***SUBSURFACE INVESTIGATION &***
***GEOTECHNICAL RECOMMENDATIONS***

***VERMILLION RISE***
***50K sf. WAREHOUSE FACILITY***
***NEWPORT, INDIANA***
***A&W PROJECT NO: 16IN0152***

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

***PREPARED FOR:***
***GARMONG CONSTRUCTION SERVICES***
***INDIANAPOLIS, INDIANA***

***MARCH 25, 2016***

*Alt & Witzig Engineering, Inc.*
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(317) 875-7000 • Fax (317) 876-3705

March 25, 2016

Garmong Construction Services
444 Decatur Boulevard, Suite 400
Indianapolis, Indiana 46250
ATTN: Mr. Dale Riley

RE: Subsurface Investigation &
Geotechnical Recommendations
Vermillion Rise
50K s.f. Warehouse Facility
Newport, Indiana
Alt & Witzig File: 16IN0152

Dear Mr. Riley:

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

The purpose of this subsurface investigation was to determine the various soils profile components, the engineering characteristics of the subsurface materials, and to provide criteria for use by the design engineers in preparing the foundation design for the proposed warehouse to be constructed at the Vermillion Rise property in Newport, Indiana.

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

Very truly yours,
***Alt & Witzig Engineering, Inc.***

BRIAN A. WIRT
REGISTERED
PE11300272
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Chris M. Kubic, E.I.
*Project Engineer*

Brian A. Wirt, P.E.

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# SUBSURFACE INVESTIGATION
# AND
# GEOTECHNICAL RECOMMENDATIONS

## INTRODUCTION

### General

This report presents the results of a subsurface investigation performed for the proposed Vermillion Rise 50k s.f. warehouse facility to be constructed in Newport, Indiana. Our investigation was conducted for Garmong Construction Services of Indianapolis, Indiana. Authorization to perform this investigation was in the form of a proposal prepared by Alt & Witzig Engineering that was accepted by Mr. Dale Riley with Garmong Construction Services.

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 engineering analysis and evaluation of the materials.

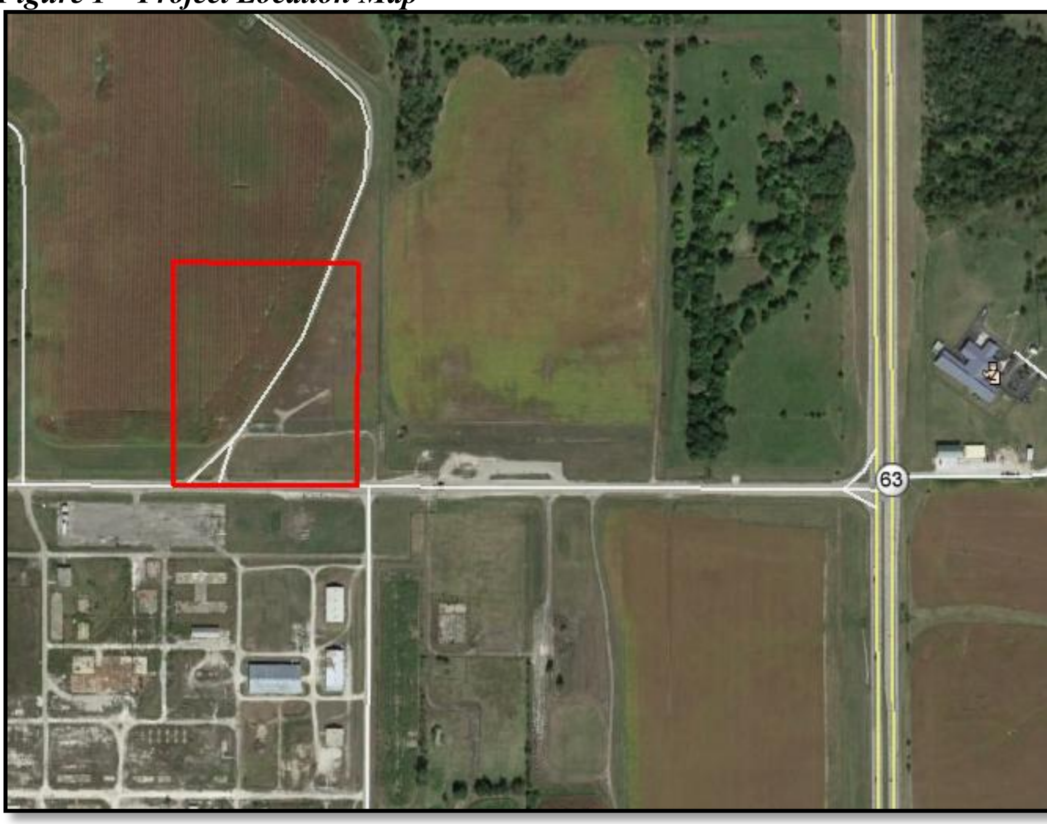
The purpose of this subsurface investigation was to determine the soil profile and the engineering characteristics of the subsurface materials in order to provide criteria for use by the design engineers and architects in preparing the foundation design for the proposed building.

## DESCRIPTION OF SITE

Site Location

The approximately 32 acre site is located in Newport, Indiana. Within that site, 10 acres of the southeast corner are currently the proposed development area. This area is located approximately 2000 feet west of State Road 63. The general vicinity of the site is indicated in the *Site Location Map* included in the Appendix of this report. An aerial photograph of the site taken in 2013 is provided in Figure 1 below.

***Figure 1 – Project Location Map***




**Google Earth 9/23/2013**

Site Description

The northwestern half of the site currently consists of an agricultural field, while the southeastern half of the site currently consists of undeveloped land. A gravel roadway runs in a southwest to northeast direction through the site. The site is relatively flat with an estimated relief of approximately five (5) feet. The surrounding properties consist of agricultural parcels and structures related to the former Newport Chemical Depot.

## FIELD INVESTIGATION

### General

Field investigations to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site and performing five (5) 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 vehicle-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.

