SUBSURFACE INVESTIGATION & GEOTECHNICAL RECOMMENDATIONS

NORTHWALK PUD
PERMEABLE PAVEMENT
WESTFIELD, INDIANA
PROJECT NO: 14IN0105

PREPARED BY:
ALT & WITZIG ENGINEERING, INC.
GEOTECHNICAL DIVISION

PREPARED FOR:
THE ANDERSON CORPORATION
WESTFIELD, INDIANA

MARCH 24, 2014

Alt & Witzig Engineering, Inc.
4105 West 99th Street • Carmel, Indiana 46032
(317) 875-7000 • Fax (317) 876-3705

March 24, 2014

The Anderson Corporation
301 S. Union Street
Westfield, Indiana 46074
ATTN: Mr. Jim Anderson

RE: Subsurface Investigation &
Geotechnical Recommendations
Northwalk PUD
Permeable Pavement
Westfield, Indiana
Alt & Witzig File: 14IN0105

Dear Mr. Anderson:

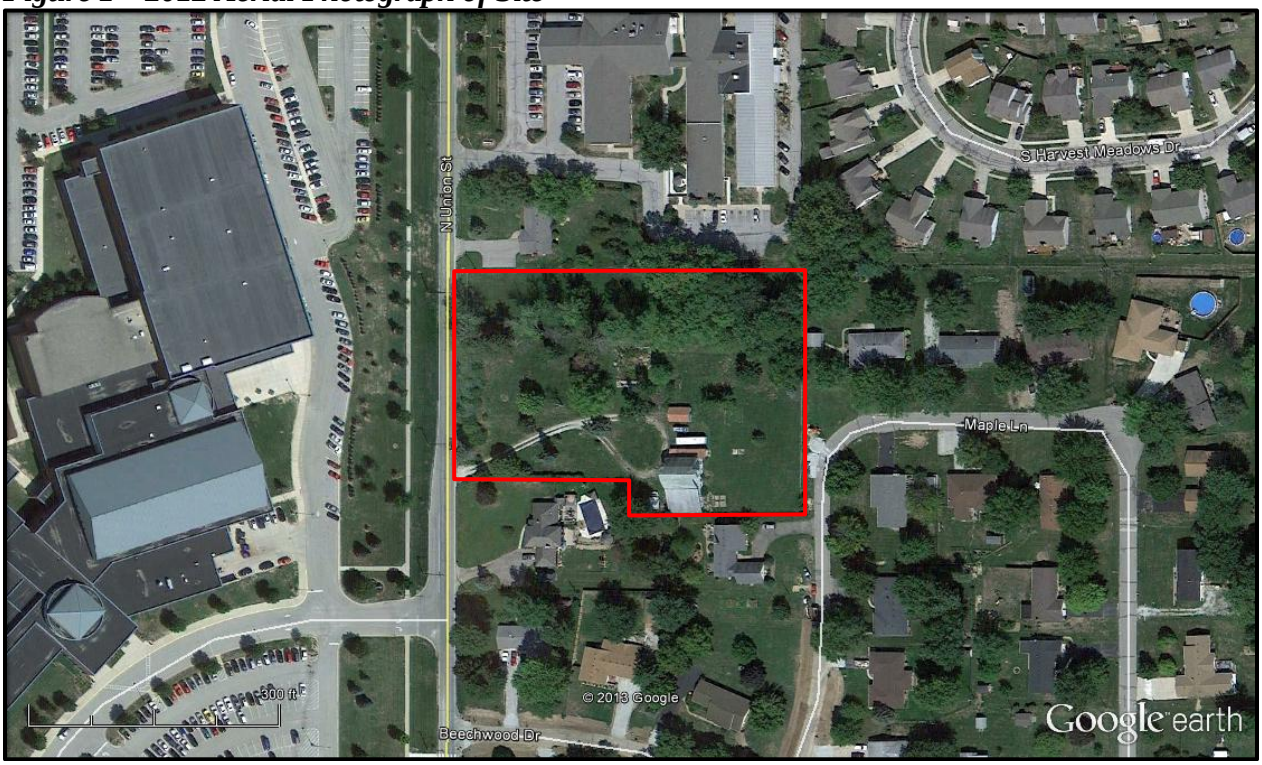
In compliance with your request, we have completed a subsurface investigation for the above-referenced project. The purpose of this subsurface investigation was to determine the soil profile and the engineering characteristics of the subsurface soils in order to provide information to be used in preparing the subgrade soils and designing the drainage systems for the proposed permeable pavement to be constructed at this site. It is our pleasure to transmit herewith two (2) copies of our report.

Site Location and Description:

The site is located at 740 N. Union Street in Westfield, Indiana. The site may also be located utilizing the Westfield, Indiana 7½ Minute Topographic map in Section 31, Township 19 North, Range 3 East.

The ground surface of the site is relatively flat with an estimated relief of five (5) to ten (10) feet across the project area. The groundcover at the time of boring operations consisted of grass and crushed stone. Drainage of the site is currently along the ground surface into low lying areas. The site is currently occupied by multiple structures. The surrounding area is developed with residential structures, paved roadways, and underground utilities. A 2012 aerial photograph of the site is provided on Figure 1 on the following page.

Figure 1 – 2012 Aerial Photograph of Site



Field Services

The field investigation included reconnaissance of the project site, performing four (4) soil borings, performing standard penetration tests, obtaining soil samples retained in the standard split-spoon sampler, and performing two (2) percolation tests. The soil borings were performed with a drilling rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes. Representative samples were obtained employing split-spoon sampling procedures in accordance with ASTM Procedure D1586. A bulk sample of the subgrade soils was obtained from boring SB-2.

During the sampling procedure, standard penetration tests were performed at regular intervals to obtain the standard penetration value of the soil. The standard penetration value is defined as the number of blows of a 140-pound hammer, falling thirty (30) inches, required to advance the split-spoon sampler one (1) foot into the soil. The results of the standard penetration tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Water level observations were made during and upon completion of the boring operations. These readings are noted on the Boring Logs presented herewith. In relatively pervious soils such as sandy soils, the indicated elevations are considered reliable groundwater levels. In relatively impervious soils, the accurate determination of the groundwater elevation is not possible in even several days observation.

