SUBSURFACE EXPLORATION AND RECOMMENDATIONS

PROPOSED PUMP STATIONS- TURKEY CREEK REGIONAL SEWER DISTRICT
Northshore – Eastshore Collection, Contract 6 (868-7701.001)
Syracuse, Indiana

GME TESTING PROJECT NO.
G21-070804

PREPARED FOR:

Jones & Henrry Engineers, Ltd.
2420 North Coliseum Blvd, Ste 214
Fort Wayne, IN 46805
Attn.: Mr. John P. Magsam, P.E.

August 12, 2021

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August 12, 2021
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REF: SUBSURFACE EXPLORATION AND RECOMMENDATIONS
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Mr. Magsam:

In compliance with your request and authorization, ***GME Testing*** is pleased to submit this report of our subsurface exploration and recommendations for the above referenced project. Our work was performed in accordance with our proposal GMEP21-040212.R1 dated April 21, 2021. Authorization to proceed with our services was provided on July 20, 2021 by acceptance of our Proposal Agreement.

1.0 INTRODUCTION

This report includes the results of our subsurface exploration and evaluation of proposed utility that will consists of five (5) pump stations and associated pipes. This utility improvement is planned for design and construction along Northshore and Eastshore Drives along the northeast side of Syracuse Lake in Syracuse, Indiana.

2.0 PURPOSE OF WORK

The purpose of this geotechnical study was to generally characterize the existing subsurface soil and groundwater conditions by drilling five (5) soil test borings (designated as PS-1 through PS-5) and performing laboratory tests on samples

recovered from the borings, and to assist the project design and construction team in preparing the foundation design plans and installation of the proposed utility.

3.0 SITE CONDITIONS AND PROJECT DESCRIPTION

3.1 Site Conditions

The following description of site conditions is derived from our field investigation and our review of publicly available geologic and topographic maps.

At the time of our field investigation, the site was relatively level to gently sloping and consisted of residential structures, driveways, roadways, golf course, and roadside ditches. The test borings were staked by the client and the borings were located along the existing roadway shoulders that were either stone or grass covered. Various underground utilities exist within close proximity to the proposed work areas.

3.2 Project Description

Based on a preliminary site plan provided to us, it is our understanding that Turkey Creek Regional Sewer District in conjunction with Jones & Henry Engineers, Ltd. are planning for the design and construction of five (5) new pump stations with gravity pipes and force mains at the above referenced project site.

Based on preliminary information obtained from Mr. John P. Magsam, P.E. of Jones & Henry Engineers, it is our understanding that the gravity pipes are planned to be 8-inch PVC, and the force mains will be 3 to 6-inch either HDPE or PVC types.

The following information presented in Table 1 regarding the proposed pump stations sizes, depths, and associated inlet pipe inverts at each of the test borings was obtained from Jones & Henry Engineers.

Table 1: Summary of Pump Stations

Approximate Location/Boring No.	Diameter, ft	Pump Station Depth, ft*	Lowest Inlet Pipe Depth, ft*
PS-1	8	±19	±15
PS-2	6	±14	±10
PS-3	6	±10	±6
PS-4	6	±10.5	±5.5
PS-5	5	±15.5	±12

**Depths referenced below existing ground surface*

GME Testing should be contacted to review design information that conflicts with our stated understanding of the project.

4.0 SUBSURFACE CONDITIONS

Our field exploration consisted of drilling five (5) test borings (designated as PS-1 through PS-5) to depths of 30 to 35-feet below the existing ground surface as shown on the Borehole Logs.

The planned locations of the test borings were staked by the client and established in the field by GME Testing personnel. These staked locations were correlated to the approximate latitude and longitude coordinates by uploading into a handheld GPS unit. Utilizing the handheld GPS unit, the locations are referred to on our boring logs and presented on Figure 1, included in Appendix A of this report. Additional details of field exploration, laboratory testing, and geologic conditions are provided in Appendix A of this report.

The lines of demarcation shown on the log represent approximate boundaries between the various classifications. The stratification of soils, as shown on the accompanying test borehole logs, represents the soil conditions at the drilled borehole locations, and variations may occur. In-situ strata changes could occur gradually or at different levels. Also, it should be noted that the boreholes depict conditions at the particular location and time indicated.

4.1 Generalized Soil Profile

Approximately 8 to 14-inches of brown, silty sandy topsoil was encountered in the borings.

The soil profile disclosed in the borings consisted of silty sand and gravel, clayey sand and gravel, fine to medium coarse sands, sandy clay, silty clay, sandy silty clay, and silty sands.

Although the test borings did not disclose significant organic content soils, GME Testing took the liberty of reviewing available soil literatures and based on *Soil Survey of Kosciusko County,* organic soils (muck) may be present between soil test borings PS-1 and PS-2. More details of these geological conditions are provided in Appendix A of this report.

The sandy soils were in the wet condition and/or completely saturated below depths of approximately 7-feet in borings PS-1 and PS-5 and below depths of approximately 20-feet in borings PS-2 through PS-4.

From our observations, the consistencies of the clays ranged from medium stiff to hard, and the relative densities of the existing cohesionless soils ranged from loose to dense, based on SPT, N-values, according to ASTM D-1586.

The foregoing discussions of subsurface conditions on this site represent generalized soil profiles at the test boring locations. A more detailed description and data for each test boring can be found on the individual Borehole Logs in Appendix B of this report.

4.2 Groundwater Conditions

Groundwater measurements were taken during our field operations by noting the depth of water on the rods and in open boreholes following withdrawal of the drilling augers after the completion of drilling activities at the test boring locations. Groundwater was observed at varying depths between approximately 5 and 21-

feet during and/or following our drilling program. Table 2 below summarizes the depth of groundwater observed in the test borings.

Table 2: Groundwater Depths in the Borings at Time of Drilling

Boring No.	*Groundwater Depth, ft	
	Observed During Drilling	Observed After Completion of Drilling
PS-1	±6	±5
PS-2	±19	†NO
PS-3	±20	NO
PS-4	±21	±21
PS-5	±8	±8

**Depths referenced below existing ground surface.*
† Not Observed (NO)

The groundwater depths shown on the boring log reflect groundwater levels only for the date which the boring was drilled.

