

HANSON TESTING & ENGINEERING, INC.

2731 EASTSIDE PARK DRIVE
EVANSVILLE, INDIANA 47715
PHONE: 812-477-8981
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June 16, 2005

Report No.: 157500

Greg Pritchett
HENDERSON COUNTY RIVERPORT AUTHORITY
6200 Riverport Road
Henderson, Kentucky 42420

Project: Geotechnical Engineering Investigation
Proposed Fertilizer Storage Facility – West Site
Henderson Riverport
Henderson, Kentucky

Dear Mr. Pritchett:

On May 23, 2005, a total of 3 test borings were drilled at the above-mentioned site. The test holes were drilled in accordance with ASTM D1586 using a truck-mounted Central Mine Equipment CME 45B drill rig and hollow stem augers to advance the borings. Standard penetration tests were made using a 140 lb. "Automatic Safety Hammer" driving a Standard (Terzaghi) 1-3/8 in. ID split barrel sampler 2-ft. long. The results are illustrated on the logs under the heading "SPT". The dashed lines on the logs indicate the approximate transitions between soil profiles.

The purpose of the borings was to determine the subsurface soil conditions in order to base recommendations relative to the foundation design for the proposed storage facility.

The boring locations were field located by Lee McClellan from Morley and Associates, Inc. and Greg Pritchett from the Henderson County Riverport Authority. At the time of the drilling operation the proposed structure was one building measuring 100-ft. by 320-ft. The borings were located at the southeast corner, the center and the northwest corner of the proposed building. Now the proposed structures are two 136-ft. diameter and one 100-ft. diameter storage domes with 8400-tons and 4400-tons of fertilizer storage capacity, respectively. The maximum anticipated floor loads are 1160-psf. Surface elevations of the borings were not measured at the time of the drilling operations.

Groundwater levels were measured in the boreholes at the end of the day's drilling operations and are shown on the logs. Groundwater encountered in clay or silty soils is trapped or perched water, which occurs in irregular, discontinuous locations within the soil overburden or at soil/rock interfaces. When these water bearing strata are exposed in excavations they can produce widely varying seepage durations and rates depending upon recent

rainfall, stream elevations and soil permeability. Groundwater levels encountered in “clean” sand and gravel are considered more reliable. The true groundwater levels can only be determined through observations made in cased holes over a long period of time. Construction of monitoring wells of this type was beyond the scope of this investigation.

As illustrated on the logs the majority of the underlying soils are very loose silts. Due to the soft and loose underlying soils and the heavy loading of the floor slab we recommend using an integral structural floor slab and foundation to keep the walls and floor slab from settling at different rates. Assuming the foundations and floor slab are designed as mentioned above, settlements in the range of 12-inches can be expected for the 136-ft. diameter dome and 11-inches for the 100-ft. diameter dome. The high settlement values are due to the soft and loose material beneath the fill and the weight of the floor slab (dead and live loads).

Additional settlement calculations were performed using smaller diameter domes to try and determine what size and load that would give an acceptable amount of settlement. If a 100-ft. diameter dome is used and loaded at 1000-psf. or 500-psf. the estimated settlement would be 10-inches and 5-inches respectively. If a 50-ft. diameter dome is used and loaded at 1000-psf. or 500-psf. the estimated settlement would be 6-inches and 3-inches respectively.

The proposed roadways are to be constructed using a staged construction. Initially only compacted aggregate will be placed for the first year or more and then topped with either concrete or asphalt pavement. We recommend placing a minimum of 12-inches of compacted dense graded aggregate “Kentucky DGA” for the initial roadway surface.

The soil samples obtained during the field exploration will be stored at this office for a period of 30 days and then discarded unless otherwise instructed.

We appreciate having the opportunity to work with you on this project. If you have any questions regarding the information contained in this report or if we can be of further service, please contact us.

Sincerely,
Hanson Testing & Engineering, Inc.

