Subsurface Investigation & Geotechnical Recommendations

Proposed 21,060 SF Building Addition
Edinburgh, Indiana
A&W Project No.: 22IN0453

Prepared For:
Runnebohm Construction Company, Inc.
Shelbyville, Indiana

Prepared By:
Alt & Witzig Engineering, Inc.
Geotechnical Division

July 25, 2022

Alt & Witzig Engineering, Inc.
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July 25, 2022

Runnebohm Construction Company, Inc.
144 East Rampart Street
Shelbyville, Indiana 46176
Attn: Mr. Michael Runnebohm

Report of Subsurface Investigation and Geotechnical Recommendations

RE: Proposed 21,060 SF Building
Sonoco Flexible Packaging
Edinburgh, Indiana
Alt & Witzig File: 22IN0453

Dear Mr. Runnebohm:

In compliance with your request, we have conducted a subsurface investigation and geotechnical evaluation for the above referenced project. It is our pleasure to transmit an electronic copy of the report.

The purpose of this subsurface investigation was to provide criteria for use by the design engineers in assessing the site for construction and determination of appropriate foundation types. A detailed discussion of our subsurface investigation results and recommendations are presented herein.

We appreciated the opportunity to work with you on this project. Often, because of design and construction details that occur on a project, questions arise concerning the soil conditions. If we can give further service in these matters, please contact us at your convenience.

Sincerely,
Alt & Witzig Engineering, Inc.

Jacob L. Rankin, M.Eng., P.E.

David C. Harness, P.E.

DAVID C. HARNESS
REGISTERED
No. 19800337
STATE OF INDIANA
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Subsurface Investigation and Foundation Engineering
Construction Materials Testing and Inspection
Environmental Services

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INTRODUCTION

This report presents the results of a subsurface investigation performed for the proposed 21,060 SF building addition to the Sonoco Flexible Packaging facility in Edinburgh, Indiana. Our investigation was conducted for Runnebohm Construction Company, Inc. of Shelbyville, Indiana. Authorization to perform this investigation was in the form of a proposal prepared by Alt & Witzig Engineering, Inc. (Alt & Witzig Proposal: *2206G040)* that was accepted by Michael Runnebohm of Runnebohm Construction Company, Inc.

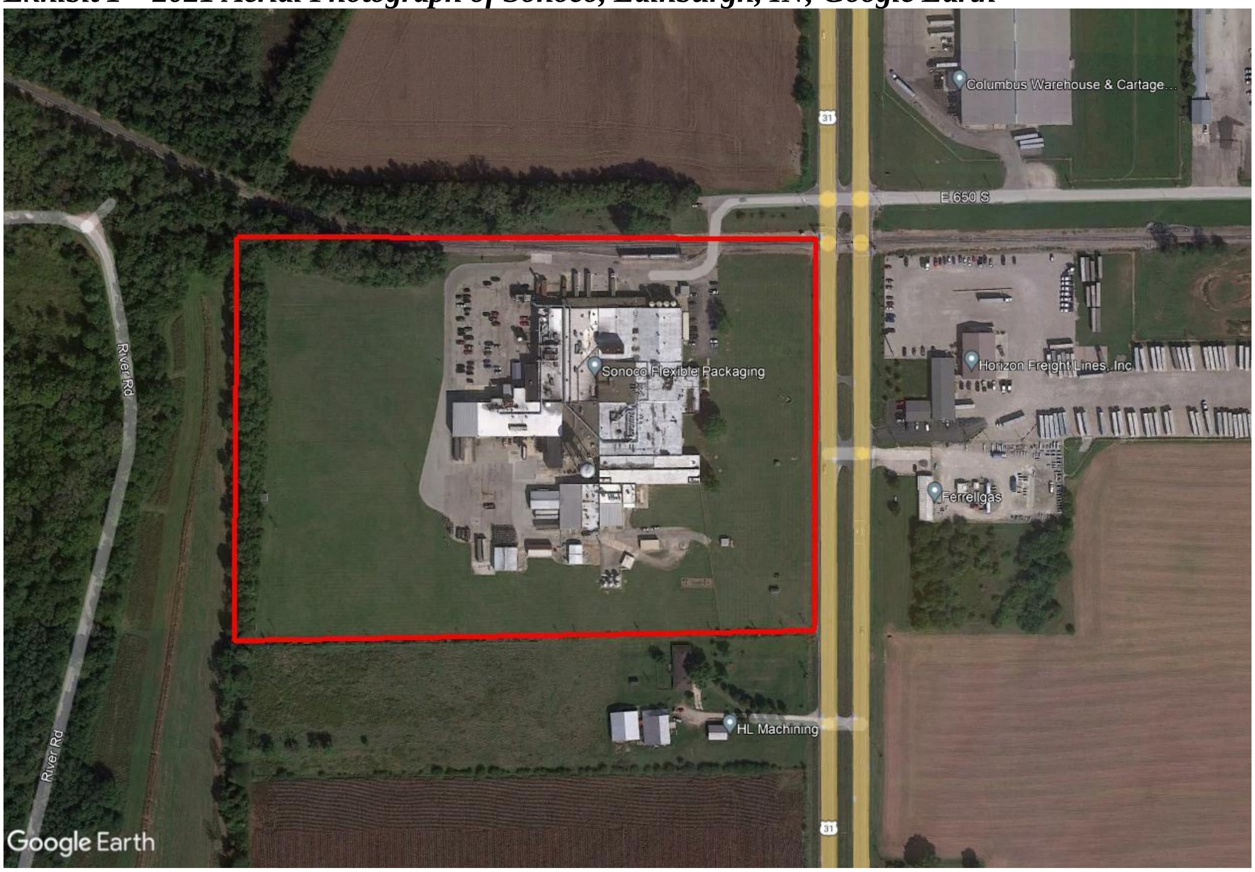
The scope of this investigation included a review of geological maps of the area and a review of geologic and related literature, a reconnaissance of the immediate site, a subsurface exploration, field and laboratory testing, and an engineering analysis and evaluation of the materials.