As an additional input, a review of the *Soil Survey of Kosciusko County* indicated that the project area is prone to seasonal high groundwater level within 1 feet of surface particularly during wetter periods of the year and in organic soils.

It must also be noted that short term groundwater level observations made in test boring are not necessarily a reliable indication of the actual groundwater elevation. Fluctuations in the level of groundwater typically occur due to variations in rainfall, water level of Syracuse Lake, run off and other hydrogeological factors.

5.0 EVALUATION AND RECOMMENDATIONS

The following design recommendations have been developed in order to aid in the design and development of the proposed project. They are intended for use with regard to the specific project discussed herein and any substantial changes in the proposed construction, scope, location, loads, or assumed grades should be brought to our attention so that we may evaluate how such changes may affect our conclusions and recommendations.

The opinions and recommendations submitted in this report are based, in part, on our interpretation of the subsurface information revealed by the subsurface test borings shown on Figure 1 included in Appendix A of this report. Understandably, this report does not reflect variations in subsurface conditions between or beyond the extent of the test boring locations. Therefore, variations in these conditions can be expected, and fluctuation of the groundwater level will occur with time. Other important limitations of this report are discussed in Appendix B of our report.

General Evaluation

Based on our observations at the test boring locations, the subsurface conditions are anticipated to be conducive for support of the proposed utility. In our opinion, the most significant geotechnical issues affecting design and construction are granular soils in the presence of groundwater (i.e., dewatering) and possibly encountering organic soils as shown in the *Soil Survey of Kosciusko County* as previously discussed.

5.1 Geotechnical Considerations

Prior to excavating trenches for the pump station and pipes, GME Testing recommends that any existing underground utilities and nearby roadway in conflict with the proposed utility construction and improvement be relocated or supported where necessary.

The available information provided to us indicated that the pump station and associated pipes are anticipated to be established within approximately 6 and 19-feet below the existing ground surface. Based on the subsurface conditions observed at the widely spaced test borings, subgrade conditions are anticipated to consist primarily of very loose and dense granular soils and medium stiff to very stiff cohesive soils. Provided that adequate dewatering and subgrade preparation is maintained, these sols are anticipated to provide adequate support of the pump station and pipes.

Improvement of the subgrade soils is anticipated to be isolated and will be dependent on the actual conditions encountered. Where deleterious materials and very loose soils and soft soils are encountered at the pipe and pump station grades (such as those observed at the location of borings PS-3 and PS-4 between depths of approximately 3 and 10-feet or possibly a combination of both as found in PS-5), we recommend that they be undercut a maximum of 2-feet and replaced with compacted granular soils. As previously discussed, wet granular soils were encountered in all five test borings. Where wet granular soils are encountered, GME Testing recommend that the groundwater level be lowered a minimum of 3-feet below the planned pipe and pump station elevations. It should be noted that the performance of the utility subgrade will be dependent on the contractor's workmanship including dewatering methods and protecting the subgrade from water, sloughing, and cave-ins.

5.2 Pump Station Recommendations

A temporary retention system to facilitate the proposed excavations, reduction of potential sloughing, and installation of the proposed pump station structures should be expected and will be required.

GME Testing should be retained on site to evaluate and test all earth-connected phases of the proposed construction.

It is recommended that the bottom of the pump station structures be underlain by a uniform layer of compacted granular bedding materials consisting of INDOT No. 53 or INDOT No. 8, extending from approved subgrade.

Provided that the pump stations are supported as recommended above, a maximum net allowable soil bearing pressure of **1,500 pounds per square foot (psf)** may be used for design purposes. This recommended soil bearing pressure assumes that disturbance to the bearing soils and groundwater related difficulties are controllable during construction to facilitate the construction of the proposed structures. The contractor should select a method during construction to maintain lateral support and positive dewatering.

Our general earthwork recommendations pertaining to groundwater and excavations are provided in this report.

Braced excavations will likely be required in areas where the proposed utility alignment is adjacent to existing features that cannot be disturbed such as other utilities, driveways, or roadways. These excavations are anticipated to include trench boxes or braced or cantilevered sheeting. Sheeting or boxes used in trenches should be placed in a manner not to disturb the embedment material. All excavations should comply with OSHA standards. In addition, proper site drainage is recommended to help minimize unwanted surface water runoff into excavations during the construction process.

5.3 General Pipe Considerations

In very loose to loose and/or wet granular soil areas, it is anticipated that the excavation banks will not remain open and sloughing and caving-in and/or excavation difficulties should be expected. Current OSHA requirements pertaining to worker safety should be met.

Any pockets soft, very loose, compressible, organic-containing and/or otherwise unsuitable materials encountered at the pipe bearing elevation must be removed to approved subgrade and replaced with engineered fill that is placed and compacted in accordance with the recommendations provided in this report. A minimum of 6-inches of well-compacted granular materials (i.e., INDOT No. 8 or INDOT No. 53) should be provided below the proposed pipe inverts.

Material supporting the pipe should exhibit less than 10 percent organic matter as determined by ASTM D-2974.

Any excavations that will extend to or below groundwater, should expect groundwater difficulties, and the contractor should be prepared to dewater the excavations in accordance with good construction practice. **We recommend that the extent of dewatering and retention systems be decided and designed**

by the contractor's professional. The contractor should select a method during construction to maintain lateral support and keep the excavations relatively dry.

In addition, it should be noted that the effectiveness of the subgrade preparation techniques is directly dependent on the effectiveness and workmanship of the contractor's water management activities (surface water and groundwater) and timely excavation of pipe placement activities.

6.0 GENERAL EARTHWORK RECOMMENDATIONS

6.1 Temporary Excavations and Shoring

Our study did not include a detailed analysis of slope stability for any temporary excavation condition. Temporary excavations will be required for this project. All temporary excavations for the installation of a pump station and any other utilities, etc., should be properly laid back or braced in accordance with Occupational Safety and Health Administration (OSHA) requirements. These regulations provide trench sloping and shoring design parameters for trenches up to 20-feet deep based on a description of the soil types encountered. Trenches and/or excavations greater than 20-feet deep should be designed by the contractor's professional engineer.