By K. L. Lautner
Kent L. Lautner, P.E.
President



APPENDIX

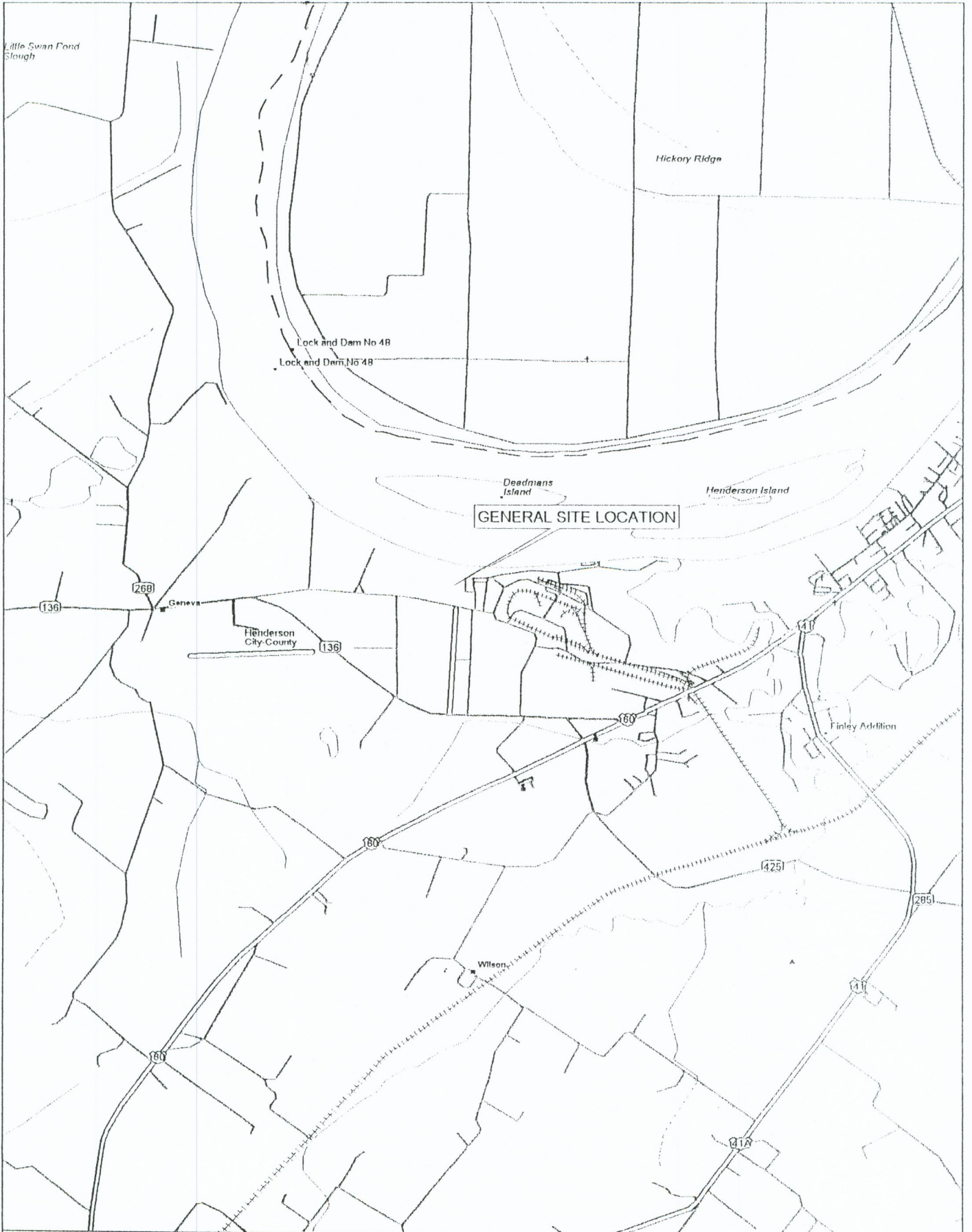
VICINITY MAP

BORING LOGS

TABLE -1 MOISTURE CONTENT DATA

FIELD CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART



GENERAL SITE LOCATION



© 2001 DeLorme, Street Atlas USA[®] Deluxe, GDT, Inc., Rel. 01/2001
 Zoom Level: 12-0 Datum: WGS84

Scale 1 : 50,000
 1" = 4170 ft



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GEOTECHNICAL
 BORING LOG

REPORT NO.: 157500
 CLIENT: Henderson County Riverport Authority
 6200 Riverport Road
 Henderson, Kentucky 42420

Project: Fertilizer Storage Facility -- West Site
 Date of Tests: May 23, 2005
 Boring No.: B1A
 Page No.: 1 of 2
 Drill Crew: DB, RH
 Drill Rig: CME 45B -- Truck Mounted

Boring Location: Southeast corner
 Surface Elevation: N/A
 Benchmark: N/A

Depth of Water: 8' Time: Upon drilling completion.
 Depth of Water: N/A Time: After 1 day.

