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## Memorandum

TO: Mr. John Molinaro (Appalachian Partnership for Economic Growth) and Ms. Melissa Clark (Economic and Community Development, Gallia County)

FROM: Shawn McGee, P.E.

DATE: August 30, 2017

RE: Executive Summary for the Preliminary Geotechnical Exploration Letter Report for the Dan Evans Industrial Park Located in Bidwell, Gallia County, Ohio; APG012.0001.

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We have prepared this Executive Summary to accompany the Preliminary Geotechnical Exploration Letter Report for the attached Dan Evans Industrial Park Site dated August 30, 2017. This summary provides relevant findings and considerations in the context of future development of commercial properties at the Site:

- The Site consists of a 77-acre parcel located approximately 1.5 miles south of the City of Bidwell in Gallia County, Ohio and is currently being utilized for agricultural purposes. The Site is undeveloped and open with a gentle slope, and has direct access to State Route 850 on the east boundary. The Site is bounded by residential and agricultural fields to the north, east, and west, with commercial businesses to the south.
- The Site will be used for commercial/industrial development of low to mid-rise buildings using typical shallow spread and strip footings.
- Based on Hull's review of the Ohio Department of Natural Resources (ODNR) Mines of Ohio GIS, there are no former or current underground or surface mines reported within the limits of the Site.
- Hull completed a field exploration that consisted of advancing 7 geotechnical borings spatially distributed across the Site on July 31 and August 1, 2017. The predominant soil types observed at the Site were a soft to hard lean clay with sand and sandy lean clay that is underlain by a loose to medium dense, medium to fine sand. The apparent top of bedrock was encountered at two locations ranging from 10.5 to 18.5 feet below existing ground surface (bgs). The remaining borings achieved their target depths of 20 feet bgs.
- A relatively high groundwater level was encountered during the subsurface exploration in most of the borings that ranged from 5.5 to 9.5 feet bgs. The groundwater levels appeared to be present within the sandy soil stratum. Water levels in each soil boring were measured immediately upon the completion of drilling and may thus be different at the time of construction. Due to the presence of a relatively high water table as observed in the borings, consideration will need to be given to a footer drainage system for the buildings.

- Based on the field observations and limited laboratory test results; Hull is of the opinion that the site soils can be suitable for the support of the anticipated lightly loaded commercial structures using conventional shallow foundations consisting of continuous (strip) or spread (column) footings when founded in the medium stiff to hard lean clay. Foundations could be designed for a maximum net allowable bearing pressure of 2,500 pounds per square foot (psf) when the Site is properly prepared and the footing excavation passes the inspection of a geotechnical engineer.
- The preliminary observations presented in the Report are based on information disclosed by the limited number of borings that were spatially distributed across the Site. The purpose of this preliminary exploration was to provide basic information to assist others in the preliminary designing and planning phases of the project. Additional borings will be required at the specific location of the building once known, to develop a detailed foundation design (structural) or economic analysis of foundation alternatives. The initial information provided in this report should not be relied upon for preparing final design and construction specifications.

If you have any questions or comments, please feel free to contact Shawn McGee at (440) 232-9945 at your first opportunity.



August 30, 2017

Mr. John Molinaro, CEO and President  
Appalachian Partnership for Economic Growth  
35 Public Square  
PO Box 456  
Nelsonville, OH 45764

RE: Preliminary Geotechnical Exploration Letter Report for the Dan Evans Industrial Park Located in Bidwell, Gallia County, Ohio; APG012.0001.

Dear Mr. Molinaro:

Hull & Associates, Inc. (Hull) is pleased to provide to the Appalachian Partnership for Economic Growth (APEG) this Preliminary Geotechnical Exploration Letter Report (Report) for the Dan Evans Industrial Park located in Bidwell, Gallia County, Ohio (Site). The purpose of the limited geotechnical exploration is to better understand the existing subsurface conditions of the Site in anticipation of future commercial development by spatially distributing geotechnical borings across the Site. This Report summarizes the findings and observations concerning the future development of commercial property based on the subsurface conditions observed at the boring locations in their current condition at the time of drilling. A geotechnical engineer has planned and supervised the performance of the geotechnical engineering services, evaluated the findings, and prepared this report in accordance with industry accepted geotechnical engineering practices.

#### **SITE AND PROJECT DESCRIPTION**

The Site consists of a 77-acre parcel located within the Dan Evans Industrial Park approximately 1.5 miles south of the City of Bidwell in Gallia County, Ohio and is currently being utilized for agricultural purposes. The Site is undeveloped and open with a gentle slope, and has direct access to State Route 850 on the east boundary. The Site is bounded by residential and agricultural fields to the north, east, and west, with commercial businesses to the south. It is our understanding that the Site will be used for commercial/industrial development of low to mid-rise buildings using typical shallow spread and strip footings.

#### **Surface and Underground Mines**

Based on Hull's review of the Ohio Department of Natural Resources (ODNR) Mines of Ohio GIS, the Site is not located above former or current abandoned coal mine or surface mining activities using the ODNR Mine Locator system. Additionally, significant void spaces, coal seams, or reclaimed strip mine spoils were not encountered at the boring locations. See Attachments A and B for additional information.

#### **FIELD EXPLORATION**

Hull completed a field exploration that consisted of advancing 7 geotechnical borings using a track mounted Geoprobe® 3230DT Combo Rig operated by EnviroCore on July 31 and August 1, 2017. Hull field personnel observed Standard Penetration Tests (SPTs), recovered split-spoon samples for laboratory analyses, and conducted visual-manual examinations of the collected samples. The borings were advanced in accessible areas spatially distributed across the Site within the parcel identified by APEG. Boring locations were located in the field using a hand held global positioning system (GPS) unit with sub-meter accuracy. The Ohio Utility Protection Service (OUPS) and Ohio Oil and Gas Producers Underground Protection Service (OGPUPS) were notified at least 48-hours prior to drilling for clearance of underground utilities.