Spoils from the trench excavation should not be placed near the edge of the excavation. For open-cut trenches, or braced excavations, the spoils should be placed away from the edge of the trench a minimum distance equal to the trench depth. This distance should be evaluated in the field by the contractor's professional engineer and may be exceeded. If spoil piles are placed closer to the recommended distance to the braced excavation, the resulting surcharge loads should be considered in the bracing or trench box design.

Soils exposed in the base of a satisfactory excavation should be protected against any detrimental change in condition such as from disturbance, rain and freezing. Surface run-off water should be drained away from the excavation.

Temporary excavations that encounter water seepage may require shoring, bracing and/or lateral supports. All excavations should be monitored by a Competent Person, as defined by the OSHA standard, and appropriate shoring or sloping techniques should be used to prevent cave-ins.

The above recommendations should be considered as guidelines only, and an experienced design engineer should be contacted for further recommendations regarding design of the shoring system.

6.2 Pipe Installation

It is anticipated that the pipe installation method planned for this project will include open-trench method installation.

Wherever open cut and cover pipe trenching methods will be employed to install the proposed sewer, it is important that suitable bedding materials be used under and around the pipe to ensure proper support. **As our field and laboratory test results encountered very stiff to hard, brown and gray clayey soils at varying depths,** we recommend that the contractor select suitable methods and equipment to facilitate installation of the proposed utilities.

Depending upon seasonal conditions at the time of construction, dewatering should be expected in open pits and/or trenches.

All pipes and fittings should also conform to state or applicable local standards, whichever is superior.

6.3 Bedding Material

Free draining granular soils consisting of INDOT No. 53 or No. 8 (with 5 to 10 percent passing number 200 sieve) be used as bedding materials. Given wet granular materials are present near or at the structures' inverts in PS-1 and PS-5, a stabilization layer of INDOT No. 1, 2 or 8 may be placed before backfilling and compacting.

Bedding material and compaction requirements should be in accordance with this report.

Testing of compacted structural fill and backfill should be performed as frequently as necessary, in order to verify that proper compaction has been achieved.

6.4 Engineered Fill

All engineered fill needed to replace undercut materials or as a grade-raise fill should consist of a non-organic, naturally occurring non-expansive soil compacted to 95 or more percent of the modified Proctor maximum dry density (ASTM D-1557). As mentioned, the pump station backfill should consist of graded sand and gravel or crushed stone. However, it is recommended that all new fill materials be evaluated by the geotechnical engineer prior to placement on site.

6.5 Groundwater Control

Water should be expected when making excavations that will extend to groundwater level. Depending on the excavation method to be selected for construction of underground structures, the means and methods of dewatering should be determined by the contractor during construction. **The possible effects of construction dewatering on adjacent construction (e.g., dewatering-induced ground subsidence) should be considered by the contractor and their dewatering subcontractors.** An experienced contractor should be hired to design and install dewatering system, if needed.

6.6 Construction Monitoring

Our experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of test boreholes made at specific locations.

A GME Testing technician should be retained to observe, test and evaluate the soils-connected phases of the project during construction, including subgrade and footing excavations before forming and placing steel or concrete, to ensure compliance with the project specifications is achieved. Concrete strength and

consistency tests should also be carried out in accordance with the project specifications.

7.0 LIMITATIONS

This field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Additional subsurface evaluation will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. GME Testing should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

Our geotechnical recommendations and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request.

Although general constructability issues have been considered in this report, the means, methods, techniques, sequences and operations of construction, safety precautions, and all items incidental thereto and consequences of, are the responsibility of parties to the Project other than GME Testing. This office should be contacted if additional guidance is needed in these matters.

The scope of our services does not include any environmental assessments or investigations for the possible presence of toxic materials in the soil, groundwater or surface water within or in the general vicinity of the site studied. Any statements made in this report or shown on the test borehole logs regarding unusual subsurface conditions and/or composition, odor, staining, origin or other characteristics of the surface and/or subsurface materials are strictly for the information of our client.

We wish to remind you that we will store the samples for 30 days after which time they will be discarded unless you request otherwise.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact us at your convenience.

Sincerely,
GME Testing

Rami M. Anabtawi, P.E., D.GE
Principal Engineer

Abby Laudenschlager
Staff Engineer

APPENDIX A

FIELD EXPLORATION

Drilling and Sampling Procedures

The test borings were drilled using conventional augers to advance the holes and representative samples of the soils were obtained employing split-barrel sampling techniques in accordance with ASTM procedures D-1586-84. After completion of the borings and water level readings, the auger holes were backfilled with auger cuttings.

The description and depths of soil strata encountered and levels at which samples were recovered are indicated on the accompanying borehole log sheets in the Appendix B. In the column “Soil/Material Description” on the drill borehole log, the horizontal lines represent stratum changes. A solid line represents an observed change, and a dashed line represents an estimated change. An explanation of the symbols and terms used on the boring log sheets is given in Appendix B of this report.

Field Tests and Measurements

Standard Penetration Test: During the sampling procedures, Standard Penetration Test (SPT) was performed at regular intervals through the depth of the borings. The SPT value (“N”-value) is defined as the number of blows required to advance a 2-inch O.D., split-barrel sampler a distance of one foot by a 140-pound hammer falling 30-inches. These values provide a useful preliminary indication of the consistency or relative density of most soil deposits and are included on the Borehole Logs in Appendix B.

Water Level Measurements: Groundwater level observations were made in the boring holes during and upon completion of the boring operations. The groundwater level measurements are noted on the boring logs presented herein.

All recovered samples were returned to GME Testing laboratory for visual examination and subsequent laboratory testing.

LABORATORY TESTING

Selected soil samples obtained from the drilling and sampling program were tested in the laboratory to evaluate additional pertinent engineering characteristics of the foundation materials necessary in estimating the engineering properties of these materials.

