HAMMER: CME AUTOMATIC	ALIGNMENT: WINCHESTER PIKE
PID: BR ID:	DRILLING METHOD: 4.5" - CFA	CALIBRATION DATE: 4/26/13	ELEVATION: 750.5 (MSL) EOB: 7.0 ft.
START: 7/15/13 END: 7/15/13	SAMPLING METHOD: SPT	ENERGY RATIO (%): 77.7	LAT / LONG : 39.888567975 ° N / 82.86038143 ° W

EXPLORATION ID B-016-0-13

MATERIAL DESCRIPTION AND NOTES	ELEV. 750.5	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	BACK FILL
0.7' - ASPHALT (8.25")	749.8																	
0.3' - AGGREGATE BASE (4.0")	749.5																	
MEDIUM DENSE, BLACK AND GRAY **GRAVEL**, LITTLE FINE TO COARSE SAND, TRACE SILT, TRACE CLAY, MOIST.	748.0	1 - 2	6 5 7	16	33	SS-1	-	77	11	4	7	1	NP	NP	NP	11	A-1-a (0)	
STIFF, DARK GRAY TO MOTTLED GRAY **SANDY SILT**, SOME CLAY, TRACE FINE GRAVEL, MOIST. -ORGANIC ODOR PRESENT IN SS-2 -SAMPLE SS-2: SULFATE CONTENT = 40 PPM	745.0	3	2 2 3	6	33	SS-2	1.50	5	14	19	38	24	38	30	8	31	A-4a (5)	
		4 - 5	2 1 2	4	56	SS-3	1.50	-	-	-	-	-	-	-	-	23	A-4a (V)	
MEDIUM STIFF, BROWNISH GRAY **SILTY CLAY**, LITTLE COARSE TO FINE SAND, TRACE FINE GRAVEL, MOIST.	743.5	6 - 7 EOB	3 4 4	10	100	SS-4	0.50	-	-	-	-	-	-	-	-	28	A-6b (V)	

NOTES: GROUNDWATER NOT ENCOUNTERED DURING DRILLING; CAVE-IN DEPTH @ 6.7'

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; COMPACTED WITH THE AUGER SOIL CUTTINGS

2013 ODOT BORING LOG 8X11 -RII- LAT/LONG - OH DOT.GDT - 12/17/13 17:11 - U:\GI8\PROJECTS\2013\W-13-054.GPJ

APPENDIX V

PAVEMENT CORE DATA SUMMARY

Pavement Core Data Summary

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

PROJECT	Winchester Pike/Shannon Rd Improvements
LOCATION	Franklin County
JOB No.	W-13-054
BORING/CORE No.	B-006-0-12
DATE CORE OBTAINED	7/15/2013

Core Composition

Core Number	Lift Thickness (in.)	Asphalt 404	Asphalt 402	Asphalt 301	Concrete	Aggregate/Granular Base	Other			
B-006-0-12	1.25	✓								
	1.00	✓								
	1.50	✓								
	1.50	✓								
	2.75		✓							

Comments/Remarks

- A few air voids evident in the top four lifts of the 404 asphalt
- Some air voids evident in the 402 lift of the asphalt
- No base depth given

Total Pavement Thickness =	8.00	in.	Total Asphalt Thickness =	8.00	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	0.00	in.

Pavement Core Data Summary

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

PROJECT: Winchester Pike/Shannon Rd Improvements
LOCATION: Franklin County
JOB No.: W-13-054

BORING/CORE No.: B-011-0-12
DATE CORE OBTAINED: 7/15/2013

Core Composition

Core Number	Lift Thickness (in.)	Asphalt 404	Asphalt 402	Asphalt 301	Concrete	Aggregate/Granular Base	Other			
B-011-0-12	1.25	✓								
	1.00	✓								
	1.00	✓								
	2.50		✓							
	2.50		✓							
	4.00					✓				

Comments/Remarks

- Some deterioration evident in the surface lift of 404 possibly due to the coring operation.
- Broken stone void evident between first and second lift of the 404 asphalt

Total Pavement Thickness = 8.25 in. Total Asphalt Thickness = 8.25 in. Total Concrete Thickness = 0.00 in. Total Base Thickness = 4.00 in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT: Winchester Pike/Shannon Rd Improvements
LOCATION: Franklin County
JOB No.: W-13-054

BORING/CORE No.: B-012-0-12
DATE CORE OBTAINED:

Core Composition

Core Number	Lift Thickness (in.)	Asphalt 404	Asphalt 402	Asphalt 301	Concrete	Aggregate/Granular Base	Other			
B-012-0-12	1.25	✓								
	1.50		✓							
	2.00		✓							
	3.25		✓							

Comments/Remarks

- Deterioration evident in the initial lift of the 402 asphalt
- Some tearing evident in the third lift of the 402 asphalt possibly due to overrolling durin gthe paving operation
- No base depth given

Total Pavement Thickness = 8.00 in.
Total Asphalt Thickness = 8.00 in.
Total Concrete Thickness = 0.00 in.
Total Base Thickness = 0.00 in.

6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT: Winchester Pike/Shannon Rd Improvements
LOCATION: Franklin County
JOB No.: W-13-054

BORING/CORE No.: B-015-0-12
DATE CORE OBTAINED: 7/15/2013

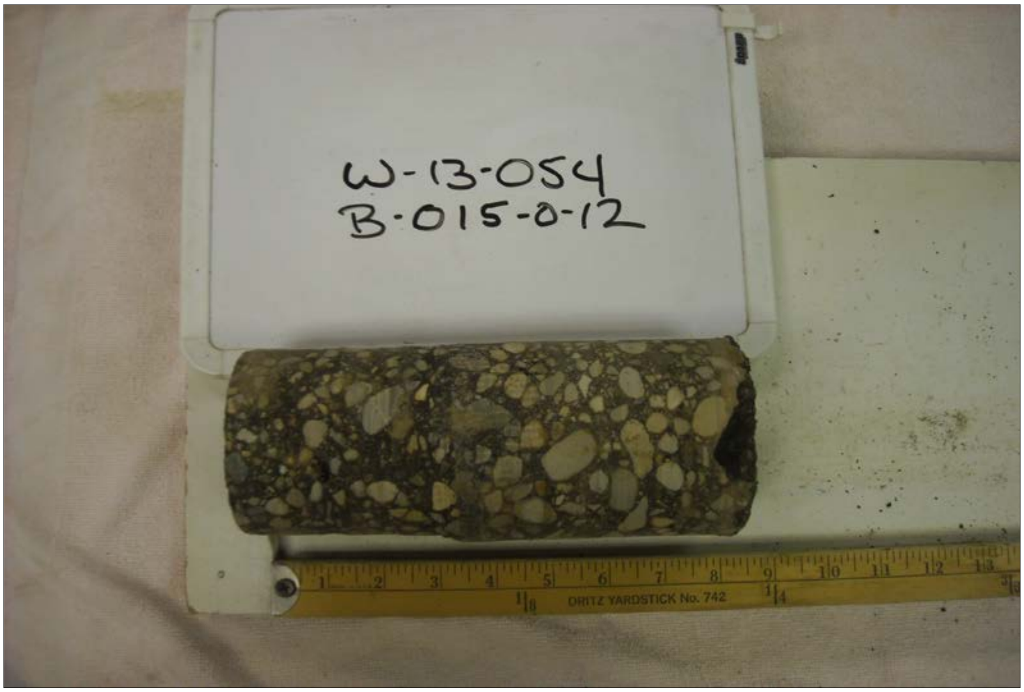
Core Composition

Core Number	Lift Thickness (in.)	Asphalt 404	Asphalt 402	Asphalt 301	Concrete	Aggregate/Granular Base	Other			
B-015-0-12	1.50	✓								
	1.75		✓							
	2.50		✓							
	2.50		✓							

Comments/Remarks

- Core appears to be in good shape
- No base depth given

Total Pavement Thickness = 8.25 in.
Total Asphalt Thickness = 8.25 in.
Total Concrete Thickness = 0.00 in.
Total Base Thickness = 0.00 in.



