SOIL SURVEY OF

Spencer County, Indiana

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Purdue University
Agricultural Experiment Station

Issued April 1973

Major fieldwork for this soil survey was done in the period 1964–66. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1966. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Spencer County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Spencer County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and woodland groups.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for recreation areas in the section "Recreation."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Spencer County will be especially interested in the "General Soil Map," where broad patterns of soils are described. They will also be interested in the information about the county given at the beginning of the publication and in the section "Additional Facts About the County" at the end of the survey.

Cover: Typical view of soils in the Zanesville-Wellston-Tilsit association used for crops, pasture, and woodland.

U.S. GOVERNMENT PRINTING OFFICE: 1973

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

SPENCER COUNTY is in the south-central part of Indiana (fig. 1). It has a total area of 253,440 acres, or 396 square miles. Rockport, the county seat, is in the south-central part of the county along the Ohio River. In 1970, according to the U.S. Census, the total population of the county was 17,245. The climate in Spencer County is favorable for farming, and farming is the main enterprise.

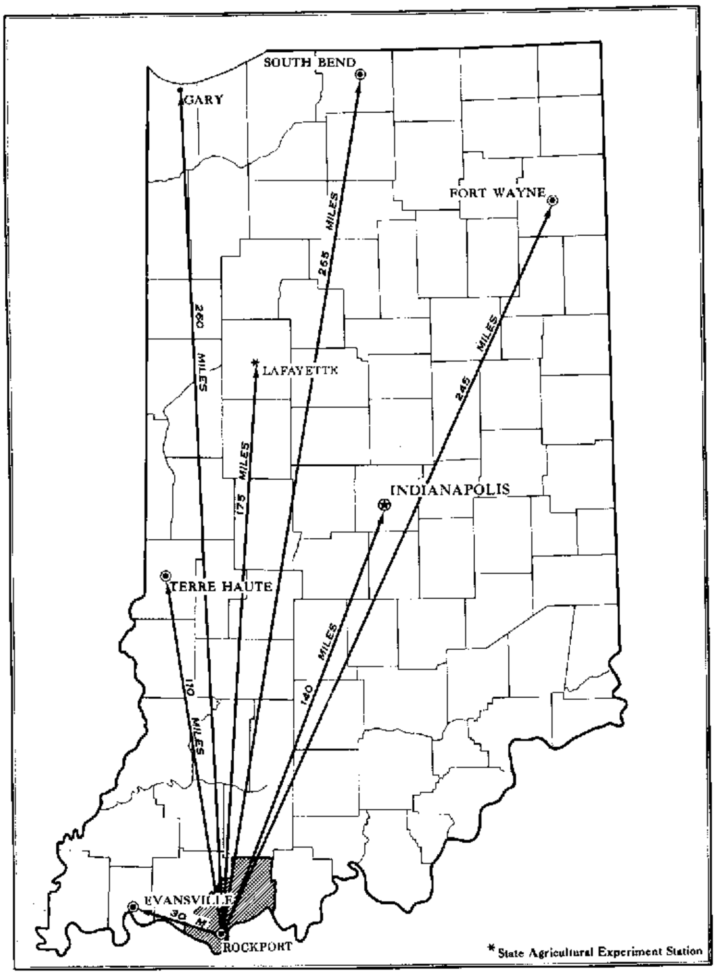

Figure 1.—Location of Spencer County in Indiana.

Relief in the county ranges from nearly level flood plains and terraces on low lands of the valleys to strongly dissected hilly uplands. The rugged terrain is mainly in the northern part of the county, and a few of the ridgetops are about 650 feet above sea level. The lowest elevation, about 360 feet above sea level, is in the southwestern part of the county. Drainage is mostly to the south and southwest through tributaries of the Ohio River. Nearly level stream terraces and lacustrine benches are in basins of the major streams.

In the uplands the soils are mostly on formations of shale and sandstone that have a capping of silty loess. The loess ranges from more than 20 feet thick in the southwestern part of the county to about 3 feet on ridges in the northeastern part of the county. The main source of the loess was the lowlands along the Wabash and Ohio Rivers to the west and southwest.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Spencer County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Johnsburg and Stendal, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase inidcates a feature that affects management. For example, Wheeling loam, 0 to 2 percent slopes, is one of several phases within the Wheeling series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit is shown on the soil map of Spencer County, the soil complex.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Gilpin-Wellston silt loams, 25 to 35 percent slopes, is a complex in this county.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Made land and Pits is a land type in Spencer County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Spencer County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The six soil associations in Spencer County are discussed in the following pages. The major soils in the northern and southern parts of the county, and their relation to the landscape, are shown in figure 2.

1. Zanesville-Wellston-Tilsit Association

Deep and moderately deep, well drained and moderately well drained, medium-textured, nearly level to very steep soils on uplands

This association consists of nearly level to very steep soils on hilly uplands. Generally the less sloping soils are on ridgetops, and the steeper soils are on hillsides (fig. 3). The areas are dissected by many small drainageways that form a dendritic pattern.

This association occupies about 41 percent of the county. Zanesville soils make up about 40 percent of the association, Wellston soils about 28 percent, Tilsit soils about 8 percent, and minor soils about 24 percent.

Zanesville soils are deep, well drained, and gently sloping to strongly sloping. They have a surface layer of dark-brown and brown silt loam. The subsoil is strong-brown and yellowish-brown silty clay loam. A firm, very slowly permeable fragipan is at a depth of about 24 inches.

Wellston soils are deep and moderately deep, well drained, and gently sloping to very steep. They have a surface layer of dark-brown and brown silt loam. The subsoil is mostly yellowish-red and strong-brown silty clay loam. Bedrock is at a depth of 36 to 60 inches.

Tilsit soils are deep, moderately well drained, and nearly level and gently sloping. Their surface layer is

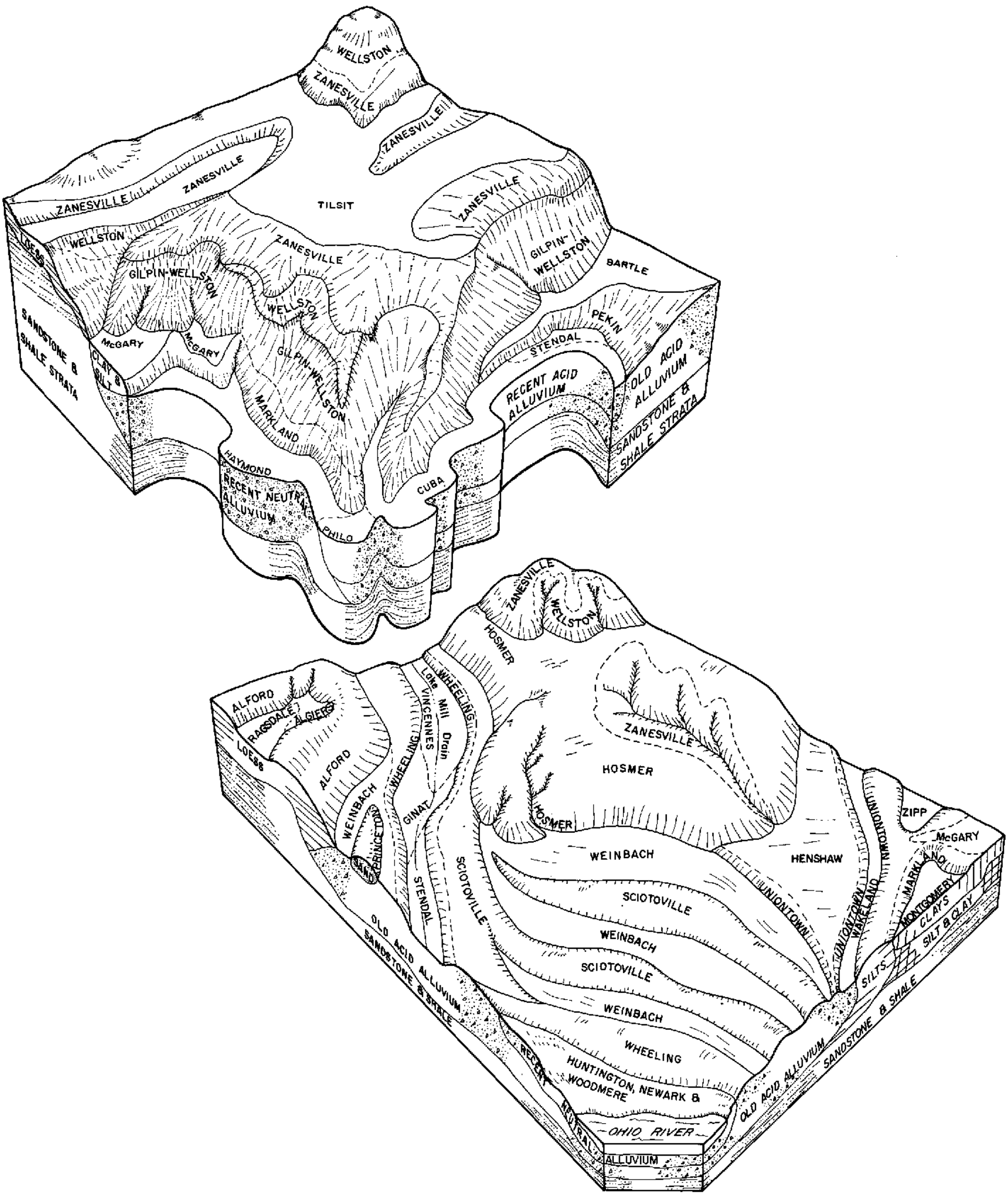

***Figure 2.*—Upper part of diagram shows landscape relationship of soils in the northern part of the county, and the lower part shows that of soils in the southern part of the county.**

Figure 3.—Representative landscape of the soils in association 1.

Figure 4.—Gently sloping and sloping Hosmer silt loams used for crops.

dark-brown and dark grayish-brown silt loam. The subsoil is yellowish-brown silt loam and silty clay loam that has light brownish-gray mottles. A firm, very slowly permeable fragipan is at a depth of about 23 inches.

Among the minor soils in this association are the Gilpin and Johnsburg on uplands; the Bartle and Pekin on old stream terraces; and the Atkins, Cuba, Philo, and Stendal on bottom lands.

Most of this association is used for small grains and meadow, but a few areas are wooded. Under good management the cropping system for a few areas can also include corn and soybeans. If cultivated, areas of the gently sloping and very steep soils are subject to erosion because of runoff.

2. Hosmer Association

Deep, well-drained, medium-textured, gently sloping to sloping soils on uplands

In this association are gently sloping soils on smooth, rounded ridges and sloping soils on hillsides. The areas are less than 50 feet higher than the nearby bottom lands.

This association occupies about 10 percent of the county. Hosmer soils make up about 68 percent of the association, and minor soils make up the remaining 32 percent.

Hosmer soils have a surface layer of dark-brown to yellowish-brown silt loam. The subsoil is mostly dark-brown and yellowish-brown heavy silt loam. A firm and brittle, very slowly permeable fragipan is at a depth of about 25 inches.

Among the minor soils in this association are the Alford and Zanesville. In addition, small areas of Gullied land, loess, occur throughout the association.

Most of this association is used for corn, soybeans, and small grains (fig. 4), but large areas are used for permanent pasture. Erosion caused by runoff is the major hazard. The very slowly permeable fragipan limits penetration of roots and water and reduces the amount of moisture available for plants.

3. Alford-Ragsdale Association

Deep, well-drained and very poorly drained, medium-textured, nearly level to very steep soils on uplands

In this association are deep, well-drained and very poorly drained soils on uplands. Some of these soils are nearly level to very steep and are on broad areas. Others are nearly level and are in depressions and in areas around the heads of drainageways.

This association occupies about 11 percent of the county. Alford soils make up about 74 percent of the association, Ragsdale soils about 11 percent, and minor soils about 15 percent.

Alford soils are well drained and nearly level to very steep. Their surface layer is dark grayish-brown and brown silt loam. The subsoil is yellowish-brown silt loam and silty clay loam.

Ragsdale soils are very poorly drained and nearly level. They are in depressions and in areas around the heads of drainageways. Their surface layer is very dark grayish-brown and very dark gray silt loam. The subsoil is olive-gray and gray silty clay loam that has pale-brown, olive, and yellowish-brown mottles.

Among the minor soils are Algiers and Iona on uplands and Henshaw and Uniontown on high terraces.

Most of this association is used for corn, soybeans, small grains, hay, and pasture, but a few areas are used for hardwoods. Erosion caused by runoff is a hazard on the soils that have slopes of more than 2 percent. Wetness limits use and management of the very poorly drained soils.