Soil Laboratory Tests and Measurements

Visual Classification: All samples were visually classified by a geotechnical engineer in general accordance with ASTM D-2488, and on the Borehole Logs, which are located in the Appendix B of this report.

Moisture Content Tests: The natural moisture content of selected samples was determined by ASTM method D-2216 and is recorded on the Borehole Logs as a percentage of dry weight of soil under the “MC”.

Hand Penetration Tests: Samples of cohesive soils obtained from the split spoon sampler were tested with a calibrated hand penetrometer to aid in evaluating the soil strength characteristics. The results from this testing are tabulated on the Borehole Logs under the heading “Q_P”.

Unconfined Compressive Strength Tests: The undrained shear strengths of the cohesive soils were evaluated utilizing unconfined compressive tests on specimens obtained from the split-barrel and/or thin wall tube sampler. The values of strength tests performed on soil samples obtained from the split-barrel sampler are considered approximate recognizing that the sampler provides a representative but somewhat disturbed sample. The test results are tabulated on the Borehole Logs under the heading “Qu”.

GEOLOGIC CONDITIONS

According to the *United States Department of Agriculture (USDA) Soil Survey and Natural Resources Conservation Service (NRCS),* the natural soils covering the majority of the site are classified as Aquents-Urban land complex, Barry loam, Boyer loamy sand, Histosols and Aquolls, Houghton muck, Kosciusko sandy loam, Miami loam, Ormas loamy sand, Riddles fine sandy loam, Sebewa loam, and Wallkill silt loam. A copy of the *Custom Soil Resource Report for Kosciusko County, Indiana* has been included in Appendix B of this report.

VICINITY MAP (NOT TO SCALE)

NOTES

1. All boring locations were staked by the client and are approximate.
2. Vicinity map generated using imagery from google.com/maps.

N

LEGEND

PS-1
Test Boring Location and Designation

FIGURE 1 – APPROXIMATE BORING LOCATION MAP

Project Name: Proposed Pump Stations- Turkey Creek RSD

Location: Northshore and Eastshore Drives, Syracuse, IN

Client Name: Jones & Henry Engineers, Ltd.

GME Project Number: G21-070804

GME TESTING

APPENDIX B

GME TESTING

TEST BORING LOG

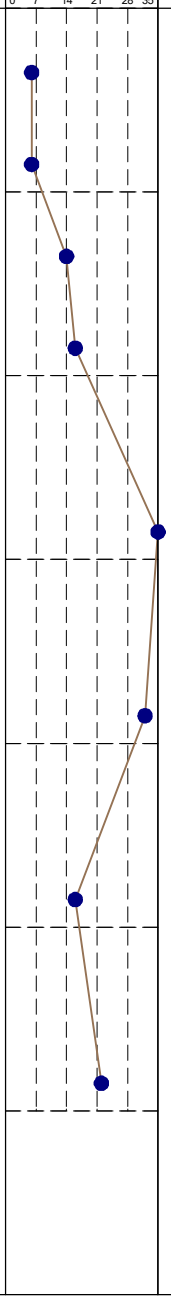
BORING NO.: **PS-1**
SHEET 1 OF 1
GME PROJECT NO: G21-070804
STRUCTURE
DATUM :
DATE STARTED : 07-27-21
DRILLER/INSP : DB/JS

CLIENT: Jones & Henry Engineers, Ltd.
PROJECT TYPE : Proposed Pump Stations- Turkey Creek RSD
LOCATION : Northshore and Eastshore Drives, Syracuse, Indiana

ELEVATION	:	BORING METHOD	: ASTM D-1586	LATITUDE	: 41.421846
STATION	:	RIG TYPE	: ATV	LONGITUDE	: -85.726614
OFFSET	:	CASING DIA.	: 3.3 in		
LINE	:	HAMMER	: Auto		
DEPTH	: 30.0 ft				

GROUNDWATER: ▽ Encountered at 6.0 ft ▼ At completion 5.0 ft ▨ Caved in at 9.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	N-Values	REMARKS
		±12" Brown, Organic TOPSOIL. 1.0								Woods
	2.5	FILL: Brown, Moist, Sandy Clay, Trace Gravel and Wood Fragments. 3.0	SS 1	4-3-3 (6)	100	14.5		2.5		
	5.0	Gray, Moist, Medium Coarse, SILTY SAND and GRAVEL.	SS 2	3-3-3 (6)	100	15.6				
	7.5	6.5	SS 3	5-5-9 (14)	100					
	10.0		SS 4	6-6-10 (16)	100					
	12.5	Brown and Gray, Wet, Fine to Medium Coarse SAND, Trace Gravel.								
	15.0		SS 5	6-15-20 (35)	100					
	17.5	17.0 Gray, SILTY CLAY, Occasional Sand Seams.								
	20.0	20.0	SS 6	10-15-17 (32)	100	21.4		3.0		
	22.5									
	25.0	Gray, Wet, CLAYEY SAND and GRAVEL.	SS 7	7-8-8 (16)	100					
	27.5	27.5 Gray, Moist, Fine SAND,								
	30.0	Occasional Clay Seams. 30.0	SS 8	9-10-12 (22)	100	18.6				
	32.5	Bottom of Boring at 30.0 ft								
	35.0									



GME TESTING

TEST BORING LOG

BORING NO.: **PS-2**
SHEET 1 OF 1
GME PROJECT NO: G21-070804
STRUCTURE
DATUM :
DATE STARTED : 07-27-21
DRILLER/INSP : DB/JS

CLIENT: Jones & Henry Engineers, Ltd.
PROJECT TYPE : Proposed Pump Stations- Turkey Creek RSD
LOCATION : Northshore and Eastshore Drives, Syracuse, Indiana

ELEVATION	:	BORING METHOD	: ASTM D-1586	LATITUDE	: 41.430938
STATION	:	RIG TYPE	: ATV	LONGITUDE	: -85.728483
OFFSET	:	CASING DIA.	: 3.3 in		
LINE	:	HAMMER	: Auto		
DEPTH	: 30.0 ft				