The percolation tests were performed by manually excavating a four (4) inch diameter hole to a depth of two (2) feet. The holes were then filled with water and measurements taken at delayed time intervals until the drop rate stabilized.

Ground surface elevations at the individual boring locations were interpolated from a one-foot interval contour map. All elevations reported on the Boring Logs are assumed to be accurate to +/- one (1) foot.

Laboratory Testing

The types of soils encountered in the borings were visually classified and are described in detail on the Boring Logs. Representative samples of the soils encountered in the field were placed in sample jars and are now stored in our laboratory. Unless notified to the contrary, all samples will be disposed of after two (2) months.

Samples were visually classified in accordance with ASTM D2488. Additionally, the four (4) critical soils types were classified in accordance with ASTM D2487. Unified Soil Classification System (USCS) was utilized to characterize the soils once the laboratory tests were complete. A standard proctor and 2-point CBR were conducted on the bulk sample obtained from boring SB-2 in general accordance with ASTM D698 and D1883, respectively.

Generalized Subsurface Conditions

The following is a generalization of the encountered subsurface soil characteristics. For a detailed description of the encountered subsurface soil conditions at the particular boring locations, please refer to the Boring Logs in the Appendix.

The borings generally encountered seven (7) to eight (8) inches of topsoil. Underlying the topsoil, the borings encountered soft to medium stiff cohesive soils to depths ranging from eight (8) to nineteen and one-half (19½) feet. Beneath the cohesive soils, the borings typically encountered wet, granular soils.

The groundwater level readings taken during, upon completion, and at delayed time intervals after completion of the drilling operation indicate groundwater between six (6) and twenty-one (21) feet below the existing ground surface. The exact location of the water table should be anticipated to fluctuate somewhat depending upon normal seasonal variations in precipitation and surface runoff.

The *Soil Survey of Hamilton County, Indiana* indicates that Brookston Silty Clay Loam (Br) and Crosby Silt Loam (CrA) are the predominant soils at this site. These soils are capable of exhibiting seasonal high groundwater level as shallow as the ground surface during the wetter portions of the year. Again, it should be noted that the groundwater level measurements recorded on the individual *Boring Logs* included in the Appendix of this report, are accurate only for the dates on which the measurements were performed. The exact location of the water table should be anticipated to fluctuate somewhat depending upon normal seasonal variations in precipitation and surface runoff.

Laboratory Results

Laboratory classifications of the soils samples produced results of Lean Clay and Silty Sands. Detailed soil descriptions at the boring location have been included on the *Boring Logs* in the Appendix of this report.

A moisture-density (proctor) test was conducted on a bulk sample collected from boring SB-2. The graphical results from the proctor (ASTM D698) test are provided in the Appendix. The test indicated that the subgrade soils possess a maximum dry density of 113.4 pounds per cubic foot at an optimum moisture content of 13.6 percent.

The CBR test results indicate a value of 2 at 95% compaction. This value would be applicable for a subgrade that has been scarified and compacted. It is generally recommended that the laboratory CBR value be slightly discounted to account for variations in the subgrade strength.

Percolation Discussion

The percolation rates as determined through the two (2) percolation tests conducted at this site can be found in the following table 1.

Table 1.

Boring	Depth (ft)	Percolation Rate (in/hr)
SB-2	2.0	0.53
SB-4	2.0	0.47

The *Soil Survey of Hamilton County, Indiana* as published by the USDA classifies the soils as Brookston Silty Clay Loam (Br) and Crosby Silt Loam (CrA). Based on these classifications, natural percolation rates for the shallow soils may range from 0.01 in/hr to 0.6 in/hr.

If we can give further service in these matters, please contact us at your convenience. Thank you for this opportunity to be of service.

Very truly yours,
ALT & WITZIG ENGINEERING, INC.

Brian A. Wirt, P.E.

Thomas J. Coffey, P.E.