4. Markland-McGary-Uniontown-Henshaw Association

Deep, well-drained to somewhat poorly drained, medium-textured and moderately fine textured, nearly level to steep soils on terraces

In this association are nearly level to sloping soils on broad terraces and strongly sloping to steep soils on short terrace breaks next to and above drainageways. Most of this association is in valleys along the tributaries of the Ohio River.

This association occupies about 13 percent of the county. Markland soils make up about 22 percent of the association, McGary soils about 21 percent, Uniontown soils about 16 percent, and Henshaw soils about 14 percent. The remaining 27 percent is minor soils.

Markland soils are well drained. Some areas are gently sloping to sloping and are on broad terraces. Others are steep and are on terrace breaks above drainageways. These soils have a surface layer of very dark grayish-brown and dark grayish-brown silt loam or silty clay loam. The subsoil is yellowish-brown and brown silty clay and clay.

McGary soils are somewhat poorly drained and nearly level. They are along drainageways. Their surface layer is dark grayish-brown and light-gray silt loam. The subsoil is mostly mottled yellowish-brown, grayish-brown, and gray silty clay.

Uniontown soils are moderately well drained and well drained. Some areas are nearly level to sloping and are on broad terraces, and others are sloping to steep and are on short terrace breaks above and next to drainageways. Their surface layer is dark-brown silt loam. The subsoil is yellowish brown and dark yellowish brown and is mainly silty clay loam.

Henshaw soils are somewhat poorly drained and nearly level. They are on low terraces along drainageways. Their surface layer is brown and yellowish-brown silt loam. The subsoil is yellowish-brown silty clay loam that has gray, pale-brown, and light yellowish-brown mottles.

Among the minor soils are Haymond and Wakeland soils on bottom lands and Montgomery and Zipp soils in depressional areas.

Most of this association is used for corn, soybeans, small grains, hay, and pasture. Erosion caused by runoff is a hazard on the soils that have slopes of more than 2 percent. Wetness limits use and management of the somewhat poorly drained soils.

5. Weinbach-Wheeling Association

Deep, somewhat poorly drained and well-drained, medium-textured, nearly level to sloping soils on terraces

In this association are somewhat poorly drained and well-drained, nearly level to sloping soils. These soils are on terraces.

This association makes up about 16 percent of the county. Weinbach soils make up about 40 percent of the association, Wheeling soils about 28 percent, and minor soils about 32 percent.

Weinbach soils are somewhat poorly drained and nearly level. Their surface layer is brown and grayish-brown loam or silt loam. The subsoil is light brownish-gray and dark-brown silt loam and clay loam that has yellowish-brown, gray, and yellowish-red mottles. A firm and brittle, very slowly permeable fragipan is at a depth of about 22 inches.

Wheeling soils are well drained and nearly level to sloping. Their surface layer is dark-brown and yellowish-brown silt loam or loam. The subsoil is strong-brown and brown sandy clay loam.

Among the minor soils are Ginat, Princeton, Rahm, Sciotoville, Vincennes, and Woodmere.

Most of this association is used for corn, soybeans, small grains, hay, and pasture. Wheeling soils are well suited to tobacco, and most of the tobacco of the county is grown on areas of these soils. Erosion caused by runoff is a hazard on the soils that have slopes of more than 2 percent. Flooding is a hazard on the soils that occupy areas near the level of the streams. Wetness limits use and management of the somewhat poorly drained soils.

6. Stendal-Philo-Huntington Association

Deep, somewhat poorly drained to well-drained, medium-textured, nearly level soils on bottom lands

In this association are somewhat poorly drained to well-drained soils that are nearly level. These soils are on bottom lands.

This association occupies about 9 percent of the county. Stendal soils make up about 37 percent of the association, Philo soils about 30 percent, Huntington soils about 19 percent, and minor soils about 14 percent.

Stendal soils are somewhat poorly drained and acid. They are on flood plains along the creeks in the northern part of the county. Their surface layer is brown silt loam. The subsoil is light brownish-gray and pale-brown silt loam.

Philo soils are moderately well drained and acid. They are on flood plains along the creeks in the northern part of the county. Their surface layer and subsoil are yellowish-brown silt loam.

Huntington soils are well drained and neutral or slightly acid. They are on flood plains along the Ohio River. Their surface layer and subsoil are dark-brown silt loam.

Among the minor soils are Huntington sandy variants and Lindside and Newark soils, on flood plains along the Ohio River, and Atkins and Cuba soils, along the creeks in the northern part of the county.

Most areas of the soils of this association are used for corn, soybeans, and pasture. Flooding is a hazard on these soils. Wetness limits use and management of the somewhat poorly drained soils, and drainage is needed for optimum use and good growth of crops.

Descriptions of the Soils

This section describes the soil series and mapping units of Spencer County. The procedure is first to describe each soil series, and then the mapping units in that series. Thus, to get full information on any mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs.

Each series contains a short nontechnical description of a representative soil profile and a more detailed description of the same profile for use by scientists, engineers, and others in making highly technical interpretations. This profile is considered representative of all the soils of a series. If the profile for a given mapping unit differs from the representative profile, the differences are stated in the description of the mapping unit, unless the differences are apparent in the name of the mapping unit. Technical terms are used in describing soil series and mapping units only when nontechnical terms cannot convey the precise meanings. Many of the more commonly used terms are defined in the Glossary.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Strip mines, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetical order along with the soil series.

In describing the representative profile, the color of each horizon is given by name and by the Munsell color notation, or by symbol for hue, value, and chroma (*7*) [1]. For the profile described, the names of the colors and the color symbols are for moist soils, unless otherwise stated.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the soil or land type on the detailed map at the back of this survey. Shown at the end of each description of each mapping unit are the capability classification and the woodland group in which the mapping unit has been placed. The page on which each is described is listed in the "Guide to Mapping Units." The location of the soils in the county is shown on the detailed map at the back of this survey, and the acreage and proportionate extent of the mapping units are shown in table 1.

[1] Italic numbers in parentheses refer to Literature Cited, p. 77.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Alford silt loam, 0 to 2 percent slopes	381	0.2
Alford silt loam, 2 to 6 percent slopes, eroded	6,345	2.5
Alford silt loam, 2 to 6 percent slopes, severely eroded	1,025	.4
Alford silt loam, 6 to 12 percent slopes, eroded	1,033	.4
Alford silt loam, 6 to 12 percent slopes, severely eroded	8,127	3.2
Alford silt loam, 12 to 18 percent slopes, eroded	282	.1
Alford silt loam, 12 to 18 percent slopes, severely eroded	3,836	1.5
Alford silt loam, 18 to 25 percent slopes	546	.2
Alford silt loam, 25 to 35 percent slopes	570	.2
Algiers silt loam	2,276	.9
Atkins silt loam	353	.1
Bartle silt loam	2,184	.9
Cuba silt loam	1,537	.6
Gilpin-Wellston silt loams, 25 to 35 percent slopes	2,731	1.1
Ginat silt loam	3,307	1.3
Gullied land, loess	801	.3
Gullied land, shale	4,364	1.7
Haymond silt loam	1,002	.4
Henshaw silt loam	4,799	1.9
Hosmer silt loam, 2 to 6 percent slopes, eroded	5,872	2.3
Hosmer silt loam, 2 to 6 percent slopes, severely eroded	969	.4
Hosmer silt loam, 6 to 12 percent slopes, eroded	985	.4
Hosmer silt loam, 6 to 12 percent slopes, severely eroded	9,338	3.7
Huntington silt loam	8,849	3.5
Huntington fine sandy loam, sandy variant	311	.1
Iona silt loam, 0 to 2 percent slopes	956	.4
Iona silt loam, 2 to 6 percent slopes, eroded	408	.2
Johnsburg silt loam, 0 to 2 percent slopes	493	.2
Lindside silt loam	2,286	.9
Made land and Pits	417	.2
Markland silt loam, 2 to 6 percent slopes, eroded	2,277	.9
Markland silt loam, 6 to 12 percent slopes, eroded	262	.1
Markland silt loam, 12 to 18 percent slopes, eroded	212	.1
Markland silt loam, 18 to 25 percent slopes	787	.3
Markland silty clay loam, 2 to 6 percent slopes, severely eroded	1,019	.4
Markland silty clay loam, 6 to 12 percent slopes, severely eroded	2,030	.8
Markland silty clay loam, 12 to 18 percent slopes, severely eroded	773	.3
McGary silt loam	7,114	2.8
Montgomery silty clay loam	556	.2
Newark silt loam	1,803	.7
Pekin silt loam, 0 to 2 percent slopes	205	.1
Pekin silt loam, 2 to 6 percent slopes, eroded	785	.3
Philo silt loam	13,637	5.4
Princeton fine sandy loam, 2 to 6 percent slopes, eroded	319	.1
Princeton fine sandy loam, 6 to 18 percent slopes, eroded	289	.1
Ragsdale silt loam	3,577	1.4
Rahm silt loam	510	0.2
Sciotoville silt loam, 0 to 2 percent slopes	1,770	.7
Sciotoville silt loam, 2 to 6 percent slopes, eroded	1,038	.4
Stendal silt loam	16,245	6.4
Strip mines	1,268	.5
Tilsit silt loam, 0 to 2 percent slopes	795	.3
Tilsit silt loam, 2 to 6 percent slopes, eroded	6,349	2.5
Tilsit silt loam, 2 to 6 percent slopes, severely eroded	1,000	.4
Uniontown silt loam, 0 to 2 percent slopes	460	.2
Uniontown silt loam, 2 to 6 percent slopes, eroded	2,511	1.0
Uniontown silt loam, 2 to 6 percent slopes, severely eroded	306	.1
Uniontown silt loam, 6 to 12 percent slopes, eroded	267	.1
Uniontown silt loam, 6 to 12 percent slopes, severely eroded	939	.4
Uniontown silt loam, 12 to 25 percent slopes, eroded	999	.4
Vincennes silt loam	3,367	1.3
Wakeland silt loam	2,243	.9
Weinbach loam, 0 to 2 percent slopes	1,089	.4
Weinbach silt loam, 0 to 2 percent slopes	15,744	6.2
Wellston silt loam, 2 to 6 percent slopes	564	.2
Wellston silt loam, 6 to 12 percent slopes, eroded	303	.1
Wellston silt loam, 6 to 12 percent slopes, severely eroded	444	.2
Wellston silt loam, 12 to 18 percent slopes, eroded	4,844	1.9
Wellston silt loam, 12 to 18 percent slopes, severely eroded	8,657	3.4
Wellston silt loam, 18 to 25 percent slopes, eroded	5,843	2.3
Wellston silt loam, 18 to 25 percent slopes, severely eroded	1,459	.6
Wheeling loam, 0 to 2 percent slopes	4,902	1.9
Wheeling loam, 2 to 6 percent slopes, eroded	2,759	1.1
Wheeling loam, 2 to 6 percent slopes, severely eroded	760	.3
Wheeling loam, 6 to 12 percent slopes, eroded	266	.1
Wheeling loam, 6 to 12 percent slopes, severely eroded	750	.3
Wheeling silt loam, 0 to 2 percent slopes	2,226	.9
Wilbur silt loam	5,547	2.2
Woodmere silt loam	1,194	.5
Zanesville silt loam, 2 to 6 percent slopes, eroded	9,354	3.7
Zanesville silt loam, 6 to 12 percent slopes, eroded	6,350	2.5
Zanesville silt loam, 6 to 12 percent slopes, severely eroded	13,154	5.2
Zanesville silt loam, 12 to 18 percent slopes, eroded	1,784	.7
Zanesville silt loam, 12 to 18 percent slopes, severely eroded	10,105	4.0
Zipp silty clay loam	2,771	1.1
Water	476	.2
Total	253,440	100.0

Alford Series

The Alford series consists of deep, well-drained, medium-textured, nearly level to very steep soils. These soils formed in silty loess and are on uplands. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown and brown silt loam about 8 inches thick. The subsoil, about 49 inches thick, is firm and yellowish brown. It is silt loam in the upper 15 inches and silty clay loam below. The underlying material is yellowish-brown, friable silt loam and silt that has light brownish-gray mottles.

Permeability is moderate, and available moisture capacity is high. The content of organic matter is low.

Most areas of Alford soils are used for crops, but small areas of the strongly sloping to very steep soils are used as pasture and as woodland.

Representative profile of Alford silt loam, 6 to 12 percent slopes, eroded (about 4 miles west of Rockport and 370 feet east of the northwest corner of SW¼ sec. 30, T. 7 S., R. 6 W.):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, medium and thick, platy structure that parts to moderate, fine, granular; friable when moist; neutral; abrupt, smooth boundary.