6350 Presidential Gateway
Columbus, Ohio 43231
Telephone: (614) 823-4949
Fax Number: (614) 823-4990

Pavement Core Data Summary

PROJECT: Winchester Pike/Shannon Rd Improvements
LOCATION: Franklin County
JOB No.: W-13-054

BORING/CORE No.: B-016-0-12
DATE CORE OBTAINED: 7/15/2013

Core Composition

Core Number	Lift Thickness (in.)	Asphalt 404	Asphalt 402	Asphalt 301	Concrete	Aggregate/Granular Base	Other			
B-016-0-12	1.25	✓								
	1.00	✓								
	1.50	✓								
	1.50	✓								
	3.00		✓							
	4.00					✓				

Comments/Remarks

- Some deterioration evident at the bottom of the 402 lift of asphalt as well as some vertical cracking

Total Pavement Thickness =	8.25	in.	Total Asphalt Thickness =	8.25	in.	Total Concrete Thickness =	0.00	in.	Total Base Thickness =	4.00	in.

APPENDIX VI

GB1 SUBGRADE STABILIZATION SUMMARY

Subgrade Analysis

V. 12.00 12/30/11

Design CBR	8

Global Options		
320	R&R	No
206	CS	Option
	LS	No
	LKD	Option
206	Depth	14

Total Borings	12
PID	NA
Location	Winchester Pike, Franklin County, Ohio

Classification Counts by Sample

R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	3	1	0	0	2	0	6	0	11	3	0	10	8	0	4	0	0
	6%	2%			4%		13%		23%	6%		21%	17%		8%		
0%	25%								75%								

Surface Class		
2-5	0	
4b	0	
5	0	
7-5	0	
7-6	1	8%
8a	0	
8b	0	
R	0	

% Borings	
N_{60L}<= 5	25%
<=10	67%
>=20	0%
M+	83%
R	0%

% Surface	
50%	
0%	50%

UC @ Surface
19.7
24
12

Rig	ER
A	78
B	
C	
D	
E	
F	
G	
H	

	N_{60}	N_{60L}	LL	PL	PI	% Silt	Clay	P 200	M	M_{OPT}	GI
Average	14.7	8.7			13.2		15.3		16.7	12.9	5.57
Maximum	41	18	45	30	25	52	35	84	31	25	14
Minimum	3	3	23	13	5	7	1	8	3	6	0

#	B #	Boring Location	Boring Depth	Boring To	Cut Fill	Subgrade Depth	Subgrade To	n_2	n_3	N	Rig	N_{60}	N_{60L}	LL	PL	PI	% Silt	% Clay	P 200	M	M_{OPT}	Ohio DOT	GI	Comments	Problem w/ Class	Problem w/ MN	Undercuts UC Class	Undercuts UC MN	Analysis
1	B-001	Sta. 98+28.61, 7.2' Lt.	1.0	2.5	-1.0	0.0	1.5	4	5	9	A	12		NP	NP	NP	31	13	44	19	11	4a	2			MN		12	UC 12" or
		Winchester Pike	2.5	4.0		1.5	3.0	7	7	14		18		29	17	12	43	23	66	15	14	6a	7						CS 12"
			4.0	5.5		3.0	4.5	6	7	13		17								18	14	6a	8						
			5.5	7.0		4.5	6.0	5	5	10		13	12							20	14	6a	8			MN		12	
2	B-002	Sta. 103+20.06, 8.2' Lt.	1.0	2.5	-1.0	0.0	1.5	7	7	14	A	18		NP	NP	NP	24	1	25	10	6	1b	0						
		Winchester Pike	2.5	4.0		1.5	3.0	4	6	10		13		33	21	12	49	35	84	22	16	6a	9			MN		12	
			4.0	5.5		3.0	4.5	2	2	4		5								28	14	6a	8			N		27	
			5.5	7.0		4.5	6.0	4	4	8		10	5							30	14	6a	8			N		15	
3	B-003	Sta. 106+67.99, 7.7' Lt.	1.0	2.5	-1.0	0.0	1.5	7	7	14	A	18		NP	NP	NP	25	15	40	10	11	4a	1						
		Winchester Pike	2.5	4.0		1.5	3.0	8	9	17		22		29	17	12	31	1	32	8	10	2-6	0						
			4.0	5.5		3.0	4.5	12	13	25		32								11	10	2-6	2						
			5.5	7.0		4.5	6.0	19	13	32		41	18							8	10	2-6	2						
4	B-006	Sta. 30+97.39, 19.7' Rt.	0.0	1.5	0.0	0.0	1.5	2	3	5	A	6		31	17	14	35	13	48	18	14	6a	4	Fill		N		24	UC 24"
		Ebright Road	1.5	3.0		1.5	3.0	1	1	2		3		38	18	20	26	13	39	19	16	6b	3			N		40	No Chemical
			3.0	4.5		3.0	4.5	3	4	7		9								23	16	6b	10			N		16	Alt
			4.5	6.0		4.5	6.0	4	6	10		13	3							16	16	6b	10						N_{60L} < 4
5	B-007	Sta. 35+98.66, 23.7' Rt.	0.0	1.5	0.0	0.0	1.5	2	3	5	A	6		45	24	21	43	21	64	18	21	7-6	11			N		24	UC 24" or
		Ebright Road	1.5	3.0		1.5	3.0	3	5	8		10		44	19	25	36	21	57	18	18	7-6	11			N		15	CS 16"
			3.0	4.5		3.0	4.5	7	10	17		22								12	18	7-6	14						
			4.5	6.0		4.5	6.0	10	14	24		31	6							13	18	7-6	14						
6	B-010	Sta. 41+11.77, 19.4' Rt.	0.0	1.5	0.0	0.0	1.5	2	3	5	A	6		28	15	13	30	23	53	19	14	6a	5			N		24	UC 24" or
		Ebright Road	1.5	3.0		1.5	3.0	4	5	9		12		29	13	16	25	26	51	16	16	6b	5						CS 16"
			3.0	4.5		3.0	4.5	4	6	10		13								17	16	6b	10						
			4.5	6.0		4.5	6.0	8	8	16		21	6							18	16	6b	10						
7	B-011	Sta. 113+59.57, 7.2' Lt.	1.0	2.5	-1.0	0.0	1.5	7	9	16	A	21		NP	NP	NP	9	1	10	8	6	1a	0	Fill					
		Winchester Pike	2.5	4.0		1.5	3.0	5	7	12		16		23	18	5	40	23	63	19	13	4a	6	Fill		M			
			4.0	5.5		3.0	4.5	5	27	32		41								9	10	2-6	2	Fill					
			5.5	5.9		4.5	4.9						16							3	10	2-6	2	Fill - Refusal					
8	B-012	Sta. 44+14.57, 23.7' Rt.	0.0	1.5	0.0	0.0	1.5	3	3	6	A	8		NP	NP	NP	40	18	58	16	11	4a	5			N		18	UC 36" or
		Shannon Road	1.5	3.0		1.5	3.0	4	4	8		10		25	17	8	52	14	66	18	12	4b	6		4b	N	36	15	CS 14"
			3.0	4.5		3.0	4.5	5	5	10		13								17	10	4b			4b	MN	36	12	
			4.5	6.0		4.5	6.0	7	8	15		19	8							20	10	4b			4b	M	36		
9	B-013	Sta. 48+89.55, 17.2' Rt.	0.0	1.5	0.0	0.0	1.5	4	5	9	A	12		31	15	16	22	5	27	7	10	2-6	1	Fill					
		Shannon Road	1.5	3.0		1.5	3.0	9	7	16		21		29	19	10	24	8	32	12	10	2-4	0	Fill					
			3.0	4.5		3.0	4.5	5	4	9		12								10	10	2-4	0	Fill					
			4.5	6.0		4.5	6.0	5	5	10		13	12							22	14	6a	8			MN		12	
10	B-014	Sta. 117+55.23, 6.5' Lt.	1.0	2.5	-1.0	0.0	1.5	5	4	9	A	12		NP	NP	NP	9	1	10	7	6	1a	0						
		Winchester Pike	2.5	4.0		1.5	3.0	7	6	13		17		27	21	6	37	23	60	18	16	4a	5						
			4.0	5.5		3.0	4.5	2	3	5		6								20	10	4a	5			N		24	
			5.5	5.9		4.5	4.9	6	7	13		17	6							22	16	6b	10			M			
11	B-015	Sta. 52+83.79, 21.8' Rt.	0.0	1.5	0.0	0.0	1.5	3	4	7	A	9		32	19	13	49	19	68	17	14	6a	8	Fill		N		16	UC 16" or
		Shannon Road	1.5	3.0		1.5	3.0	4	7	11		14		NP	NP	NP	42	25	67	16	11	4a	6			MN		12	CS 14"
			3.0	4.5		3.0	4.5	2	4	6		8								21	10	4a	5			N		18	
			4.5	6.0		4.5	6.0	5	6	11		14	8							21	10	4a	5			MN		12	
12	B-016	Sta. 121+73.38, 7.0' Lt.	1.0	2.5	-1.0	0.0	1.5	5	7	12	A	16		NP	NP	NP	7	1	8	11	6	1a	0						
		Winchester Pike	2.5	4.0		1.5	3.0	2	3	5		6		38	30	8	38	24	62	31	25	4a	5			N		24	
			4.0	5.5		3.0	4.5	1	2	3		4								23	10	4a	5			N		30	
			5.5	5.9		4.5	4.9	4	4	8		10	4							28	16	6b	10			N		15	