The purpose of this subsurface investigation was to provide soil bearing criteria for use in designing the foundations for the proposed addition. The scope of this investigation did not specifically or by any implication provide an environmental assessment of the site.

DESCRIPTION OF SITE

The site is located at 6502 S Hwy 31, in Edinburgh, Indiana. An aerial photograph of the Sonoco Flexible Packaging facility taken in 2021 is provided in *Exhibit 1,* below.

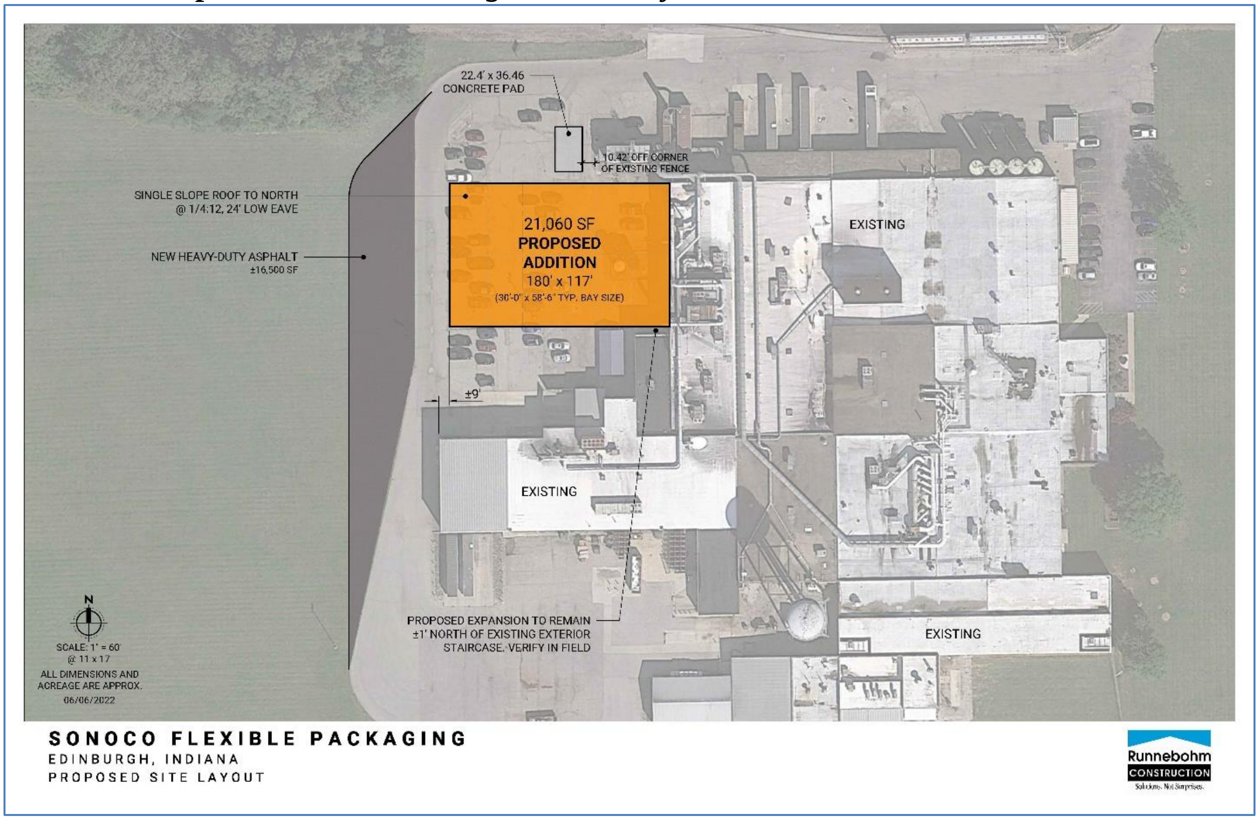
Exhibit 1 – 2021 Aerial Photograph of Sonoco, Edinburgh, IN; Google Earth



Site Description

The site is relatively flat with a slight slope from west to east, with an estimated elevation difference of four (4) feet across the site. The approximate elevation of the site ranges between 681 feet to 677 feet, per Google Earth. The area of the addition is shown in Exhibit 2. The document shown in Exhibit 2 was provided by the client and is entitled “Proposed Site Layout.”