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 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 the Appendix 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 INVESTIGATIONS

In addition to the field investigations, a supplemental laboratory investigation was conducted to ascertain additional pertinent engineering characteristics of the subsurface at the site of the chicken housing structures. All phases of the laboratory investigation were conducted in general accordance with applicable ASTM Specifications. The laboratory-testing program also included:

- Classification of soils in accordance with ASTM D 2488
- Moisture content tests in accordance with ASTM D 2216
- Rimac Compression spring test in accordance with ASTM D 2166
- Pocket Penetrometer readings used to aid in determining the strength of soil samples.

## 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 boring locations encountered three (3) inches of topsoil or gravel pavement material at the ground surface. Beneath the surface material, dark brown, brown, and gray, soft to medium stiff, silty sandy clay extending to depths ranging from seven (7) and fifteen (15) feet were encountered. Beneath the softer clay stratum, brown and gray, very stiff to hard lean sandy clay extended to the terminations depths. Borings B-2 and B-3 noted wet brown sand and gravel extending from seven (7) to a depth of twenty (20) feet. Detailed soil descriptions at each boring location have been included on the *Boring Logs* in the Appendix of this report.

According to the *Soil Survey of Vermillion County, Indiana* published by the United States Department of Agriculture Soil Conservation Service, the majority of the soils covering this site are classified as Ragsdale silt loam (Ra) and Reesville silt loam (ReA). The *Custom Soil Resource Report for Vermillion County, Indiana* is located in the Appendix.

### Seismic Parameters

Based on the field and laboratory tests performed on the encountered subsurface materials and an assumption of similar soil conditions present at depths below the boring termination depth, this site should be considered a Site Class C in accordance with the 2012 International Building Code.

Maximum spectral response acceleration values of Ss=0.205 g and S1=0.099 g are recommended for seismic design.

Groundwater

Groundwater level measurements taken during and upon completion of boring operations indicate groundwater levels ranging from four (4) to seventeen (17) feet. The exact location of the water table may fluctuate somewhat depending upon normal seasonal variations in precipitation and surface runoff.

*Boring Logs* included in the Appendix of this report are accurate only for the dates on which the measurements were performed. The exact location of the water table should be anticipated to fluctuate somewhat depending upon normal seasonal variations in precipitation and surface runoff.

According to the *Soil Survey of Vermillion County, Indiana* the seasonal high groundwater ranges from the ground surface to two (2) feet below the ground surface.

## GEOTECHNICAL DISCUSSION & RECOMMENDATIONS

### Project Description

It is anticipated that the warehouse facility will consist of a 50,000 square foot high-bay structure constructed as a slab-on-grade. Paved parking and loading docks areas are to be constructed as well. The location of the soil borings in relation to the size and preliminary configuration 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, it is anticipated that finished floor elevation will be established at or slightly above the existing grade.

Structural loads were not available at the time of this report, however, it was assumed for analysis purposes that the structure will be lightly to moderately loaded, with column and wall loads not exceeding 150 kips and 4 klf, respectively.

If the final design loads differ from those assumed for this analysis, it is recommended that they be submitted to Alt & Witzig Engineering, Inc. for review. After the completion of this review, it will be determined if changes to these recommendations are needed.

### Foundation Recommendations

Numerous foundation variations have been considered for supporting the Vermillion Rise facility. Due to the soil conditions encountered at the boring locations, the anticipated loads of the structure, and the relative economics of the available foundation systems, the foundation types considered included conventional spread and continuous wall footings.

We recommend that net allowable bearing pressures of 2,500 and 2,000 psf be utilized for dimensioning spread footings and continuous wall foundations, respectively. Depending on final grading, isolated undercuts may be necessary in the area of boring B-2 due to soft soils and B-4 due to disturbed soils.

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 on natural soils.

The above-recommended bearing pressures are "net allowable soil pressures". In utilizing these net allowable pressures for dimensioning footings, it is necessary to consider only those loads applied above the finished floor elevation.

To ensure that adequate bearing soils are present at the base of the footings, it is recommended that a representative of Alt & Witzig Engineering inspect all foundation excavations. At the time of footing inspections, Housel Penetration Tests or other approved tests should be performed on these foundation soils.

If it is not convenient to lower the footings to the level of suitable bearing materials, then the footing areas can be re-established to the proposed footing elevation by placing granular structural fill in accordance with the *Excavation Detail in Unstable Material* in the appendix. Using approved materials, it is recommended that a density of 95 percent maximum dry density in accordance with ASTM D-1557 be achieved in all areas which will be stressed by the foundation loads. Footing undercuts may also be re-established with lean concrete, if desired. If so, the footing undercut geometry may be conducted in accordance with the *Excavation Detail in Unstable Material* in the appendix.

## Truck Dock Foundations

Plans indicate that multiple truck docks are to be constructed on the south end of the structure. It is understood that three of the docks will be recessed and one dock will be at grade. The foundations recommendations provided above are also applicable to the truck dock foundations.

## Lateral Earth Pressures on Subsurface Truck Dock Walls

The amount of pressure exerted by the backfill on the walls will depend on the height of the wall, drainage provisions, type of backfill, method of placing the backfill, and the proximity of nearby shallow foundations. The free draining material should be placed behind the wall and include an area on a 1:1 slope from the heel of the wall up to the ground surface. The backfill material should be provided a drainage outlet in order to minimize hydrostatic pressure against the walls.

It is recommended that the material used as backfill consist of clean sand and gravel containing less than five (5) percent fines by weight. A representative of Alt & Witzig Engineering, Inc. should inspect this material to determine its suitability. Over-tamping the granular backfill in shallow layers may increase the coefficient of earth pressure to 0.6 and, therefore, increase the lateral earth pressure.

The lateral earth pressure will be minimized if the backfill is a clean granular material, and if the backfill is placed with a minimum amount of tamping. For design purposes, it is recommended that coefficient of at rest earth pressure ($k_o$) of 0.45 be used for structurally designing subsurface walls where minimal compactive effort can be used on the backfill.