Split-spoon samples were collected from the borings using the SPT Method (American Society of Testing and Materials [ASTM] D1586). The SPT method involves measuring the number of blows required to drive the

split spoon sampler 18 inches into the soil. Blow counts for each six (6) inch interval are recorded separately and the SPT test result is the number of blows required to advance the last 12 inches (N-value). The SPT N-value serves as an indicator of soil consistency for cohesive soils and density of granular soils. SPT data was recorded and representative soil samples were collected at 2.5-foot intervals for the upper 10 feet of depth, followed by 5-foot intervals to the termination depth of the boring for each boring. All borings were advanced to their respective target depths or auger or sampler (N-value greater than 50 blows over a 2-inch or less penetration with the split spoon sampler) refusal, whichever occurred first.

The predominant overburden soil types consisted of a soft to hard lean clay with sand and sandy lean clay underlain by a loose to medium dense and medium to fine sand. Auger refusal, or the apparent top of bedrock, was encountered at 2 locations at depths of 18.5 feet below existing ground surface (BGS) in boring B17-2 and at 10.5 feet bgs in boring B17-7. A clayey shale was also encountered between 15 to 20 feet bgs in borings B17-5 and 6, but the augers were able to be advanced to the target depths. The remaining borings were also advanced to the target depths of 20 feet bgs.

Table 1 summarizes the coordinates, existing ground surface elevations, depth to the top of weathered bedrock, and termination depths at each boring location. The soil borings were immediately backfilled with drill cuttings upon completion of drilling.

**Table 1 – Summary of Borings**

Boring	Boring Locations		Elevation of Existing Ground Surface <sup>1</sup>	Topsoil Thickness (in)	Depth to Auger Refusal (ft. bgs <sup>2</sup> )	Termination Depth (ft. bgs <sup>2</sup> )
	Latitude	Longitude				
B17-1	38.89654	-82.30201	676	0.5	18.5	18.5
B17-2	38.89640	-82.29787	664	0.5	N/A	20
B17-3	38.89469	-82.30318	685	0.5	N/A	20
B17-4	38.89489	-82.30013	672	0.5	N/A	20
B17-5	38.89381	-82.29789	659	0.5	N/A	20
B17-6	38.89305	-82.30158	669	0.5	N/A	20
B17-7	38.89170	-82.29785	647	0.8	10.5	10.5

1. Elevation data and coordinates were provided from the Ohio Geographically Referenced Program (OGRIP).
2. bgs = below existing ground surface
3. N/A = not encountered

Refer to the boring logs in Attachment B for more detailed descriptions of subsurface units, sample data, SPT results, groundwater conditions, pocket penetrometer test results, and other pertinent information. All soil borings were completed under the direct supervision of a geologist from Hull. In addition to drilling oversight, Hull personnel recorded observations of existing ground cover thicknesses, groundwater conditions, surface features, and other site observations deemed important to the planned site development.

See Figure 1 for a map that illustrates the locations of the “as drilled” borings.

## **GROUNDWATER OBSERVATIONS**

Water levels in each soil boring were measured immediately upon the completion of drilling. All borings encountered a groundwater level after drilling completion, except for borings B17-3 and B17-7. See Table 2 for a summary of groundwater data when encountered at the time of drilling, including boring location, depth bgs, and associated elevation of the recorded water level. The boreholes were subsequently backfilled with soil cuttings on the same day. The depths of seepage or significant changes in moisture conditions within the borings were also noted on the boring logs, when observed.

**Table 2 – Groundwater Measurements**

<b>Boring</b>	<b>Measurement Date</b>	<b>Depth to Water (ft bgs)</b>	<b>Water Elevation (ft)</b>
B17-1	7/31/17	9.5	666.5
B17-2	8/1/17	6	658
B17-4	7/31/17	9.5	662.5
B17-5	7/31/17	5.5	653.5
B17-6	7/31/17	8.5	660.5

Hydrostatic groundwater levels and upper (perched) saturation zones should be expected to fluctuate seasonally due to variations in rainfall, runoff, evapotranspiration, and other factors. Consequently, the measured groundwater levels shown on the boring log only represent conditions at the time the readings were collected and may thus be different at the time of construction. Furthermore, the actual groundwater levels, seepage, and localized saturated conditions may be observed at shallower depths during periods of heavy precipitation.

## **LABORATORY TESTING PROGRAM**

Soil samples collected by Hull were described based on the visual-manual examination method (ASTM D2488). Select samples collected from the borings were subjected to grain-size analyses (ASTM D422), moisture content determination (ASTM D2216), Atterberg Limits tests (ASTM D4318). The laboratory-testing program was conducted in general accordance with applicable ASTM specifications.

Laboratory testing indicated that the select soil samples tested classified as a lean clay with sand and sandy lean clay (CL) under the Unified Soil Classification System (USCS). Atterberg limit testing indicated that clayey samples had liquid limits that ranged from 23 to 31, and plasticity indices that ranged from 6 to 18. Moisture contents as received by the laboratory were also completed for select soil samples and ranged from 12.1 to 20.7 percent.

It is anticipated that the measured moisture contents suggest in situ Site water contents will probably be above and below their optimum moisture, with most being above. This would indicate that the earthwork contractor may need to moisture condition the soils (i.e., dry) to achieve proper moisture content and desired compaction in some areas during earthwork activities. Proctor testing will be necessary prior to construction to characterize and evaluate moisture-density relationships of Site soils.

Copies of the laboratory test results are provided in Attachment C. Remaining soil samples will be stored at our geotechnical/materials testing laboratory for 90 days from the date of this report unless otherwise directed by you.

## **GEOTECHNICAL OBSERVATIONS AND CONSTRUCTION CONSIDERATIONS**

Based on our assumption that minimal cut/fill will be required to achieve the final grades, field observations, laboratory test results, Hull's experience with similar projects and geologic settings, and our engineering analyses; the subsurface conditions will be able to support the proposed development when the subgrade is prepared as discussed below:

### **Preliminary Design Considerations**

Hull understands that site development plans for the Dan Evans Industrial Park have not been completed as of the writing of this Report. Therefore, actual structural/foundation drawings, grading plans, or structural loads were not available or provided to Hull.

Based on the field observations and limited laboratory test results; we are of the opinion that the site soils can be suitable for the support of the anticipated lightly loaded commercial structures using conventional shallow foundations consisting of continuous (strip) or spread (column) footings when founded in the medium stiff to hard lean clay. Foundations could be designed for a maximum net allowable bearing pressure of 2,500 pounds per square foot (psf) when the Site is properly prepared and the footing excavation passes the inspection of a geotechnical engineer. All exterior footings should be extended to local frost bearing depth or to a stable bearing depth, whichever is deeper. Interior footings in heated areas, if present, may be placed at a convenient depth below building floor slab level, provided they bear on suitable material. The final choice of the foundation type and size should be based on the relative economic, design feasibility, and construction advantages.