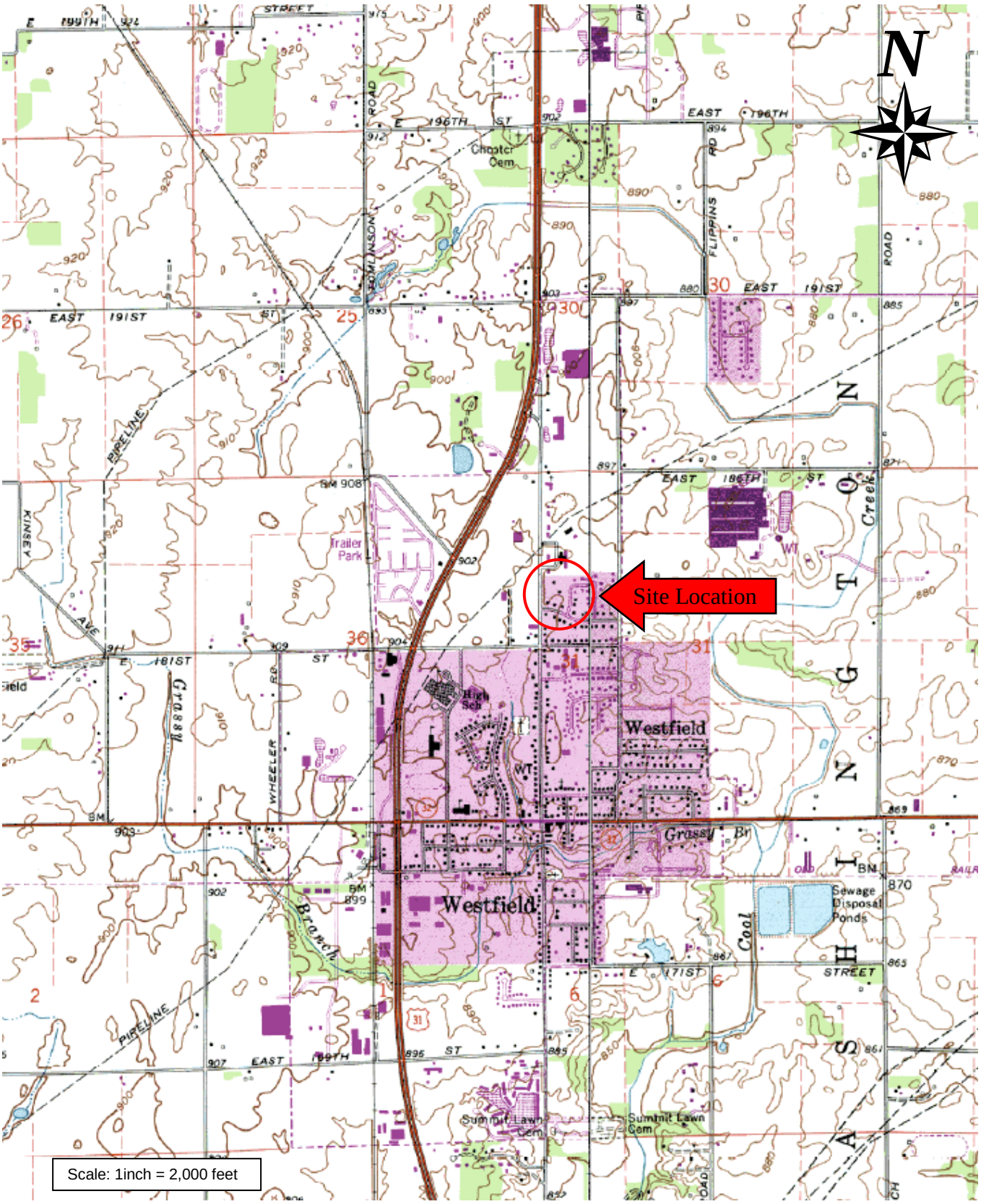
APPENDIX

Recommended Specifications for Compacted Fills and Backfills
Site Location Map
Boring Location Plan
Boring Logs
Grain Size Distribution
Atterberg Limits
Moisture-Density Relationship
Dry Density vs. Soaked CBR
General Notes
Custom Soil Resource Report for Hamilton County