GROUNDWATER: ▽ Encountered at 19.0 ft ▼ At completion Dry ▨ Caved in at 19.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	N-Values	REMARKS
	0	±14" Brown, Sandy Clayey TOPSOIL.								Sod
	1.2		SS 1	5-5-4 (9)	100	11.3		2.0		
	2.5	Brown, Moist, SANDY CLAY, Trace Gravel.	SS 2	9-13-13 (26)	100	10.5		4.5		
	5.0		SS 3	10-14-17 (31)	100	10.0				
	7.5		SS 4	10-12-13 (25)	100	11.2				
	7.5									
	10.0									
	12.5		SS 5	10-13-13 (26)	100	14.0				
	15.0									
	17.5	Brown, Moist, Fine SAND, Trace Gravel								
	19.0	Wet Sand @±19'.	SS 6	15-16-17 (33)	100					
	20.0									
	22.5		SS 7	10-11-12 (23)	100					
	25.0									
	27.5		SS 8	9-15-16 (31)	100					
	30.0									
	30.0	Bottom of Boring at 30.0 ft								
	32.5									
	35.0									

N-Values: 0 7 14 21 28 35

GME TESTING

TEST BORING LOG

BORING NO.: **PS-3**
SHEET 1 OF 1
GME PROJECT NO: G21-070804
STRUCTURE
DATUM :
DATE STARTED : 07-27-21
DRILLER/INSP : DB/JS

CLIENT: Jones & Henry Engineers, Ltd.
PROJECT TYPE : Proposed Pump Stations- Turkey Creek RSD
LOCATION : Northshore and Eastshore Drives, Syracuse, Indiana

ELEVATION	:	BORING METHOD	: ASTM D-1586	LATITUDE	: 41.431742
STATION	:	RIG TYPE	: ATV	LONGITUDE	: -85.732525
OFFSET	:	CASING DIA.	: 3.3 in		
LINE	:	HAMMER	: Auto		
DEPTH	: 30.0 ft				

GROUNDWATER: ▽ Encountered at 20.0 ft ▼ At completion Dry ▨ Caved in at 16.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	N-Values	REMARKS
	0.0	±9" Brown, Sandy TOPSOIL. 0.8								Grass
	2.5	FILL: Dark Brown, Sand, Trace Gravel. 3.5	SS 1	4-5-3 (8)	100	8.8				
	5.0	FILL: Dark Brown, Clayey Sand, Trace Glass Fragments and Gravel.	SS 2	2-2-2 (4)	100	15.8				
	7.5	7.5	SS 3	4-2-2 (4)	0					
	10.0	Dark Brown, SILTY SAND. 10.0	SS 4	5-4-2 (6)	100	20.3				
	12.5									
	15.0		SS 5	6-6-7 (13)	100	15.6				
	17.5									
	20.0	Brown, Moist, Fine SAND	SS 6	6-5-3 (8)	100					
	22.5	Wet Sand @ ±20'.								
	25.0		SS 7	4-5-3 (8)	100					
	27.5									
	30.0	30.0	SS 8	5-6-3 (9)	100					
	32.5	Bottom of Boring at 30.0 ft								
	35.0									

N-Values: 0 7 14 21 28 35

GME TESTING

TEST BORING LOG

BORING NO.: **PS-4**
SHEET 1 OF 1
GME PROJECT NO: G21-070804
STRUCTURE
DATUM :
DATE STARTED : 07-27-21
DRILLER/INSP : RS/DM

CLIENT: Jones & Henry Engineers, Ltd.
PROJECT TYPE : Proposed Pump Stations- Turkey Creek RSD
LOCATION : Northshore and Eastshore Drives, Syracuse, Indiana

ELEVATION	:	BORING METHOD	: ASTM D-1586	LATITUDE	: 41.431521
STATION	:	RIG TYPE	: Skid	LONGITUDE	: -85.735787
OFFSET	:	CASING DIA.	: 3.3 in		
LINE	:	HAMMER	: Auto		
DEPTH	: 35.0 ft				

GROUNDWATER: ▽ Encountered at 21.0 ft ▼ At completion 21.5 ft ⊠ Caved in at 21.5 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	N-Values	REMARKS
		±8" Dark Brown, Moist, Silty Sand TOPSOIL. 0.7								Sod
		FILL: Dark Brown, Clay, Sand, Gravel and Asphalt Fragments Mixed. 3.0	SS 1	7-5-4 (9)	100	6.1				
	5	POSSIBLE FILL: Brown, Clayey Sand and Sandy Clay, Trace Gravel and Fine Roots. 8.5	SS 2	2-2-3 (5)	100	13.6				
			SS 3	3-4-4 (8)	100	14.1		1.5		
	10	Dark Brown, Moist, SILTY SAND. 11.0	SS 4	5-6-5 (11)	100	13.1				
	15	Brown, Moist, Fine SAND, Trace Gravel.	SS 5	4-5-5 (10)	100	6.3				
	20	21.0	SS 6	5-5-5 (10)	100	5.7				
	25	Brown, Wet, Fine to Medium Coarse SAND.	SS 7	4-3-4 (7)	100					
	30		SS 8	Void-- ()	100					
	35	35.0	SS 9	3-4-5 (9)	100					
	40	Bottom of Boring at 35.0 ft								

N-Values: 0 7 14 21 28 35

GME TESTING

TEST BORING LOG

BORING NO.: **PS-5**
SHEET 1 OF 1
GME PROJECT NO: G21-070804
STRUCTURE
DATUM :
DATE STARTED : 07-27-21
DRILLER/INSP : RS/DM

CLIENT: Jones & Henry Engineers, Ltd.
PROJECT TYPE : Proposed Pump Stations- Turkey Creek RSD
LOCATION : Northshore and Eastshore Drives, Syracuse, Indiana

ELEVATION	:	BORING METHOD	: ASTM D-1586	LATITUDE	: 41.432362
STATION	:	RIG TYPE	: Skid	LONGITUDE	: -85.74216
OFFSET	:	CASING DIA.	: 3.3 in		
LINE	:	HAMMER	: Auto		
DEPTH	: 30.0 ft				