Exhibit 2 – Proposed Site and Building Addition Layout; Not to Scale



Ground cover across the building addition site during drilling operations consisted of asphalt pavements. The soil boring locations were at the approximate corners of the addition and appeared to have less than 2 feet of relief across the proposed addition. Drainage on the site appears to be routed to storm drains located within the existing parking and drive areas.

FIELD INVESTIGATION

Boring Locations

The boring locations were selected by the client and were marked in the field by a representative of the client prior to our arrival. Field investigations included a reconnaissance of the project site and performing four (4) soil borings, located approximately as shown on the *Boring Location Plan*, performing standard penetration tests, and obtaining soil samples retained in the standard spilt-spoon sampler for further laboratory testing. The apparent groundwater level at each boring location was also determined.

Drilling and Sampling Procedures

The soil borings were drilled using a truck-mounted drilling rig equipped with a rotary head. Hollow-stem augers were used to advance the holes. The advancement of the borings was temporarily stopped at regular intervals in order to perform standard penetration tests in accordance with ASTM Procedure D-1586 to obtain the standard penetration value of the soil.

The standard penetration test involves driving a split spoon soil sampler into the ground by dropping a 140-pound hammer, thirty (30) inches. The number of hammer drops required to advance the split-spoon sampler one (1) foot into the soil is defined as the standard penetration value. The soil samples retained in the split-spoon sampling device as a result of the penetration tests were obtained, classified, and labeled for further laboratory investigation.

Water Level Measurements

The apparent groundwater level at each boring location was measured during and upon completion of the drilling operations. These water level measurements consisted of observing the depth at which water was encountered on the drilling rods during the soil sampling procedure and measuring the depth to the top of any water following removal of the hollow stem augers. It should be noted that the groundwater level measurements recorded on the individual *Boring Logs* in Appendix A of this report are accurate only for the specific dates on which the measurements were performed. It must be understood that the groundwater levels will fluctuate throughout the year and the *Boring Logs* do not indicate these fluctuations.

LABORATORY INVESTIGATION

In addition to field investigations, a supplemental laboratory investigation was conducted to ascertain additional pertinent engineering characteristics of the subsurface materials. The laboratory-testing program included:

- Classification of soils in general accordance with ASTM D-2488
- Moisture content tests in general accordance with ASTM D-2216
- Samples of the cohesive soil were frequently tested in unconfined compression by use of a calibrated spring testing machine.
- A soil Penetrometer was used as an aid in determining the strength of the soil.

The values of the unconfined compressive strength as determined on soil samples from the split-spoon sampling must be considered, recognizing the manner in which they were obtained since the split-spoon sampling techniques provide a representative but somewhat disturbed soil sample.

SUBSURFACE CONDITIONS

General

The types of foundation materials encountered have been visually classified and are described in detail on the *Boring Logs*. The results of the field penetration tests, strength tests, water level observations and laboratory water contents are presented on the *Boring Logs* in numerical form. Representative samples of the soils encountered in the field were placed in sample jars and are now stored in our laboratory for further analysis if desired. Unless notified to the contrary, all samples will be disposed of after two (2) months.

Soil Conditions

The borings encountered approximately 3 inches of asphalt pavement underlain by 3 to 6 inches of gravelly subbase. Beneath the pavement layer, the borings generally encountered 2 to 4 feet of soft to medium stiff sandy clay material. All borings then encountered moist to wet, loose to medium dense, sand below this upper sandy clay to the termination depth of the borings at twenty-five (25) feet.

Detailed soil descriptions at each boring location have been included on the *Boring Logs* in Appendix A of this report.

According to the *Soil Survey of Johnson County, Indiana* published by the United States Department of Agriculture Soil Conservation Service, the shallow natural soil covering this site is classified as Ockley loam (ObaA). These soils are characterized by shallow clay loam underlain by sand at depths of 44-79 inches below the natural ground surface. The soil boring information is consistent with the mapped soil type. The *Custom Soil Resource Report for Johnson County, Indiana* has been included in Appendix B.

Bedrock Geology

Geologic maps published by the Indiana Geological Survey indicate the bedrock at this site consists of the New Albany Shale of the Devonian-Mississippian age. The approximate elevation of this bedrock is 600 feet, which is approximately 80 feet below the existing ground surface.

Seismic Consideration

Based on the field and laboratory tests performed on the subsurface materials and an assumption that the bedrock surface is at a depth of 80 feet, this site should be considered a Site Class D in accordance with the current Indiana Building Code.

Maximum spectral response acceleration values of Ss=0.169 g and S_1=0.091 g are recommended for seismic design. Although the site is underlain by sand with a relatively high groundwater table, the risk for liquefaction induced settlements during a seismic event is low due to the density of the sands encountered.

Groundwater

The soil borings encountered wet soil conditions at depths ranging from 13 to 16 feet below existing grade. Upon completion, the soil borings caved between the depths of 12 and 19 feet. The hole generated by our drilling will typically cave when the hollow stem augers are removed from the borehole at or near the elevation of the groundwater level. Based on the four borings conducted at the site and the limited groundwater information, we recommend that a design groundwater depth of 12 feet (approximate elevation 668 feet) be used.