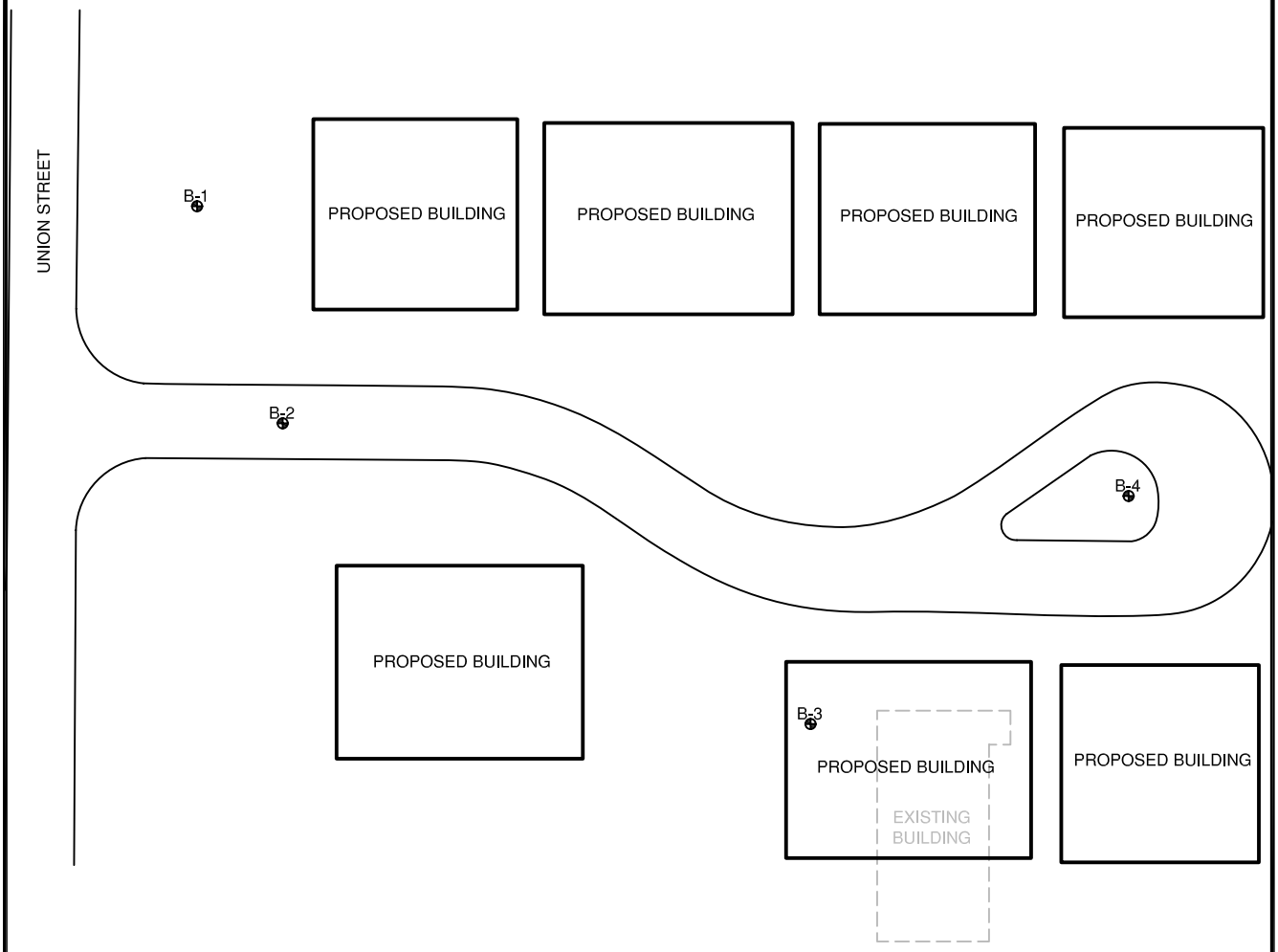
RECOMMENDED SPECIFICATIONS FOR COMPACTED FILLS AND BACKFILLS

All fill shall be formed from material free of vegetable matter, rubbish, large rock, and other deleterious material. Prior to placement of fill, a sample of the proposed fill material should be submitted to the soils engineer for his approval. The surface of each layer will be approximately horizontal but will be provided with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point. The fill material should be placed in layers not to exceed eight (8) inches in loose thickness and should be sprinkled with water as required to secure specified compactions. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Under no circumstances should a bulldozer or similar tracked vehicles be used as compacting equipment. Material containing an excess of water so the specified compaction limits cannot be attained should be spread and dried to a moisture content that will permit proper compaction. All fill should be compacted to the specified percent of the maximum density obtained in accordance with ASTM density Test D698 (95% in parking lot areas). Should the results of the in-place density tests indicate that the specified compaction limits are not obtained, the areas represented by such tests should be reworked and re-tested as required until the specified limits are reached.

SITE LOCATION MAP



Prepared For: The Anderson Corporation		**Prepared By:** Alt & Witzig Engineering, Inc.	
Project Name: Northwalk HUD		**Project No:** 14IN0105	**Date:** 03/14



BORING LOCATION PLAN

PROJECT NAME: Northwalk PUD
LOCATION: 740 N. Union Street, Westfield, IN
PREPARED FOR: The Anderson Corporation
PROJECT NO: 14IN0105

Project Manager: BW
Checked By: DH
Drawn By: JT
Date: 03/14

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BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **The Anderson Corporation**
PROJECT NAME **Northwalk PUD**
PROJECT LOCATION **Westfield, Indiana**

BORING # **SB-1**
ALT & WITZIG FILE # **14IN0105**

DRILLING and SAMPLING INFORMATION

Date Started **3/3/14**
Date Completed **3/3/14**
Boring Method **HSA**
Driller **D. McWherter**

Hammer Wt. **140** lbs.
Hammer Drop **30** in.
Spoon Sampler OD **2** in.
Rig Type **B-57 Truck**

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION 890.2	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	TEST DATA: Standard Penetration Test, N - blows/foot	TEST DATA: Qu-tsf Unconfined Compressive Strength	TEST DATA: PP-tsf Pocket Penetrometer	TEST DATA: Moisture Content % / *Dry Unit Weight (pcf)*	Remarks
889.6	TOPSOIL *(Visual)*	0.6										
				1	SS			7		1.8	21.8	
	Brown Sandy CLAY		5	2	SS		▼	5		0.5	22.2	
882.2		8.0		3	SS		▼	7				
			10	4	SS		○	12				
	Brown, Wet Silty SAND											
875.2		15.0	15	5	SS			12		2.5	11.7	
874.2	Gray Silty CLAY with Sand	16.0										
	End of Boring at 16 feet											

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *9.5 ft.*
▽ At Completion *7.5 ft.*
Caved At Completion *7.5 ft.*
▼ After *1* hours *6.0 ft.*
Caved After *1* hours at *7.5 ft*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **The Anderson Corporation** BORING # **SB-2**

PROJECT NAME **Northwalk PUD** ALT & WITZIG FILE # **14IN0105**

PROJECT LOCATION **Westfield, Indiana**

DRILLING and SAMPLING INFORMATION

Date Started **3/3/14** Hammer Wt. **140** lbs.

Date Completed **3/3/14** Hammer Drop **30** in.

Boring Method **HSA** Spoon Sampler OD **2** in.

Driller **D. McWherter** Rig Type **B-57 Truck**

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION 892.0	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	TEST DATA: Standard Penetration Test, N - blows/foot	TEST DATA: Qu-tsf Unconfined Compressive Strength	TEST DATA: PP-tsf Pocket Penetrometer	TEST DATA: Moisture Content % / *Dry Unit Weight (pcf)*	Remarks
891.4	TOPSOIL *(Visual)*	0.6										
				1	SS			10		1.5	23.4	
	Brown LEAN CLAY		5	2	SS			8		0.3	20.0	
884.0		8.0		3	SS			4				
	Brown, Wet Silty SAND		10	4	SS			4				
877.5		14.5										
	Gray Silty CLAY		15	5	SS			33		3.8	10.7	
			20	6	SS			14		3.0	12.2	
871.0	End of Boring at 21 feet	21.0										

Sample Type
- SS - Driven Split Spoon
- ST - Pressed Shelby Tube
- CA - Continuous Flight Auger
- RC - Rock Core
- CU - Cuttings
- CT - Continuous Tube

Groundwater
- During Drilling *11.0 ft.*
- At Completion *21.0 ft.*
- Caved At Completion *14.0 ft.*
- After *2* hours *9.0 ft.*
- Caved After *2* hours at *11.0 ft*

Boring Method
- HSA - Hollow Stem Augers
- CFA - Continuous Flight Augers
- DC - Driving Casing
- MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **The Anderson Corporation**
PROJECT NAME **Northwalk PUD**
PROJECT LOCATION **Westfield, Indiana**

BORING # **SB-3**
ALT & WITZIG FILE # **14IN0105**

DRILLING and SAMPLING INFORMATION

Date Started **3/3/14**
Date Completed **3/3/14**
Boring Method **HSA**
Driller **D. McWherter**

Hammer Wt. **140** lbs.
Hammer Drop **30** in.
Spoon Sampler OD **2** in.
Rig Type **B-57 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION 894.2	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % / *Dry Unit Weight (pcf)*	Remarks
893.6	TOPSOIL *(Visual)*	0.6										
				1	SS			2		0.3	28.9	
			5	2	SS			3			29.4	
				3	SS			14		4.5	11.3	
	Brown Silty CLAY		10	4	SS			18		4.0	11.5	
			15	5	SS			18			21.2	
878.2	End of Boring at 16 feet	16.0										