Where the backfill is placed to support shallow slabs and adjacent footings a coefficient of lateral earth pressure of 0.4 is recommended. The walls should also be designed to accept the additional load imparted by nearby footings and floor slabs. Assuming the unit weight of the backfill is 125 pcf, a $k_o = 0.4$ would correspond to an equivalent fluid pressure of 63 pcf per foot of wall height. This equivalent fluid pressure would increase linearly from 0 psf at ground surface to a maximum at the bottom of the dock wall foundation. Please note that the above pressures are applicable during a fully drained condition.

Floor Slab

It is typically desirable to place the floor slab as a slab-on-grade supported by firm natural soils or compacted fill. 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. Approved borrow materials may be used if moisture content and compaction procedures are properly maintained.

After stripping the site of topsoil and organics, prior to the placement of fill, it is recommended that the subgrade areas be proofrolled in order to detect possible soft areas. Shallow unstable materials should be anticipated in most areas due to the elevated moistures contents. As such, it is not anticipated that the subgrade will favorably pass a proof roll inspection. Where unstable areas are determined to exist, chemical stabilization may be required. The exact stabilization method used will be dependent upon the size of the area and the types of materials encountered, as well as the project schedule. Due to the number of variables involved, it is recommended that the owner, the contractor, and a field representative of Alt & Witzig Engineering, Inc. determine the stabilization method at the time of necessity. If construction is to take place during, winter, spring, or early summer, the areas requiring stabilization are anticipated to more extensive.

After the building area has been leveled to the proper elevation, a minimum six (6) inch layer of granular material should be placed below the floor slab. It is recommended that all material placed with the intent of supporting the floor slab be compacted to 93 percent of the maximum dry density as determined by ASTM D-1557. Recommendations for proper filling procedures are presented in the Appendix.

## 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 is recommended that all topsoil be stripped from the construction areas and wasted or stockpiled for later use.

The condition of the subgrade at the time of earthmoving operations and the methods used by the contractor will influence the depth of stripping. Heavy equipment used to strip in areas where the subgrade soils are soft or wet will push organic soils into the subgrade. Some consideration should be given to stripping topsoil using a tracked vehicle. A representative of Alt & Witzig Engineering, Inc. in the field should determine the exact depth of stripping and undercutting at the time of stripping operations.

It is recommended that after the above-mentioned stripping procedures have been performed, the exposed subgrade should be proofrolled with approved equipment. This proofrolling will determine where soft unstable materials are encountered. Due to the elevated moisture contents encountered across the site, it is not anticipated that the subgrade soils will favorable pass a proof roll inspection. Additionally, the time of year that construction takes place will impact the areas of soft materials. As such it may be necessary to chemically stabilize the subgrade soils. It is recommended that a representative of Alt & Witzig Engineering, Inc. be present for this phase of this project.

It is imperative that groundwater and surface water control be established early in the construction process and be maintained throughout construction. Because of the anticipated duration of this project, the subgrade likely will be exposed to freeze/thaw and wet/dry cycles. The soils are sensitive to these cycles and will fail if not protected.

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 the Appendix of this report; thus minimizing volume changes and differential settlements which are detrimental to behavior of shallow foundations, floor slabs and pavements.

Groundwater

Groundwater level measurements taken during and upon completion of the boring operations indicate groundwater levels as shallow as four (4) feet below the ground surface. The exact location of the water table will fluctuate depending upon normal seasonal variations in precipitation and surface runoff.

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 these foundation materials tend to loosen when exposed to free water, every effort should be made to keep the excavations dry should water be encountered. Sump pumps should be anticipated to maintain dry foundations and utility excavations. It is recommended that all concrete for footings be poured the same day as the excavation is made.

## SUMMARY

A subsurface exploration and engineering evaluation of the foundation conditions has been conducted for the proposed Vermillion Rise 50k s.f. warehouse facility to be constructed in Newport, Indiana.

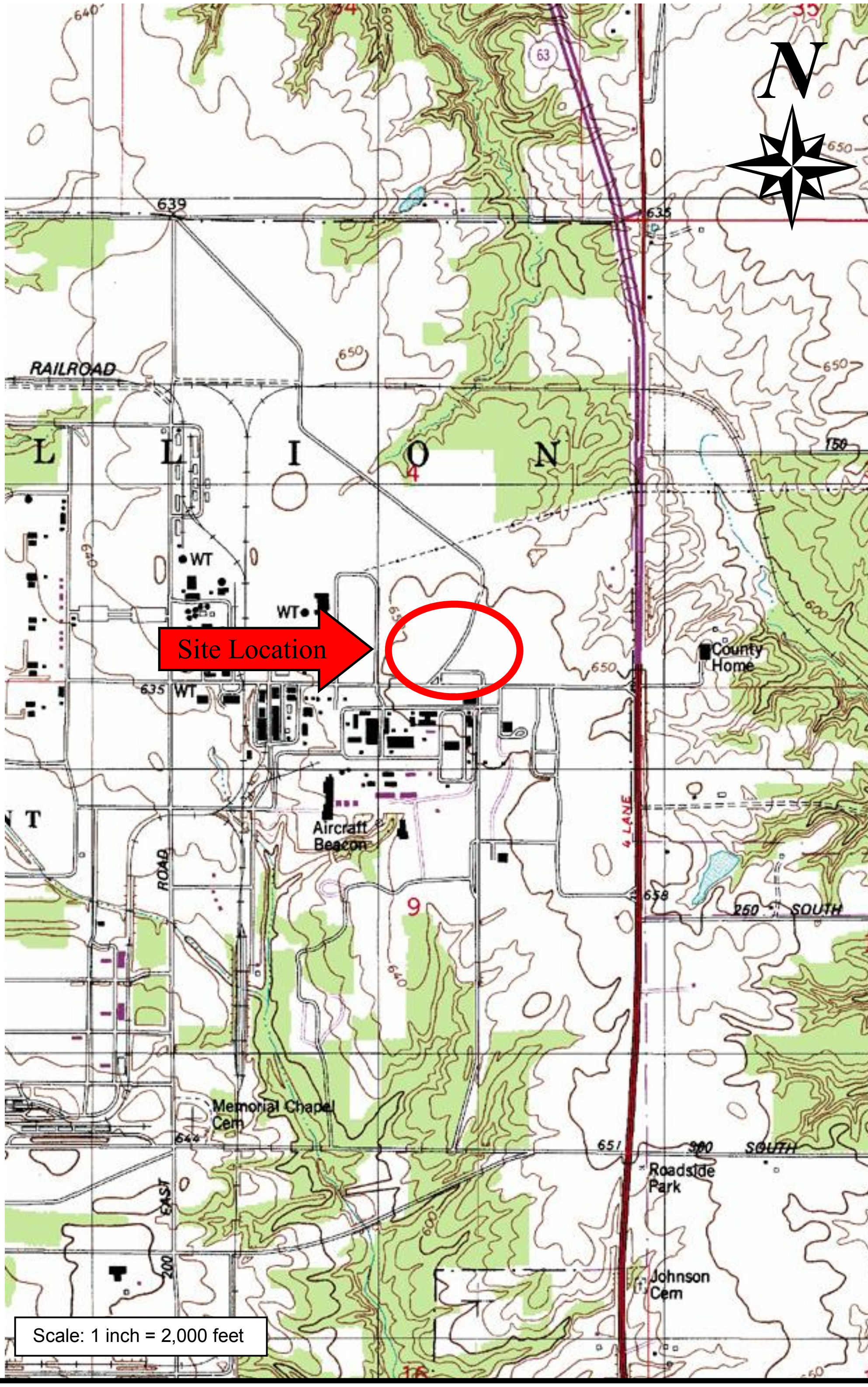
The exploration and analysis of the foundation conditions reported herein is considered in sufficient detail and scope to form a reasonable basis for final design. It is recommended that when final plans are complete that a representative of Alt & Witzig Engineering, Inc. reviews them in order to make necessary changes to the recommendations. The recommendations submitted are based on the available soil information and the design details furnished by the architect for the proposed structure. Any revision in the plans for the proposed structure from those enumerated in this report 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. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of Alt & Witzig Engineering, Inc.