DEPTH	MATERIAL DESCRIPTION	SPT	W, %	UCS, tsf	NOTES
1					
2	Orange/tan and gray mottled silt, very loose	1/2/2	23.4	1.25	
3	-----				
4	Orange/tan and gray silty clay				
5	Orange/tan and gray silty clay, medium stiff	1/3/5	24.0	2.5	
6					
7	Orange/tan and gray silty clay, soft				
8	-----	1/3/2	29.1	0.0	
9	Orange/tan and gray silt, very loose				
10	Orange/tan and gray clay, medium stiff	2/2/4	24.1	1.75	
11					
12	-----				
13	Orange/tan and gray silt, loose	2/3/4	26.7	1.0	
14					
15	Orange/tan and gray silt, very loose	2/2/3	27.1	0.75	

	Brown and gray mottled clay				

SPT = STANDARD PENETRATION TEST, BLOWS PER 6 INCH INCREMENT - ASTM D1586. THE "N" VALUE EQUALS THE SUM OF THE LAST TWO 6 INCH INCREMENTS.

UCS = UNCONFINED COMPRESSIVE STRENGTH (HAND PENETROMETER).

W, % = NATURAL MOISTURE CONTENT.

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 Page No.: 2 of 2
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 Drill Rig: CME 45B – Truck Mounted

Boring Location: Southeast corner
 Surface Elevation: N/A
 Benchmark: N/A

Depth of Water: 8' Time: Upon drilling completion.
 Depth of Water: N/A Time: After 1 day.

DEPTH	MATERIAL DESCRIPTION	SPT	W, %	UCS, tsf	NOTES
16					
17					
18					
19					
20	Brown and gray mottled clay, medium stiff	2/3/4	24.1	2.25	
21					
22					
23					
24					
25	Gray clay, very soft	2/1/2	24.5	1.0	
26	Boring Terminated at 25 ½ Feet				
27					
28					
29					
30					

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Project: Fertilizer Storage Facility – West Site
 Date of Tests: May 23, 2005
 Boring No.: B2A
 Page No.: 1 of 2
 Drill Crew: DB, RH
 Drill Rig: CME 45B – Truck Mounted

Boring Location: Center
 Surface Elevation: N/A
 Benchmark: N/A
 Depth of Water: 8' Time: Upon drilling completion.
 Depth of Water: N/A Time: After 1 day.

DEPTH	MATERIAL DESCRIPTION	SPT	W, %	UCS, tsf	NOTES
1					
2	Orange/tan and gray mottled silt, loose	1/3/4	25.7	2.0	
3					
4	Orange/tan and gray mottled silty clay				
5	Orange/tan and gray mottled clay, medium stiff	2/4/5	25.9	2.5	
6					
7					
8	Orange/tan and gray silt, very loose	1/1/1	32.8	0.0	
9					
10	Brown, tan and gray clay with thin layers of silt, medium stiff	1/3/5	22.9	2.5	
11					
12					
13	Orange/tan and gray silt, very loose	1/1/2	30.9	0.0	
14					
15	Orange/tan and gray silt, very loose	1/1/2	28.1	0.5	
	Brown and gray silty clay				

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 Boring No.: B2A
 Page No.: 2 of 2
 Drill Crew: DB, RH
 Drill Rig: CME 45B – Truck Mounted

Boring Location: Center
 Surface Elevation: N/A
 Benchmark: N/A

Depth of Water: 8' Time: Upon drilling completion.
 Depth of Water: N/A Time: After 1 day.

DEPTH	MATERIAL DESCRIPTION	SPT	W, %	UCS, tsf	NOTES
16					
17					
18					
19					
20	Brown and gray clay with thin layers of tan and gray silt, medium stiff	2/3/5	23.5	3.0	
21					
22					
23					
24					
25	Gray silty clay, very soft	1/1/2	24.0	1.0	
26	Boring Terminated at 25 ½ Feet				
27					
28					
29					
30					

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 Henderson, Kentucky 42420

Project: Fertilizer Storage Facility -- West Site

Date of Tests: May 23, 2005

Boring No.: B3A

Page No.: 1 of 2

Drill Crew: DB, RH

Drill Rig: CME 45B -- Truck Mounted

Boring Location: Northwest corner

Surface Elevation: N/A

Benchmark: N/A

Depth of Water: None

Depth of Water: N/A

Time: Upon drilling completion.

Time: After 1 day.

DEPTH	MATERIAL DESCRIPTION	SPT	W, %	UCS, tsf	NOTES
1					
2	Tan silty clay, soft	2/1/3	26.9	1.0	
3	Orange/tan silty clay				
4					
5	Orange/tan and gray silty clay, medium stiff	2/3/5	27.2	2.5	
6	Orange/tan, brown, and gray clayey silt				
7					
8	Orange/tan and gray silt, very loose	1/2/2	29.5	1.0	
9					
10	Orange/tan and gray silt, very loose	1/0/0	33.9	0.0	
11					
12					
13	Orange/tan and gray silt, very loose	1/1/1	32.8	0.0	
14					
15	Orange/tan and gray silt, very loose	1/1/1	31.8	0.0	
	Brown and gray clay				

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 Drill Rig: CME 45B – Truck Mounted

Boring Location: Northwest corner
 Surface Elevation: N/A
 Benchmark: N/A

Depth of Water: None Time: Upon drilling completion.
 Depth of Water: N/A Time: After 1 day.