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *8.0 ft.*
▽ At Completion *Caved@11.0 ft.*
Caved At Completion *11.0 ft.*
▼ After *3* hours *6.0 ft.*
Caved After *3* hours at *6.0 ft*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **The Anderson Corporation**
PROJECT NAME **Northwalk PUD**
PROJECT LOCATION **Westfield, Indiana**

BORING # **SB-4**
ALT & WITZIG FILE # **14IN0105**

DRILLING and SAMPLING INFORMATION

Date Started **3/3/14**
Date Completed **3/3/14**
Boring Method **HSA**
Driller **D. McWherter**

Hammer Wt. **140** lbs.
Hammer Drop **30** in.
Spoon Sampler OD **2** in.
Rig Type **B-57 Truck**

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION 892.9	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % / *Dry Unit Weight (pcf)*	Remarks
892.2	TOPSOIL *(Visual)*	0.7										
				1	SS			6		2.0	26.7	
			5	2	SS			12		4.5	19.7	
	Brown Silty CLAY			3	SS			22		4.5	11.0	
			10	4	SS			14		4.5	11.1	
880.9		12.0					○					
	Gray Silty CLAY		15	5	SS			15				Driving on a Rock. No Recovery.
873.4		19.5										
			20	6	SS			24				
871.9	Gray, Wet Silty SAND with Gravel	21.0										
	End of Boring at 21 feet											

TEST DATA

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *14.0 ft.*
▽ At Completion *ft.*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

MATERIAL GRAPHICS LEGEND


CL: USCS Low Plasticity Clay


CL-ML: USCS Low Plasticity Silty Clay


CLS: USCS Low Plasticity Sandy Clay


SM: USCS Silty Sand


TOPSOIL

SOIL PROPERTY SYMBOLS

N: *Standard "N" penetration value. Blows per foot of a 140-lb hammer falling 30" on a 2" O.D. split-spoon.*

Qu: *Unconfined Compressive Strength, tsf* PP: *Pocket Penetrometer, tsf*

LL: *Liquid Limit, %* PL: *Plastic Limit, %* PI: *Plasticity Index, %*

DRILLING AND SAMPLING SYMBOLS

GROUNDWATER SYMBOLS

○ *Apparent water level noted while drilling.*

▽ *Apparent water level noted upon completion.*

▼ *Apparent water level noted upon delayed time.*

SAMPLER SYMBOLS


SS: Split Spoon

RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (NON-COHESIVE SOILS)

TERM	*BLOWS PER FOOT*
Very Loose	0 - 5
Loose	6 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	>51

RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (COHESIVE SOILS)

TERM	*BLOWS PER FOOT*
Very Soft	0 - 3
Soft	4 - 5
Medium Stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	>31

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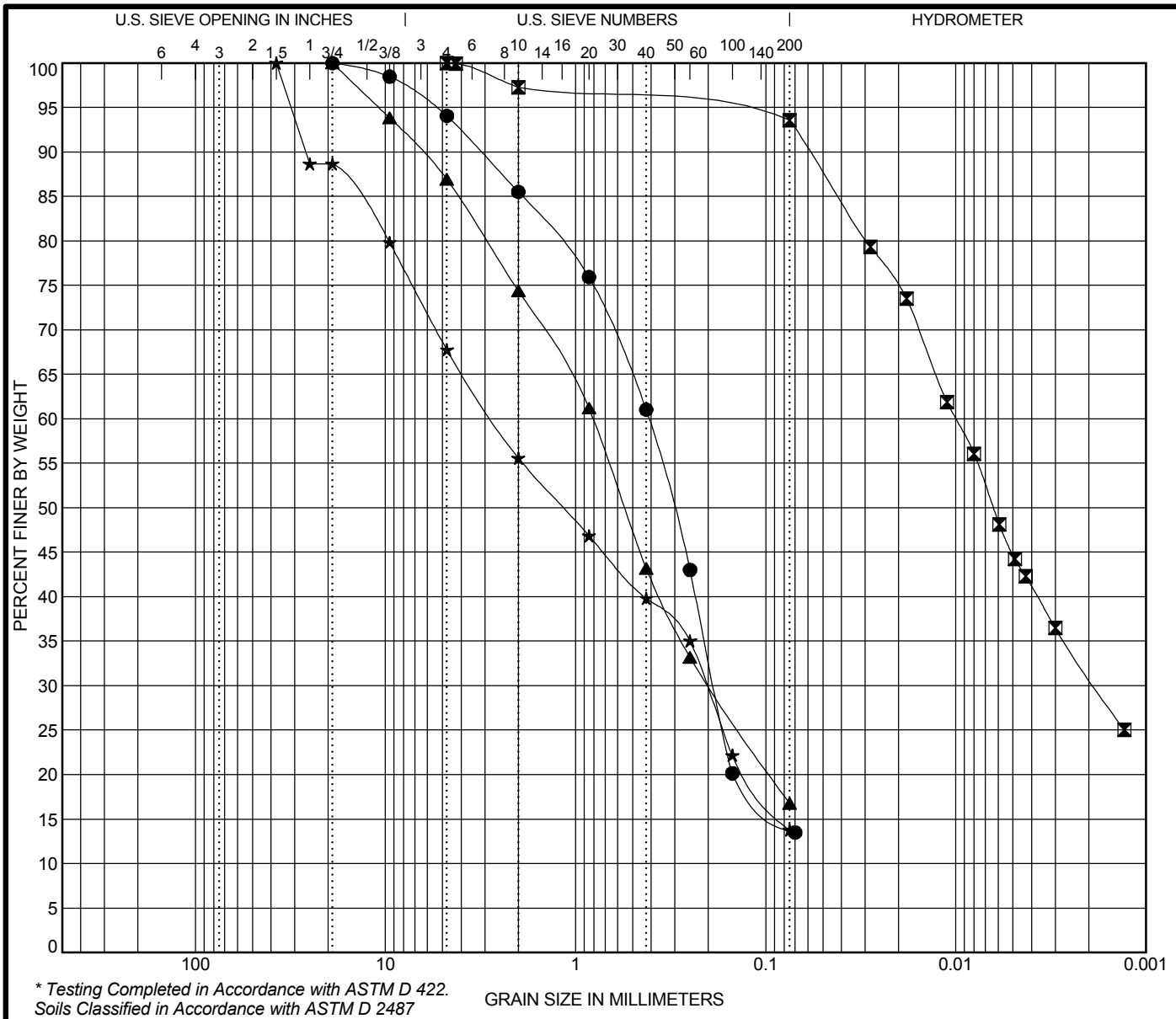
Fax: 317-876-3705