A2—6 to 8 inches, brown (10YR 5/3) silt loam; weak, medium and thick, platy structure; friable when moist; slightly acid; abrupt, smooth boundary.

B21t—8 to 23 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, subangular blocky structure; firm when moist; a few, dark-brown (7.5YR 4/4) clay films; strongly acid; clear, smooth boundary.

B22t—23 to 57 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, medium, subangular blocky structure; firm when moist; many dark-brown (7.5YR 4/4) clay films on ped faces; a few, fine, very dark brown (10YR 2/2) manganese stains; very strongly acid; clear, smooth boundary.

C1—57 to 64 inches, yellowish-brown (10YR 5/6) silt loam that has a few, fine, distinct light brownish-gray (10YR 6/2) mottles; massive; friable when moist; a few, very fine, very dark brown (10YR 2/2) manganese stains; medium acid; gradual, smooth boundary.

C2—64 to 110 inches, yellowish-brown (10YR 5/6) silt that has a few, fine, distinct light brownish-gray (10YR 6/2) mottles; massive; very friable when moist; a few, fine, very dark brown (10YR 2/2) manganese stains; medium acid.

The B horizon ranges from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6) in color and from 30 to 54 inches in thickness. The C horizon is at a depth of 30 to 60 inches. It ranges from neutral to medium acid in reaction. The silty loess material ranges from about 6 to 20 feet in thickness.

Alford silt loam, 0 to 2 percent slopes (AfA).—This soil occupies moderately broad and narrow areas on long ridgetops. Its surface layer is a few inches thicker than that in the profile described as representative of the series.

Included with this soil in mapping are a few small areas of gently sloping Alford soils.

Runoff is slow on this Alford soil. This soil has few limitations to use. It is well suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow. Capability unit I-1; woodland group 1.

Alford silt loam, 2 to 6 percent slopes, eroded (AfB2).—This soil has short and moderately long slopes. It occurs below nearly level soils on ridgetops.

Included with this soil in mapping are small areas of steeper Alford soils that are severely eroded.

Runoff is slow on this Alford soil, and further erosion is the main hazard. All crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. Capability unit IIe-3; woodland group 1.

Alford silt loam, 2 to 6 percent slopes, severely eroded (AfB3).—This soil is on short and moderately long areas below nearly level soils on ridgetops. The plow layer consists mostly of yellowish-brown material formerly in the subsoil, but the profile otherwise is like that described for the series.

Included with this soil in mapping are small areas of steeper Alford soils.

Runoff is medium on this Alford soil. If this soil is cultivated, further erosion is a major hazard. Most crops commonly grown in the county are well suited. The main crops are corn, soybeans, small grains, and meadow. Capability unit IIIe-3; woodland group 1.

Alford silt loam, 6 to 12 percent slopes, eroded (AfC2).—This soil has the profile described as representative for the series. It is on hillsides below nearly level and gently sloping soils on ridgetops.

Included in mapping are small areas of gently sloping Alford soils that are severely eroded.

Runoff is medium on this Alford soil. If this soil is used intensively for crops, further erosion is a hazard. Most crops commonly grown in the county are suited. The main crops are corn, soybeans, and small grains. Capability unit IIIe-3; woodland group 1.

Alford silt loam, 6 to 12 percent slopes, severely eroded (AfC3).—This soil is on hillsides below nearly level and gently sloping soils on ridgetops. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion and the present surface layer is mainly yellowish-brown material formerly in the subsoil. In a few areas the gullies have been smoothed over, and the friable silt loam material below is exposed. In a few places deep gullies have formed.

Included with this soil in mapping are a few small areas of Gullied land, loess.

Runoff is rapid on this Alford soil, and further erosion is a major hazard. Most crops commonly grown in the county are suited. The main crops are small grains and meadow. Capability unit IVe-3; woodland group 1.

Alford silt loam, 12 to 18 percent slopes, eroded (AfD2).—This soil occupies small narrow breaks between areas of gently sloping soils on uplands and nearly level soils on bottom lands. The profile is similar to that described as representative for the series, except that the subsoil ranges from 30 to 36 inches in thickness.

Included with this soil in mapping are a few areas of severely eroded Alford soils that are strongly sloping and steep.

Runoff is rapid on this Alford soil, and further erosion is a major hazard. Small grains, meadow crops, and trees are suited. Most areas of this soil are used as pasture and as woodland. Capability unit IVe-3; woodland group 1.

Alford silt loam, 12 to 18 percent slopes, severely eroded (AfD3).—This soil occurs between nearly level soils on bottom lands and gently sloping soils on upland ridges. The surface layer consists mainly of yellowish-brown material formerly in the subsoil, but the profile otherwise is like that described as representative of the series. Also, depth to friable silt generally is about 30 inches.

Included with this soil in mapping are a few small areas where the friable silt underlying material is exposed. Also included are a few small areas of Gullied land, loess, and some deep gullies.

Runoff is rapid on this Alford soil, and further erosion is a major hazard. Pasture and trees are well suited. Under good management, grasses and trees of high quality can be produced on this soil. Capability unit VIe–1; woodland group 1.

Alford silt loam, 18 to 25 percent slopes (AfE).—This steep soil occupies short bluffs between nearly level soils on bottom lands or terraces and gently sloping soils on uplands. The profile is similar to that described as representative of the series, except that the subsoil is only 30 to 36 inches thick.

Included with this soil in mapping are a few small areas of strongly sloping Alford soils that are eroded and severely eroded.

Runoff is rapid on this Alford soil, and further erosion is a major hazard. Pasture plants and trees are well suited. Capability unit VIe–1; woodland group 2.

Alford silt loam, 25 to 35 percent slopes (AfF).—This very steep soil occupies short bluffs between nearly level alluvial soils and gently sloping and sloping Alford soils. Depth to the underlying silty material generally is less than 36 inches, but the profile otherwise is like that described as representative of the series. Included in mapping are a few small areas of less steep Alford soils.

Runoff is rapid on this soil, and erosion is a hazard. Pasture plants and trees are well suited. Capability unit VIe–1; woodland group 2.

Algiers Series

The Algiers series consists of deep, poorly drained, medium-textured, nearly level soils in depressions and other low areas. These soils formed in moderately deep recent alluvium over buried soils. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The upper part of the subsoil, about 15 inches thick, is friable silt loam. It is dark brown in the upper 7 inches and dark grayish brown mottled with olive gray in the next 8 inches. Below is a buried very dark gray soil about 23 inches thick that is mottled with olive and olive gray. The underlying material is yellowish-brown and brownish-yellow friable silt loam that has gray mottles.

Permeability is moderate in these soils, and available moisture capacity is high. These soils have a seasonal high water table. Most areas are used for crops.

Representative profile of Algiers silt loam (in a cultivated field one-half mile west of Rockport and 1,080 feet west and 300 feet north of the southeast corner of SW¼ sec. 27, T. 7 S., R. 6 W.):

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; weak, very fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21—7 to 14 inches, dark-brown (10YR 4/3) silt loam; weak, thick, platy structure that parts to fine granular; friable when moist; a few brown (10YR 5/3) silt coatings in root channels; slightly acid; clear, smooth boundary.

B22g—14 to 22 inches, dark grayish-brown (10YR 4/2) silt loam; many, fine, olive-gray (5Y 5/2) mottles; weak, fine, granular structure; friable when moist; many, fine, dark-brown (7.5YR 4/4) manganese stains; slightly acid; clear, smooth boundary.

IIAb—22 to 47 inches, very dark gray (10YR 3/1) silt loam; common, fine, distinct, olive-gray (5Y 5/2) and olive (5Y 5/3) mottles; massive; friable when moist; many, fine, very dark grayish-brown (10YR 3/2) manganese stains; neutral; gradual, irregular boundary.

IICg—47 to 85 inches, yellowish-brown (10YR 5/8) and brownish-yellow (10YR 6/6) silt loam; many, fine, prominent, gray (N 5/10) mottles; massive; friable when moist; a few, very fine, very dark brown (10YR 2/2) manganese stains and soft concretions; mildly alkaline.

The A horizon is dark grayish brown, brown, or dark brown in color. The A and B horizons range from neutral to medium acid in reaction. The buried soil is at a depth of 20 to 30 inches. It ranges from silt loam to silty clay loam in texture.

Algiers soils have a lower content of sand than is defined for the series, but this difference does not alter their usefulness and behavior.

Algiers silt loam (0 to 2 percent slopes) (Ag).—This is the only Algiers soil mapped in the county. It is in depressional areas on deep loess uplands and along the boundary between the loess uplands and lacustrine flats. Included in mapping are a few small areas of Wakeland soil and a few small areas of Wilbur soil.

Runoff is slow to ponded on this Algiers soil. Wetness is the major limitation to use. Crops are subject to damage from soil material washed in from surrounding areas. This soil is suited to most crops commonly grown in the county, and the main crops are corn and soybeans. Capability unit IIw–1; woodland group 11.

Atkins Series

In the Atkins series are deep, poorly drained, medium-textured, nearly level soils on flood plains. These acid soils formed in mixed alluvium, mainly from material weathered from shale and sandstone. The native vegetation was mixed hardwoods that could tolerate wetness.

In a representative profile the surface layer is brown silt loam about 9 inches thick. The subsoil, about 16 inches thick, is grayish-brown, friable silt loam that has mottles of dark yellowish brown and yellowish brown. The underlying material is gray, friable silt loam that has brown mottles.

Atkins soils are subject to occasional flooding, and they have a seasonal high water table. Permeability is moderate, and available moisture capacity is high.

If these soils are properly drained, they are well suited to row crops. Many unimproved areas are used as pasture and as woodland.

Representative profile of Atkins silt loam (in a cultivated field one-half mile north of Lincoln City and 1,500 feet south and 60 feet east of the northwest corner of sec. 32, T. 4 S., R. 5 W.):

Ap—0 to 9 inches, brown (10YR 5/3) silt loam; moderate, medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B2g—9 to 25 inches, grayish-brown (10YR 5/2) silt loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/8) mottles; moderate, fine, granular structure; friable when moist; many iron and manganese concretions that range from 1 to 2 millimeters in diameter; very strongly acid; gradual, smooth boundary.

Cg—25 to 53 inches, gray (10YR 5/1) silt loam; a few, fine, faint, brown (10YR 5/3) mottles; massive; friable when moist; many iron and manganese concretions; very strongly acid.

The A horizon ranges from brown to light gray in color. In places a few fine shale and sandstone fragments are in the lower part of this horizon.

Atkins silt loam (0 to 2 percent slopes) (Ak).—This is the only Atkins soil mapped in the county. It is on flood plains along small creeks. Included are a few small areas of Stendal soils.

Runoff is slow on this soil, and flooding is a hazard. Wetness is the main limitation to use. If drained, this soil is suited to most crops commonly grown in the county. The main crops are corn and soybeans. Capability unit IIIw-10; woodland group 11.

Bartle Series

The Bartle series consists of deep, somewhat poorly drained, medium-textured, nearly level soils. These soils are on terraces along major tributaries of the Ohio River. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is grayish-brown silt loam about 10 inches thick. The subsurface layer, about 9 inches thick, is light yellowish-brown and light brownish-gray silt loam that has yellowish-brown mottles. The subsoil is about 45 inches thick. In the upper 9 inches, it is friable, light yellowish-brown light silty clay loam that has mottles of light brownish gray and yellowish brown. Below is a light brownish-gray firm fragipan layer that has mottles of yellowish brown. The underlying material is stratified brownish-yellow to yellowish-brown silt loam, light yellowish-brown silty clay loam, and light-gray loam.

Permeability is very slow in these soils, and available moisture capacity is moderate. Fertility is low.

Most areas of the Bartle soils are used for crops.

Representative profile of Bartle silt loam (in a cultivated field 845 feet east and 50 feet south of the northwest corner of sec. 7, T. 4 S., R. 5 W.):

Ap—0 to 10 inches, grayish-brown (10YR 5/2) silt loam; moderate, medium, platy structure; friable when moist; neutral; abrupt, smooth boundary.

A21—10 to 14 inches, light brownish-gray (10YR 6/2) silt loam; common, fine, faint, light yellowish-brown (10YR 6/4) mottles; moderate, medium, platy structure; friable when moist; medium acid; clear, irregular boundary.

A22—14 to 19 inches, light yellowish-brown (10YR 6/4) and light brownish-gray (10YR 6/2) silt loam; common, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, very thick, platy structure that parts to moderate, medium, subangular blocky; friable when moist; very strongly acid; clear, wavy boundary.