GROUNDWATER: ▽ Encountered at 8.5 ft ▼ At completion 8.0 ft ▨ Caved in at 9.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	N-Values	REMARKS
		FILL: ±8" Brown, Moist, Gravelly Sand. 0.7								Sod
	2.5	FILL: Black, Gravelly Sand With Trace Asphalt Fragments. 2.5	SS 1	15-14-3 (17)	100	4.3				
	5.0	POSSIBLE FILL: Brown, Very Moist, Clayey Silty Sand, With Roots. 6.0	SS 2	1-1-1 (2)	100	14.0				
	7.5	Brown, SILTY SANDY CLAY, Trace Gravel. 8.5	SS 3	3-4-4 (8)	100	19.6	2.90	2.5		
	10.0		SS 4	2-6-6 (12)	100					
	12.5									
	15.0		SS 5	5-7-7 (14)	100					
	17.5	Gray, Wet, Fine, SILTY SAND, Trace Gravel.								
	20.0		SS 6	7-10-11 (21)	100					
	22.5									
	25.0		SS 7	10-11-13 (24)	100					
	27.5	27.5								
	30.0	Brown, Very Moist, Fine SAND. 30.0	SS 8	10-12-14 (26)	100	19.7				
	32.5	Bottom of Boring at 30.0 ft								
	35.0									

N-Values: 0 7 14 21 28 35

GENERAL NOTES

SAMPLE IDENTIFICATION

Visual soil classifications are made in general accordance with the United States Soil Classification System on the basis of textural and particle size categorization, and various soil behavior and characteristics. Visual classifications should be made by appropriate laboratory testing when more exact soil identification is required to satisfy specific project applications criteria.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Term	Defining Range by % of Weight
Trace	1-10 %
Little	11-20 %
Some	21-35 %
And	36-50 %

WATER LEVEL MEASUREMENT

NE	No Water Encountered
BF	Backfilled upon Completion

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	LOI
w/ organic matter	4-15 %
Organic Soil (A-8)	16-30 %
Peat (A-8)	More than 30%

LABORATORY TESTS

Qp	Penetrometer Reading, tsf
Qu	Unconfined Strength, tsf
MC	Moisture Content, %
LL	Liquid Limit, %
PL	Plastic Limit, %
PI	Plastic Index
SL	Shrinkage Limit, %
pH	Measure of Soil Alkalinity/Acidity
γ	Dry Unit Weight, pcf
LOI	Loss of Ignition, %

DRILLING AND SAMPLING SYMBOLS

AS	Auger Sample
BS	Bag Sample
PID	Photo ionization Detector (Hnu meter) volatile vapor level,(PPM)
COA	Clean-Out Auger
CS	Continuous Sampling
FA	Flight Auger
HA	Hand Auger
HAS	Hollow Stem Auger
NR	No Recovery
PT	3” O.D. Piston Tube Sample
RB	Rock Bit
RC	Rock Coring
REC	Recovery
RQD	Rock Quality Designation
RS	Rock Sounding
S	Soil Sounding
SS	2”O.D. Split-Barrel Sample
2ST	2”O.D. Tin-Walled Tube Sample
3ST	3” O.D. Thin-Walled Tube Sample
VS	Vane Shear Test
DB	Diamond Bit
WS	Wash Sample
RB	Roller Bit
ST	Shelby Tube, 2” O.D. or 3” O.D.
CB	Carbide Bit
WOH	Weight of the Hammer

GRAIN SIZE TERMINOLOGY

Soil fraction	Particle size	Us standard sieve size
Boulders	larger than 75 mm	Larger than 3”
Gravel	2mm to 75 mm	#10 to 75 mm
Coarse Sand	0.425 mm to 2 mm	#40 to #10
Fine Sand	0.075mm to 0.425 mm	#200 to #40
Silt	0.002 mm to 0.075 mm	Smaller than #200
Clay	Smaller than 0.002 mm	Smaller than #200

RELATIVE DENSITY

Term	“N” Value
Very Loose	0-5
Loose	6-10
Medium Dense	11-30
Dense	31-50
Very Dense	51+

CONSISTENCY

Term	“N” Value
Very Soft	0-3
Soft	4-5
Medium Stiff	6-10
Stiff	11-15
Very Stiff	16-30
Hard	31+

PLASTICITY

Term	Plastic Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High/Very High	Over 22

Note(s):
The penetration resistance, “N” Value, is the summation of the number of blows required to effect two successive 6-inch penetrations of the 2-inch split-barrel sampler. The sampler is driven with a 140-lb. weight falling 30-inches and is seated to a depth of 6-inches before commencing the standard penetration test.
Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils

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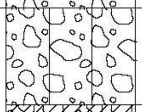
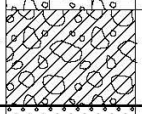
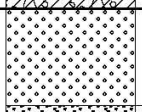
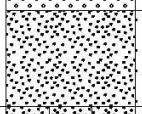
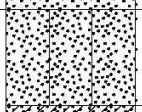
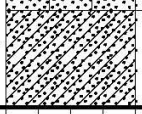
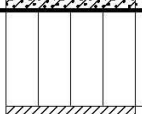
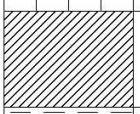
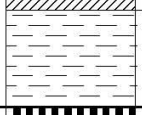
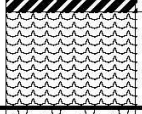
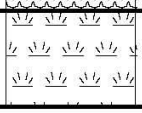
SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

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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 Kosciusko County, Indiana

August 11, 2021

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 (https://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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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

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 1:20,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Kosciusko County, Indiana
Survey Area Data: Version 23, Jun 4, 2020