APPENDIX VII

DRIVEN Analysis Output

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: J:\GEOTECH\JRH\B4-12.DVN
Project Name: Winchester Pike - B-004 Project Date: 12/09/2013
Project Client: ms Consultants
Computed By: JRH
Project Manager: JPS

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 10.00 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	18.00 ft
	- Driving/Restrike	18.00 ft
	- Ultimate:	18.00 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	15.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	3.00 ft	0.00%	110.00 pcf	28.0/28.0	Nordlund
2	Cohesive	10.00 ft	0.00%	120.00 pcf	2000.00 psf	T-79 Steel
3	Cohesionless	5.00 ft	0.00%	110.00 pcf	28.0/28.0	Nordlund
4	Cohesionless	14.00 ft	0.00%	115.00 pcf	30.0/30.0	Nordlund
5	Cohesive	20.00 ft	0.00%	125.00 pcf	3000.00 psf	T-79 Steel
6	Cohesionless	18.00 ft	0.00%	130.00 pcf	34.0/34.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	1165.00 psf	0.00 Kips
12.01 ft	Cohesive	N/A	N/A	1188.45 psf	7.50 Kips
12.99 ft	Cohesive	N/A	N/A	1199.88 psf	11.27 Kips
13.01 ft	Cohesionless	1530.55 psf	16.46	N/A	11.32 Kips
17.99 ft	Cohesionless	1804.45 psf	16.46	N/A	17.98 Kips
18.01 ft	Cohesionless	2080.26 psf	17.64	N/A	18.01 Kips
27.01 ft	Cohesionless	2316.96 psf	17.64	N/A	36.05 Kips
31.99 ft	Cohesionless	2447.94 psf	17.64	N/A	47.62 Kips
32.01 ft	Cohesive	N/A	N/A	1164.17 psf	47.68 Kips
41.01 ft	Cohesive	N/A	N/A	1300.00 psf	84.44 Kips
50.01 ft	Cohesive	N/A	N/A	1300.00 psf	121.19 Kips
51.99 ft	Cohesive	N/A	N/A	1300.00 psf	129.28 Kips
52.01 ft	Cohesionless	4068.74 psf	19.99	N/A	129.37 Kips
61.01 ft	Cohesionless	4372.94 psf	19.99	N/A	180.03 Kips
69.99 ft	Cohesionless	4676.46 psf	19.99	N/A	237.61 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	22.80	10.46 Kips	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	22.80	10.46 Kips	0.00 Kips
3.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	N/A	14.14 Kips
12.01 ft	Cohesive	N/A	N/A	N/A	14.14 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	14.14 Kips
13.01 ft	Cohesionless	1531.10 psf	22.80	10.46 Kips	10.46 Kips
17.99 ft	Cohesionless	2078.90 psf	22.80	10.46 Kips	10.46 Kips
18.01 ft	Cohesionless	2080.53 psf	30.00	10.46 Kips	10.46 Kips
27.01 ft	Cohesionless	2553.93 psf	30.00	10.46 Kips	10.46 Kips
31.99 ft	Cohesionless	2815.87 psf	30.00	10.46 Kips	10.46 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
41.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
50.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
51.99 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
52.01 ft	Cohesionless	4069.08 psf	55.60	57.74 Kips	57.74 Kips
61.01 ft	Cohesionless	4677.48 psf	55.60	57.74 Kips	57.74 Kips
69.99 ft	Cohesionless	5284.52 psf	55.60	57.74 Kips	57.74 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	14.14 Kips	14.14 Kips
12.01 ft	7.50 Kips	14.14 Kips	21.64 Kips
12.99 ft	11.27 Kips	14.14 Kips	25.41 Kips
13.01 ft	11.32 Kips	10.46 Kips	21.78 Kips
17.99 ft	17.98 Kips	10.46 Kips	28.44 Kips
18.01 ft	18.01 Kips	10.46 Kips	28.47 Kips
27.01 ft	36.05 Kips	10.46 Kips	46.51 Kips
31.99 ft	47.62 Kips	10.46 Kips	58.08 Kips
32.01 ft	47.68 Kips	21.21 Kips	68.88 Kips
41.01 ft	84.44 Kips	21.21 Kips	105.64 Kips
50.01 ft	121.19 Kips	21.21 Kips	142.40 Kips
51.99 ft	129.28 Kips	21.21 Kips	150.49 Kips
52.01 ft	129.37 Kips	57.74 Kips	187.12 Kips
61.01 ft	180.03 Kips	57.74 Kips	237.78 Kips
69.99 ft	237.61 Kips	57.74 Kips	295.35 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	1165.00 psf	0.00 Kips
12.01 ft	Cohesive	N/A	N/A	1188.45 psf	7.50 Kips
12.99 ft	Cohesive	N/A	N/A	1199.88 psf	11.27 Kips
13.01 ft	Cohesionless	1530.55 psf	16.46	N/A	11.32 Kips
17.99 ft	Cohesionless	1804.45 psf	16.46	N/A	17.98 Kips
18.01 ft	Cohesionless	2080.26 psf	17.64	N/A	18.01 Kips
27.01 ft	Cohesionless	2316.96 psf	17.64	N/A	36.05 Kips
31.99 ft	Cohesionless	2447.94 psf	17.64	N/A	47.62 Kips
32.01 ft	Cohesive	N/A	N/A	1164.17 psf	47.68 Kips
41.01 ft	Cohesive	N/A	N/A	1300.00 psf	84.44 Kips
50.01 ft	Cohesive	N/A	N/A	1300.00 psf	121.19 Kips
51.99 ft	Cohesive	N/A	N/A	1300.00 psf	129.28 Kips
52.01 ft	Cohesionless	4068.74 psf	19.99	N/A	129.37 Kips
61.01 ft	Cohesionless	4372.94 psf	19.99	N/A	180.03 Kips
69.99 ft	Cohesionless	4676.46 psf	19.99	N/A	237.61 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	22.80	10.46 Kips	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	22.80	10.46 Kips	0.00 Kips