### **Drainage**

Due to the presence of a relatively high water table as observed in the borings, it is anticipated that water seepage may be encountered during excavation of building foundations. Dewatering and water management may be required to maintain a reasonably dry excavation and work area. The contractors should be prepared to deal with any seepage or surface water that may accumulate in the work area. Adequate drainage should be established at the Site to minimize any increase in the moisture content of the subgrade material. Surface water runoff should be properly controlled and drained away from the work area. It should be noted that the subgrade soils are subject to shrinking and swelling whenever their seasonal moisture contents vary. Also, a proper footer drainage system for the buildings may be required.

### **Next Steps**

The preliminary observations presented in this report are based on information disclosed by the limited number of borings that were spatially distributed across the Site. The boring information must be extrapolated to determine the subsurface conditions occurring over the entire project. This extrapolation is based on the limited understanding of previous Site operations, knowledge of soil forming geological processes, and on past experience. Therefore, the observations presented in this report are based in part on the assumption that certain natural conditions will actually be encountered and not be altered during construction.

As previously discussed, the purpose of this preliminary exploration was to provide basic information to assist others in the preliminary designing and planning phases of the project. **Additional borings will be required at the specific location of the building once known, to develop a detailed foundation design (structural) or economic analysis of foundation alternatives.** The initial information provided in this report should not be relied upon for preparing final design and construction specifications.

### **CLOSING REMARKS**

The evaluations, conclusions, and observations presented in this Report are based on information disclosed by the limited number of soil borings, our interpretation of the field and laboratory data obtained during the exploration, and our understanding of the project. The information obtained from the individual borings are representative of the subsurface conditions at the specific boring locations at the time of drilling, and must be extrapolated to get an understanding of the subsurface conditions between the borings advanced over the entire Site. This extrapolation is based on the knowledge of soil forming geological processes, our understanding that underground and surface mining activities did not occur at the Site, and on past experience. Therefore, the recommendations presented in this Report are based in part on the assumption that certain natural conditions will actually be encountered and not be altered during construction. Consequently, it is recommended that Hull/Jobes perform the construction observation and testing to make certain the intent of our recommendations as presented in this Report is being followed and to make real-time changes to our recommendations in the event that site conditions vary from those observed in the borings. The recommendations in this report are considered final only if Hull observes the excavation and other earthwork activities to determine if actual subsurface conditions differ from those encountered during this exploration.

Furthermore, any revision in the plans for the proposed Site from those enumerated in this Report should be brought to the attention of Hull so it may be determined if changes in the earthwork recommendations are required. If additional data are needed for design purposes or if deviations from the noted subsurface conditions are encountered during construction, they should all be brought immediately to the attention of Hull. At that time, it may be necessary for Hull to submit modified or supplementary recommendations, if needed.

### **STANDARD OF CARE AND LIMITATIONS**

The observations presented herein are based on the level of effort and investigative techniques using that degree of care and skill ordinarily exercised under similar conditions by reputable members of the profession practicing in the same or similar locality at the time of service. No other warranties, expressed or implied, are made or intended by this report. An evaluation of past or present compliance with federal, state, or local environmental or land use laws or regulations has not been conducted. Conclusions presented by Hull regarding the Site are consistent with the level of effort specified and investigative techniques employed. Reports, opinions, letters, and other documents do not evaluate the presence or absence of any compound or parameter not specifically analyzed and reported. Hull makes no guarantees regarding the completeness or accuracy of any information obtained from public or private files or information provided by subcontractors. In addition, Hull makes no guarantees on the conditions of the Site or changes in Site records after the date reviewed as indicated in the report.


Furthermore, this letter-report is prepared and made available for the sole use of APEG and Gallia County Economic and Community Development and their assigns for the specific purposes mentioned above. The

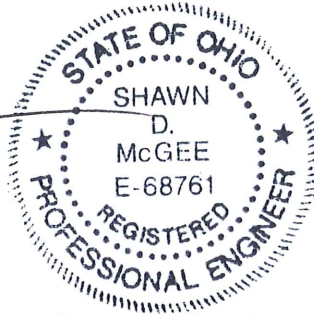
Mr. John Molinaro  
APG012.0001  
August 30, 2017  
Page 8

contents thereof may not be used or relied upon by any other person or entity, without the express written consent and authorization of APEG and Hull.

If you have any questions or comments, please feel free to contact the undersigned at (440) 232-9945 at your first opportunity.

Sincerely,

  
Shawn D. McGee, P.E.  
Geotechnical Practice Leader



Attachments



cc: Melissa Clark, Economic and Community Development, Gallia County (w/Attachments)  
Paige Kelley, Jobes Henderson (w/Attachments)  
Justin Lowe, P.E., Jobes Henderson (w/Attachments)



## **FIGURES**





 Property Boundary  
 Geotechnical Boring

**Notes:**  
The aerial photo was acquired through the ESRI Imagery web service. Aerial photography dated 2015.



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July 2017

Dan Evans Industrial Park

## Geotechnical Map

3350 State Route 850  
Bidwell, Gallia County, Ohio

Figure

1



## **ATTACHMENT A**

ODNR Mining Location GIS Map

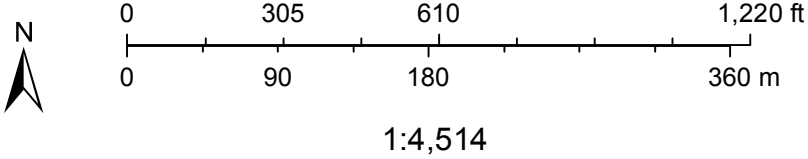


# Dan Evans Industrial Park



July 20, 2017

<b>Current</b>		<b>Proposed</b>		<b>Known</b>	
	Air Shaft		Original Application		AUM level 3
	Drift Entry		Adjacent Area Application		AUM level 2
	Vertical Mine Shaft		Current		AUM level 1
	Slope Entry		Past		
<b>Locations - From Geologic Maps</b>			Historic - From Topo Maps		
	Abandoned pit		Historic - From Geology Maps		
	Abandoned quarry				
	Quarry area				
	Sand, gravel, or barrow pit				





## **ATTACHMENT B**

General Information, Drilling Procedures, and Logs of Borings  
Definition of Terms Used to Describe Subsurface Materials on Boring Logs  
Geotechnical Soil Boring Logs – 7 Borings



## **GENERAL INFORMATION, DRILLING PROCEDURES AND LOGS OF BORINGS**

Drilling and sampling were conducted in accordance with procedures generally recognized and accepted as standardized methods of investigation of subsurface conditions concerning geotechnical engineering considerations. Borings were drilled with either a truck-mounted or ATV-mounted drill rig.