GENERAL NOTES

Project: Northwalk PUD

Location: Westfield, Indiana

Number: 14IN0105



** Testing Completed in Accordance with ASTM D 422.*
Soils Classified in Accordance with ASTM D 2487

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	SB-1	7.0 to 8.5	SILTY SAND SM	NP	NP	NP		
⊠	SB-2	2.0 to 3.5	LEAN CLAY CL	47	16	31		
▲	SB-2	7.0 to 8.5	SILTY SAND SM	NP	NP	NP		
★	SB-4	19.5 to 21.0	SILTY SAND with GRAVEL SM	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SB-1	7.0 to 8.5	19	0.412	0.187		5.9	80.0	14.1	
⊠	SB-2	2.0 to 3.5	4.75	0.01	0.002		0.0	6.4	62.7	30.9
▲	SB-2	7.0 to 8.5	19	0.811	0.198		13.0	70.2	16.8	
★	SB-4	19.5 to 21.0	37.5	2.738	0.205		32.2	54.0	13.8	

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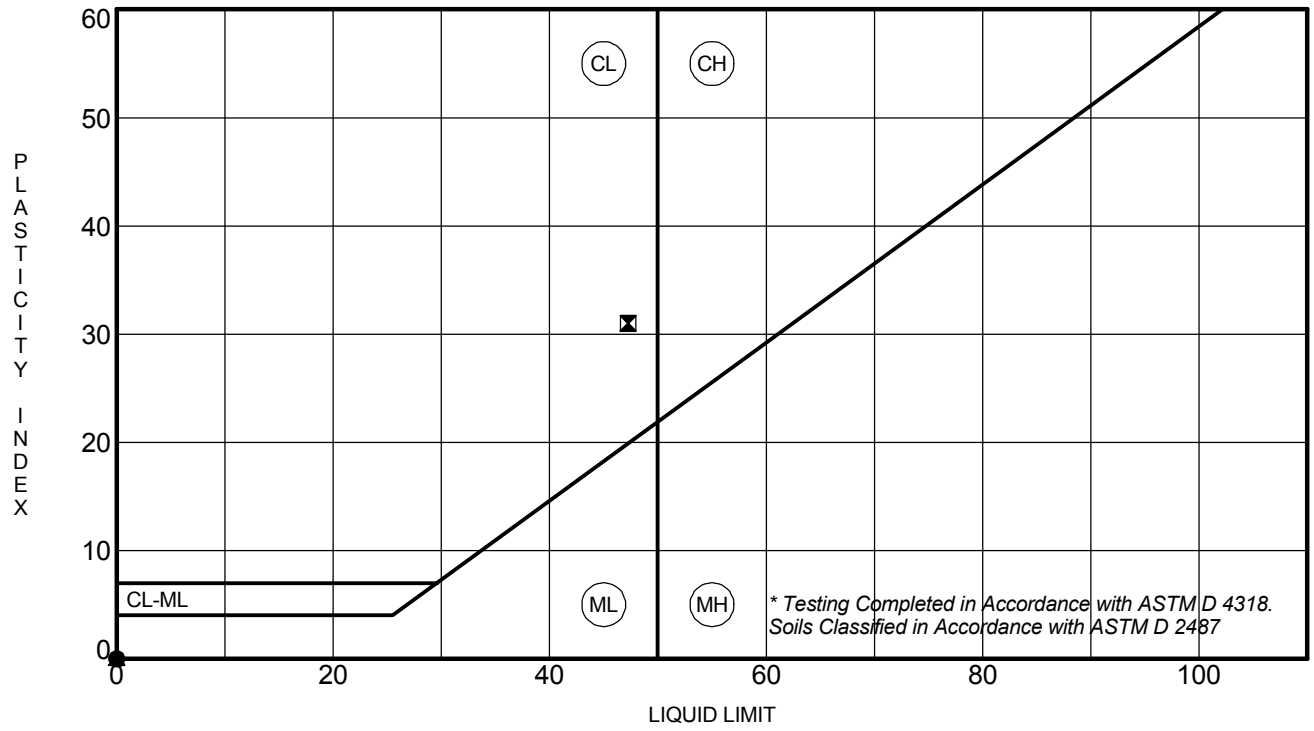
GRAIN SIZE DISTRIBUTION

Project: Northwalk PUD

Location: Westfield, Indiana

Number: 14IN0105

A&W GRAIN SIZE USCS 14IN0105.GPJ US EVAL.GDT 3/24/14



	Specimen Identification	LL	PL	PI	Fines	Classification
●	**SB-1 - 7.0 to 8.5**	**NP**	**NP**	**NP**	**14**	**SILTY SAND SM**
⊠	**SB-2 - 2.0 to 3.5**	**47**	**16**	**31**	**94**	**LEAN CLAY CL**
▲	**SB-2 - 7.0 to 8.5**	**NP**	**NP**	**NP**	**17**	**SILTY SAND SM**
★	**SB-4 - 19.5 to 21.0**	**NP**	**NP**	**NP**	**14**	**SILTY SAND with GRAVEL SM**