3.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	N/A	14.14 Kips
12.01 ft	Cohesive	N/A	N/A	N/A	14.14 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	14.14 Kips
13.01 ft	Cohesionless	1531.10 psf	22.80	10.46 Kips	10.46 Kips
17.99 ft	Cohesionless	2078.90 psf	22.80	10.46 Kips	10.46 Kips
18.01 ft	Cohesionless	2080.53 psf	30.00	10.46 Kips	10.46 Kips
27.01 ft	Cohesionless	2553.93 psf	30.00	10.46 Kips	10.46 Kips
31.99 ft	Cohesionless	2815.87 psf	30.00	10.46 Kips	10.46 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
41.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
50.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
51.99 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
52.01 ft	Cohesionless	4069.08 psf	55.60	57.74 Kips	57.74 Kips
61.01 ft	Cohesionless	4677.48 psf	55.60	57.74 Kips	57.74 Kips
69.99 ft	Cohesionless	5284.52 psf	55.60	57.74 Kips	57.74 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	14.14 Kips	14.14 Kips
12.01 ft	7.50 Kips	14.14 Kips	21.64 Kips
12.99 ft	11.27 Kips	14.14 Kips	25.41 Kips
13.01 ft	11.32 Kips	10.46 Kips	21.78 Kips
17.99 ft	17.98 Kips	10.46 Kips	28.44 Kips
18.01 ft	18.01 Kips	10.46 Kips	28.47 Kips
27.01 ft	36.05 Kips	10.46 Kips	46.51 Kips
31.99 ft	47.62 Kips	10.46 Kips	58.08 Kips
32.01 ft	47.68 Kips	21.21 Kips	68.88 Kips
41.01 ft	84.44 Kips	21.21 Kips	105.64 Kips
50.01 ft	121.19 Kips	21.21 Kips	142.40 Kips
51.99 ft	129.28 Kips	21.21 Kips	150.49 Kips
52.01 ft	129.37 Kips	57.74 Kips	187.12 Kips
61.01 ft	180.03 Kips	57.74 Kips	237.78 Kips
69.99 ft	237.61 Kips	57.74 Kips	295.35 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
3.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
12.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
17.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
27.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
29.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
30.00 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
31.99 ft	Cohesionless	1013.54 psf	17.64	N/A	1.74 Kips
32.01 ft	Cohesive	N/A	N/A	1164.17 psf	1.79 Kips
41.01 ft	Cohesive	N/A	N/A	1300.00 psf	38.55 Kips
50.01 ft	Cohesive	N/A	N/A	1300.00 psf	75.31 Kips
51.99 ft	Cohesive	N/A	N/A	1300.00 psf	83.39 Kips
52.01 ft	Cohesionless	2318.74 psf	19.99	N/A	83.46 Kips
61.01 ft	Cohesionless	2622.94 psf	19.99	N/A	113.85 Kips
69.99 ft	Cohesionless	2926.46 psf	19.99	N/A	151.20 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
2.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
3.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
12.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
12.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
17.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
18.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
27.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
29.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
30.00 ft	Cohesionless	961.20 psf	30.00	10.46 Kips	10.46 Kips
31.99 ft	Cohesionless	1065.87 psf	30.00	10.46 Kips	10.46 Kips
32.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
41.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
50.01 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
51.99 ft	Cohesive	N/A	N/A	N/A	21.21 Kips
52.01 ft	Cohesionless	2319.08 psf	55.60	57.74 Kips	57.74 Kips
61.01 ft	Cohesionless	2927.48 psf	55.60	57.74 Kips	57.74 Kips
69.99 ft	Cohesionless	3534.52 psf	55.60	57.74 Kips	57.74 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
2.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
3.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
12.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
12.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
17.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
27.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
30.00 ft	0.00 Kips	10.46 Kips	10.46 Kips
31.99 ft	1.74 Kips	10.46 Kips	12.21 Kips
32.01 ft	1.79 Kips	21.21 Kips	23.00 Kips
41.01 ft	38.55 Kips	21.21 Kips	59.76 Kips
50.01 ft	75.31 Kips	21.21 Kips	96.51 Kips
51.99 ft	83.39 Kips	21.21 Kips	104.60 Kips
52.01 ft	83.46 Kips	57.74 Kips	141.21 Kips
61.01 ft	113.85 Kips	57.74 Kips	171.60 Kips
69.99 ft	151.20 Kips	57.74 Kips	208.94 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: J:\GEOTECH\JRH\B5-14.DVN
Project Name: Winchester Pike - B-005 Project Date: 12/09/2013
Project Client: ms Consultants
Computed By: JRH
Project Manager: JPS