The *Soil Survey of Johnson County, Indiana* indicates that the groundwater table remains at a depth greater than 80 inches throughout the year. Again, it should be noted that the groundwater level measurements recorded on the individual *Boring Logs* included in Appendix B of this report, are accurate **only** for the dates on which the measurements were performed.

GEOTECHNICAL ANALYSIS & RECOMMENDATIONS

Project Description

Provided plans indicate the proposed building will be an approximately 21,060 square foot, slab-on-grade structure. The location of the soil borings in relation to the layout of the site is shown on the enclosed *Boring Location Plan*.

Grading plans were not available at the time of this report. Based on the existing topography of the site, approximately one (1) foot of relief exists across the footprint of the proposed addition. As such, it is expected that minor fills will be necessary to achieve design grade of the building footprint.

Structural loads were not available at the time of this report; however, it was assumed for analysis purposes that the structure will be constructed with maximum column and wall loads not exceeding 150 kips and 4 klf, respectively. Once final design loads and grading plans are available, they should be submitted to Alt & Witzig Engineering, Inc. for review. After a review of this information, it will be determined if changes to these recommendations are warranted.

Foundation Recommendations

We recommend conventional spread and continuous wall footings be founded on the sand strata present at a depth of approximately 4 feet below the existing pavements.

Conventional Footings

Due to the presence of the granular soils at this site, after the excavations for foundations reach the sand bearing stratum, it is recommended that 2 passes with a plate compactor be used to densify and firm the base of all footing excavations. A net allowable bearing pressures of **2,000 psf** is recommended for dimensioning spread footings and continuous wall footings, provided they are founded on this sand bearing stratum. If loads differ from the assumed 150 kips for maximum column loads, alternate foundation recommendations may be necessary.

It is recommended that a representative of Alt & Witzig Engineering, Inc. inspect all foundation excavations prior to the placement of concrete. At the time of this inspection, Housel penetrometer or other approved tests may be performed in order to confirm that suitable materials are present.

General

The above recommended bearing pressure will help reduce total settlements associated with footings founded on soil with varying densities across the building pad. Using the above-mentioned bearing pressure and recommendations for limiting settlements, total settlements of less than one (1) inch and differential settlements of one half (½) inch or less can be anticipated. In utilizing the above-mentioned net allowable pressure for dimensioning footings, it is necessary to consider only those loads applied above the finished floor elevation.

In order to alleviate the effects of seasonal variation in moisture content on the behavior of the footings and eliminate the effects of frost action, all exterior foundations should be founded a minimum of three (3) feet below the final grade.

Some modifications to the recommendations provided in this report may be necessary based on potential complications or modifications to the design plan. The modifications may influence the overall cost of the project and construction sequence. If complications become apparent to the design team or owner, this information should be provided to Alt & Witzig Engineering, Inc. at the earliest possible date.

Floor Slab Recommendations

In those areas where the existing grade is below the final floor elevation, a well-compacted structural fill will be necessary to raise the site to the desired grade. We recommend granular fills be used to elevate the building pad. The existing pavements may remain in place below the new structural fills and floor slab. However, storm lines and other utilities that will be rerouted or terminated should be properly abandoned within the footprint of the addition. Prior to elevating the site, the existing ground surface must be proofrolled with approved equipment. It is recommended that a representative of Alt & Witzig Engineering, Inc. be present to determine the exact depth of undercutting and to monitor backfilling operations if necessary.

After the building area has been raised to the proper elevation, a layer of free draining granular material should be placed immediately beneath all floor slabs. It is recommended that the materials within the subgrade area, above footing elevation, be compacted to a minimum density of 93 percent of maximum density in accordance with ASTM D-1557.

CONSTRUCTION CONSIDERATIONS

Site Preparation

Excessively organic topsoil and loose dumped fill materials will generally undergo high volume changes that are detrimental to the behavior of pavements, floor slabs, structural fills, and foundations placed upon them.

It should be noted that the soil borings only indicate the approximate asphalt thickness at their specific locations. Borings do not indicate variations in the thickness of this layer between selected locations. Thus, borings only provide a general indication of the amount of asphalt and subbase material. As indicated in the floor slab section of this report, the existing asphalt pavements may remain in place. However, it is recommended that the pavements be punctured or perforated to allow for drainage of the new fills during construction.

It is recommended that the subgrade be proofrolled with approved equipment prior to placing new fills. This proofrolling will determine where areas of soft unsuitable materials are encountered. Due to the clayey subgrade and thin asphalt pavements, it is possible that some areas may not favorably pass a proofroll inspection. Several areas of alligator cracking were evident during our field investigation. It is recommended that a representative of Alt & Witzig Engineering, Inc. be present for this phase of this project.

After the existing subgrade soils are excavated to design grade, proper control of subgrade compaction and fill, and structural fill replacement should be maintained in accordance with the *Recommended Specifications for Compacted Fills and Backfills*, presented in Appendix A of this report; thus minimizing volume changes and differential settlements which are detrimental to behavior of shallow foundations and floor slabs.

Groundwater

Depending upon the time of the year and the weather conditions when the excavations are made, seepage from surface runoff may occur into shallow excavations or soften the subgrade soils. Since the sidewall materials tend to slough when exposed to free water, every effort should be made to keep the excavations dry should water be encountered.