B2t—19 to 28 inches, light yellowish-brown (10YR 6/4) light silty clay loam; many, fine, faint, light brownish-gray 10YR 6/2) and yellowish-brown (10YR 5/6) mottles; weak, medium and coarse, subangular blocky structure; friable when moist; a few brown (10YR 5/3) and light brownish-gray (10YR 6/2) clay films; a few, fine, very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, wavy boundary.

B'x—28 to 64 inches, light brownish-gray (10YR 6/2) light silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate to strong, very coarse, prismatic structure; firm when moist; light brownish-gray (10YR 6/2) silt coatings along prisms; a few brown (7.5YR 5/4) and reddish-brown (5YR 5/4) clay films; very strongly acid; clear, wavy boundary.

C1—64 to 78 inches, brownish-yellow (10YR 6/6) to yellowish-brown (10YR 5/6) silt loam; massive; firm when moist; gray (10YR 6/1) silt coatings in voids and in soil crevices; fibrous black (10YR 2/1) organic coatings in seams on the gray silt coatings; a few, patchy, reddish-brown (5YR 4/4) clay films; strongly acid; gradual, wavy boundary.

C2—78 to 118 inches, light yellowish-brown (10YR 6/4) silty clay loam; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; massive; firm when moist; slightly acid; clear, smooth boundary.

IIC3—118 to 124 inches, light-gray (10YR 7/1) loam; common, fine, distinct, brownish-yellow (10YR 6/6) and yellowish-brown (10YR 5/8) mottles; massive; friable when moist; a few dark yellowish-brown (10YR 3/4) manganese stains; neutral.

The A horizon ranges from silt loam to loam in texture. The Ap horizon ranges from grayish brown (10YR 5/2) to dark grayish brown (10YR 4/2) in color. The A2 horizon ranges from 6 to 9 inches in thickness, and the B'x horizon from 24 to 36 inches in thickness. Depth to the underlying stratified material ranges from 50 to 65 inches.

Bartle silt loam (0 to 2 percent slopes) (Ba).—This is the only Bartle soil mapped in the county. It is on terraces.

Included with this soil in mapping are a few small areas that have a surface layer of loam. Also included are a few areas that have a darker surface layer than that described as representative of the series and some areas of gently sloping soils that are slightly eroded or moderately eroded.

Runoff is slow on this soil. The very slowly permeable fragipan in the subsoil restricts drainage, and wetness is the major limitation to use. If properly drained, this soil is suited to most crops commonly grown in the county. The main crops are corn and soybeans. Capability unit IIw-3; woodland group 5.

Cuba Series

The Cuba series consists of deep, well-drained, medium-textured, nearly level soils on flood plains. These acid soils formed in mixed alluvium, mainly from material weathered from shale and sandstone. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown silt loam about 8 inches thick. The subsoil is dark-brown, friable silt loam about 49 inches thick. The underlying material is dark-brown, friable silt loam.

Permeability is moderate in these soils, and available moisture capacity is high. Flooding is a hazard. In areas that have not been limed, the soils are strongly acid to very strongly acid throughout the profile.

Cuba soils are intensively cultivated, and corn is the main crop.

Representative profile of Cuba silt loam (in a cultivated field 900 feet north of Highway 62 along Hurricane Creek and 1,050 feet east and 990 feet south of the northwest corner of NE¼ sec. 12, T. 4 S., R. 4 W.):

Ap—0 to 8 inches, dark-brown (10YR 4/3) silt loam; moderate, medium and thin, platy structure; friable when moist; slightly acid; abrupt, smooth boundary.

B—8 to 57 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable when moist; very strongly acid; clear, smooth boundary .

C—57 to 80 inches, dark-brown (10YR 4/3) silt loam; massive; friable when moist; a few, fine, faint pale-brown (10YR 6/3) and yellowish-brown (10YR 5/8) splotches; a few, fine specks of very dark brown (10YR 2/2) iron and manganese stains; very strongly acid.

The A horizon ranges from dark brown to yellowish brown in color. The C horizon contains a few thin strata of silt loam that contains enough sand to make it feel gritty when rubbed between the fingers and a few fragments of shale and sandstone. In places in this horizon a few gray mottles are at a depth below 30 inches.

In a few areas these soils have a lower content of clay than is defined for the series, but this difference does not alter their usefulness and behavior.

Cuba silt loam (0 to 2 percent slopes) (Cu).—This is the only Cuba soil mapped in the county. It is on flood plains along small streams.

Included with this soil in mapping, and making up about 15 percent of the mapped areas, are a few areas of Cuba soils that have a surface layer of loam. Also included are a few small areas of moderately well drained soils and a few areas where the soil is moderately deep to channery material.

Runoff is slow on this Cuba soil. This soil is subject to occasional flooding, but otherwise it has few limitations to use. All crops commonly grown in the county are suited. The main crops are corn and soybeans. Capability unit I–2; woodland group 8.

Gilpin Series

The Gilpin series consists of moderately deep, well-drained, very steep soils that are medium textured. These soils are on uplands. They formed in material weathered from shale and sandstone. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is very dark grayish-brown silt loam about 3 inches thick. The subsurface layer is yellowish-brown silt loam about 7 inches thick. The subsoil, about 18 inches thick, is brown to strong-brown friable silt loam and loam. Sandstone fragments occur throughout the profile, but they are more numerous in the lower part of the subsoil. The underlying material is interbedded sandstone and shale bedrock.

Permeability is moderate in these soils, and available moisture capacity is low or moderate.

Most areas of Gilpin soils are used for growing hardwood trees, but a few small areas are in pasture.

Representative profile of Gilpin silt loam, in an area of Gilpin-Wellston silt loams, 25 to 35 percent slopes (in a wooded area 1 mile south of St. Meinrad and 1,070 feet east and 570 feet south from center of sec. 23, T. 4 S., R. 4 W.):

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, very fine, granular structure; friable when moist; a few small sandstone fragments; slightly acid; clear, smooth boundary.

A2—3 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak, very thick, platy structure; friable when moist; a few small sandstone fragments; strongly acid; clear, wavy boundary.

B1—10 to 12 inches, brown (7.5YR 5/4) silt loam; weak, fine, subangular blocky structure; friable when moist; a few small sandstone fragments; very strongly acid; clear, wavy boundary.

IIB21t—12 to 16 inches, brown (7.5YR 5/4) to strong-brown (7.5YR 5/6) silt loam; weak, medium, subangular blocky structure; friable when moist; common, dark-brown (7.5YR 4/4), very thin clay films on ped surfaces and on sandstone fragments; very strongly acid; clear, wavy boundary.

IIB22t—16 to 28 inches, strong-brown (7.5YR 5/6) heavy loam; weak to moderate, medium and coarse, subangular blocky structure; friable when moist; many yellowish-red (5YR 5/6) clay films; many sandstone fragments (more than 50 percent, by volume, of the horizon mass); very strongly acid; clear, irregular boundary.

R—28 inches, sandstone bedrock interbedded with shale.

The A1 horizon ranges from very dark grayish brown to grayish brown in color and from 3 to 10 inches in thickness. The B horizon ranges from grayish brown to strong brown in color, from 15 to 30 inches in thickness, and from heavy loam to clay loam in texture. The material in the B21t horizon is silt loam that contains enough sand to make it feel gritty when rubbed between the fingers. The silt capping is less than 15 inches thick. Depth to the shale and sandstone bedrock ranges from 20 to 36 inches.

Gilpin-Wellston silt loams, 25 to 35 percent slopes (GmF).—The soils in this unit are on sandstone and shale uplands. Gilpin silt loam makes up about 60 percent of the unit, Wellston silt loam about 25 percent, and other soils the remaining 15 percent.

Gilpin silt loam is mainly in areas between benches or on shelflike areas on hillsides. Other areas, however, are near the base of escarpments. It has the profile described as representative of the Gilpin series.

Wellston silt loam is mainly on benches and foot slopes on hillsides, but it also is in areas between natural downslope drainageways. It has the profile described as representative of the Wellston series.

Included with this unit in mapping are small areas of rock escarpments, shallow soils that have a high content of channery material, and moderately deep soils that are weakly developed. These included areas are on sharp breaks to drainageways near the crest of hillsides. Also included are small areas of very steep soils that have a surface layer of loam. These areas are near St. Meinrad.

Runoff is rapid on the soils in the Gilpin-Wellston unit, and further erosion is the major hazard. These soils are suitable for use as woodland. Capability unit VIIe–1; woodland group 10.

Ginat Series

The Ginat series consists of deep, poorly drained, medium-textured, nearly level soils on terraces. These soils formed in old acid alluvium. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is grayish-brown silt loam about 9 inches thick. The subsurface layer, about 9 inches thick, is light brownish-gray silt loam that has yellowish-brown mottles. The subsoil, about 32 inches thick, is a firm silty clay loam fragipan. It is light brownish-gray in the upper 21 inches and gray below, and both parts have yellowish-brown mottles. The underlying material is gray, firm silty clay loam that has yellowish-brown and dark yellowish-brown mottles to a depth of 65 inches. At a depth of 65 to 100 inches is dark-brown silty clay loam and heavy silt loam that has grayish-brown mottles.

Permeability is very slow in these soils, and available moisture capacity is moderate. These soils are strongly acid in areas that have not been limed. They have a low content of organic matter and are low in natural fertility.

Ginat soils are used for trees, pasture, and cultivated crops.

Representative profile of Ginat silt loam (in a cultivated field north of Grandview Cemetery, 850 feet south and 1,070 feet west of the northeast corner of sec. 5, T. 7 S., R. 5 W.):

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam; weak, very thick, platy structure that parts to weak, very fine, granular; friable when moist; neutral; abrupt, smooth boundary.

A21—9 to 14 inches, light brownish-gray (10YR 6/2) silt loam; a few, fine, distinct, yellowish-brown (10YR 5/6) mottles; moderate, thin and medium, platy structure; friable when moist; many fine specks of dark yellowish-brown (10YR 4/4) and very dark brown (10YR 2/2) manganese concretions; very strongly acid; abrupt, smooth boundary.

A22—14 to 18 inches, gray (10YR 6/1) silt loam; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; weak, very thick, platy structure; friable when moist; a few, fine, dark yellowish-brown (10YR 4/4) specks and many very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, irregular boundary.

B'x1—18 to 39 inches, light brownish-gray (10YR 6/2) light silty clay loam; many, fine, distinct, yellowish-brown (10YR 5/8) mottles; moderate, very coarse, prismatic structure; firm when moist; many very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, irregular boundary.

B'x2—39 to 50 inches, gray (10YR 6/1) silty clay loam; many, fine, distinct, yellowish-brown (10YR 5/8) mottles; moderate, coarse, prismatic structure; firm when moist; many very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, irregular boundary.

C1—50 to 65 inches, gray (10YR 6/1) silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; massive; firm when moist; many hard, rounded iron concretions that have thick gray (10YR 6/1) clay films and black (10YR 2/1) manganese coatings; strongly acid; gradual, wavy boundary.

IIC2—65 to 100 inches, dark-brown (7.5YR 4/4) light silty clay loam to heavy silt loam; common, fine, distinct, grayish-brown (10YR 5/2) mottles; massive; firm when moist; a few, very dark brown (10YR 2/2) manganese stains; many very fine mica flakes; strongly acid.

The A horizon ranges from gray to light brownish-gray and grayish-brown in color, from silt loam to loam in texture, and from 14 to 20 inches in thickness. The B'x horizon ranges from heavy silt loam to silty clay loam in texture and from 20 to 36 inches in thickness. The underlying stratified material is at a depth of 45 to 70 inches. It ranges from sand to silty clay loam in texture and from strongly acid to medium acid in reaction.

Ginat silt loam (0 to 2 percent slopes) (Gn).—This is the only Ginat soil mapped in the county. It is on terraces. Many of the areas are broad and appear as gray flats.

Included with this soil in mapping, and making up less than 10 percent of the mapped areas, are areas where the surface layer is loam. These areas are principally in the Hatfield and Grandview communities.

Runoff is slow on this soil. Wetness is the major limitation to use.

If drained, this soil is suited to most crops commonly grown in the county, and the main crops are corn, soybeans, small grains, and meadow. Capability unit IIIw-12; woodland group 11.

Gullied Land, Loess

Gullied land, loess (Go) consists of very severely eroded, sloping to very steep areas. The areas are on deep loess uplands near Alford soils. They consist mainly of a series of closely spaced V-shaped gullies cut into deep friable silt. They are dominantly 2 to 5 acres, but a few areas are larger than 20 acres. Included in mapping are small areas of Alford soils between the gullies.