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 10.00 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	8.00 ft
	- Driving/Restrike	8.00 ft
	- Ultimate:	8.00 ft
Ultimate Considerations:	- Local Scour:	10.00 ft
	- Long Term Scour:	10.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	7.50 ft	0.00%	115.00 pcf	500.00 psf	T-79 Steel
2	Cohesionless	10.50 ft	0.00%	120.00 pcf	32.0/32.0	Nordlund
3	Cohesive	24.00 ft	0.00%	125.00 pcf	2500.00 psf	T-79 Steel
4	Cohesionless	28.00 ft	0.00%	130.00 pcf	34.0/34.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
7.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
7.51 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
8.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.00 ft	Cohesionless	1037.70 psf	21.33	N/A	0.00 Kips
17.01 ft	Cohesionless	1239.59 psf	21.33	N/A	13.64 Kips
17.99 ft	Cohesionless	1267.81 psf	21.33	N/A	15.90 Kips
18.01 ft	Cohesive	N/A	N/A	1095.15 psf	15.97 Kips
27.01 ft	Cohesive	N/A	N/A	1230.15 psf	56.55 Kips
36.01 ft	Cohesive	N/A	N/A	1365.15 psf	106.04 Kips
41.99 ft	Cohesive	N/A	N/A	1454.85 psf	143.85 Kips
42.01 ft	Cohesionless	3001.24 psf	22.66	N/A	143.97 Kips
51.01 ft	Cohesionless	3305.44 psf	22.66	N/A	200.66 Kips
60.01 ft	Cohesionless	3609.64 psf	22.66	N/A	267.77 Kips
69.01 ft	Cohesionless	3913.84 psf	22.66	N/A	345.32 Kips
69.99 ft	Cohesionless	3946.96 psf	22.66	N/A	354.40 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
7.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
7.51 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
8.01 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
10.00 ft	Cohesionless	1037.70 psf	40.40	35.28 Kips	28.04 Kips
17.01 ft	Cohesionless	1441.48 psf	40.40	35.28 Kips	35.28 Kips
17.99 ft	Cohesionless	1497.92 psf	40.40	35.28 Kips	35.28 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
27.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
36.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
41.99 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
42.01 ft	Cohesionless	3001.58 psf	55.60	78.59 Kips	78.59 Kips
51.01 ft	Cohesionless	3609.98 psf	55.60	78.59 Kips	78.59 Kips
60.01 ft	Cohesionless	4218.38 psf	55.60	78.59 Kips	78.59 Kips
69.01 ft	Cohesionless	4826.78 psf	55.60	78.59 Kips	78.59 Kips
69.99 ft	Cohesionless	4893.02 psf	55.60	78.59 Kips	78.59 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	28.04 Kips	28.04 Kips
17.01 ft	13.64 Kips	35.28 Kips	48.92 Kips
17.99 ft	15.90 Kips	35.28 Kips	51.18 Kips
18.01 ft	15.97 Kips	24.05 Kips	40.02 Kips
27.01 ft	56.55 Kips	24.05 Kips	80.60 Kips
36.01 ft	106.04 Kips	24.05 Kips	130.09 Kips
41.99 ft	143.85 Kips	24.05 Kips	167.90 Kips
42.01 ft	143.97 Kips	78.59 Kips	222.57 Kips
51.01 ft	200.66 Kips	78.59 Kips	279.25 Kips
60.01 ft	267.77 Kips	78.59 Kips	346.37 Kips
69.01 ft	345.32 Kips	78.59 Kips	423.92 Kips
69.99 ft	354.40 Kips	78.59 Kips	432.99 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
7.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
7.51 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
8.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.00 ft	Cohesionless	1037.70 psf	21.33	N/A	0.00 Kips
17.01 ft	Cohesionless	1239.59 psf	21.33	N/A	13.64 Kips
17.99 ft	Cohesionless	1267.81 psf	21.33	N/A	15.90 Kips
18.01 ft	Cohesive	N/A	N/A	1095.15 psf	15.97 Kips
27.01 ft	Cohesive	N/A	N/A	1230.15 psf	56.55 Kips
36.01 ft	Cohesive	N/A	N/A	1365.15 psf	106.04 Kips
41.99 ft	Cohesive	N/A	N/A	1454.85 psf	143.85 Kips
42.01 ft	Cohesionless	3001.24 psf	22.66	N/A	143.97 Kips
51.01 ft	Cohesionless	3305.44 psf	22.66	N/A	200.66 Kips
60.01 ft	Cohesionless	3609.64 psf	22.66	N/A	267.77 Kips
69.01 ft	Cohesionless	3913.84 psf	22.66	N/A	345.32 Kips
69.99 ft	Cohesionless	3946.96 psf	22.66	N/A	354.40 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
7.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
7.51 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
8.01 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
10.00 ft	Cohesionless	1037.70 psf	40.40	35.28 Kips	28.04 Kips
17.01 ft	Cohesionless	1441.48 psf	40.40	35.28 Kips	35.28 Kips
17.99 ft	Cohesionless	1497.92 psf	40.40	35.28 Kips	35.28 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
27.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
36.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
41.99 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
42.01 ft	Cohesionless	3001.58 psf	55.60	78.59 Kips	78.59 Kips
51.01 ft	Cohesionless	3609.98 psf	55.60	78.59 Kips	78.59 Kips
60.01 ft	Cohesionless	4218.38 psf	55.60	78.59 Kips	78.59 Kips
69.01 ft	Cohesionless	4826.78 psf	55.60	78.59 Kips	78.59 Kips
69.99 ft	Cohesionless	4893.02 psf	55.60	78.59 Kips	78.59 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	28.04 Kips	28.04 Kips
17.01 ft	13.64 Kips	35.28 Kips	48.92 Kips
17.99 ft	15.90 Kips	35.28 Kips	51.18 Kips
18.01 ft	15.97 Kips	24.05 Kips	40.02 Kips
27.01 ft	56.55 Kips	24.05 Kips	80.60 Kips
36.01 ft	106.04 Kips	24.05 Kips	130.09 Kips
41.99 ft	143.85 Kips	24.05 Kips	167.90 Kips
42.01 ft	143.97 Kips	78.59 Kips	222.57 Kips
51.01 ft	200.66 Kips	78.59 Kips	279.25 Kips
60.01 ft	267.77 Kips	78.59 Kips	346.37 Kips
69.01 ft	345.32 Kips	78.59 Kips	423.92 Kips
69.99 ft	354.40 Kips	78.59 Kips	432.99 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
7.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
7.51 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
8.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.00 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
17.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
17.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
27.01 ft	Cohesive	N/A	N/A	1230.15 psf	31.61 Kips
36.01 ft	Cohesive	N/A	N/A	1365.15 psf	80.11 Kips
41.99 ft	Cohesive	N/A	N/A	1454.85 psf	117.26 Kips
42.01 ft	Cohesionless	1963.54 psf	22.66	N/A	117.36 Kips
51.01 ft	Cohesionless	2267.74 psf	22.66	N/A	156.25 Kips
60.01 ft	Cohesionless	2571.94 psf	22.66	N/A	205.57 Kips
69.01 ft	Cohesionless	2876.14 psf	22.66	N/A	265.33 Kips
69.99 ft	Cohesionless	2909.26 psf	22.66	N/A	272.47 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
7.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
7.51 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
8.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
10.00 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
17.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
17.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
18.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.00 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
27.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
36.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
41.99 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
42.01 ft	Cohesionless	1963.88 psf	55.60	78.59 Kips	77.37 Kips
51.01 ft	Cohesionless	2572.28 psf	55.60	78.59 Kips	78.59 Kips
60.01 ft	Cohesionless	3180.68 psf	55.60	78.59 Kips	78.59 Kips
69.01 ft	Cohesionless	3789.08 psf	55.60	78.59 Kips	78.59 Kips
69.99 ft	Cohesionless	3855.32 psf	55.60	78.59 Kips	78.59 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
17.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
17.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.00 ft	0.00 Kips	24.05 Kips	24.05 Kips
27.01 ft	31.61 Kips	24.05 Kips	55.66 Kips
36.01 ft	80.11 Kips	24.05 Kips	104.16 Kips
41.99 ft	117.26 Kips	24.05 Kips	141.31 Kips
42.01 ft	117.36 Kips	77.37 Kips	194.73 Kips
51.01 ft	156.25 Kips	78.59 Kips	234.84 Kips
60.01 ft	205.57 Kips	78.59 Kips	284.17 Kips
69.01 ft	265.33 Kips	78.59 Kips	343.92 Kips
69.99 ft	272.47 Kips	78.59 Kips	351.06 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: J:\GEOTECH\JRH\B8-14.DVN
Project Name: Winchester Pike - B-008 Project Date: 12/09/2013
Project Client: ms Consultants
Computed By: JRH
Project Manager: JPS