APPENDIX

## 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 his approval. The surface of each layer will be approximately horizontal but will be provided with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point. The fill material should be placed in layers not to exceed eight (8) inches in loose thickness and should be sprinkled with water as required to secure specified compactions. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Under no circumstances should a bulldozer or similar tracked vehicles be used as compacting equipment. Material containing an excess of water so the specified compaction limits cannot be attained should be spread and dried to a moisture content that will permit proper compaction. All fill should be compacted to the specified percent of the maximum density obtained in accordance with ASTM density Test D-1557 (95 percent of maximum dry density below the base of footing elevation, 93 percent below floor slabs). 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.

# SITE LOCATION MAP




***USGS Topographic Map:***
Dana Quadrangle

***Township: T 16 N.***
***Range: R 9 W.***
***Section: 4***

**PROJECT:** **Vermillion Rise 50K SF Warehouse Facility**
**LOCATION:** Newport, Indiana
**CLIENT:** **Garmong Construction Services**
**A&W File No.:** 16IN0152

*Alt & Witzig Engineering Inc.*
*4105 W. 99th Street ·Carmel, IN 46032*
*TEL (317)875-7000 · FAX (317) 876-3705*
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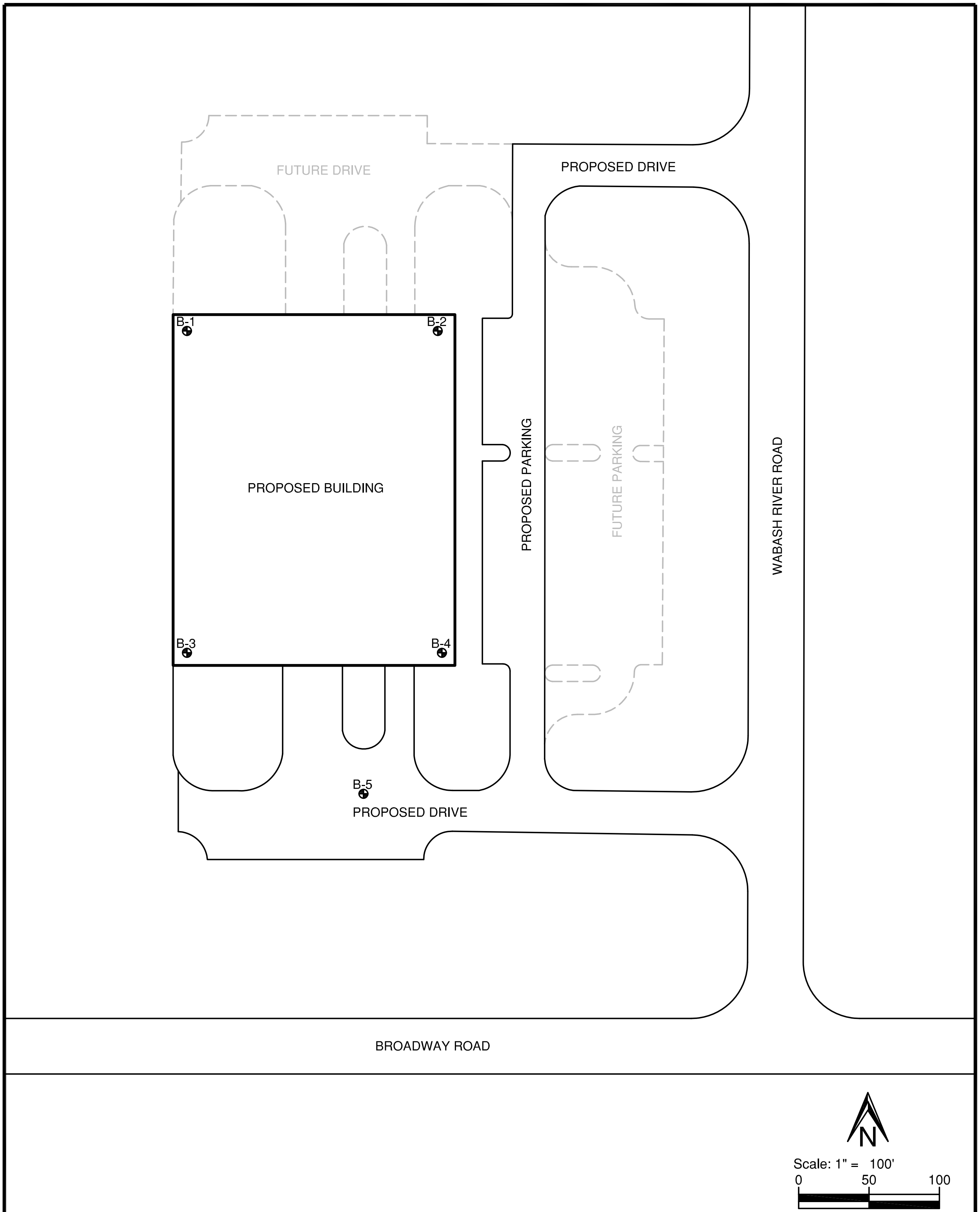
*Last Modified: 3/24/2016 9:30 AM*