DEPTH	MATERIAL DESCRIPTION	SPT	W, %	UCS, tsf	NOTES
16					
17					
18					
19					
20	Brown and gray clay with thin layers of tan and gray silt, medium stiff	2/4/4	27.2	2.75	
21					
22					
23					
24					
25	Dark gray silt, very loose	3/2/3	27.5	1.0	
26	Boring Terminated at 25 ½ Feet				
27					
28					
29					
30					

SPT = STANDARD PENETRATION TEST, BLOWS PER 6 INCH INCREMENT - ASTM D1586. THE "N" VALUE EQUALS THE SUM OF THE LAST TWO 6 INCH INCREMENTS.

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FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON-COHESIVE SOILS

DENSITY

Very Loose	5 blows/ft. or less
Loose	6 to 10 blows/ft.
Medium Dense	11 to 30 blows/ft.
Dense	31 to 50 blows/ft.
Very dense	51 blows/ft. or more

PARTICLE SIZE IDENTIFICATION

Boulders	8" diameter or more
Cobbles	3" to 8" diameter
Gravel	Coarse 1" to 3" Medium 1/2" to 1" Fine 1/4" to 1/2"
Sand	Coarse 2.00mm to 4.75 mm Medium 0.42mm to 2.00mm Fine .074mm to 0.42mm
Silt	.005mm to .074mm
Clay	<.005mm

COHESIVE SOILS

CONSISTENCY

Very Soft	3 blows/ft. or less
Soft	4 to 5 blows/ft.
Medium Stiff	6 to 10 blows/ft.
Stiff	11 to 15 blows/ft.
Very Stiff	16 to 30 blows/ft.
Hard	31 blows/ft. or more

PLASTICITY

Degree of Plasticity	Plasticity Index
None to slight	0-4
Slight	5-7
Medium	8-20
High	Over 20

Degree of Expansion	Percentage of Swell	Approximate Plasticity Index (PI)
Nonexpansive	2 or less	0 to 10
Moderately expansive	2 to 4	10 to 20
Highly expansive	more than 4	More than 20

Classifications on logs are made by visual inspection of samples.

Standard Penetration Test - Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. The number of hammer blows for making the test is recorded on the drilling log in 6-inch increments. The sum of the last two 6-inch increments is considered the "N" value.

Groundwater observations were made at the end of the day's drilling unless otherwise noted. Porosity of the soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.

Soil Classification Chart

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests				Soil Classification		
				Group Symbol	Group Name	
Coarse-Grained Soils More than 50% retained on #200 sieve	Gravels More than 50% of coarse fraction retained on #4 sieve	Clean Gravels	$Cu \geq 4$ and $1 < Cc \leq 3$	GW	Well graded gravel	
		Less than 5% fines	$Cu >$ and/or $1 > Cc > 3$	GP	Poorly graded gravel	
		Gravels with fines more than 12% fines	Fines classify as ML or MH	GM	Silty gravel	
			Fines classify as CL or CH	GC	Clayey gravel	
	Sands 50% or more of coarse fraction passes #4 sieve	Clean sands less than 5% fines	$Cu \geq 6$ and $1 \leq Cc \leq 3$	SW	Well graded sand	
			$Cu < 6$ and/or $1 > Cc > 3$	SP	Poorly graded sand	
		Sands with fines more than 12% fines	Fines classify as ML or MH	SM	Silty sand	
			Fines classify as CL or CH	SC	Clayey sand	
	Fined-Grained Soils 50% or more passes the #200 sieve	Silts and Clays Liquid Limit less than 50	Inorganic	PI > 7 and plots on or above "A" line	CL	Lean clay
				PI < 4 or plots on or above "A" line	ML	Silt
Organic			LL (oven dried) < 0.75 LL (not dried)	OL	Organic clay/silt	
Silts and Clays Liquid Limit 50 or more		Inorganic	PI plots on or above "A" line	CH	Fat clay	
			PI plots below "A" line	MH	Elastic clay	
		Organic	LL (oven dried) < 0.75 LL (not dried)	OH	Organic clay/silt	
Highly organic soils	Primarily organic matter, dark in color, and organic odor		PT	Peat		