It is also recommended that all concrete for footings be poured the same day the excavations are made. If this is not possible it should be anticipated that a mud mat will be necessary to protect the foundation soils from water seepage, weather, and construction activity.

STATEMENT OF LIMITATIONS

This report is solely for the use of Runnebohm Construction Company, Inc. and any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties for other uses. This report shall only be presented in full and may not be used to support any other objectives than those set out in the scope of work, except where written approval and consent are provided by Runnebohm Construction Company, Inc. and Alt & Witzig Engineering, Inc.

An inherent limitation of any geotechnical engineering study is that conclusions must be drawn based on data collected at a limited number of discrete locations. The geotechnical parameters provided in this report were developed from the information obtained from the test borings that depict subsurface conditions only at these specific locations and on the date indicated on the boring logs. Soil conditions at other locations may differ from conditions encountered at these boring locations and groundwater levels shall be expected to vary with time. The nature and extent of variations between the borings may not become evident until the course of construction.

The exploration and analysis reported herein is considered in sufficient detail and scope to form a reasonable basis for initial design. No structural loading or specific details about the building addition were provided. The recommendations submitted are based on the available soil information and assumed design details enumerated in this report. If actual design details differ from those specified in this report, this information should be brought to the attention of Alt & Witzig Engineering, Inc. so that it may be determined if changes in the foundation recommendations are required.

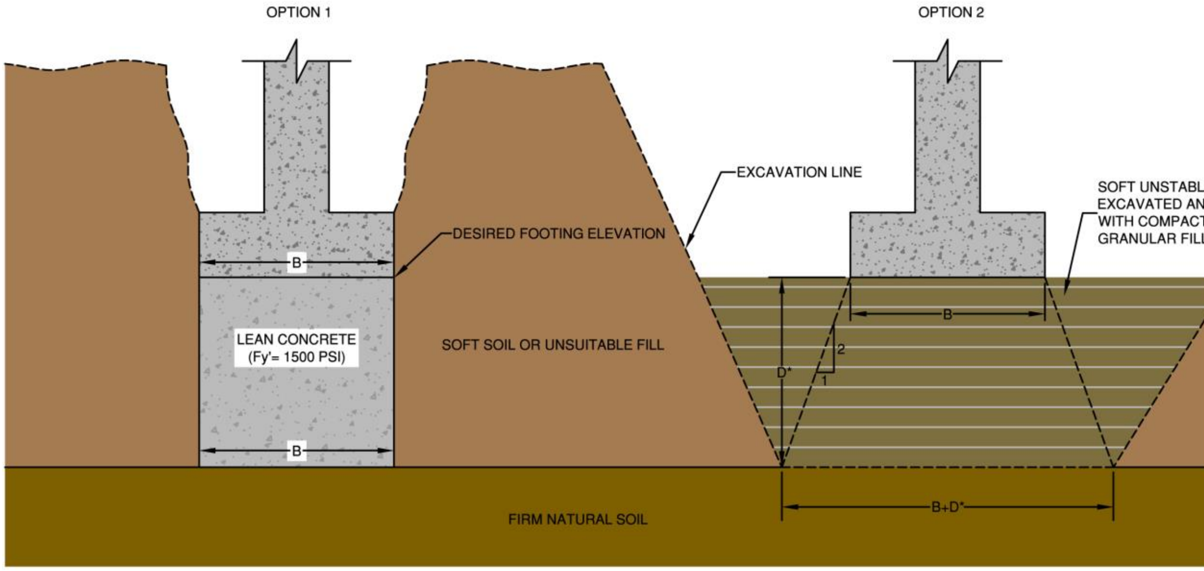
APPENDIX A

Recommended Specifications for Compacted Fills and Backfills
Undercut Detail for Footing Excavation in Unstable Materials
Boring Location Plan
Boring Logs
General Notes