Runoff is rapid on Gullied land, loess, and further erosion is a major hazard. The areas are suitable for growing trees and for use as wildlife habitat. A few of the sloping areas are suitable for use as pasture. Capability unit VIIe-2; woodland group 3.

Gullied Land, Shale

Gullied land, shale (Gs) consists of very severely eroded, sloping to very steep areas. The areas occur mainly near sloping Hosmer soils, sloping to very steep Gilpin and Wellston soils, and sloping to strongly sloping Zanesville soils. Areas of Gullied land, shale, are dominantly 3 to 10 acres in size, but a few areas are as large as 60 acres. In the gullied areas most of the original soil material has been removed through erosion, and the exposed soil material ranges from loam to clay. Many shaly fragments and a few angular sandstone fragments generally are on the surface, and in places the underlying shale and sandstone are exposed.

Runoff is very rapid on this land, and further erosion is a major hazard (fig. 5). Most of the areas are bare of plants except for a few trees, shrubs, weeds, and grasses. A few areas can be planted to trees or used as wildlife habitat. Capability unit VII-2; woodland group 14.

Haymond Series

The Haymond series consists of deep, well-drained, medium-textured, nearly level soils on flood plains. These soils formed in mixed alluvium washed mainly from shale and sandstone uplands capped with loess. Some of the alluvium, however, came from limestone washed from calcareous lacustrine terraces and from backwater sediment deposited by the Ohio River. The native vegetation was mixed hardwoods.

Figure 5.—**A severely eroded area of Gullied land, shale.**

In a representative profile the surface layer is dark-brown to dark grayish-brown silt loam about 9 inches thick. The subsoil is dark-brown, friable silt loam about 11 inches thick. The underlying material is dark-brown, friable silt loam and loam that contains thin lenses of fine sand in the lower part.

Permeability is moderate, and available moisture capacity is high. Flooding is a hazard.

Haymond soils are used intensively for crops, and the main crops are corn and soybeans. A few areas along meandering stream channels, however, are used for trees.

Representative profile of Haymond silt loam (in a cultivated field east of St. Meinrad and 460 feet east and 850 feet north of the southwest corner of SE¼ sec. 13, T. 4 S., R. 4 W.):

Ap—0 to 9 inches, dark-brown (10YR 4/3) to dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

B21—9 to 12 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

B22—12 to 20 inches, dark-brown (10YR 4/3) light silt loam; thin layers of pale-brown (10YR 6/3) loam; weak, fine, granular structure; friable when moist; medium acid; gradual, smooth boundary.

C1—20 to 50 inches, dark-brown (10YR 4/3) silt loam; a few thin layers of pale-brown (10YR 6/3) and dark-brown (7.5YR 4/4) loam; massive; friable when moist; medium acid; abrupt, smooth boundary.

C2—50 to 92 inches, dark-brown (10YR 4/3) loam; common layers of light yellowish-brown (10YR 6/4) fine sand about 5 millimeters thick; massive; friable when moist; slightly acid.

The A horizon ranges from dark brown and dark grayish brown to grayish brown in color. In places a few gray mottles occur below a depth of 30 inches. Reaction in the profile ranges from medium acid to slightly acid.

Where they occur along the banks of the Anderson River, these soils have a higher content of sand than is defined for the series, but this difference does not materially alter their usefulness and behavior.

Haymond silt loam (0 to 2 percent slopes) (Ha).—This is the only Haymond soil mapped in the county. It is on flood plains. Included in mapping, and making up about 8 percent of the mapped areas, are a few areas where the surface layer is loam.

Runoff is slow on this soil. Except for occasional flooding, limitations to use are few. Most crops commonly grown in the county are suited, and the main crops are corn and soybeans. Pasture plants and trees are also suited. Capability unit I–2; woodland group 8.

Henshaw Series

The Henshaw series consists of deep, somewhat poorly drained, medium-textured, nearly level soils. These soils are on lacustrine terraces that had a capping of loess. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is brown silt loam about 10 inches thick. The subsurface layer, about 3 inches thick, is yellowish-brown silt loam that is mottled with gray. The subsoil is about 44 inches thick. It is yellowish-brown, friable silty clay loam that has gray and pale-brown mottles in the upper 17 inches. Below is yellowish-brown, firm silty clay loam that has gray and light yellowish-brown mottles. The underlying material is stratified silt and clay. It is yellowish-brown, friable silt that has gray streaks in the upper 23 inches. Below is dark-brown, firm, mottled clay that extends to a depth of 93 inches or more.

Permeability is moderately slow in these soils, and available moisture capacity is high.

Henshaw soils are used mainly for corn, soybeans, small grains, and meadow crops. A few small areas, however, are in pasture or are used as woodland.

Representative profile of Henshaw silt loam (in a cultivated field about 3 miles south of New Boston and 570 feet west and 980 feet north of the southeast corner of NW¼ sec. 7, T. 6 S., R. 3 W.):

Ap—0 to 10 inches, brown (10YR 5/3) silt loam; moderate, fine, granular structure; friable when moist; a few manganese and iron concretions; neutral; abrupt, smooth boundary.

A2—10 to 13 inches, yellowish-brown (10YR 5/4) silt loam; common, fine, distinct, gray (10YR 6/1) mottles; weak, thick to very thick, platy structure; friable when moist; a few manganese and iron concretions; very strongly acid; clear, smooth boundary.

B21t—13 to 30 inches, yellowish-brown (10YR 5/4) silty clay loam; common, fine, distinct, gray (10YR 6/1) mottles and a few, faint, pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; friable when moist; a few, patchy, yellowish-brown (10YR 5/4) clay films and pale-brown (10YR 6/3) silt coatings on cleavage surfaces; a few manganese and iron concretions; very strongly acid; clear, smooth boundary.

IIB22t—30 to 40 inches, yellowish-brown (10YR 5/4) heavy silty clay loam; a few, fine, distinct, gray (10YR 6/1) mottles and many, medium, faint, yellowish-brown (10YR 5/6–5/8) mottles; moderate, coarse, angular and subangular blocky structure; firm when moist; many gray (10YR 6/1) clay films and silt coatings on cleavage surfaces; a few brown (7.5YR 5/4) clay films on a few peds; very dark brown (10YR 2/2) manganese stains and concretions; very strongly acid; clear, smooth boundary.

IIB3—40 to 57 inches, yellowish-brown (10YR 5/6–5/8) silty clay loam; common, fine, distinct, gray (10YR 6/1) mottles and a few, faint, light yellowish-brown (10YR 6/4) mottles; weak, very coarse, angular and subangular blocky structure; firm when moist; a few gray (10YR 6/1) and yellowish-brown (10YR 5/4) clay films on cleavage surfaces and in voids; a few very dark brown (10YR 2/2) manganese and iron stains and concretions; strongly acid; clear, irregular boundary.

IIC1—57 to 80 inches, yellowish-brown (10YR 5/4–5/6) silt; massive; friable when moist; a few very dark brown (10YR 2/2) concretions and stains; a few streaks of gray (10YR 6/1); neutral; gradual, smooth boundary.

IIC2—80 to 93 inches, dark-brown (10YR 4/3) clay; a few, fine, distinct, brownish-yellow (10YR 6/6) mottles; massive; firm when moist; a few gray (10YR 6/1) streaks; mildly alkaline.

The A horizon ranges from grayish brown to yellowish brown in color. The B horizon ranges from yellowish brown to pale brown in color and from silt loam to silty clay in texture. The loess cap ranges from 20 to 40 inches in thickness. The underlying stratified material ranges from clay to sand in texture. At various depths below 36 inches it ranges from neutral to mildly alkaline in reaction.

Henshaw silt loam (0 to 2 percent slopes) (He).—This is the only Henshaw soil mapped in the county. It is on broad lacustrine terraces. Included in mapping, and making up about 5 percent of the mapped areas, are a few gently sloping areas.

Runoff is slow on this Henshaw soil, and wetness is the major limitation to use. If drained, this soil is suited to most crops commonly grown in the county. Corn, soybeans, and small grains are the main crops. Capability unit IIw–2; woodland group 5.

Hosmer Series

The Hosmer series consists of deep, well-drained, medium-textured, gently sloping and sloping soils on uplands. These acid soils formed in silty loess. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown to yellowish-brown silt loam about 7 inches thick. The subsoil, about 58 inches thick, is strong-brown and dark-brown, friable heavy silt loam in the upper 18 inches and a yellowish-brown firm and brittle heavy silt loam fragipan below. The underlying material is yellowish-brown, very friable silt loam.

Permeability is very slow in these Hosmer soils. Available moisture capacity is moderate because the fragipan in the subsoil restricts movement of water. As a result, areas above the fragipan become saturated early in spring and erosion is a hazard. During years of low rainfall, or if the rain is poorly distributed, these soils are droughty in midsummer.

Most areas of Hosmer soils are cultivated and are used to grow row crops, small grains, and pasture plants.

Representative profile of Hosmer silt loam, 2 to 6 percent slopes, eroded (in a cultivated field 570 feet south and 200 feet east of the northwest corner of SW¼ sec. 3, T. 7 S., R. 6 W.):

Ap—0 to 7 inches, dark-brown (10YR 4/3) to yellowish-brown (10YR 5/4) silt loam; weak, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21t—7 to 19 inches, strong-brown (7.5YR 5/6) heavy silt loam; weak, medium and coarse, subangular blocky structure; friable when moist; a few, patchy, dark-brown (7.5YR 4/4) clay films on ped faces and in soil pores; very strongly acid; clear, wavy boundary.

B22t—19 to 25 inches, dark-brown (7.5YR 4/4) heavy silt loam; weak, medium and coarse, subangular and angular blocky structure; friable when moist; a few dark-brown (7.5YR 4/4) clay films in pores; a few light yellowish-brown (10YR 6/4) silt coatings on ped faces; a few, fine, very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, wavy boundary.

B'x—25 to 65 inches, yellowish-brown (10YR 5/6) heavy silt loam; strong, very coarse, prismatic structure; firm when moist and brittle when dry; light brownish-gray (10YR 6/2) silt cap and coatings on prism faces; a few dark-brown (7.5YR 4/4) clay films; a few, fine, very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, smooth boundary.

C—65 to 83 inches, yellowish-brown (10YR 5/6) silt loam; massive; very friable when moist; light brownish-gray (10YR 6/2) streaks and silt coatings throughout the horizon; strongly acid.

The silty loess mantle is 4 to 8 feet thick over material weathered from sandstone and shale. The fragipan is at a depth of 24 to 30 inches, and it ranges from 24 to 40 inches in thickness.

Hosmer silt loam, 2 to 6 percent slopes, eroded (HoB2).—This soil is on ridgetops on uplands. It has the profile described as representative of the series. Part of the original surface layer has been lost through erosion. In places the present surface layer contains a moderate amount of yellowish-brown material formerly in the subsoil. Penetration of most plant roots is restricted by the very slowly permeable fragipan that occurs in the subsoil at a moderate depth.

Included with this soil in mapping are small areas of nearly level and gently sloping soils that are moderately well drained.

Runoff is slow on this Hosmer soil, and further erosion is a major hazard. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. Because of the very slowly permeable fragipan in the subsoil, this soil is not suited to such deep-rooted plants as alfalfa. Capability unit IIe–7; woodland group 9.

Hosmer silt loam, 2 to 6 percent slopes, severely eroded (HoB3).—This soil is on ridgetops on uplands. Most of the original surface layer has been removed through erosion, but the profile otherwise is similar to that described as representative of the series. The present surface layer is mainly yellowish-brown material formerly in the subsoil. The areas generally are less than 10 acres in size.

Included with this soil in mapping are a few small areas of Gullied land, loess, where the underlying fragipan is exposed in the bottom of the gullies.

Runoff is medium on this Hosmer soil, and further erosion is a major hazard. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. Capability unit IIIe–7; woodland group 9.

Hosmer silt loam, 6 to 12 percent slopes, eroded (HoC2).—This soil is on side slopes below ridgetops on uplands. The areas range from 5 to 15 acres in size.

Runoff is medium, and further erosion is a major hazard. This soil is suited to cultivated crops, hay, pasture plants, and trees. Deep-rooted legumes are not suited, because the slowly permeable fragipan in the subsoil restricts penetration of roots. Most areas of this soil are used as pasture and as woodland. Capability unit IIIe–7; woodland group 9.

Hosmer silt loam 6 to 12 percent slopes, severely eroded (HoC3).—This soil is on uplands on side slopes near ridgetops. The areas generally range from 150 to 300 feet in length. Most of the original surface layer has been removed through erosion, but the profile otherwise is similar to that described for the series. The present surface layer is mainly yellowish-brown material formerly in the subsoil.