Drive split-barrel sampling was performed in 1.5-foot increments at intervals not exceeding 5 feet. In the event the sampler encountered resistance to penetration of 6 inches or less after 50 blows of the drop more representative samples were preserved from each sampling increment.

In borings where rock was cored, NXM or NQ sized diamond coring tools were used.

Depth of water recorded in the boring is measured from the top of existing ground surface to the top of water level. Initial water level measurement indicates the water level observed during the drilling activities and the static water level indicates the water level observed immediately after drilling. In relatively pervious soils, such as sandy soils, the indicated depth is considered a reliable groundwater level for that date. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils. In fine-grained soils, such as clay and silt, such readings are less reliable.

In the laboratory, all samples were described based on the visual-manual examination soil classification system in accordance with ASTM D2488. Moisture contents of representative fine-grained soil samples were determined. A limited number of samples, considered representative of foundation materials present, were selected for performance of grain-size analyses and plasticity characteristics test.

The boring logs included in the Attachment have been prepared on the basis of the field record of drilling and sampling, and the results of the laboratory examination and testing of samples. Stratification lines on the boring logs indicating changes in soil stratigraphy represent depths of changes approximated by the driller, by sampling effort and recovery, and by laboratory test results. Actual depths to changes may differ somewhat from the estimated depths, or transitions may occur gradually and not be sharply defined. The boring logs presented in this report therefore contain both factual and interpretative information and are not an exact copy of the field log.

Although it is considered that the borings have disclosed information generally representative of actual site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil/rock samples will be stored at Hull & Associates Inc.'s laboratory for a period of 90 days. After this period of time, they will be discarded, unless notified to the contrary by the client.



## DEFINITION OF TERMS USED TO DESCRIBE SUBSURFACE MATERIALS ON BORING LOGS

### DESCRIPTION OF SOILS

The soil descriptions on the boring logs are based on visual-manual examination (ASTM D 2488) of soil samples, Standard Penetration Test (ASTM D 1586) results, and the results of laboratory testing on selected soil samples. Soils are described as to density or consistency, color, grain size distribution, moisture condition, and other pertinent properties, in that order. SAA indicates material can be described as "Same As Above", with any differences noted. Soil descriptions are according to the following criteria, with the principal constituent, written in capital letters.

#### **Standard Penetration Test (ASTM D 1586)**

In the Standard Penetration Test, a 2.0-inch outside diameter, 1.375-inch inside diameter split-spoon sampler is driven 18 inches into soil by means of a 140-pound hammer falling freely through a vertical distance of 30 inches. The sampler is normally driven in three successive 6-inch increments. The total number of blows required to drive the split spoon sampler over 12 inches of penetration during the second and third successive increments is the Standard Penetration Test N-Value. If the blow count for any half foot increment exceeded 50, the SPT was stopped and the distance the sampler was driven was measured and recorded (e.g., 50/3 indicates 50 blows were recorded for a 3-inch penetration).

#### **Sampling method abbreviations**

Methods by which soil samples are collected for analysis are abbreviated as follows:

AS - Auger Sample - directly from auger flight  
SP - Split Spoon Sample  
ST - Shelby Tube Sample  
RC - Rock Core  
DP - Direct Push Sample

#### **Density of cohesionless soils**

Density of **cohesionless** soils is based upon results of Standard Penetration Tests as indicated below:

Density Term	N-Value (Blows per foot)
Very loose	0-4
Loose	5-10
Medium Dense	11-30
Dense	31-50
Very Dense	Over 50

#### **Consistency of cohesive soils**

Consistency of cohesive soils is based on Standard Penetration Test results and the unconfined compressive strength.

Consistency Term	N-Value (Blows per foot)	Unconfined Compressive Strength (tons per square foot)
Very soft	<2	<0.25
Soft	2-4	0.25-0.5
Medium stiff	5-8	0.5-1.0
Stiff	9-15	1.0-2.0
Very stiff	16-30	2.0-4.0
Hard	>30	>4.0

#### **Color**

Soil color is described in basic terms, such as brown, black, red, grey, and yellow. If the soil is a uniform color throughout, the term is single, modified by adjectives such as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

**Component definitions by grain size (ASTM D 653)**

Material	Definitions	Fractions	Sieve Limits	
			Upper	Lower
Boulders	Material too large to pass through an opening 12 in. square.			
Cobbles	Material passing through a 12 in. square opening and retained on the 3-inch sieve.			
Gravel	Material passing the 3 in. sieve and retained on 1/4 in. (No. 4) sieve.	Coarse Fine	3 in 3/4 in.	3/4 in No. 4 (1/4in.)
Sand	Material passing the No. 4 sieve and retained on the No. 200 Sieve.	Coarse Medium Fine	No. 4 (1/4") No. 10 (1/8") No. 40 (1/32")	No. 10 (1/8") No. 40 (1/32") No. 200
Silt	Material passing the No. 200 sieve, which is usually non-plastic or very slightly plastic in character and exhibits little or no strength when air dried.		No. 200	
Clay	Material passing the No. 200 sieve, which can also be made to exhibit plasticity within a certain range of moisture contents and which exhibits considerable strength when air dried.		No. 200	

Soil constituents may be stated in terms of percentages (by weight) of gravel, sand, and fines, as follows:

Trace - particles of a given size range present, but present at <5%

Few - 5 to 15%

Little - 15 to 25%

Some - 30 to 45%

Mostly - 50 to 100%

**Moisture condition**

Moisture contents may be written as dry, moist or wet as described below:

Dry                Absence of moisture, dusty, dry to the touch

Moist            Damp but no visible moisture

Wet              Visible free water, usually soil below the water table

**DESCRIPTION OF ROCK**

The following terms are used to describe the degree of weathering of the rock specimen relative to that of the comparable unweathered parent rock. (Do not confuse relative strength/hardness with weathering.):

Unweathered                No evidence of any chemical or mechanical alternation of the rock mass. Mineral crystals have a bright appearance with no discoloration. Fractures show little or no staining on surfaces.