RECOMMENDED SPECIFICATIONS FOR COMPACTED FILLS AND BACKFILLS

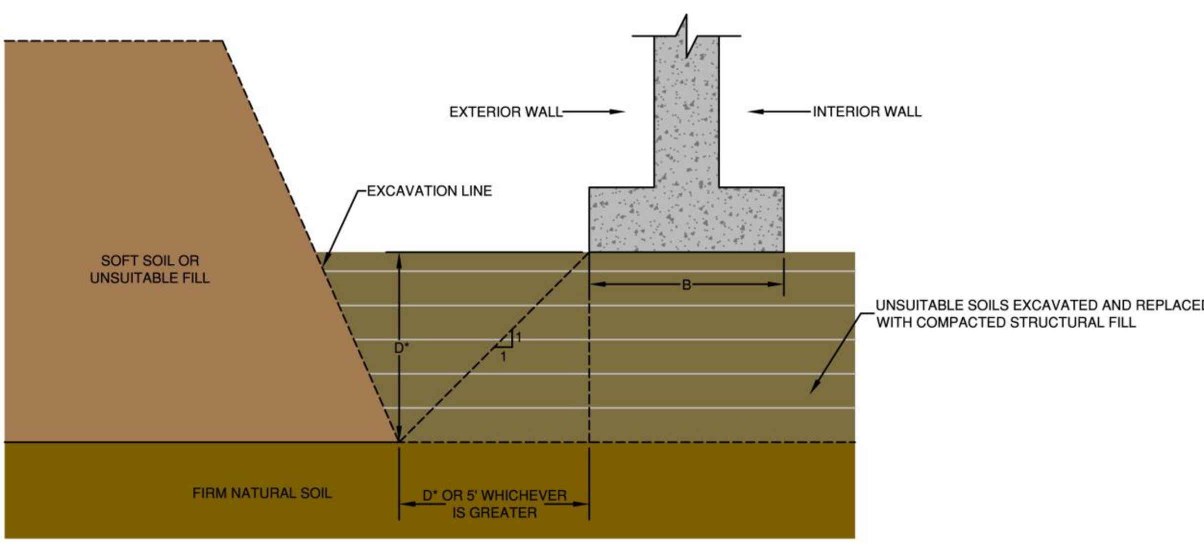
All fill shall be formed from material free of vegetable matter, rubbish, large rock, and other deleterious material. Prior to placement of fill, a sample of the proposed fill material should be submitted to Alt & Witzig Engineering, Inc. for approval. The surface of each layer will be approximately 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. 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. The addition of water may be required if the fill is below moisture content that will permit compaction. All fill should be compacted to the specified percent of the maximum density obtained in accordance with ASTM density Test D-1557 (95 percent of maximum dry density below the base of footing elevation, 93 percent of maximum dry density beneath floor slabs and pavements). 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 retested as required until the specified limits are reached.

UNDERCUT EXCAVATION FOR ISOLATED FOOTINGS IN UNSTABLE MATERIALS



D* IS DEPTH FOR SUITABLE SOILS

MASS EXCAVATION FOR FOOTINGS IN UNSTABLE MATERIALS



D* IS DEPTH FOR SUITABLE SOILS

Undercut Detail for Footing Excavation in Unstable Material

PROJECT: **Proposed Commercial Building**
LOCATION: Eginburgh, IN
CLIENT: **Runnebohm Construction Company, Inc.**
A&W File No.: 22IN0453

Alt & Witzig Engineering Inc.
4105 W. 99th Street ·Carmel, IN 46032
TEL (317)875-7000 · FAX (317) 876-3705
www.altwitzig.com

BORING LOCATION PLAN

PROJECT: **Proposed Commercial Building**
LOCATION: Eginburgh, IN
CLIENT: **Runnebohm Construction Company, Inc.**
A&W File No.: 22IN0453

Alt & Witzig Engineering Inc.
4105 W. 99th Street ·Carmel, IN 46032
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www.altwitzig.com

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **Runnebohm Construction Company, Inc.**
PROJECT NAME **Proposed Commercial Building**
PROJECT LOCATION **Edinburgh, IN**

BORING # **B-1**
ALT & WITZIG FILE # **22IN0453**

DRILLING and SAMPLING INFORMATION

Date Started	**7/6/22**	Hammer Wt.	**140** lbs.
Date Completed	**7/6/22**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**C. Peterman**	Rig Type	**D-50 Track ATV**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	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
	3" Asphalt	0.3										
	6" Sand and Gravel	0.8										
	Brown Silty Sandy CLAY			1	SS			4	2.3	2.5	15.9	
		4.5										
	Brown, Moist SAND		5	2	SS			13				
				3	SS			15				
			10	4	SS			23				
		13.0					○ ▽					
	Brown, Wet SAND		15	5	SS			23				
							Caved					
			20	6	SS			21				
			25	7	SS			21				
		26.0										
	End of Boring at 26 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 *13.0 ft.*
▽ At Completion *13.0 ft.*
Caved At Completion *19.0 ft.*

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

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **Runnebohm Construction Company, Inc.**
BORING # **B-2**
PROJECT NAME **Proposed Commercial Building**
ALT & WITZIG FILE # **22IN0453**
PROJECT LOCATION **Edinburgh, IN**

DRILLING and SAMPLING INFORMATION

Date Started	**7/6/22**	Hammer Wt.	**140** lbs.
Date Completed	**7/6/22**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**C. Peterman**	Rig Type	**D-50 Track ATV**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	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
	2" Asphalt	0.2										
	3" Sand and Gravel	0.4										
	Brown Sandy CLAY	2.0		1	SS			6				
	Brown, Moist SAND		5	2	SS			18				
				3	SS			15				
			10	4	SS			17				
		13.5										
	Brown, Wet SAND		15	5	SS			12				
			20	6	SS			19				
			25	7	SS			33				2' Heave
		26.0										
	End of Boring at 26 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 *13.5 ft.*
At Completion *13.5 ft.*
Caved At Completion *18.0 ft.*

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

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **Runnebohm Construction Company, Inc.**
PROJECT NAME **Proposed Commercial Building**
PROJECT LOCATION **Edinburgh, IN**