Included with this soil in mapping are a few small areas of Gullied land, loess, where the fragipan layer and the underlying material are exposed in the bottom of the gullies.

Runoff is rapid on this Hosmer soil, and further erosion is a major hazard to use. Hay, pasture plants, and trees are well suited. Deep-rooted legumes are not suited, because the fragipan in the subsoil restricts penetration of roots. Most areas are used as pasture and as woodland. Capability unit IVe–7; woodland group 9.

Huntington Series

The Huntington series consists of deep, well-drained, medium-textured, nearly level soils. These soils are on flood plains along the Ohio River. They formed in alluvium of mixed origin. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown silt loam about 19 inches thick. The subsoil is dark-brown, friable silt loam about 18 inches thick. Below is dark-brown, firm silt loam.

Permeability is moderate in these soils, and available moisture capacity is high.

Most areas are used intensively for crops, mainly corn. A few small areas, however, remain in hardwoods.

Representative profile of Huntington silt loam (in a cultivated field 2 miles south of Rockport and 60 feet north of the southwest corner of sec. 2, T. 8 S., R. 6 W.):

Ap—0 to 9 inches, dark-brown (10YR 3/3) silt loam; brown (10YR 5/3) when dry; moderate, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

A1—9 to 19 inches, dark-brown (10YR 3/3) silt loam; brown (10YR 5/3) when dry; weak, fine, granular structure to weak, coarse, subangular blocky; friable when moist; dark-gray (10YR 4/1) and very dark grayish-brown (10YR 3/2) worm casts; neutral; gradual, wavy boundary.

B—19 to 37 inches, dark-brown (10YR 4/3) silt loam; pale brown (10YR 6/3) when dry; weak, fine, granular structure to weak, coarse, subangular blocky; friable when moist; dark-gray (10YR 4/1) and very dark grayish-brown (10YR 3/2) worm casts; neutral; gradual, wavy boundary.

C—37 to 80 inches, dark-brown (10YR 4/3) silt loam; massive; firm when moist; neutral.

The A horizon ranges from dark brown to very dark grayish brown in color and from silt loam to loam in texture. The C horizon ranges from dark brown to dark yellowish brown in hues of 10YR and 7.5YR. Reaction throughout the profile ranges from neutral to slightly acid, but it generally is neutral. Very fine mica flakes occur throughout the profile.

Huntington silt loam (0 to 2 percent slopes) (Hu).—This is the only Huntington soil mapped in the county. It is on flood plains along the Ohio River (fig. 6). The areas are long and almost parallel the river.

Included with this soil in mapping are small areas of soils that have a surface layer of loam.

Available moisture capacity is high in Huntington silt loam. Permeability is moderate, and runoff is slow.

Except for occasional flooding, this soil has few limitations to use. All crops commonly grown in the county are suited, but the main crops are corn and soybeans. Controlling johnsongrass is a major concern of management. Capability unit I-2; woodland group 8.

Huntington Series, Sandy Variant

These variants from the normal Huntington soils are deep, well drained, moderately coarse textured, and nearly level. They are on flood plains along the Ohio River. These soils formed in alluvium of mixed origin. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown fine sandy loam about 10 inches thick. The next layer, about 38 inches thick, is dark-brown, friable fine sandy loam that has strata of brown loamy fine sand. It is underlain by dark yellowish-brown, friable silt loam.

Permeability is moderately rapid in these soils, and available moisture capacity is moderate. Flooding is a hazard.

Most areas of these soils are used intensively for crops, mainly corn. A few small areas, however, remain in hardwoods.

Figure 6.—An area of Huntington silt loam.

Representative profile of Huntington fine sandy loam, sandy variant (in a cultivated field about 5 miles south of Rockport and 660 feet east of the southwest corner of sec. 22, T. 8 S., R. 6 W.):

Ap—0 to 8 inches, dark-brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) when dry; weak, very fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

A1—8 to 10 inches, dark-brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) when dry; weak, thick, platy structure; friable when moist; neutral; abrupt, smooth boundary.

C1—10 to 48 inches, dark-brown (10YR 4/3) fine sandy loam, light yellowish-brown (10YR 6/4) when dry; the upper 2 inches is brown (10YR 5/3) loamy fine sand, pale brown (10YR 6/3) when dry; massive; friable when moist; neutral; clear, smooth boundary.

C2—48 to 62 inches, dark yellowish-brown (10YR 4/4) silt loam; massive; friable when moist; neutral.

The upper part of the profile is mainly fine sandy loam, but thin strata of loamy fine sand 1 to 3 inches thick occur in a few areas. The underlying silt loam is at a depth of 30 to 60 inches. Reaction throughout the profile ranges from neutral to slightly acid, but it generally is neutral. Very fine mica flakes are throughout the profile.

Huntington fine sandy loam, sandy variant (0 to 2 percent slopes) (Ht).—This is the only Huntington sandy variant mapped in the county. It is on flood plains along the Ohio River. The areas are near the river, and they occur as natural riverbank levees.

Included with this soil in mapping are a few small areas of coarse-textured and medium-textured soils formed in alluvium.

Permeability is moderately rapid in this soil, and available moisture capacity is moderate. Runoff is slow, and occasional flooding is a hazard.

The moderately rapid permeability and the moderate available moisture capacity limit use of this soil. The areas are small, however, and they are used and managed along with other Huntington soils. Most crops commonly grown in the county are suited, but the main crops are corn and soybeans. Capability unit I-2; woodland group 8.

Iona Series

In this series are deep, moderately well drained, medium-textured, nearly level and gently sloping soils. These soils are on uplands. They formed in silty loess. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsoil, about 30 inches thick, is friable and firm. It is yellowish-brown heavy silt loam in the upper 16 inches and yellowish-brown light silty clay loam and silt loam that has light brownish-gray mottles in the lower 14 inches. The underlying material is yellowish-brown, friable silt. It has light brownish-gray mottles.

Permeability is moderately slow in these soils, and available moisture capacity is high.

Most areas of Iona soils are used for cultivated crops.

Representative profile of Iona silt loam, 2 to 6 percent slopes, eroded (in a cultivated field 1,056 feet west and 460 feet north of the southeast corner of NW¼ sec. 19, T. 7 S., R. 6 W.):

Ap—0 to 8 inches, brown (10YR 5/3) silt loam that contains a few spots of yellowish-brown (10YR 5/4) subsoil material; weak, very fine, granular structure; friable when moist; strongly acid; abrupt, smooth boundary.

B21t—8 to 15 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, medium, subangular blocky structure; friable when moist; a few, patchy, yellowish-brown (10YR 5/4) clay films and brown (10YR 5/3) silt coatings on ped surfaces; strongly acid; clear, wavy boundary.

B22t—15 to 24 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate, coarse, subangular blocky structure; firm when moist; common, brown (7.5YR 5/4) clay films and a few reddish-brown (5YR 4/4) clay films; many pale-brown (10YR 6/3) silt coatings; a few, fine, very dark brown (10YR 2/2) manganese stains; very strongly acid; clear, wavy boundary.

B23t—24 to 35 inches, yellowish-brown (10YR 5/4) light silty clay loam; common, fine, faint, light brownish-gray (10YR 6/2) mottles; moderate, coarse, subangular blocky structure; firm when moist; a few brown (7.5YR 5/4) clay films and fine, very dark brown (10YR 2/2) manganese stains; a few light brownish-gray (10YR 6/2) silt coatings; very strongly acid; gradual, wavy boundary.

B3—35 to 38 inches, yellowish-brown (10YR 5/6) silt loam; a few, faint, light brownish-gray (10YR 6/2) mottles; weak, very coarse, subangular blocky structure; friable when moist; a few, patchy, brown (10YR 5/3) clay films and very dark brown (10YR 2/2) manganese stains; slightly acid; gradual, wavy boundary.

C—38 to 68 inches, yellowish-brown (10YR 5/8) silt; many, fine, distinct, light brownish-gray (10YR 6/2) mottles and a few, fine, faint, light yellowish-brown (10YR 6/4) mottles; massive; very friable when moist; a few, fine, very dark brown (10YR 2/2) manganese concretions and stains; neutral.

The A2 horizon, where present, is brown friable silt loam about 4 to 6 inches thick. Mottles occur at a depth of 20 to 30 inches. In places the B3 horizon is absent. The C horizon is at a depth of about 36 to 40 inches.

Iona silt loam, 0 to 2 percent slopes (IoA).—This soil is on broad ridgetops on uplands that have a thick mantle of loess. The surface layer is about 12 inches thick, but the profile otherwise is similar to that described as representative of the series.

Included with this soil in mapping are a few small areas of Alford soils.

Runoff is slow on this Iona soil, and limitations to use are few. All crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. Capability unit I–1; woodland group 1.

Iona silt loam, 2 to 6 percent slopes, eroded (IoB2).—This soil is on slopes below areas of nearly level ridgetops on uplands that have a thick mantle of loess. It has the profile described as representative of the series.

Included with this soil in mapping are a few small areas of Iona soil that is slightly eroded.

Runoff is medium on this Iona soil, and further erosion is a major hazard. All crops commonly grown in the county are well suited. The major crops are corn, soybeans, small grains, and meadow. Capability unit IIe–3; woodland group 1.

Johnsburg Series

The Johnsburg series consists of deep, somewhat poorly drained, medium-textured, nearly level soils on uplands. These acid soils formed in silty loess and in the underlying material weathered from sandstone and shale. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is silt loam about 11 inches thick. It is very dark grayish brown and brown in the upper 7 inches and light yellowish brown below. The subsoil is about 37 inches thick. The upper 11 inches is light yellowish-brown, friable heavy silt loam that has gray and brownish-yellow to yellowish-brown mottles. Below is a firm fragipan of brown silty clay loam that has light brownish-gray mottles. A few shale and sandstone fragments are in the lower 21 inches of the subsoil. The underlying material is yellowish-brown and brownish-yellow, firm silty clay loam that contains a few fragments of shale and sandstone. Sandstone bedrock occurs at a depth of 91 inches.

Permeability is very slow in these soils, and available moisture capacity is moderate. The content of organic matter is low. Most areas of the Johnsburg soils are used for cultivated crops.

Representative profile of Johnsburg silt loam, 0 to 2 percent slopes (in a recently cleared field northeast of Dale and 265 feet south and 1,320 feet east of the northwest corner of sec. 2, T. 4 S., R. 5 W.):

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

A21—2 to 7 inches, brown (10YR 5/3) silt loam; weak, medium, platy structure; friable when moist; strongly acid; clear, smooth boundary.

A22—7 to 11 inches, light yellowish-brown (10YR 6/4) silt loam; weak, very thick, platy structure; friable when moist; a few, fine, very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, wavy boundary.

B2t—11 to 22 inches, light yellowish-brown (10YR 6/4) heavy silt loam; common, fine, distinct, gray (10YR 6/1) and brownish-yellow (10YR 6/8) to yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; friable when moist; a few brown (10YR 5/3) clay films in lower part of horizon; a few, fine, very dark brown (10YR 2/2) manganese concretions; very strongly acid; clear, wavy boundary.

B'x1—22 to 27 inches, brown (10YR 5/3) silty clay loam; many, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, coarse, prismatic structure; firm when moist; prominent coatings of light brownish-gray (10YR 6/2) silt on prism faces and in crevices between prisms; a few brown (7.5YR 5/4) clay films in voids and on cleavage surfaces; a few, fine and medium, very dark brown (10YR 2/2) manganese concretions; very strongly acid; gradual, wavy boundary.

IIB'x2—27 to 48 inches, brown (10YR 5/3) and dark-brown (7.5YR 4/4) silty clay loam; many, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, very coarse, prismatic structure; firm when moist; light brownish-gray (10YR 6/2) silt coatings on prism faces and in soil crevices; a few brown (7.5YR 5/4) clay films; a few, fine, very dark brown (10YR 2/2) manganese concretions; a few small sandstone and shale fragments; very strongly acid; clear, smooth boundary.

IIC—48 to 91 inches, yellowish-brown (10YR 5/8) and brownish-yellow (10YR 6/6) silty clay loam; massive; firm when moist; gray (10YR 6/1) silt and clay in soil cracks and seams; a few organic stains along the gray seams; a few shale and sandstone fragments; very strongly acid; abrupt, smooth boundary.

R—91 inches, sandstone bedrock.