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 10.00 ft
Diameter of Pile: 14.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	12.00 ft
	- Driving/Restrike	12.00 ft
	- Ultimate:	12.00 ft
Ultimate Considerations:	- Local Scour:	10.00 ft
	- Long Term Scour:	10.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesive	5.50 ft	0.00%	120.00 pcf	500.00 psf	T-79 Steel
2	Cohesionless	9.50 ft	0.00%	120.00 pcf	32.0/32.0	Nordlund
3	Cohesive	25.50 ft	0.00%	125.00 pcf	2500.00 psf	T-79 Steel
4	Cohesionless	29.50 ft	0.00%	130.00 pcf	34.0/34.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
5.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
5.51 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.00 ft	Cohesionless	1200.00 psf	21.33	N/A	0.00 Kips
11.99 ft	Cohesionless	1319.40 psf	21.33	N/A	4.12 Kips
12.01 ft	Cohesionless	1440.29 psf	21.33	N/A	4.17 Kips
14.99 ft	Cohesionless	1526.11 psf	21.33	N/A	11.31 Kips
15.01 ft	Cohesive	N/A	N/A	1050.15 psf	11.37 Kips
24.01 ft	Cohesive	N/A	N/A	1185.15 psf	50.47 Kips
33.01 ft	Cohesive	N/A	N/A	1320.15 psf	98.48 Kips
40.49 ft	Cohesive	N/A	N/A	1432.35 psf	145.15 Kips
40.51 ft	Cohesionless	3209.44 psf	22.66	N/A	145.28 Kips
49.51 ft	Cohesionless	3513.64 psf	22.66	N/A	205.53 Kips
58.51 ft	Cohesionless	3817.84 psf	22.66	N/A	276.22 Kips
67.51 ft	Cohesionless	4122.04 psf	22.66	N/A	357.34 Kips
69.99 ft	Cohesionless	4205.86 psf	22.66	N/A	381.53 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
5.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
5.51 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
10.00 ft	Cohesionless	1200.00 psf	40.40	35.28 Kips	32.42 Kips
11.99 ft	Cohesionless	1438.80 psf	40.40	35.28 Kips	35.28 Kips
12.01 ft	Cohesionless	1440.58 psf	40.40	35.28 Kips	35.28 Kips
14.99 ft	Cohesionless	1612.22 psf	40.40	35.28 Kips	35.28 Kips
15.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
40.49 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
40.51 ft	Cohesionless	3209.78 psf	55.60	78.59 Kips	78.59 Kips
49.51 ft	Cohesionless	3818.18 psf	55.60	78.59 Kips	78.59 Kips
58.51 ft	Cohesionless	4426.58 psf	55.60	78.59 Kips	78.59 Kips
67.51 ft	Cohesionless	5034.98 psf	55.60	78.59 Kips	78.59 Kips
69.99 ft	Cohesionless	5202.62 psf	55.60	78.59 Kips	78.59 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	32.42 Kips	32.42 Kips
11.99 ft	4.12 Kips	35.28 Kips	39.40 Kips
12.01 ft	4.17 Kips	35.28 Kips	39.44 Kips
14.99 ft	11.31 Kips	35.28 Kips	46.59 Kips
15.01 ft	11.37 Kips	24.05 Kips	35.42 Kips
24.01 ft	50.47 Kips	24.05 Kips	74.52 Kips
33.01 ft	98.48 Kips	24.05 Kips	122.53 Kips
40.49 ft	145.15 Kips	24.05 Kips	169.20 Kips
40.51 ft	145.28 Kips	78.59 Kips	223.87 Kips
49.51 ft	205.53 Kips	78.59 Kips	284.13 Kips
58.51 ft	276.22 Kips	78.59 Kips	354.81 Kips
67.51 ft	357.34 Kips	78.59 Kips	435.93 Kips
69.99 ft	381.53 Kips	78.59 Kips	460.12 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
5.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
5.51 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.00 ft	Cohesionless	1200.00 psf	21.33	N/A	0.00 Kips
11.99 ft	Cohesionless	1319.40 psf	21.33	N/A	4.12 Kips
12.01 ft	Cohesionless	1440.29 psf	21.33	N/A	4.17 Kips
14.99 ft	Cohesionless	1526.11 psf	21.33	N/A	11.31 Kips
15.01 ft	Cohesive	N/A	N/A	1050.15 psf	11.37 Kips
24.01 ft	Cohesive	N/A	N/A	1185.15 psf	50.47 Kips
33.01 ft	Cohesive	N/A	N/A	1320.15 psf	98.48 Kips
40.49 ft	Cohesive	N/A	N/A	1432.35 psf	145.15 Kips
40.51 ft	Cohesionless	3209.44 psf	22.66	N/A	145.28 Kips
49.51 ft	Cohesionless	3513.64 psf	22.66	N/A	205.53 Kips
58.51 ft	Cohesionless	3817.84 psf	22.66	N/A	276.22 Kips
67.51 ft	Cohesionless	4122.04 psf	22.66	N/A	357.34 Kips
69.99 ft	Cohesionless	4205.86 psf	22.66	N/A	381.53 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
5.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
5.51 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	40.40	35.28 Kips	0.00 Kips
10.00 ft	Cohesionless	1200.00 psf	40.40	35.28 Kips	32.42 Kips
11.99 ft	Cohesionless	1438.80 psf	40.40	35.28 Kips	35.28 Kips
12.01 ft	Cohesionless	1440.58 psf	40.40	35.28 Kips	35.28 Kips
14.99 ft	Cohesionless	1612.22 psf	40.40	35.28 Kips	35.28 Kips
15.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
40.49 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
40.51 ft	Cohesionless	3209.78 psf	55.60	78.59 Kips	78.59 Kips
49.51 ft	Cohesionless	3818.18 psf	55.60	78.59 Kips	78.59 Kips
58.51 ft	Cohesionless	4426.58 psf	55.60	78.59 Kips	78.59 Kips
67.51 ft	Cohesionless	5034.98 psf	55.60	78.59 Kips	78.59 Kips
69.99 ft	Cohesionless	5202.62 psf	55.60	78.59 Kips	78.59 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	32.42 Kips	32.42 Kips
11.99 ft	4.12 Kips	35.28 Kips	39.40 Kips
12.01 ft	4.17 Kips	35.28 Kips	39.44 Kips
14.99 ft	11.31 Kips	35.28 Kips	46.59 Kips
15.01 ft	11.37 Kips	24.05 Kips	35.42 Kips
24.01 ft	50.47 Kips	24.05 Kips	74.52 Kips
33.01 ft	98.48 Kips	24.05 Kips	122.53 Kips
40.49 ft	145.15 Kips	24.05 Kips	169.20 Kips
40.51 ft	145.28 Kips	78.59 Kips	223.87 Kips
49.51 ft	205.53 Kips	78.59 Kips	284.13 Kips
58.51 ft	276.22 Kips	78.59 Kips	354.81 Kips
67.51 ft	357.34 Kips	78.59 Kips	435.93 Kips
69.99 ft	381.53 Kips	78.59 Kips	460.12 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
5.49 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
5.51 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
10.00 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
11.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
12.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
15.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
19.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
20.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
24.01 ft	Cohesive	N/A	N/A	1185.15 psf	17.42 Kips
33.01 ft	Cohesive	N/A	N/A	1320.15 psf	62.95 Kips
40.49 ft	Cohesive	N/A	N/A	1432.35 psf	107.57 Kips
40.51 ft	Cohesionless	2009.44 psf	22.66	N/A	107.67 Kips
49.51 ft	Cohesionless	2313.64 psf	22.66	N/A	147.35 Kips
58.51 ft	Cohesionless	2617.84 psf	22.66	N/A	197.46 Kips
67.51 ft	Cohesionless	2922.04 psf	22.66	N/A	258.00 Kips
69.99 ft	Cohesionless	3005.86 psf	22.66	N/A	276.52 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
5.49 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
5.51 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
9.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
10.00 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
11.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
12.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
14.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
15.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
19.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
20.00 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
24.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
33.01 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
40.49 ft	Cohesive	N/A	N/A	N/A	24.05 Kips
40.51 ft	Cohesionless	2009.78 psf	55.60	78.59 Kips	78.59 Kips
49.51 ft	Cohesionless	2618.18 psf	55.60	78.59 Kips	78.59 Kips
58.51 ft	Cohesionless	3226.58 psf	55.60	78.59 Kips	78.59 Kips
67.51 ft	Cohesionless	3834.98 psf	55.60	78.59 Kips	78.59 Kips
69.99 ft	Cohesionless	4002.62 psf	55.60	78.59 Kips	78.59 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.49 ft	0.00 Kips	0.00 Kips	0.00 Kips
5.51 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
11.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
12.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
15.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
19.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
20.00 ft	0.00 Kips	24.05 Kips	24.05 Kips
24.01 ft	17.42 Kips	24.05 Kips	41.47 Kips
33.01 ft	62.95 Kips	24.05 Kips	87.00 Kips
40.49 ft	107.57 Kips	24.05 Kips	131.62 Kips
40.51 ft	107.67 Kips	78.59 Kips	186.26 Kips
49.51 ft	147.35 Kips	78.59 Kips	225.94 Kips
58.51 ft	197.46 Kips	78.59 Kips	276.05 Kips
67.51 ft	258.00 Kips	78.59 Kips	336.60 Kips
69.99 ft	276.52 Kips	78.59 Kips	355.11 Kips