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

Date(s) aerial images were photographed: Feb 14, 2012—Dec 27, 2016

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ao	Aquents-Urban land complex, rarely flooded	4.7	5.6%
Bc	Barry loam	2.2	2.6%
BoB	Boyer loamy sand, 1 to 6 percent slopes	0.4	0.4%
He	Histosols and Aquolls	0.1	0.1%
Ht	Houghton muck, undrained, 0 to 1 percent slopes	2.3	2.7%
KoA	Kosciusko sandy loam, 0 to 2 percent slopes	3.4	3.9%
KoB	Kosciusko sandy loam, 2 to 6 percent slopes	0.0	0.0%
MlB	Miami loam, 2 to 6 percent slopes	6.0	7.0%
MlC	Miami loam, 6 to 12 percent slopes	0.9	1.1%
OrA	Ormas loamy sand, 0 to 2 percent slopes	13.6	15.9%
RlA	Riddles fine sandy loam, 0 to 2 percent slopes	1.0	1.2%
RlB	Riddles fine sandy loam, 2 to 6 percent slopes	40.0	46.9%
RlC	Riddles fine sandy loam, 6 to 12 percent slopes	7.2	8.4%
Se	Sebewa loam, drained, 0 to 1 percent slopes	0.6	0.7%
Wa	Wallkill silt loam	3.0	3.5%
Totals for Area of Interest		**85.3**	**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.

Kosciusko County, Indiana

Ao—Aquents-Urban land complex, rarely flooded

Map Unit Setting

National map unit symbol: 5dcm
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Aquents and similar soils: 60 percent
Urban land: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Aquents

Setting

Landform: Outwash plains, till plains, moraines
Parent material: Loamy drift

Typical profile

H1 - 0 to 60 inches: variable

Properties and qualities

Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Depth to water table: More than 80 inches
Frequency of flooding: RareVery rare
Frequency of ponding: Rare
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: No

Description of Urban Land

Setting

Landform: Outwash plains

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Bc—Barry loam

Map Unit Setting

National map unit symbol: 5dcq
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Barry and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barry

Setting

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

Typical profile

Ap - 0 to 8 inches: loam
A - 8 to 15 inches: loam
Bg1,Bg2,Bg3 - 15 to 50 inches: sandy clay loam
C - 50 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 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 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: R111CY005IN - Glacial Depression
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

BoB—Boyer loamy sand, 1 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2t6l4
Elevation: 700 to 1,250 feet
Mean annual precipitation: 32 to 40 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 120 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Boyer and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boyer

Setting

Landform: Moraines, terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope, tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Loamy outwash and/or sandy outwash over sandy and gravelly outwash

Typical profile

Ap - 0 to 9 inches: loamy sand
E - 9 to 17 inches: loamy sand
Bt - 17 to 30 inches: sandy loam
2C - 30 to 79 inches: stratified coarse sand to gravelly sand to very gravelly sand

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Ecological site: F111BY404IN - DRY OUTWASH UPLAND
Hydric soil rating: No

Minor Components

Oshtemo
Percent of map unit: 9 percent
Landform: Stream terraces, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Linear
Across-slope shape: Convex, linear
Ecological site: F111BY404IN - DRY OUTWASH UPLAND
Hydric soil rating: No

Bronson
Percent of map unit: 6 percent
Landform: Moraines, stream terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: F111BY404IN - DRY OUTWASH UPLAND
Hydric soil rating: No

He—Histosols and Aquolls

Map Unit Setting
National map unit symbol: 5ddb
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition
Histosols, undrained, and similar soils: 80 percent
Aquolls, undrained, and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Histosols, Undrained

Setting
Landform: Depressions on outwash plains, depressions on terraces, depressions on till plains, depressions on moraines
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Herbaceous organic material

Typical profile
Oa - 0 to 60 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: Frequent

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: Yes

Description of Aquolls, Undrained

Setting

Landform: Depressions on outwash plains, depressions on terraces, depressions on till plains, depressions on moraines
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy drift

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: Frequent

Interpretive groups

Land capability classification (irrigated): None specified
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Ht—Houghton muck, undrained, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2w64n
Elevation: 750 to 1,020 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 230 days
Farmland classification: Not prime farmland

Map Unit Composition

Houghton, undrained, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houghton, Undrained

Setting

Landform: Depressions on outwash plains, lake plains, till plains, moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Herbaceous organic material

Typical profile

Oa1 - 0 to 12 inches: muck
Oa2 - 12 to 35 inches: muck
Oa3 - 35 to 80 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 0.6
Available water capacity: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F098XA006MI - Mucky Depressions, R111BY003IN - DEEP MUCK
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Minor Components

Granby, undrained

Percent of map unit: 7 percent
Landform: Depressions on outwash plains, lake plains, till plains, moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: R110XY015IL - Wet Sand Prairie
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Edwards, undrained

Percent of map unit: 1 percent
Landform: Depressions on outwash plains, lake plains, till plains, moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope

Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: R111BY002IN - LIMNIC MUCK
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Adrian, undrained

Percent of map unit: 1 percent
Landform: Depressions on outwash plains, lake plains, till plains, moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: R111BY001IN - MINERAL MUCK
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Wallkill, undrained

Percent of map unit: 1 percent
Landform: Moraines, depressions on outwash plains, lake plains, till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Linear
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

KoA—Kosciusko sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 5ddg
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kosciusko and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kosciusko

Setting

Landform: Outwash plains, moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy outwash over sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 13 inches: sandy loam
Bt2 - 13 to 22 inches: gravelly sandy clay loam
Bt3 - 22 to 34 inches: gravelly sandy clay loam
2BC - 34 to 39 inches: gravelly loamy sand
2C - 39 to 60 inches: stratified very gravelly coarse sand to coarse sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Available water capacity: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

KoB—Kosciusko sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 5ddh
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kosciusko and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kosciusko

Setting

Landform: Outwash plains, moraines
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Loamy outwash over sandy and gravelly outwash

Typical profile

Ap - 0 to 8 inches: sandy loam
Bt1 - 8 to 13 inches: sandy loam
Bt2 - 13 to 22 inches: gravelly sandy clay loam
Bt3 - 22 to 34 inches: gravelly sandy clay loam
2BC - 34 to 39 inches: gravelly loamy sand
2C - 39 to 60 inches: stratified very gravelly coarse sand to coarse sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 24 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Available water capacity: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