BORING # **B-3**
ALT & WITZIG FILE # **22IN0453**

DRILLING and SAMPLING INFORMATION

Date Started	**7/6/22**	Hammer Wt.	**140** lbs.
Date Completed	**7/6/22**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**C. Peterman**	Rig Type	**D-50 Track ATV**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	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
	3" Asphalt	0.3										
	4" Sand and Gravel	0.6										
	Brown Sandy CLAY	3.5		1	SS			5	1.2	1.0	19.9	
	Brown, Moist SAND		5	2	SS			12				
				3	SS			15				
		14.0	10	4	SS			19				
	Brown, Wet SAND		15	5	SS			22				
			20	6	SS			20				1.5' Heave
		26.0	25	7	SS			25				1.0' Heave
	End of Boring at 26 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 *14.0 ft.*
▽ At Completion *Dry ft.*
Caved At Completion *12.0 ft.*

Boring Method

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

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT Runnebohm Construction Company, Inc.
BORING # B-4
PROJECT NAME Proposed Commercial Building
ALT & WITZIG FILE # 22IN0453
PROJECT LOCATION Edinburgh, IN

DRILLING and SAMPLING INFORMATION

Date Started	7/6/22	Hammer Wt.	140 lbs.
Date Completed	7/6/22	Hammer Drop	30 in.
Boring Method	HSA	Spoon Sampler OD	2 in.
Driller	C. Peterman	Rig Type	D-50 Track ATV

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	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
	3" Asphalt	0.3										
	6" Sand and Gravel	0.8										
	Brown Sandy CLAY	4.0		1	SS			5			16.4	
	Brown, Moist SAND	14.0	5	2	SS			4				
				3	SS			4				
			10	4	SS			21				
	Brown, Wet SAND	26.0	15	5	SS			19				
			20	6	SS			24				
			25	7	SS			35				
	End of Boring at 26 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 *16.0 ft.*
▽ At Completion *14.0 ft.*
Caved At Completion *19.0 ft.*

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

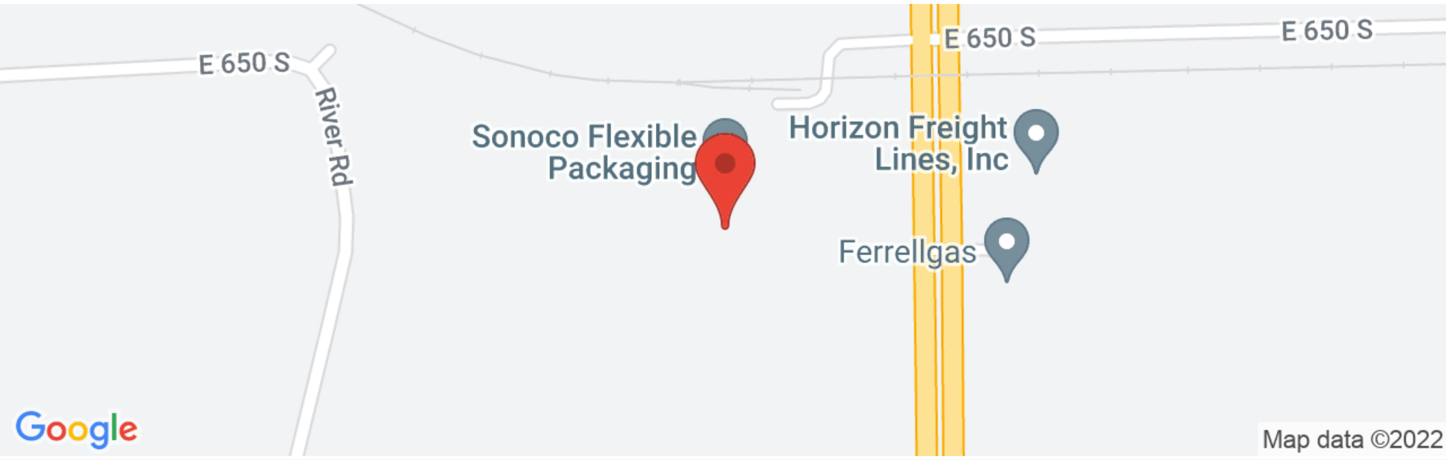
APPENDIX B

Seismic Design Parameters
Custom Soil Resource Report for Johnson County, Indiana

22IN0453

6502 S U.S Hwy 31, Edinburgh, IN 46124, USA

Latitude, Longitude: 39.381746, -85.9883938



Date	7/25/2022, 9:47:25 AM
Design Code Reference Document	IBC-2012
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.169	MCE_R ground motion. (for 0.2 second period)
S_1	0.091	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.271	Site-modified spectral acceleration value
S_{M1}	0.218	Site-modified spectral acceleration value
S_{DS}	0.181	Numeric seismic design value at 0.2 second SA
S_{D1}	0.145	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	C	Seismic design category
F_a	1.6	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.078	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.125	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.169	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.187	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.091	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.105	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.6	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.905	Mapped value of the risk coefficient at short periods

Type	Value	Description
C_{R1}	0.864	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

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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

Johnson County, Indiana

July 25, 2022

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.