DRIVEN 1.2

GENERAL PROJECT INFORMATION

Filename: J:\GEOTECH\JRH\B9-12.DVN
Project Name: Winchester Pike - B-009 Project Date: 12/09/2013
Project Client: ms Consultants
Computed By: JRH
Project Manager: JPS

PILE INFORMATION

Pile Type: Pipe Pile - Closed End
Top of Pile: 10.00 ft
Diameter of Pile: 12.00 in

ULTIMATE CONSIDERATIONS

Water Table Depth At Time Of:	- Drilling:	18.00 ft
	- Driving/Restrike	18.00 ft
	- Ultimate:	18.00 ft
Ultimate Considerations:	- Local Scour:	15.00 ft
	- Long Term Scour:	15.00 ft
	- Soft Soil:	0.00 ft

ULTIMATE PROFILE

Layer	Type	Thickness	Driving Loss	Unit Weight	Strength	Ultimate Curve
1	Cohesionless	8.00 ft	0.00%	120.00 pcf	32.0/32.0	Nordlund
2	Cohesive	6.00 ft	0.00%	115.00 pcf	500.00 psf	T-79 Steel
3	Cohesionless	13.00 ft	0.00%	120.00 pcf	32.0/32.0	Nordlund
4	Cohesive	5.00 ft	0.00%	125.00 pcf	4500.00 psf	T-79 Steel
5	Cohesionless	15.00 ft	0.00%	120.00 pcf	32.0/32.0	Nordlund
6	Cohesionless	23.00 ft	0.00%	130.00 pcf	34.0/34.0	Nordlund

RESTRIKE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
8.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
13.99 ft	Cohesive	N/A	N/A	421.97 psf	5.29 Kips
14.01 ft	Cohesionless	1650.60 psf	18.82	N/A	5.32 Kips
17.99 ft	Cohesionless	1889.40 psf	18.82	N/A	13.39 Kips
18.01 ft	Cohesionless	2130.29 psf	18.82	N/A	13.44 Kips
26.99 ft	Cohesionless	2388.91 psf	18.82	N/A	36.47 Kips
27.01 ft	Cohesive	N/A	N/A	1047.83 psf	36.53 Kips
31.99 ft	Cohesive	N/A	N/A	1129.17 psf	54.20 Kips
32.01 ft	Cohesionless	2961.69 psf	18.82	N/A	54.27 Kips
41.01 ft	Cohesionless	3220.89 psf	18.82	N/A	85.38 Kips
46.99 ft	Cohesionless	3393.11 psf	18.82	N/A	108.82 Kips
47.01 ft	Cohesionless	3825.74 psf	19.99	N/A	108.91 Kips
56.01 ft	Cohesionless	4129.94 psf	19.99	N/A	156.76 Kips
65.01 ft	Cohesionless	4434.14 psf	19.99	N/A	211.65 Kips
69.99 ft	Cohesionless	4602.46 psf	19.99	N/A	245.06 Kips

RESTRIKE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	40.40	25.92 Kips	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	40.40	25.92 Kips	0.00 Kips
8.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	N/A	3.53 Kips
13.99 ft	Cohesive	N/A	N/A	N/A	3.53 Kips
14.01 ft	Cohesionless	1651.20 psf	40.40	25.92 Kips	25.92 Kips
17.99 ft	Cohesionless	2128.80 psf	40.40	25.92 Kips	25.92 Kips
18.01 ft	Cohesionless	2130.58 psf	40.40	25.92 Kips	25.92 Kips
26.99 ft	Cohesionless	2647.82 psf	40.40	25.92 Kips	25.92 Kips
27.01 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
31.99 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
32.01 ft	Cohesionless	2961.98 psf	40.40	25.92 Kips	25.92 Kips
41.01 ft	Cohesionless	3480.38 psf	40.40	25.92 Kips	25.92 Kips
46.99 ft	Cohesionless	3824.82 psf	40.40	25.92 Kips	25.92 Kips
47.01 ft	Cohesionless	3826.08 psf	55.60	57.74 Kips	57.74 Kips
56.01 ft	Cohesionless	4434.48 psf	55.60	57.74 Kips	57.74 Kips
65.01 ft	Cohesionless	5042.88 psf	55.60	57.74 Kips	57.74 Kips
69.99 ft	Cohesionless	5379.52 psf	55.60	57.74 Kips	57.74 Kips

RESTRIKE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	3.53 Kips	3.53 Kips
13.99 ft	5.29 Kips	3.53 Kips	8.82 Kips
14.01 ft	5.32 Kips	25.92 Kips	31.24 Kips
17.99 ft	13.39 Kips	25.92 Kips	39.31 Kips
18.01 ft	13.44 Kips	25.92 Kips	39.36 Kips
26.99 ft	36.47 Kips	25.92 Kips	62.38 Kips
27.01 ft	36.53 Kips	31.81 Kips	68.34 Kips
31.99 ft	54.20 Kips	31.81 Kips	86.00 Kips
32.01 ft	54.27 Kips	25.92 Kips	80.18 Kips
41.01 ft	85.38 Kips	25.92 Kips	111.30 Kips
46.99 ft	108.82 Kips	25.92 Kips	134.74 Kips
47.01 ft	108.91 Kips	57.74 Kips	166.66 Kips
56.01 ft	156.76 Kips	57.74 Kips	214.50 Kips
65.01 ft	211.65 Kips	57.74 Kips	269.40 Kips
69.99 ft	245.06 Kips	57.74 Kips	302.80 Kips