Slightly Weathered        <10% of rock volume altered. Slight discoloration of the surface w/minor alterations along open fractures.

Moderately Weathered    Portions of the rock mass are discolored as evident by a dull appearance. Surfaces may have a pitted appearance. Isolated zones of varying rock strengths due to alteration may be present. 10 to 15 percent of the rock volume presents alterations.

Highly Weathered           Entire rock mass appears discolored and dull. Some pockets of slightly to moderately weathered rock may be present and some areas of severely weathered materials may be present.

Severely Weathered        Majority of the rock mass reduced to a soil-like state with visible relict rock texture. Zones of more resistant rock may be present, but the material can generally be molded and crumbled by hand pressures.

The following terms are used to describe the relative strength/hardness of the bedrock:

Very Weak                    Can be easily scratched by fingernail or knife. Pieces 1 inch (25 mm) or more in thickness can be broken by finger pressure.

Weak                            Can be grooved or gouged readily by a knife or pick. Can be excavated in small fragments by moderate blows of a pick point. Small, thin pieces can be broken by finger pressure.

Moderately Strong        Can be scratched with a knife or pick. Grooves or gouges to 1/4" (6mm) deep can be excavated by hand blows of a geologist's pick. Requires moderate hammer blows to detach specimen.

Strong                          Can be scratched with a knife or pick only with difficulty. Requires hard hammer blows to detach specimen.

Very Strong                 Cannot be scratched by a knife or sharp pick. Breaking of hand specimens requires hard repeated blows of the geologist hammer.

Rock Quality Designation, RQD – This value is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core recovered.





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# BORING NUMBER B17-1

PAGE 1 OF 1

<b>CLIENT</b> Gallia County Economic Development	<b>PROJECT NAME</b> Dan Evans Industrial Park
<b>PROJECT NUMBER</b> APG012	<b>PROJECT LOCATION</b> 3350 State Route 850, Bidwell, OH 45614
<b>DATE STARTED</b> 7/31/17	<b>COMPLETED</b> 7/31/17
<b>DRILLING CONTRACTOR</b> Envirocore	<b>GROUND ELEVATION</b> 676 ft
<b>RIG TYPE</b> 3230DT	<b>DRILLING METHOD</b> 3.25" Hollow Stem Auger
<b>LOGGED BY</b> N. Kasper	<b>CHECKED BY</b>
<b>COORDINATES</b> (38.89654, -82.30201)	
<b>GROUND WATER LEVELS:</b>	
<b>AT TIME OF DRILLING</b> ---	
<b>AT END OF DRILLING</b> 9.50 ft / Elev 666.50 ft	
<b>AFTER DRILLING</b> ---	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		1/2" Topsoil Soft, brown with gray mottling, lean CLAY, moist, medium plasticity.	SS 1	73	2-1-2 (3)	2.5						
5		Stiff, brown with gray mottling, lean CLAY with sand, moist, low-medium plasticity (CL).	SS 2	80	2-5-6 (11)	4.5		17.3	27	15	12	72
		Stiff, gray, lean CLAY, moist, low-medium plasticity.	SS 3	80	2-5-6 (11)	NA						
10		Medium dense, brownish orange, clayey SAND, moist.	SS 4	100	2-14-14 (28)	NA						
15		Medium dense, brown, SAND, wet.	SS 5	87	3-10-10 (20)	NA						
20			SS 6	73	2-5-8 (13)	NA						

Bottom of borehole at 20 feet.



Hull & Associates, Inc.  
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Fax (440) 232-9946

# BORING NUMBER B17-2

PAGE 1 OF 2

CLIENT Gallia County Economic Development

PROJECT NAME Dan Evans Industrial Park

PROJECT NUMBER APG012

PROJECT LOCATION 3350 State Route 850, Bidwell, OH 45614

DATE STARTED 8/1/17

COMPLETED 8/1/17

GROUND ELEVATION 664 ft

DRILLING CONTRACTOR Envirocore

GROUND WATER LEVELS:

RIG TYPE 3230DT

DRILLING METHOD 3.25" Hollow Stem Auger

AT TIME OF DRILLING ---

LOGGED BY N. Kasper

CHECKED BY

▼ AT END OF DRILLING 6.00 ft / Elev 658.00 ft

COORDINATES (38.896340, -82.29787)

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		1/2' Topsoil										
		Firm, dark brown, sandy SILT, moist.										
		Medium stiff, light brown with gray mottling, sandy CLAY, moist, low plasticity.	SS 1	67	1-3-5 (8)	4.5						
		Stiff, light brown with gray mottling, sandy CLAY, dry, low plasticity.	SS 2	73	3-7-7 (14)	4.5						
5		Medium dense, brown and orange, clayey SAND, moist/wet, non-plastic.	SS 3	80	3-6-6 (12)	0.5						
		Very loose, brown and orange, clayey SAND, wet, non-plastic.	SS 4	80	2-1-1 (2)	NA						
10		Loose, dark brown, clayey SAND, wet, non-plastic.	SS 5	73	2-1-3 (4)	NA						
15		Hard, grey and blue, CLAY and severely weathered SHALE, moist.	SS 6	33	8-36-50 (86)	NA						

(Continued Next Page)



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## BORING NUMBER B17-2

PAGE 2 OF 2

**CLIENT** Gallia County Economic Development

**PROJECT NAME** Dan Evans Industrial Park

**PROJECT NUMBER** APG012

**PROJECT LOCATION** 3350 State Route 850, Bidwell, OH 45614

DEPTH (ft) GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	

Auger refusal at 18.5 feet.  
Bottom of borehole at 18.5 feet.