In most cultivated fields the Ap horizon ranges from dark grayish brown to grayish brown in color. Depth to the B'x horizon ranges from 20 to 30 inches. Depth to the residuum from shale and sandstone is about 24 to 36 inches.

Johnsburg silt loam, 0 to 2 percent slopes (JoA).—This soil occurs on broad ridges and in small depressional areas on uplands. It is acid and is low in fertility.

Included with this soil in mapping, mainly near Dale, are small areas of nearly level and gently sloping soils that have a darker surface layer. Also included are a few areas of soil near Midway that formed in a mantle of loess more than 60 inches thick.

Runoff is slow on this Johnsburg soil, and wetness is the major limitation to use. If drained, this soil is suited to most crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow. Deep-rooted legumes are not well suited, because the fragipan in the subsoil restricts penetration of roots. Capability unit IIw-3; woodland group 5.

Lindside Series

In this series are deep, moderately well drained, medium-textured, nearly level soils on flood plains. These soils formed in alluvium of mixed origin. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown silt loam about 9 inches thick. The subsoil, about 12 inches thick, is firm silt loam. It is dark brown to dark yellowish brown and has a few thin lenses of very fine sand. The underlying material is grayish-brown and dark grayish-brown firm silt loam and silty clay loam. It has grayish-brown, dark-brown, and strong-brown mottles.

Permeability is moderate in these soils. Available moisture capacity is high. Lindside soils are used mainly for growing corn, but a few low swales are in trees.

Representative profile of Lindside silt loam (in a cultivated field 1,140 feet north and 500 feet east of the southwest corner of SE$\frac{1}{4}$ sec. 20, T. 8 S., R. 6 W.):

Ap—0 to 9 inches, dark-brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) when dry; moderate, fine and medium, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B—9 to 21 inches, dark-brown (10YR 4/3) to dark yellowish-brown (10YR 3/4) silt loam, pale brown (10YR 6/3) when dry; weak, fine, granular structure; firm when moist; a few, fine, distinct, strong-brown (7.5YR 5/6) specks; a few thin layers of brown (10YR 5/3) to yellowish-brown (10YR 5/4) very fine sand; neutral; clear, smooth boundary.

C1—21 to 33 inches, dark grayish-brown (10YR 4/2) silt loam; a few, fine, distinct, grayish-brown (10YR 5/2) and dark-brown (7.5YR 4/4) mottles; massive; firm when moist; a few thin streaks of black (10YR 2/1) organic stain in old root channels; very fine mica flakes; neutral; clear, smooth boundary.

C2—33 to 48 inches, grayish-brown (10YR 5/2) light silty clay loam; many, fine, distinct, strong-brown (7.5YR 5/6) mottles; massive; firm when moist; a few black (10YR 2/1) organic stains; a few, fine, soft, very dark brown (10YR 2/2) manganese concretions; a few very fine mica flakes; neutral.

The A horizon ranges from dark brown to dark yellowish brown in color. Mottles occur at a depth of 20 to 30 inches. Reaction throughout the profile ranges from neutral to slightly acid, but it generally is neutral.

Lindside silt loam (0 to 2 percent slopes) (Ls).—This is the only Lindside soil mapped in the county. It is on flood plains along the Ohio River. The areas are long and narrow and almost parallel the river.

Included with this soil in mapping are a few areas where the soil has a surface layer of silty clay loam.

Runoff is slow on this soil. Except for occasional flooding, limitations to use are few. Most crops commonly grown in the county are suited, but the main crops are corn and soybeans. Controlling johnsongrass is a major concern on this soil. Capability unit I-2; woodland group 8.

Made Land and Pits

Made land and Pits (Md) occur in many parts of the county. Areas of made land consist mainly of reclaimed old sand pits that have been filled and partly smoothed. Most of these areas are used for pasture, but a few small areas are suitable for crops. Other small areas are used for nonfarming purposes. The manmade beach at Lake Lincoln is an example of such use.

The pits in this unit consist mainly of open excavations from which the topsoil and subsoil have been removed for use as subgrade material in constructing roadbeds and for use as molding material. The areas are narrow and are in alluvial soils along the Owensboro Highway north of the Ohio River. They are about 2 to 5 feet deep and are on both sides of the road for about 2$\frac{1}{2}$ miles. Some of the pits retain floodwater for long periods. A few young trees, such as willow, sycamore, cottonwood, and soft maple, grow in some of these pits. Other borrow pits are scattered on sandy ridges of Princeton and Wheeling soils near Richland City and Hatfield. The material excavated from these pits is used for molding sand. Capability unit VIIe-2; woodland group 16.

Markland Series

The Markland series consists of deep, well-drained, gently sloping to steep soils. These soils have a medium-textured or a moderately fine textured surface layer and a fine-textured subsoil. They formed in slack water, neutral and calcareous clay, and silt on terraces along the major streams of the county. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is very dark grayish-brown and dark grayish-brown silt loam about 6 inches thick. The subsoil, about 24 inches thick, is yellowish-brown, very firm silty clay in the upper 6 inches and brown, very firm clay below. The underlying material is brown, firm heavy silty clay.

Permeability is slow in these soils. Available moisture capacity is high.

Most areas of the Markland soils are used as pasture and as woodland. A few small areas are used for row crops and small grains.

Representative profile of Markland silt loam, 6 to 12 percent slopes, eroded (in a wooded area one-half mile south of Lamar and 1,300 feet east of the northwest corner of sec. 30, T. 5 S., R. 4 W.):

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, very fine and fine, granular structure; friable when moist; many roots; neutral; clear, smooth boundary.

A2—3 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and thick, platy structure; friable when moist; many roots; neutral; clear, smooth boundary.

IIB21t—6 to 12 inches, yellowish-brown (10YR 5/4) silty clay; strong, fine, angular blocky structure; very firm when moist; thin, continuous, dark yellowish-brown (10YR 4/4) clay films; a few, fine, faint, pale-brown (10YR 6/3) silt coatings; common fine roots; strongly acid; clear, wavy boundary.

IIB22t—12 to 21 inches, brown (10YR 5/3) clay; weak, medium, prismatic structure that parts to strong, fine and medium, angular blocky; very firm when moist; thin, continuous, dark yellowish-brown (10YR 4/4) clay films; slightly acid; clear, irregular boundary.

IIB3—21 to 30 inches, brown (10YR 5/3) clay; weak, medium, prismatic structure that parts to strong, fine and medium, angular blocky; very firm when moist; slightly acid in the upper part and mildly alkaline below; gradual, irregular boundary.

IICca—30 to 44 inches, brown (10YR 5/3) heavy silty clay; massive, but parts to moderate, fine and medium, angular blocky structure; firm when moist; common, discontinuous, yellowish-brown (10YR 5/4) clay films on ped surfaces; calcareous and has a concentrated zone of lime nodules.

The loess mantle is less than 15 inches thick to fine-textured lacustrine silty clay and clay. The Ap horizon ranges from brown to yellowish brown in color. It is at a depth of 7 to 10 inches. The A1 horizon is silt loam or heavy silt loam. It ranges from very dark grayish brown to dark grayish brown in color and from 1 to 4 inches in thickness. The A2 horizon ranges from dark grayish brown to brown in color. The B horizon ranges from dark brown to yellowish brown in color. Depth to underlying stratified calcareous clay ranges from 20 to 45 inches.

Markland silt loam, 2 to 6 percent slopes, eroded (MkB2).—This soil occurs near areas of nearly level soils along the edges of broad lacustrine terraces and next to drainageways.

Included with this soil in mapping are small areas of nearly level and gently sloping Markland soils that are only slightly eroded. Also included are small areas of moderately well drained, nearly level and gently sloping soils that are slightly eroded and moderately eroded.

Runoff is slow on this Markland soil, and further erosion is a hazard. Most crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. Deep-rooted plants, such as alfalfa, grass, and trees, are also well suited. Capability unit IIIe–11; woodland group 18.

Markland silt loam, 6 to 12 percent slopes, eroded (MkC2).—This soil is on lacustrine terraces along the edges of areas of nearly level soils and next to drainageways. It has the profile described as representative of the Markland series. Included in mapping are small areas of severely eroded Markland soils.

Runoff is medium on this soil, and further erosion is the major hazard.

This soil is suited to small grains and meadow plants and to limited use for row crops. Mixtures of alfalfa and grass for meadow are well suited. Capability unit IVe–11; woodland group 18.

Markland silt loam, 12 to 18 percent slopes, eroded (MkD2).—This soil is on lacustrine terraces on breaks next to drainageways and to soils formed in alluvium along creek bottoms. Depth to underlying calcareous material is less than 24 inches, but the profile otherwise is like that described as representative of the series. Included in mapping are small wooded areas where little erosion has occurred.

Runoff is medium to rapid on this soil, and further erosion is the chief hazard. Permanent plant cover is suited, and the areas are used mainly for pasture and trees. Capability unit VIe–1; woodland group 18.

Markland silt loam, 18 to 25 percent slopes (MkE).—This soil occurs on lacustrine terraces on breaks next to drainageways and to soils formed in alluvium along creek bottoms. The profile is similar to that described as representative of the series, except that depth to underlying calcareous material is less than 24 inches.

Included with this soil in mapping are small areas of moderately eroded soils. Also included are small areas of very steep soils that are slightly eroded, moderately eroded, or severely eroded.

Runoff is rapid on this Markland soil, and further erosion is the major hazard. Permanent plant cover is suited, and the areas are used mainly for trees and pasture. The short, steep and very steep slopes restrict use of farm machinery. Capability unit VIe–1; woodland group 18.

Markland silty clay loam, 2 to 6 percent slopes, severely eroded (MlB3).—This soil is mainly on escarpmentlike breaks along the edges of lacustrine terraces and next to drainageways. The profile is similar to that described for the series, except that most of the original surface layer has been lost through erosion. In many places yellowish-brown material formerly in the subsoil is exposed at the surface.

Included with this soil in mapping are a few small gullied areas and a few areas of moderately well drained soils that have a surface layer of silty clay.

Runoff is medium on this Markland soil, and further erosion is a major hazard. Small grains, meadow plants, and a few row crops are suited, and mixtures of alfalfa and grass are especially well suited. Capability unit IVe–11; woodland group 18.

Markland silty clay loam, 6 to 12 percent slopes, severely eroded (MlC3).—This soil is on lacustrine terraces along the edges of areas of nearly level soils and next to drainageways. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. In many places yellowish-brown material formerly in the subsoil is exposed at the surface. Included in mapping are small gullied areas.

Runoff is rapid on this Markland soil, and further erosion is the major hazard. Permanent plant cover is suited, and the areas are used mainly for pasture and for trees. This soil is in poor tilth, and new seedings are difficult to establish. Capability unit VIe–1; woodland group 18.

Markland silty clay loam, 12 to 18 percent slopes, severely eroded (MlD3).—This soil is on lacustrine terraces on breaks next to drainageways and soils formed in alluvium along creek bottoms. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. In many places yellowish-brown material formerly in the subsoil is exposed at the surface.

Included with this soil in mapping are a few small gullied areas. Also included are small areas of a severely eroded Markland soil that has steep slopes.

Runoff is rapid on this Markland soil, and further erosion is the major hazard. Permanent plant cover is suited, and most areas are used for trees and for pasture. Capability unit VIIe-1; woodland group 18.

McGary Series

In the McGary series are deep, somewhat poorly drained, nearly level soils on lacustrine terraces along the major streams of the county. These soils have a medium-textured surface layer and a mainly fine-textured subsoil. They formed in neutral and calcareous slack water clay and silt. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown silt loam about 2 inches thick. The subsurface layer is light-gray, friable silt loam about 7 inches thick. The subsoil, about 46 inches thick, is pale-olive, friable to firm silty clay loam in the upper 4 inches. The middle 32 inches is dominantly yellowish-brown very firm silty clay that has grayish-brown mottles. Below is gray firm silty clay that has yellowish-brown and light yellowish-brown mottles. The underlying material is pale-brown silty clay. It has gray and yellowish-brown mottles.

Permeability is slow in these soils, and available moisture capacity is high.

McGary soils are used mainly for corn, soybeans, small grains, and meadow crops, though small areas are in pasture and in woodland.

Representative profile of McGary silt loam (in white oak woods, 1,040 feet west of the northeast corner of SE¼ sec. 33, T. 5 S., R. 6 W.):

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable when moist; strongly acid; abrupt, smooth boundary.

A2—2 to 9 inches, light-gray (10YR 7/2) silt loam; common, fine, distinct, brownish-yellow (10YR 6/6) mottles; moderate, medium, platy structure; friable when moist; very strongly acid; clear, smooth boundary.