# BORING LOCATION PLAN

| | | |
|---|---|---|
| PROJECT:Vermillion Rise 50K SF Warehouse Facility | Project Manager:CK | Alt & Witzig Engineering, Inc. |
| LOCATION: Newport, Indiana | Checked By:TC | 4105 West 99th Street • Carmel, IN 46032 |
| PREPARED FOR: Garmong Construction Services | Drawn By:JT | Telephone: (317) 875-7000 • Fax (317) 876-3705 |
| PROJECT NO: 16IN0152 | Date:03/16 | |

# BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT Garmong
BORING # B-1
PROJECT NAME 50k s.f. warehouse at Vermillion Rise
ALT & WITZIG FILE # 16IN0152
PROJECT LOCATION Newport, Indiana

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | 3/16/16 | Hammer Wt. | 140 lbs. |
| Date Completed | 3/16/16 | Hammer Drop | 30 in. |
| Boring Method | HSA | Spoon Sampler OD | 2 in. |
| Driller | J. Livingston | Rig Type | D-50 Truck |

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOPSOIL | 0.2 | | | | | | | | | | |
| | Brown Sandy CLAY with trace silt | | | 1 | SS | | | 8 | 0.5 | 2.5 | 29.1 | |
| | | | 5 | 2 | SS | | ⊻ | 7 | 3.7 | 2.5 | 17.3 | |
| | | | | 3 | SS | | | 10 | 1.6 | 2.5 | 12.7 | |
| | | | 10 | 4 | SS | | | 11 | | 2.5 | 11.6 | |
| | | 15.5 | 15 | 5 | SS | | | 38 | | 3.0 | 8.2 | |
| | Gray LEAN Sandy CLAY with Sand Seams *(Glacial Till)* | | | | | | ○ | | | | | |
| | | | 20 | 6 | SS | | | 30 | | 3.0 | 11.2 | |
| | | 26.0 | 25 | 7 | SS | | | 22 | | 2.0 | 17.4 | |
| | 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 *17.0 ft.*
⊻ At Completion *5.0 ft.*

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

# BORING LOG

**Alt & Witzig Engineering, Inc.**

CLIENT **Garmong** BORING # **B-2**

PROJECT NAME **50k s.f. warehouse at Vermillion Rise** ALT & WITZIG FILE # **16IN0152**

PROJECT LOCATION **Newport, Indiana**

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | **3/16/16** | Hammer Wt. | **140** lbs. |
| Date Completed | **3/16/16** | Hammer Drop | **30** in. |
| Boring Method | **HSA** | Spoon Sampler OD | **2** in. |
| Driller | **J. Livingston** | Rig Type | **D-50 Truck** |

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 | 0.2 | | | | | | | | | | |
| | 3" Crushed Stone | 0.5 | | | | | | | | | | |
| | Brown Sandy Silty CLAY | | | 1 | SS | | | 9 | | 2.5 | 27.1 | |
| | | | | | | | ∇ | | | | | |
| | | | 5 | 2 | SS | | | 3 | | | | |
| | | 7.0 | | | | | | | | | | |
| | Brown, Wet Fine to Medium SAND with Clay | | | 3 | SS | | ○ | 16 | | | | |
| | | | 10 | 4 | SS | | | 22 | | | | |
| | | 15.0 | | | | | | | | | | |
| | Gray LEAN CLAY with Gravel *(Glacial Till)* | | 15 | 5 | SS | | | 27 | | | 9.0 | 2.0' Heave |
| | | | 20 | 6 | SS | | | 50/5" | 5.4 | | 9.6 | |
| | | | 25 | 7 | SS | | | 50/4" | | | 8.3 | |
| | | 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 *7.5 ft.*
∇ At Completion *4.0 ft.*

**Boring Method**

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

# BORING LOG

**Alt & Witzig Engineering, Inc.**

CLIENT **Garmong** — BORING # **B-3**

PROJECT NAME **50k s.f. warehouse at Vermillion Rise** — ALT & WITZIG FILE # **16IN0152**

PROJECT LOCATION **Newport, Indiana**

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | **3/16/16** | Hammer Wt. | **140** lbs. |
| Date Completed | **3/16/16** | Hammer Drop | **30** in. |
| Boring Method | **HSA** | Spoon Sampler OD | **2** in. |
| Driller | **J. Livingston** | Rig Type | **D-50 Truck** |

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOPSOIL | 0.2 | | | | | | | | | | |
| | Brown and Gray Silty Sandy CLAY | | | 1 | SS | | | 8 | | 2.0 | 30.8 | |
| | | | 5 | 2 | SS | | ⊻ | 7 | | 1.0 | 16.9 | |
| | | | | 3 | SS | | | 10 | 3.4 | 3.5 | 14.7 | |
| | | | 10 | 4 | SS | | | 13 | | 2.5 | 13.8 | |
| | | | | | | | ○ | | | | | |
| | Brown, Wet SAND and GRAVEL | 15.0 | 15 | 5 | SS | | | 37 | | | | |
| | Gray LEAN Sandy CLAY with Gravel *(Glacial Till)* | 19.5 | 20 | 6 | SS | | | 50/4" | | 2.0 | 11.8 | |
| | End of Boring at 21 feet | 21.0 | | | | | | | | | | |