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ATTERBERG LIMITS RESULTS

Project: Northwalk PUD

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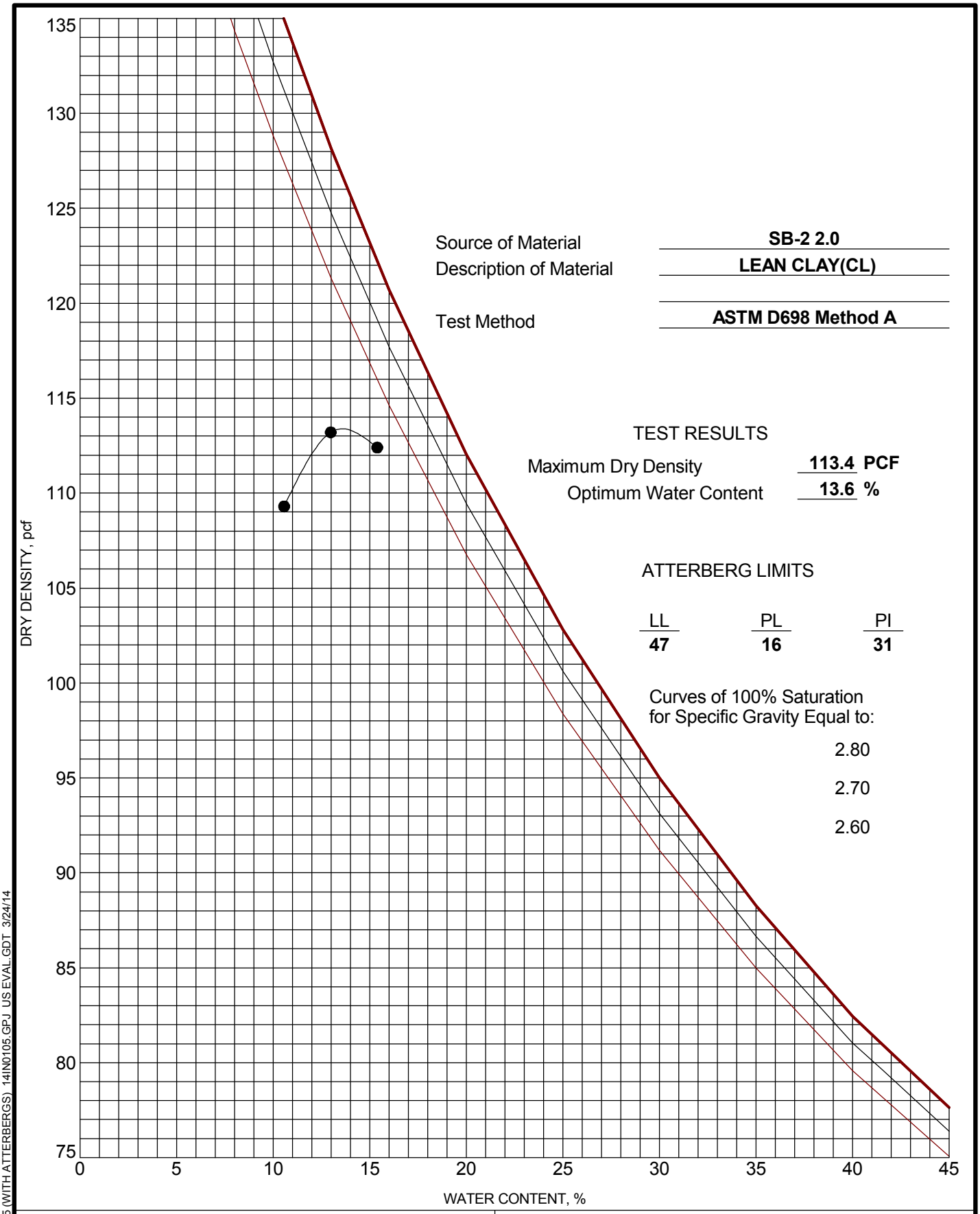

Source of Material: **SB-2 2.0**

Description of Material: **LEAN CLAY(CL)**

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density: **113.4** **PCF**

Optimum Water Content: **13.6** **%**

ATTERBERG LIMITS

LL	PL	PI
47	**16**	**31**

Curves of 100% Saturation for Specific Gravity Equal to:

2.80

2.70

2.60

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MOISTURE-DENSITY RELATIONSHIP

Project: Northwalk PUD

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DRY DENSITY vs SOAKED CBR

CLIENT The Anderson Corporation **PROJECT NAME** Northwalk PUD

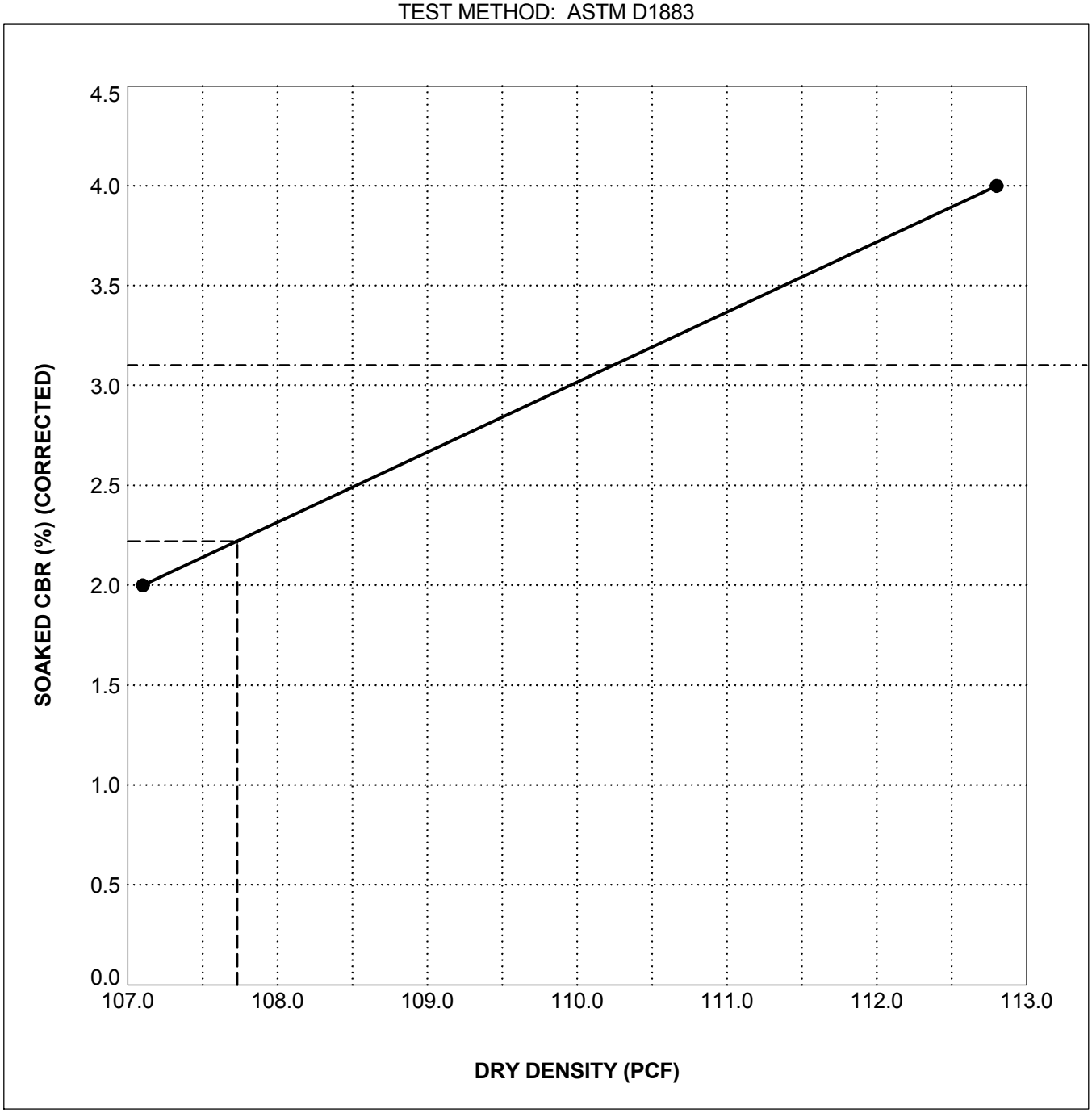
PROJECT NUMBER 14IN0105 **PROJECT LOCATION** Westfield, Indiana