DRIVING - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
8.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	410.00 psf	0.00 Kips
13.99 ft	Cohesive	N/A	N/A	421.97 psf	5.29 Kips
14.01 ft	Cohesionless	1650.60 psf	18.82	N/A	5.32 Kips
17.99 ft	Cohesionless	1889.40 psf	18.82	N/A	13.39 Kips
18.01 ft	Cohesionless	2130.29 psf	18.82	N/A	13.44 Kips
26.99 ft	Cohesionless	2388.91 psf	18.82	N/A	36.47 Kips
27.01 ft	Cohesive	N/A	N/A	1047.83 psf	36.53 Kips
31.99 ft	Cohesive	N/A	N/A	1129.17 psf	54.20 Kips
32.01 ft	Cohesionless	2961.69 psf	18.82	N/A	54.27 Kips
41.01 ft	Cohesionless	3220.89 psf	18.82	N/A	85.38 Kips
46.99 ft	Cohesionless	3393.11 psf	18.82	N/A	108.82 Kips
47.01 ft	Cohesionless	3825.74 psf	19.99	N/A	108.91 Kips
56.01 ft	Cohesionless	4129.94 psf	19.99	N/A	156.76 Kips
65.01 ft	Cohesionless	4434.14 psf	19.99	N/A	211.65 Kips
69.99 ft	Cohesionless	4602.46 psf	19.99	N/A	245.06 Kips

DRIVING - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	40.40	25.92 Kips	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	40.40	25.92 Kips	0.00 Kips
8.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	N/A	3.53 Kips
13.99 ft	Cohesive	N/A	N/A	N/A	3.53 Kips
14.01 ft	Cohesionless	1651.20 psf	40.40	25.92 Kips	25.92 Kips
17.99 ft	Cohesionless	2128.80 psf	40.40	25.92 Kips	25.92 Kips
18.01 ft	Cohesionless	2130.58 psf	40.40	25.92 Kips	25.92 Kips
26.99 ft	Cohesionless	2647.82 psf	40.40	25.92 Kips	25.92 Kips
27.01 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
31.99 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
32.01 ft	Cohesionless	2961.98 psf	40.40	25.92 Kips	25.92 Kips
41.01 ft	Cohesionless	3480.38 psf	40.40	25.92 Kips	25.92 Kips
46.99 ft	Cohesionless	3824.82 psf	40.40	25.92 Kips	25.92 Kips
47.01 ft	Cohesionless	3826.08 psf	55.60	57.74 Kips	57.74 Kips
56.01 ft	Cohesionless	4434.48 psf	55.60	57.74 Kips	57.74 Kips
65.01 ft	Cohesionless	5042.88 psf	55.60	57.74 Kips	57.74 Kips
69.99 ft	Cohesionless	5379.52 psf	55.60	57.74 Kips	57.74 Kips

DRIVING - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	3.53 Kips	3.53 Kips
13.99 ft	5.29 Kips	3.53 Kips	8.82 Kips
14.01 ft	5.32 Kips	25.92 Kips	31.24 Kips
17.99 ft	13.39 Kips	25.92 Kips	39.31 Kips
18.01 ft	13.44 Kips	25.92 Kips	39.36 Kips
26.99 ft	36.47 Kips	25.92 Kips	62.38 Kips
27.01 ft	36.53 Kips	31.81 Kips	68.34 Kips
31.99 ft	54.20 Kips	31.81 Kips	86.00 Kips
32.01 ft	54.27 Kips	25.92 Kips	80.18 Kips
41.01 ft	85.38 Kips	25.92 Kips	111.30 Kips
46.99 ft	108.82 Kips	25.92 Kips	134.74 Kips
47.01 ft	108.91 Kips	57.74 Kips	166.66 Kips
56.01 ft	156.76 Kips	57.74 Kips	214.50 Kips
65.01 ft	211.65 Kips	57.74 Kips	269.40 Kips
69.99 ft	245.06 Kips	57.74 Kips	302.80 Kips

ULTIMATE - SKIN FRICTION

Depth	Soil Type	Effective Stress At Midpoint	Sliding Friction Angle	Adhesion	Skin Friction
0.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
8.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
13.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
17.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
18.01 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
26.99 ft	Cohesionless	0.00 psf	0.00	N/A	0.00 Kips
27.01 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
29.99 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
30.00 ft	Cohesive	N/A	N/A	0.00 psf	0.00 Kips
31.99 ft	Cohesive	N/A	N/A	1129.17 psf	7.06 Kips
32.01 ft	Cohesionless	1191.69 psf	18.82	N/A	7.11 Kips
41.01 ft	Cohesionless	1450.89 psf	18.82	N/A	21.13 Kips
46.99 ft	Cohesionless	1623.11 psf	18.82	N/A	33.21 Kips
47.01 ft	Cohesionless	2055.74 psf	19.99	N/A	33.26 Kips
56.01 ft	Cohesionless	2359.94 psf	19.99	N/A	60.60 Kips
65.01 ft	Cohesionless	2664.14 psf	19.99	N/A	94.99 Kips
69.99 ft	Cohesionless	2832.46 psf	19.99	N/A	117.05 Kips

ULTIMATE - END BEARING

Depth	Soil Type	Effective Stress At Tip	Bearing Cap. Factor	Limiting End Bearing	End Bearing
0.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
7.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
8.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
9.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
10.00 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
13.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
14.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
17.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
18.01 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
26.99 ft	Cohesionless	0.00 psf	0.00	0.00 Kips	0.00 Kips
27.01 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
29.99 ft	Cohesive	N/A	N/A	N/A	0.00 Kips
30.00 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
31.99 ft	Cohesive	N/A	N/A	N/A	31.81 Kips
32.01 ft	Cohesionless	1191.98 psf	40.40	25.92 Kips	23.66 Kips
41.01 ft	Cohesionless	1710.38 psf	40.40	25.92 Kips	25.92 Kips
46.99 ft	Cohesionless	2054.82 psf	40.40	25.92 Kips	25.92 Kips
47.01 ft	Cohesionless	2056.08 psf	55.60	57.74 Kips	57.74 Kips
56.01 ft	Cohesionless	2664.48 psf	55.60	57.74 Kips	57.74 Kips
65.01 ft	Cohesionless	3272.88 psf	55.60	57.74 Kips	57.74 Kips
69.99 ft	Cohesionless	3609.52 psf	55.60	57.74 Kips	57.74 Kips

ULTIMATE - SUMMARY OF CAPACITIES

Depth	Skin Friction	End Bearing	Total Capacity
0.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
7.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
8.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
9.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
10.00 ft	0.00 Kips	0.00 Kips	0.00 Kips
13.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
14.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
17.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
18.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
26.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
27.01 ft	0.00 Kips	0.00 Kips	0.00 Kips
29.99 ft	0.00 Kips	0.00 Kips	0.00 Kips
30.00 ft	0.00 Kips	31.81 Kips	31.81 Kips
31.99 ft	7.06 Kips	31.81 Kips	38.87 Kips
32.01 ft	7.11 Kips	23.66 Kips	30.77 Kips
41.01 ft	21.13 Kips	25.92 Kips	47.04 Kips
46.99 ft	33.21 Kips	25.92 Kips	59.13 Kips
47.01 ft	33.26 Kips	57.74 Kips	91.00 Kips
56.01 ft	60.60 Kips	57.74 Kips	118.34 Kips
65.01 ft	94.99 Kips	57.74 Kips	152.73 Kips
69.99 ft	117.05 Kips	57.74 Kips	174.79 Kips