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

**Groundwater**
○ During Drilling *14.0 ft.*
⊻ At Completion *5.0 ft.*

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

# BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **Garmong**
PROJECT NAME **50k s.f. warehouse at Vermillion Rise**
PROJECT LOCATION **Newport, Indiana**
BORING # **B-4**
ALT & WITZIG FILE # **16IN0152**

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | **3/16/16** | Hammer Wt. | **140** lbs. |
| Date Completed | **3/16/16** | Hammer Drop | **30** in. |
| Boring Method | **HSA** | Spoon Sampler OD | **2** in. |
| Driller | **J. Livingston** | Rig Type | **D-50 Truck** |

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TOPSOIL | 0.2 | | | | | | | | | | |
| | Dark Brown CLAY *(Possible Fill)* | 3.5 | | 1 | SS | | | 9 | | 2.5 | 30.8 | |
| | Brown Silty Sandy CLAY with Sand Seams | 15.0 | 5 | 2 | SS | | ⊻ | 8 | 1.2 | 1.5 | 26.2 | |
| | | | | 3 | SS | | | 5 | | 2.5 | 13.3 | |
| | | | 10 | 4 | SS | | ○ | 7 | | 4.5 | 14.2 | |
| | Gray LEAN CLAY with Gravel *(Glacial Till)* | 21.0 | 15 | 5 | SS | | | 53 | | 4.5 | 8.0 | |
| | | | 20 | 6 | SS | | | 50/3" | | 4.5 | 8.1 | |
| | End of Boring at 21 feet | | | | | | | | | | | |

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

Groundwater
○ During Drilling *9.0 ft.*
⊻ At Completion *4.0 ft.*

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

# BORING LOG

**Alt & Witzig Engineering, Inc.**

CLIENT **Garmong**

BORING # **B-5**

PROJECT NAME **50k s.f. warehouse at Vermillion Rise**

ALT & WITZIG FILE # **16IN0152**

PROJECT LOCATION **Newport, Indiana**

DRILLING and SAMPLING INFORMATION

| | | | |
|---|---|---|---|
| Date Started | **3/16/16** | Hammer Wt. | **140** lbs. |
| Date Completed | **3/16/16** | Hammer Drop | **30** in. |
| Boring Method | **HSA** | Spoon Sampler OD | **2** in. |
| Driller | **J. Livingston** | Rig Type | **D-50 Truck** |

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" Gravel | 0.2 | | | | | | | | | | |
| | Brown Sandy Silty CLAY | | | 1 | SS | | | 7 | | 1.5 | 27.5 | |
| | | | 5 | 2 | SS | | | 6 | | 0.5 | 13.8 | |
| | | | | | | | ⊻ | | | | | |
| | | | | 3 | SS | | | 7 | | 0.5 | 12.1 | |
| | | | | | | | ○ | | | | | |
| | | | 10 | 4 | SS | | | 7 | 2.0 | 0.5 | 11.7 | |
| | | 14.5 | | | | | | | | | | |
| | Gray LEAN CLAY with Gravel *(Glacial Till)* | | 15 | 5 | SS | | | 80 | | 4.5 | 7.6 | |
| | | | 20 | 6 | SS | | | 50/4" | | 0.5 | 13.0 | |
| | | 21.0 | | | | | | | | | | |
| | End of Boring at 21 feet | | | | | | | | | | | |

**Sample Type**

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

**Groundwater**

○ During Drilling *9.0 ft.*
⊻ At Completion *6.0 ft.*

**Boring Method**

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

## MATERIAL GRAPHICS LEGEND

| | | |
|---|---|---|
| ASPHALT: Asphalt | CL: USCS Low Plasticity Clay | CL-ML: USCS Low Plasticity Silty Clay |
| CLS: USCS Low Plasticity Sandy Clay | FILL: Fill (made ground) | IN GRAVEL: INDOT Gravel |
| SP: USCS Poorly-graded Sand | SPG: USCS Poorly-graded Gravelly Sand | TOPSOIL |

## SOIL PROPERTY SYMBOLS

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

Qu: *Unconfined Compressive Strength, tsf*

PP: *Pocket Penetrometer, tsf*

LL: *Liquid Limit, %*

PL: *Plastic Limit, %*

PI: *Plasticity Index, %*

## DRILLING AND SAMPLING SYMBOLS

*GROUNDWATER SYMBOLS*

○ *Apparent water level noted while drilling.*

∇ *Apparent water level noted upon completion.*

▼ *Apparent water level noted upon delayed time.*

*SAMPLER SYMBOLS*

SS: Split Spoon

## RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (NON-COHESIVE SOILS)

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

## RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (COHESIVE SOILS)

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

Alt & Witzig Engineering, Inc.
4105 West 99th St.
Carmel, IN 46032
Telephone: 317-875-7000
Fax:

## GENERAL NOTES

Project: 50k s.f. warehouse at Vermillion Rise

Location: Newport, Indiana

Number: 16IN0152

# Design Maps Summary Report

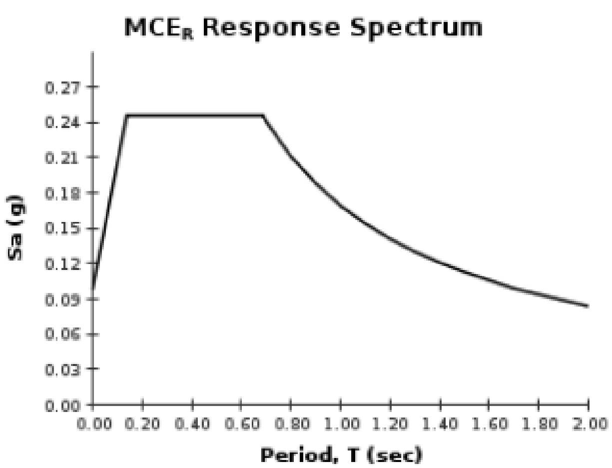
## User–Specified Input

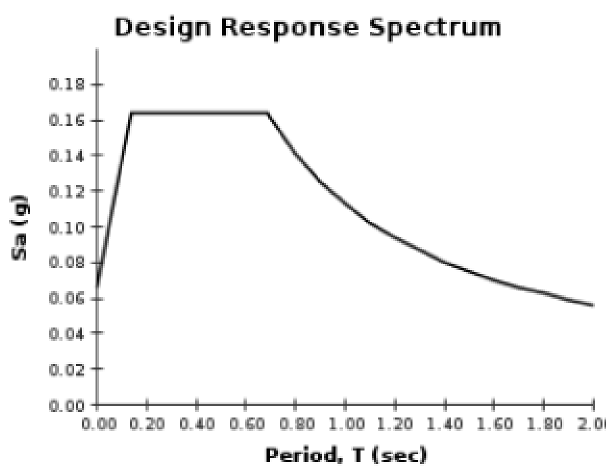
| | |
|---|---|
| **Building Code Reference Document** | 2012 International Building Code<br>(which utilizes USGS hazard data available in 2008) |
| **Site Coordinates** | 39.84791°N, 87.41°W |
| **Site Soil Classification** | Site Class C – "Very Dense Soil and Soft Rock" |
| **Risk Category** | I/II/III |


## USGS–Provided Output

| | | | | | |
|---|---|---|---|---|---|
| $S_S$ = | 0.205 g | $S_{MS}$ = | 0.246 g | $S_{DS}$ = | 0.164 g |
| $S_1$ = | 0.099 g | $S_{M1}$ = | 0.169 g | $S_{D1}$ = | 0.113 g |

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.



United States Department of Agriculture

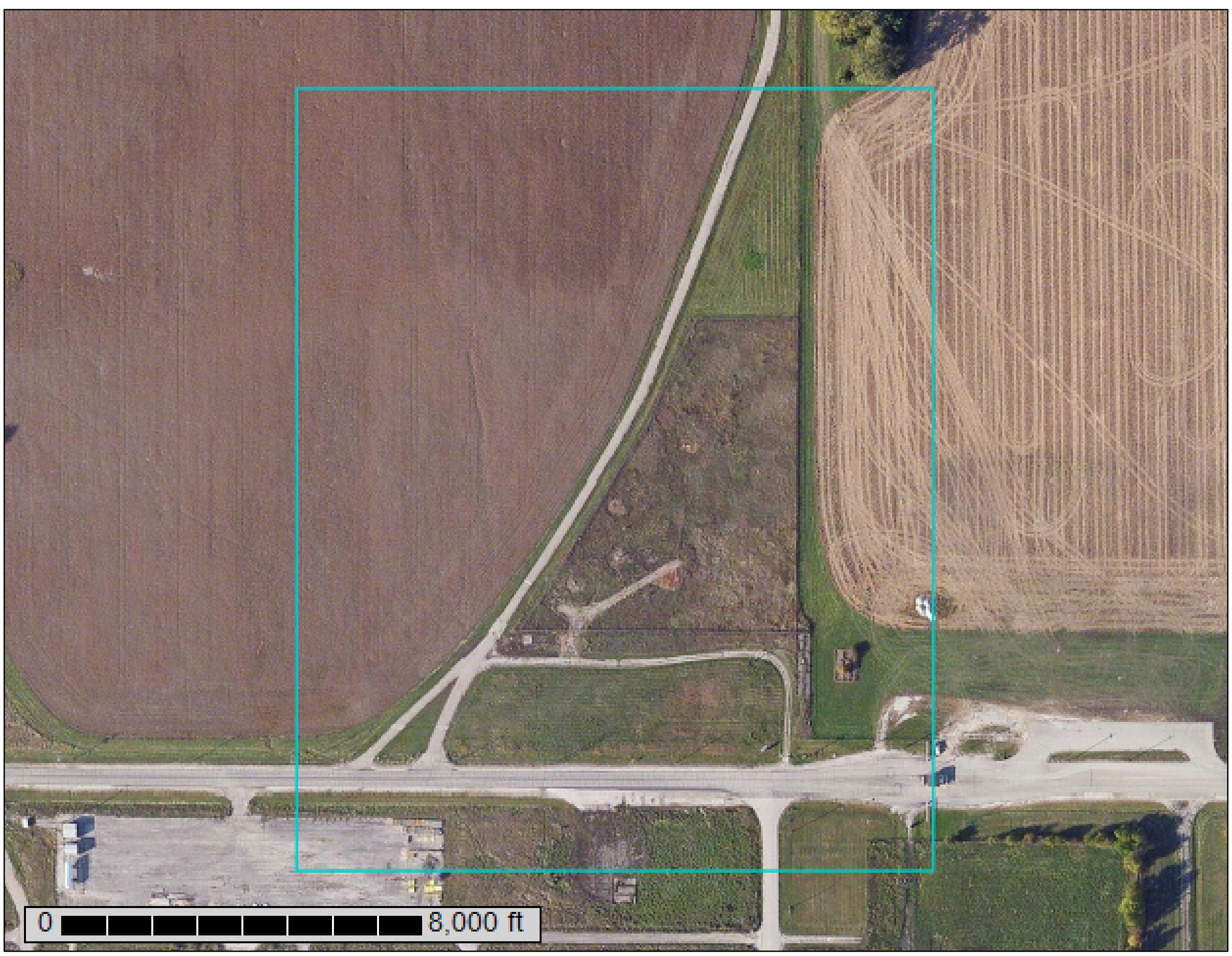
NRCS

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

# Vermillion County, Indiana




March 23, 2016

# Preface

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

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

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

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

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

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

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# 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.