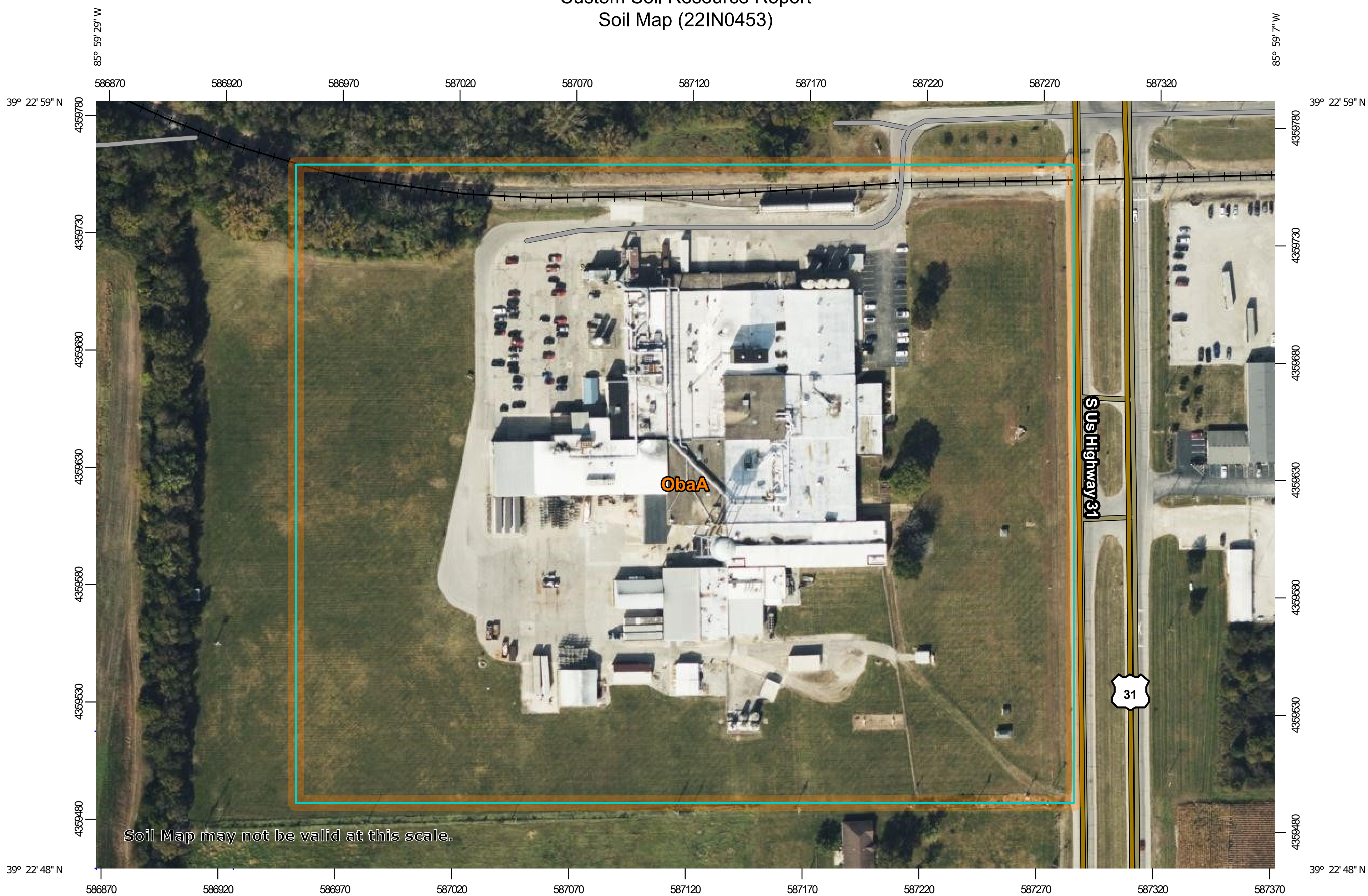
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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 (22IN0453)



Map Scale: 1:2,310 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

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:
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: Johnson County, Indiana
Survey Area Data: Version 29, Sep 8, 2021

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

Date(s) aerial images were photographed: Oct 17, 2019—Oct 20, 2019

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 (22IN0453)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ObaA	Ockley loam, 0 to 2 percent slopes	22.5	100.0%
Totals for Area of Interest		**22.5**	**100.0%**

Map Unit Descriptions (22IN0453)

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.

Johnson County, Indiana

ObaA—Ockley loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t4lp
Elevation: 560 to 1,250 feet
Mean annual precipitation: 37 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 155 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Ockley

Setting

Landform: Stream terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy outwash over sandy and gravelly outwash

Typical profile

Ap - 0 to 10 inches: loam
Bt1 - 10 to 24 inches: clay loam
Bt2 - 24 to 38 inches: sandy clay loam
Bt3 - 38 to 44 inches: sandy clay loam
2C - 44 to 79 inches: stratified extremely gravelly coarse sand to sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 40 to 72 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: 55 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F111AY015IN - Dry Outwash Upland
Hydric soil rating: No

Minor Components

Fox

Percent of map unit: 10 percent
Landform: Stream terraces
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F111AY015IN - Dry Outwash Upland
Hydric soil rating: No

Sleeth

Percent of map unit: 10 percent
Landform: Channels on stream terraces, stream terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Ecological site: F111AY014IN - Outwash Upland
Hydric soil rating: No

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