Sample Ident: **SB-2 at a Depth of 2'** Date:

Description: LEAN CLAY(CL)

LL 47 PL 16 PI 31 Swell 1.41%

TEST METHOD: ASTM D1883



Dry Density @ 90% 102.1 pcf CBR @ 90% Density

Dry Density @ 95% 107.7 pcf CBR @ 95% Density 2.2

Dry Density @ 100% 113.4 pcf CBR @ 100% Density

Figure

CBR VS DRY DENSITY 14IN0105.GPJ CBR TEST.GDT 3/24/14

MATERIAL GRAPHICS LEGEND


CL: USCS Low Plasticity Clay


CL-ML: USCS Low Plasticity Silty Clay


CLS: USCS Low Plasticity Sandy Clay


SM: USCS Silty Sand


TOPSOIL

SOIL PROPERTY SYMBOLS

N: *Standard "N" penetration value. Blows per foot of a 140-lb hammer falling 30" on a 2" O.D. split-spoon.*

Qu: *Unconfined Compressive Strength, tsf* PP: *Pocket Penetrometer, tsf*

LL: *Liquid Limit, %* PL: *Plastic Limit, %* PI: *Plasticity Index, %*

DRILLING AND SAMPLING SYMBOLS

GROUNDWATER SYMBOLS

○ *Apparent water level noted while drilling.*

▽ *Apparent water level noted upon completion.*

▼ *Apparent water level noted upon delayed time.*

SAMPLER SYMBOLS


SS: Split Spoon

RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (NON-COHESIVE SOILS)

TERM	*BLOWS PER FOOT*
Very Loose	0 - 5
Loose	6 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	>51

RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (COHESIVE SOILS)

TERM	*BLOWS PER FOOT*
Very Soft	0 - 3
Soft	4 - 5
Medium Stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	>31

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GENERAL NOTES

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Hamilton County, Indiana

A&W File: 14IN0105

March 6, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hamilton County, Indiana
Survey Area Data: Version 14, Dec 16, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 17, 2011—Mar 28, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Hamilton County, Indiana (IN057)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Br	Brookston silty clay loam	0.4	12.7%
CrA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	2.5	87.3%
Totals for Area of Interest		**2.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Hamilton County, Indiana

Br—Brookston silty clay loam

Map Unit Setting

Elevation: 720 to 980 feet
Mean annual precipitation: 36 to 42 inches
Mean annual air temperature: 49 to 52 degrees F
Frost-free period: 175 to 185 days

Map Unit Composition

Brookston and similar soils: 100 percent

Description of Brookston

Setting

Landform: Depressions on till plains
Landform position (two-dimensional): Footslope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Loamy till

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Available water capacity: High (about 10.0 inches)

Interpretive groups

Farmland classification: Prime farmland if drained
Land capability (nonirrigated): 2w
Hydrologic Soil Group: B/D
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)

Typical profile

0 to 11 inches: Silty clay loam
11 to 58 inches: Clay loam
58 to 70 inches: Loam

CrA—Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes

Map Unit Setting

Elevation: 600 to 1,000 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 49 to 54 degrees F

Frost-free period: 145 to 180 days

Map Unit Composition

Crosby and similar soils: 93 percent
Minor components: 7 percent

Description of Crosby

Setting

Landform: Recessionial moraines, ground moraines, water-lain moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Silty material or loess over loamy till

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 6.5 inches)

Interpretive groups

Farmland classification: Prime farmland if drained
Land capability (nonirrigated): 2w
Hydrologic Soil Group: C/D

Typical profile

0 to 10 inches: Silt loam
10 to 17 inches: Silty clay loam
17 to 29 inches: Clay loam
29 to 36 inches: Loam
36 to 79 inches: Loam

Minor Components

Williamstown, eroded

Percent of map unit: 5 percent
Landform: Water-lain moraines, ground moraines, recessionial moraines
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, head slope, nose slope, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex

Treaty, drained

Percent of map unit: 2 percent
Landform: Water-lain moraines, swales, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, dip

Down-slope shape: Linear
Across-slope shape: Concave