MIB—Miami loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2wp1m
Elevation: 670 to 1,180 feet
Mean annual precipitation: 37 to 39 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 150 to 170 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Miami and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Miami

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Side slope

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 9 inches: loam
Bt1 - 9 to 13 inches: loam
Bt2 - 13 to 31 inches: clay loam
BCt - 31 to 36 inches: loam
Cd - 36 to 79 inches: loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 35 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
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 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F111BY503IN - TILL RIDGE
Hydric soil rating: No

Minor Components

Crosier

Percent of map unit: 9 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F111BY502IN - WET TILL RIDGE
Hydric soil rating: No

Brookston

Percent of map unit: 6 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Ecological site: F111BY501IN - TILL DEPRESSION
Hydric soil rating: Yes

MIC—Miami loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2wp1p
Elevation: 670 to 1,180 feet
Mean annual precipitation: 37 to 39 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 150 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Miami and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Miami

Setting

Landform: Moraines
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 8 inches: loam
Bt1 - 8 to 13 inches: loam
Bt2 - 13 to 30 inches: clay loam
BCt - 30 to 35 inches: loam
Cd - 35 to 79 inches: loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 33 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: High
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 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

Ecological site: F111BY503IN - TILL RIDGE
Hydric soil rating: No

Minor Components

Crosier
Percent of map unit: 9 percent
Landform: Moraines
Landform position (two-dimensional): Shoulder, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F111BY502IN - WET TILL RIDGE
Hydric soil rating: No

Brookston
Percent of map unit: 6 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Ecological site: F111BY501IN - TILL DEPRESSION
Hydric soil rating: Yes

OrA—Ormas loamy sand, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 5df8
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition
Ormas and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ormas

Setting
Landform: Outwash plains, stream terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy over loamy outwash over sandy and gravelly outwash

Typical profile
Ap - 0 to 10 inches: loamy sand

E1 - 10 to 22 inches: loamy sand
E2 - 22 to 34 inches: sand
Bt1,2Bt2 - 34 to 48 inches: gravelly coarse sandy loam
2C1 - 48 to 52 inches: gravelly coarse sand
2C2 - 52 to 60 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 45 to 75 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

RIA—Riddles fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2yc50
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Riddles and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Riddles

Setting

Landform: Ground moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wisconsin sandy and loamy till derived from limestone and shale

Typical profile

Ap - 0 to 11 inches: fine sandy loam
Bt1 - 11 to 31 inches: loam
Bt2 - 31 to 40 inches: loam
C - 40 to 79 inches: fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F111CY007IN - Glacial Ridge, R111CY010IN - Well Drained Overflow
Hydric soil rating: No

Minor Components

Crosier

Percent of map unit: 5 percent
Landform: Ground moraines
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: R111CY006IN - Flat Glacial Ridge
Hydric soil rating: No

Ormas

Percent of map unit: 5 percent
Landform: Outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R111CY001IN - Sand Dune
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Miami

Percent of map unit: 5 percent
Landform: Ground moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F111CY007IN - Glacial Ridge

Hydric soil rating: No

Brookston, frequently ponded

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Ecological site: R111CY005IN - Glacial Depression
Hydric soil rating: Yes

RIB—Riddles fine sandy loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2yc4z
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Riddles and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Riddles

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wisconsin sandy and loamy till derived from limestone and shale

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bt1 - 10 to 31 inches: loam
Bt2 - 31 to 40 inches: loam
C - 40 to 79 inches: fine sandy loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water capacity: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F111CY007IN - Glacial Ridge, R111CY010IN - Well Drained Overflow
Hydric soil rating: No

Minor Components

Miami

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: F111CY007IN - Glacial Ridge
Hydric soil rating: No

Brookston, frequently ponded

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave, linear
Ecological site: R111CY005IN - Glacial Depression
Hydric soil rating: Yes

Crosier

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: R111CY006IN - Flat Glacial Ridge
Hydric soil rating: No

Ormas

Percent of map unit: 5 percent
Landform: Outwash terraces
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R111CY001IN - Sand Dune
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

RIC—Riddles fine sandy loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 5dfp
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Riddles and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Riddles

Setting

Landform: Till plains, moraines
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bt1,Bt2,Bt3 - 8 to 43 inches: loam
BC - 43 to 48 inches: loam
C - 48 to 60 inches: loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water capacity: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F111CY007IN - Glacial Ridge, R111CY010IN - Well Drained Overflow
Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: No

Se—Sebewa loam, drained, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2v2cb
Elevation: 770 to 950 feet
Mean annual precipitation: 30 to 41 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Sebewa, drained, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sebewa, Drained

Setting

Landform: Drainageways, outwash fans
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave, linear
Parent material: Loamy drift over sandy and gravelly outwash

Typical profile

Ap - 0 to 11 inches: loam
Btg1 - 11 to 21 inches: clay loam
Btg2 - 21 to 33 inches: clay loam
2Cg - 33 to 80 inches: sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: 23 to 39 inches to strongly contrasting textural stratification
Drainage class: Poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.01 to 1.42 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 3.0
Available water capacity: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Minor Components

Rensselaer, drained
Percent of map unit: 10 percent
Landform: Depressions on outwash plains
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Homer
Percent of map unit: 5 percent
Landform: Outwash plains
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Wa—Wallkill silt loam

Map Unit Setting
National map unit symbol: 5dg5
Elevation: 600 to 1,150 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Wallkill and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wallkill

Setting
Landform: Depressions on moraines, depressions on till plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loamy slope alluvium over herbaceous organic material

Typical profile

A - 0 to 8 inches: silt loam
ACg - 8 to 18 inches: silt loam
Cg - 18 to 24 inches: silt loam
2Oa1 - 24 to 34 inches: muck
2Oa2 - 34 to 48 inches: muck
2Oa3 - 48 to 60 inches: muck

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Available water capacity: Very high (about 18.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B/D
Ecological site: R111CY011IN - Limnic Muck
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

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