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# BORING NUMBER B17-3

PAGE 1 OF 1

<b>CLIENT</b> Gallia County Economic Development	<b>PROJECT NAME</b> Dan Evans Industrial Park
<b>PROJECT NUMBER</b> APG012	<b>PROJECT LOCATION</b> 3350 State Route 850, Bidwell, OH 45614
<b>DATE STARTED</b> 7/31/17	<b>COMPLETED</b> 7/31/17
<b>DRILLING CONTRACTOR</b> Envirocore	<b>GROUND ELEVATION</b> 685 ft
<b>RIG TYPE</b> 3230DT	<b>DRILLING METHOD</b> 3.25" Hollow Stem Auger
<b>LOGGED BY</b> N. Kasper	<b>CHECKED BY</b>
<b>COORDINATES</b> (38.89469, -82.30318)	<b>GROUND WATER LEVELS:</b>
	<b>AT TIME OF DRILLING</b> ---
	<b>AT END OF DRILLING</b> ---
	<b>AFTER DRILLING</b> ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		1/2" Topsoil										
		Medium dense, brownish red with gray mottling, SILT with sand, dry, non-plastic.	SS 1	80	3-5-9 (14)	4.5						
		Medium dense, reddish brown, SILT with sand, dry, non-plastic.	SS 2	80	3-8-9 (17)	4.0						
5		Medium, red, lean CLAY with sand, moist, low plasticity.	SS 3	93	3-3-4 (7)	2.0						
		Stiff, brownish red with gray mottling, sandy CLAY, moist, low plasticity.	SS 4	100	3-4-5 (9)	2.0						
10		Stiff, red, sandy CLAY, moist, low plasticity.	SS 5	100	3-6-6 (12)	2.0						
15		Medium stiff, brown, lean CLAY, moist, medium-high plasticity.	SS 6	100	3-3-3 (6)	1.0						
20												

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Bottom of borehole at 20 feet.



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# BORING NUMBER B17-4

PAGE 1 OF 1

<b>CLIENT</b> Gallia County Economic Development	<b>PROJECT NAME</b> Dan Evans Industrial Park
<b>PROJECT NUMBER</b> APG012	<b>PROJECT LOCATION</b> 3350 State Route 850, Bidwell, OH 45614
<b>DATE STARTED</b> 7/31/17	<b>COMPLETED</b> 7/31/17
<b>DRILLING CONTRACTOR</b> Envirocore	<b>GROUND ELEVATION</b> 672 ft
<b>RIG TYPE</b> 3230DT	<b>DRILLING METHOD</b> 3.25" Hollow Stem Auger
<b>LOGGED BY</b> N. Kasper	<b>CHECKED BY</b>
<b>COORDINATES</b> (38.89489, -82.30013)	<b>GROUND WATER LEVELS:</b>
	<b>AT TIME OF DRILLING</b> ---
	<b>AT END OF DRILLING</b> 9.50 ft / Elev 662.50 ft
	<b>AFTER DRILLING</b> ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		1/2" Topsoil										
		Medium stiff, dark grey, sandy CLAY, moist, low plasticity.										
		Medium stiff, light brown with grey mottling, lean CLAY with sand, moist, low plasticity.	SS 1	80	2-3-5 (8)	0.5		19.5	30	18	12	
		Stiff, light brown with grey mottling, lean CLAY with sand, dry, low plasticity.	SS 2	67	3-6-7 (13)	4.0		20.7				
5		Loose, brownish red, silty SAND, dry, non-plastic.	SS 3	87	2-3-4 (7)	4.0		15.0				
		Loose, brownish red, silty SAND, moist, non-plastic.	SS 4	100	4-5-4 (9)	2.0		12.1				
10		Medium dense, brownish gray, SAND, wet.	SS 5	100	8-10-6 (16)	1.0		20.7				
15												
			SS 6	100	7-12-12 (24)	N/A		20.4				
20												

Bottom of borehole at 20 feet.

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# BORING NUMBER B17-5

PAGE 1 OF 1

CLIENT Gallia County Economic Development

PROJECT NAME Dan Evans Industrial Park

PROJECT NUMBER APG012

PROJECT LOCATION 3350 State Route 850, Bidwell, OH 45614

DATE STARTED 7/31/17

COMPLETED 7/31/17

GROUND ELEVATION 659 ft

DRILLING CONTRACTOR Envirocore

GROUND WATER LEVELS:

RIG TYPE 3230DT

DRILLING METHOD 3.25" Hollow Stem Auger

AT TIME OF DRILLING ---

LOGGED BY N. Kasper

CHECKED BY

▼ AT END OF DRILLING 5.50 ft / Elev 653.50 ft

COORDINATES (38.89381, -82.29789)

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		1/2" Topsoil Very loose, grey with brown mottling, silty CLAY, moist.	SS 1	53	1-2-1 (3)	2.0		19.0	23	17	6	
5		Medium dense, grey with brown mottling, silty SAND, dry, non-plastic.	SS 2	80	4-8-7 (15)	4.5						
		Loose, brownish red, silty SAND, wet.	SS 3	60	4-3-4 (7)	NA						
10		Medium stiff, brownish red, lean CLAY, moist, low plasticity.	SS 4	100	2-1-4 (5)	3.5						
15		Hard, grey, lean CLAY and very weak SHALE, dry.	SS 5	80	7-21-25 (46)	4.0						
20		Hard, grey and blue, clayey SHALE, dry.	SS 6	55	11-50/5 (50/5)	4.0						

Bottom of borehole at 20 feet.



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# BORING NUMBER B17-6

PAGE 1 OF 1

CLIENT	Gallia County Economic Development	PROJECT NAME	Dan Evans Industrial Park
PROJECT NUMBER	APG012	PROJECT LOCATION	3350 State Route 850, Bidwell, OH 45614
DATE STARTED	7/31/17	COMPLETED	7/31/17
DRILLING CONTRACTOR	Envirocore	GROUND ELEVATION	669 ft
RIG TYPE	3230DT	DRILLING METHOD	3.25" Hollow Stem Auger
LOGGED BY	N. Kasper	CHECKED BY	
COORDINATES	(38.89305, -82.30158)	GROUND WATER LEVELS:	
		AT TIME OF DRILLING	---
		AT END OF DRILLING	8.50 ft / Elev 660.50 ft
		AFTER DRILLING	---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		1/2" Topsoil										
		Medium stiff, brownish tan with gray mottling, lean CLAY, with sand, moist, medium plasticity.	SS 1	67	1-2-4 (6)	4.0						
5			SS 2	87	3-6-8 (14)	4.0						
		Medium stiff, brownish red with grey mottling, lean CLAY, moist, medium-high plasticity.	SS 3	100	3-3-5 (8)	3.0						
10		Medium dense, brownish black, SAND, trace silt, wet.	SS 4	80	4-5-10 (15)	NA						
15		Medium dense, brown, gravelly SAND, wet.	SS 5	47	3-8-12 (20)	NA						
20		Hard, blue and grey, clayey SHALE, moist.	SS 6	80	8-50/3 (50/3)	4.0						

Bottom of borehole at 20 feet.