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

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

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

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

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

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

Soil Survey Area: Vermillion County, Indiana
Survey Area Data: Version 16, Sep 11, 2015

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

Date(s) aerial images were photographed: Jul 9, 2011—Oct 4, 2011

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

| Vermillion County, Indiana (IN165) | | | |
|---|---|---|---|
| **Map Unit Symbol** | **Map Unit Name** | **Acres in AOI** | **Percent of AOI** |
| FcA | Fincastle silt loam, Bloomington Ridged Plain, 0 to 2 percent slopes | 6.6 | 24.8% |
| OrB | Orthents, loamy, 0 to 8 percent slopes | 4.5 | 17.1% |
| Ra | Ragsdale silt loam | 7.9 | 29.8% |
| ReA | Reesville silt loam, 0 to 2 percent slopes | 7.5 | 28.3% |
| **Totals for Area of Interest** | | **26.5** | **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.

## Vermillion County, Indiana

### FcA—Fincastle silt loam, Bloomington Ridged Plain, 0 to 2 percent slopes

**Map Unit Setting**

*National map unit symbol:* 2smzy
*Elevation:* 570 to 790 feet
*Mean annual precipitation:* 36 to 44 inches
*Mean annual air temperature:* 49 to 54 degrees F
*Frost-free period:* 155 to 195 days
*Farmland classification:* Prime farmland if drained

**Map Unit Composition**

*Fincastle and similar soils:* 94 percent
*Minor components:* 6 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Fincastle**

**Setting**

*Landform:* End moraines, ground moraines
*Landform position (two-dimensional):* Summit, footslope
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Loess over loamy till

**Typical profile**

*Ap - 0 to 10 inches:* silt loam
*BE - 10 to 14 inches:* silt loam
*Bt1 - 14 to 35 inches:* silty clay loam
*2Bt2 - 35 to 43 inches:* clay loam
*2BC - 43 to 49 inches:* clay loam
*2Cd - 49 to 60 inches:* loam

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* 40 to 60 inches to densic material
*Natural drainage class:* Somewhat poorly drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.06 to 0.60 in/hr)
*Depth to water table:* About 6 to 24 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 40 percent
*Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
*Available water storage in profile:* Moderate (about 8.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* B/D

### Minor Components

#### Ragsdale, drained

*Percent of map unit:* 3 percent
*Landform:* Depressions
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Concave
*Across-slope shape:* Concave

#### Drummer, drained

*Percent of map unit:* 3 percent
*Landform:* Swales on ground moraines
*Landform position (two-dimensional):* Toeslope
*Landform position (three-dimensional):* Base slope
*Down-slope shape:* Linear
*Across-slope shape:* Concave

## OrB—Orthents, loamy, 0 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 5cys
*Elevation:* 660 to 750 feet
*Mean annual precipitation:* 38 to 42 inches
*Mean annual air temperature:* 50 to 54 degrees F
*Frost-free period:* 175 to 190 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Orthents and similar soils:* 90 percent
*Minor components:* 3 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Orthents

#### Setting

*Parent material:* Coal extraction mine spoil

#### Typical profile

*H1 - 0 to 5 inches:* shaly silt loam
*H2 - 5 to 60 inches:* gravelly clay loam

#### Properties and qualities

*Slope:* 0 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Natural 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
*Available water storage in profile:* Low (about 4.5 inches)

**Interpretive groups**
*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* C
*Other vegetative classification:* Trees/Timber (Woody Vegetation)

**Minor Components**

**Water**
*Percent of map unit:* 3 percent

## Ra—Ragsdale silt loam

**Map Unit Setting**
*National map unit symbol:* 5cz1
*Elevation:* 660 to 750 feet
*Mean annual precipitation:* 38 to 42 inches
*Mean annual air temperature:* 50 to 54 degrees F
*Frost-free period:* 175 to 190 days
*Farmland classification:* Prime farmland if drained

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

**Description of Ragsdale**

**Setting**
*Landform:* Depressions on terraces
*Landform position (two-dimensional):* Footslope
*Landform position (three-dimensional):* Dip
*Down-slope shape:* Concave
*Across-slope shape:* Linear
*Parent material:* Loess

**Typical profile**
*H1 - 0 to 13 inches:* silt loam
*H2 - 13 to 46 inches:* silty clay loam
*H3 - 46 to 57 inches:* silt loam
*H4 - 57 to 80 inches:* loam

**Properties and qualities**
*Slope:* 0 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Poorly drained
*Runoff class:* Negligible

*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.02 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 in profile:* 30 percent
*Available water storage in profile:* High (about 11.8 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)

## ReA—Reesville silt loam, 0 to 2 percent slopes

**Map Unit Setting**

*National map unit symbol:* 5cz3
*Elevation:* 660 to 750 feet
*Mean annual precipitation:* 38 to 42 inches
*Mean annual air temperature:* 50 to 54 degrees F
*Frost-free period:* 175 to 190 days
*Farmland classification:* Prime farmland if drained

**Map Unit Composition**

*Reesville and similar soils:* 90 percent
*Minor components:* 6 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Reesville**

**Setting**

*Landform:* Till plains
*Landform position (two-dimensional):* Summit
*Landform position (three-dimensional):* Interfluve
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Loess over loamy till

**Typical profile**

*H1 - 0 to 12 inches:* silt loam
*H2 - 12 to 38 inches:* silty clay loam
*H3 - 38 to 54 inches:* silt loam
*H4 - 54 to 66 inches:* loam

**Properties and qualities**

*Slope:* 0 to 2 percent
*Depth to restrictive feature:* 40 to 60 inches to densic material
*Natural drainage class:* Somewhat poorly drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately low to moderately high (0.02 to 0.20 in/hr)

*Depth to water table:* About 6 to 24 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum in profile:* 40 percent
*Available water storage in profile:* High (about 10.8 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 2w
*Hydrologic Soil Group:* B/D
*Other vegetative classification:* Trees/Timber (Woody Vegetation)

**Minor Components**

**Ragsdale**

*Percent of map unit:* 3 percent
*Landform:* Depressions
*Other vegetative classification:* Mixed/Transitional (Mixed Native Vegetation)

**Poorly drained aqualfs**

*Percent of map unit:* 3 percent
*Landform:* Divides
*Other vegetative classification:* Trees/Timber (Woody Vegetation)

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