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# BORING NUMBER B17-7

PAGE 1 OF 1

<b>CLIENT</b> Gallia County Economic Development	<b>PROJECT NAME</b> Dan Evans Industrial Park
<b>PROJECT NUMBER</b> APG012	<b>PROJECT LOCATION</b> 3350 State Route 850, Bidwell, OH 45614
<b>DATE STARTED</b> 7/31/17	<b>COMPLETED</b> 7/31/17
<b>DRILLING CONTRACTOR</b> Envirocore	<b>GROUND ELEVATION</b> 647 ft
<b>RIG TYPE</b> 3230DT	<b>DRILLING METHOD</b> 3.25" Hollow Stem Auger
<b>LOGGED BY</b> N. Kasper	<b>CHECKED BY</b>
<b>COORDINATES</b> (38.89170, -82.29785)	<b>GROUND WATER LEVELS:</b>
	<b>AT TIME OF DRILLING</b> ---
	<b>AT END OF DRILLING</b> ---
	<b>AFTER DRILLING</b> ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		1/2" Topsoil Very stiff, brown with grey mottling, sandy CLAY, moist, low plasticity.										
2.5		Medium stiff, brown with grey mottling, lean CLAY with sand, dry, low plasticity.	SS 1	87	2-3-5 (8)	4.0		15.3				
5.0		Stiff, brown with grey mottling, lean CLAY, trace sand, moist, medium-high plasticity.	SS 2	100	3-4-5 (9)	3.5		16.2	31	13	18	
7.5			SS 3	80	3-4-9 (13)	4.0						
10.0		Hard, grey clayey SHALE, dry.	SS 4	30	14-50	4.5						

Auger refusal at 10.5 feet.  
Bottom of borehole at 10.5 feet.

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## **ATTACHMENT C**

### **Geotechnical Laboratory Testing Results**



Resource International, Inc.  
6350 Presidential Gateway  
Columbus, Ohio 43231  
Telephone: 614-823-4949  
Fax: 614-823-4990

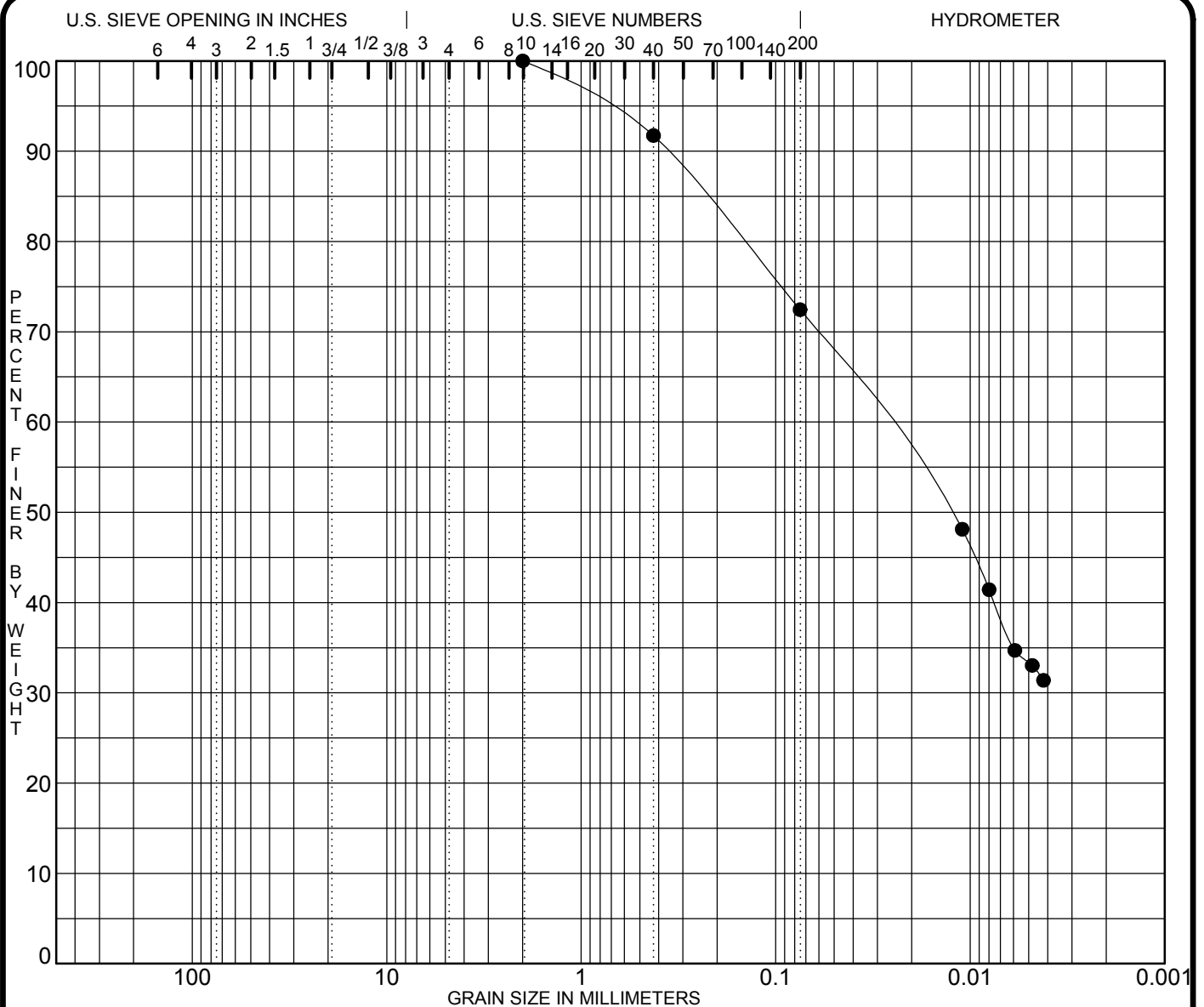
## SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

PROJECT DAN EVANS INDUSTRIAL PARK

PROJECT NO.: N-16-034-26

Borehole	Sample	Depth	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	%<#200 Sieve	Classification	LOI
B-17-1	SS-2	3.5	17.3	27	15	12	72	LEAN CLAY with SAND CL	
B-17-4	SS-1	1.0	19.5	30	18	12			
B-17-4	SS-2	3.5	20.7						
B-17-4	SS-3	6.0	15.0						
B-17-4	SS-4	8.5	12.1						
B-17-4	SS-5	13.5	20.7						
B-17-4	SS-6	18.5	20.4						
B-17-5	SS-1	1.0	19.0	23	17	6			
B-17-5	SS-3	6.0	20.5				37		
B-17-7	SS-1	1.0	15.3						
B-17-7	SS-2	3.5	16.2	31	13	18			



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

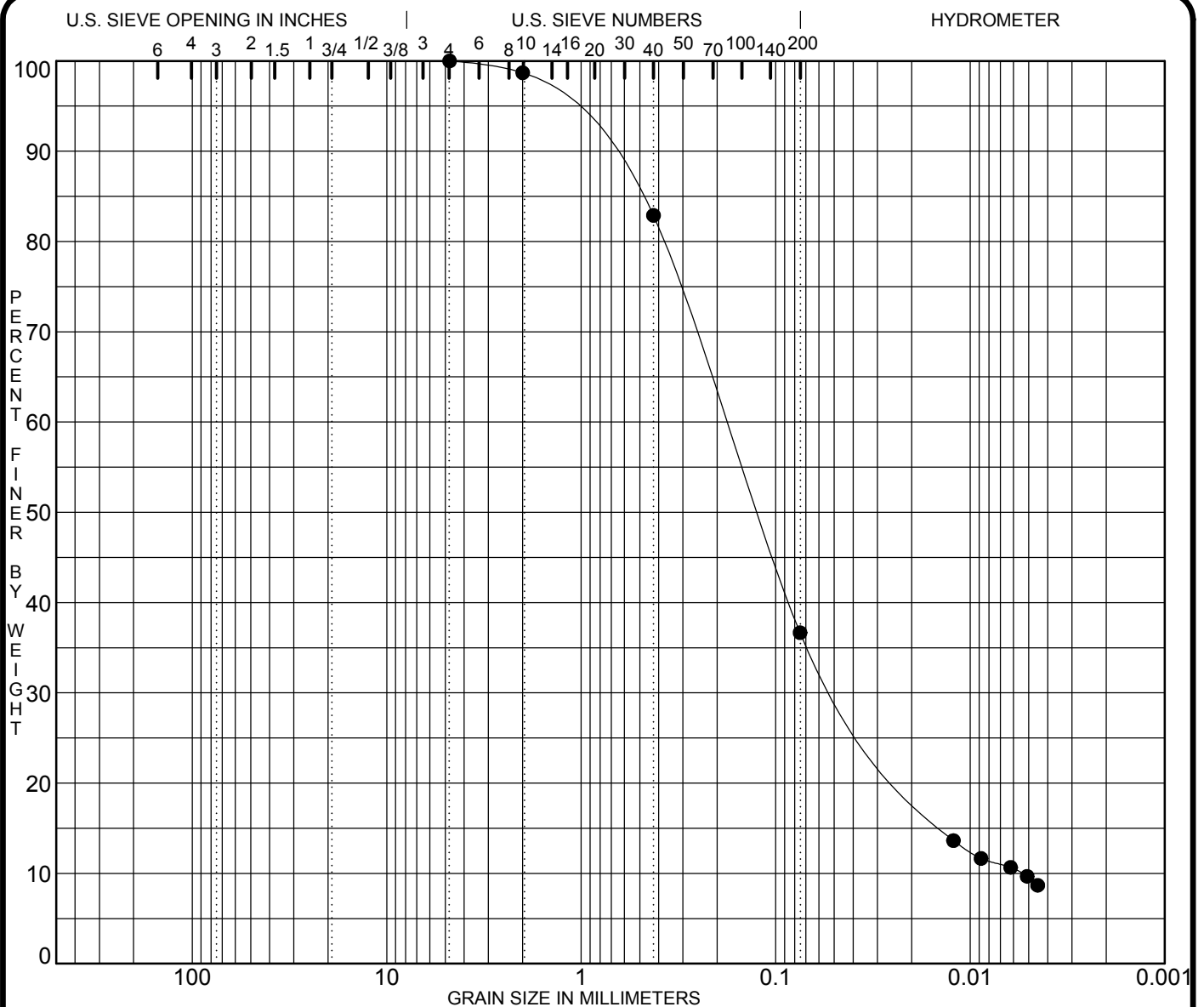
Specimen ID		Depth	Classification				MC%	LL	PL	PI	Cc	Cu	
●	B-17-1	3.5	LEAN CLAY with SAND CL				17	27	15	12			
Specimen ID		Depth	D100	D60	D30	D10	%Gravel coarse      fine		%Sand coarse    medium    fine			%Silt	%Clay
●	B-17-1	3.5	2.00	0.03			0.0	0.0	0.0	8.3	19.3	39.1	33.4

PROJECT Dan Evans Industrial Park

PROJECT NO. N-16-034-26

## GRADATION CURVES

R11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen ID		Depth	Classification				MC%	LL	PL	PI	Cc	Cu	
●	B-17-5	6.0	SANDY LEAN CLAY (visual)				21				2.01	33.1	
Specimen ID		Depth	D100	D60	D30	D10	%Gravel coarse      fine		%Sand coarse    medium    fine			%Silt	%Clay
●	B-17-5	6.0	4.75	0.18	0.044	0.0054	0.0	0.0	1.3	15.8	46.2	27.2	9.5

PROJECT Dan Evans Industrial Park PROJECT NO. N-16-034-26

## GRADATION CURVES

R11