B1—9 to 13 inches, pale-olive (5YR 6/3) silty clay loam; common, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable to firm when moist; light brownish-gray (10YR 6/2) silt coatings; very strongly acid; clear, wavy boundary.

IIB21t—13 to 36 inches, mottled yellowish-brown (10YR 5/4) and grayish-brown (2.5Y 5/2) silty clay; strong, medium, angular and subangular blocky structure; very firm when moist; thin grayish-brown (2.5Y 5/2) clay films on peds; very strongly acid; clear, wavy boundary.

IIB22t—36 to 45 inches, mottled yellowish-brown (10YR 5/4) and grayish-brown (2.5Y 5/2) silty clay; strong, fine and medium, angular blocky structure; very firm when moist; gray (5Y 5/1) clay films on ped faces; strongly acid; clear, wavy boundary.

IIB3—45 to 55 inches, gray (5Y 5/1) silty clay; many, medium, prominent, yellowish-brown (10YR 5/6) mottles and common, medium, distinct, light yellowish-brown (2.5Y 6/4) mottles; strong, medium, angular blocky structure; firm when moist; many black (10YR 2/1) organic coatings and stains in cracks and in root channels; a few, fine, very dark brown (10YR 2/2) manganese concretions and stains; a few, fine, yellowish-red (5YR 5/6) stains; neutral; gradual, irregular boundary.

IIC—55 to 65 inches, pale-brown (10YR 6/3) silty clay; common, fine, prominent, gray (N 5/0) mottles and a few, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; firm when moist; a few very dark brown (10YR 2/2) manganese stains; calcareous; mildly alkaline.

The A horizon ranges from 7 to 15 inches in thickness. The A1 horizon ranges from dark grayish brown to very dark grayish brown; the Ap horizon, from dark grayish brown to grayish brown or brown; and the A2 horizon, from pale brown and light gray to grayish brown. The C horizon is calcareous clay to silty clay. It contains a small amount of silt.

McGary silt loam (0 to 2 percent slopes) (Mr).—This is the only McGary soil mapped in the county. It is on broad flats on lacustrine terraces. Included in mapping are a few small areas of moderately eroded, gently sloping soils on breaks.

Runoff is slow on this soil, and wetness is the major limitation to use. If drained, this soil is suited to most crops commonly grown in the county. Most areas are used for corn, soybeans, small grains, and meadow plants, but a few large areas are in trees. An adequate drainage system is difficult to establish because of the slow runoff and the slow permeability. Capability unit IIIw-6; woodland group 5.

Montgomery Series

The Montgomery series consists of deep, very poorly drained, moderately fine textured, nearly level soils in depressions on slack water terraces. These soils formed in neutral and calcareous lacustrine clay and silt. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is very dark gray silty clay loam about 18 inches thick. The subsoil, about 32 inches thick, is gray, very firm heavy silty clay that has light olive-brown and light brownish-gray mottles. The underlying material is gray, very firm silty clay, clay, and silt. It has light olive-brown mottles.

Permeability is very slow in these soils, and available moisture capacity is high.

Montgomery soils are used intensively for crops.

Representative profile of Montgomery silty clay loam (in a cultivated field 1½ miles southeast of Lamar and 285 feet north and 100 feet east of the southwest corner of sec. 20, T. 5 S., R. 4 W.):

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; weak, fine, granular structure to massive; very hard when dry, firm when moist; neutral; abrupt, smooth boundary.

A1—8 to 18 inches, very dark gray (10YR 3/1) heavy silty clay loam to silty clay; a few, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; strong, medium to coarse, angular blocky structure; very firm when moist; neutral; gradual, smooth boundary.

B2g—18 to 50 inches, gray (5Y 6/1) heavy silty clay; many, fine, distinct, light olive-brown (2.5Y 5/4) and light brownish-gray (2.5YR 6/2) mottles; weak, medium, prismatic structure that parts to strong, coarse, angular blocky; very hard when dry, very firm when moist; dark-gray (N 4/0) organic films and clay films on prism faces and in root and worm channels; common crayfish holes filled with dark-gray (N 4/0) silty clay that extends into the C horizon; many, fine, soft manganese and iron concretions; neutral; diffuse, wavy boundary.

C1g—50 to 80 inches, gray (5Y 6/1) silty clay; many, medium, distinct, light olive-brown (2.5Y 5/4) mottles; massive;

very firm when moist; many soft manganese and iron concretions; neutral; clear, wavy boundary.

C2g—80 to 90 inches, gray (5Y 6/1) stratified clay and silt, dominantly clay; many, medium, distinct, light olive-brown (2.5Y 5/4) mottles; massive; very firm when moist; calcareous; mildly alkaline.

The Ap horizon ranges from black to very dark gray or very dark grayish brown in color. The A1 horizon ranges from black to very dark gray to olive gray in color. It has a few olive mottles. The B horizon ranges from very dark gray to olive gray in color and has olive mottles. It is at a depth of 7 to 24 inches. Depth to the underlying neutral clay and silt is 36 to 60 inches.

Montgomery silty clay loam (0 to 2 percent slopes) (Ms).—This is the only Montgomery soil mapped in the county. It is in depressions on lacustrine terraces.

Included with this soil in mapping are small areas of Montgomery soil where the surface layer is silt loam. These areas are along open drainage ditches and are subject to occasional overwash.

Runoff is ponded to slow on this Montgomery soil, and wetness is the major limitation to use. If drained, this soil is suited to most crops commonly grown in the county. Corn and soybeans are the main crops. The slow permeability and depressional relief make the installing of adequate drainage systems difficult. Capability unit IIIw-2; woodland group 11.

Newark Series

In the Newark series are deep, somewhat poorly drained, medium-textured, nearly level soils on flood plains. These soils formed in alluvium of mixed origin. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark grayish-brown silt loam about 9 inches thick. The subsurface layer, about 3 inches thick, is dark grayish-brown silty clay loam mottled with dark clay. The subsoil, about 13 inches thick, is firm silty clay loam. It is gray to dark gray and has dark yellowish-brown mottles. The underlying material is firm silty clay loam that is gray and yellowish brown.

Permeability is moderate in these soils, and available moisture capacity is high. These soils have a seasonal high water table.

Newark soils are used mainly for corn and soybeans, but a few areas in low swales are in trees.

Representative profile of Newark silt loam (in a cultivated field about 2 miles west of Eureka and 170 feet north and 142 feet west of the southeast corner of NE¼ sec. 25, T. 7 S., R. 8 W.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) to dark-brown (10YR 3/3) heavy silt loam; pale brown (10YR 6/3) to light brownish gray (10YR 6/2) when dry; weak, fine, granular structure; firm when moist; neutral; abrupt, smooth boundary.

A2—9 to 12 inches, dark grayish-brown (10YR 4/2) silty clay loam; a few, fine, faint, dark-gray (5Y 4/1) mottles; weak, thick, platy structure; firm when moist; neutral; clear, wavy boundary.

Bg—12 to 25 inches, gray (10YR 5/1) to dark-gray (10YR 4/1) silty clay loam; many, very fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium, subangular blocky structure; firm when moist; a few, very dark brown (10YR 2/2) manganese and iron concretions and a few, dark-brown (7.5YR 4/4) stains; neutral; gradual, smooth boundary.

C1g—25 to 47 inches, gray (10YR 6/1) silty clay loam, many, fine, prominent, strong-brown (7.5YR 5/6) mottles; massive; firm when moist; a few, very dark brown (10YR 2/2) manganese and iron concretions that are as much as 5 millimeters in diameter; neutral; gradual, smooth boundary.

C2g—47 to 78 inches, mottled yellowish-brown (10YR 5/8) and gray (10YR 5/1) silty clay loam; massive; firm when moist; a few, very dark brown (10YR 2/2) manganese and iron concretions; neutral.

In wooded areas the A1 horizon is very dark grayish-brown. Very fine mica flakes occur throughout the profile. Reaction is neutral to slightly acid.

Newark silt loam (0 to 2 percent slopes) (Ne).—This is the only Newark soil mapped in the county. It is in long narrow swales on flood plains. Included in mapping are areas where the surface layer is light silty clay loam.

Runoff is slow on this soil. Wetness is the major limitation to use. If drained, this soil is suited to most crops commonly grown in the county. This soil generally has a seasonal high water table and is subject to occasional flooding. Late planting is sometimes necessary because of flooding late in spring. Capability unit IIw-7; woodland group 13.

Pekin Series

The Pekin series consists of deep, medium-textured, moderately well drained, nearly level and gently sloping soils on old alluvial terraces along the major streams of the county. These soils are underlain by stratified layers of silt loam, loam, fine sand, and silty clay loam. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is pale-brown silt loam about 9 inches thick. The subsoil is about 35 inches thick. It is friable and firm light yellowish-brown and brownish-yellow silt loam that is mottled with light brownish gray in the upper 17 inches. Below is a firm and brittle fragipan of yellowish-brown and light brownish-gray silt loam that has light brownish-gray, pale-brown, and dark yellowish-brown mottles. The underlying material is mottled gray to yellowish brown, friable silt loam, loam, and fine sand.

Pekin soils are very slowly permeable, and available moisture capacity is moderate. They are very strongly acid unless limed.

These soils are well suited to corn, soybeans, small grains, and grasses for hay and pasture. Alfalfa is poorly suited because the fragipan in the subsoil restricts penetration of roots.

Representative profile of Pekin silt loam, 0 to 2 percent slopes (in a cultivated field 2 miles south of St. Meinrad and 460 feet south and 175 feet east of the northwest corner of NE¼ sec. 26, T. 4 S., R. 4 W.):

Ap—0 to 9 inches, pale-brown (10YR 6/3) silt loam; moderate, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B1—9 to 12 inches, light yellowish-brown (10YR 6/4) silt loam; weak, medium, subangular blocky structure; friable when moist; slightly acid; clear, smooth boundary.

B2t—12 to 26 inches, brownish-yellow (10YR 6/6) heavy silt loam; common, fine, distinct, light brownish-gray (10YR 6/2) mottles in lower part of horizon; moderate, medium, subangular blocky structure; firm when moist; a few, discontinuous, yellowish-brown (10YR 5/6) clay films on ped faces and in a few voids; pale-brown (10YR 6/3) silt films along a few old voids and on structural faces; very strongly acid; clear, smooth boundary.

B'x1—26 to 35 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, distinct, light brownish-gray (10YR 6/2), pale-brown (10YR 6/3), and yellowish-brown (10YR 5/8) mottles; massive to weak, coarse, prismatic structure; firm when moist; brittle, weak fragipan; a few, discontinuous, yellowish-brown (10YR 5/6) clay films in a few voids and cracks; many black (10YR 2/1) soft manganese and iron concretions; common crawfish burrows filled with light yellowish-brown (10YR 6/4) silt are throughout the horizon; very strongly acid; gradual, wavy boundary.

B'x2—35 to 44 inches, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) silt loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, coarse, prismatic structure to massive; firm when moist; somewhat brittle, weak fragipan; many manganese and iron concretions; a few, thin, discontinuous, pale-brown (10YR 6/3) clay films on some peds and in a few voids; many, fine, discontinuous, pale-brown (10YR 6/3) silt coatings along prism faces; very strongly acid; gradual, irregular boundary.

C1—44 to 75 inches, mottled light brownish-gray (10YR 6/2), pale-brown (10YR 6/3), and brown (10YR 5/3) silt loam; massive; friable when moist; many soft manganese and iron concretions; medium acid, but neutral in lower part of horizon; clear, wavy boundary.

C2—75 to 85 inches, mottled gray (10YR 6/1), dark yellowish-brown (10YR 4/6), and yellowish-brown (10YR 5/8) stratified silt loam, loam, and fine sand; massive; friable when moist; neutral.

The A horizon ranges from very dark grayish brown to pale brown in color. The B horizon ranges from dark brown to brownish yellow and light brownish gray in color and from heavy loam to silty clay loam in texture. Gray mottles are at a depth of 10 to 20 inches from the top of this horizon. The weakly developed fragipan is at a depth of 20 to 30 inches. The B2 horizon and the B'x horizons range from strongly acid to extremely acid in reaction. In places the B'x1 horizon and the C1 horizon consist of silt loam that contains enough sand to feel gritty when rubbed between the fingers. The stratified material is at a depth of 40 to 80 inches.

Pekin silt loam, 0 to 2 percent slopes (PeA).—This soil has the profile described as representative of the series. It is on terraces along streams, slightly above surrounding areas of recent alluvial soils.

Included with this soil in mapping are a few small areas of well-drained soils. A few of these soils have a surface layer of loam.

Runoff is slow on this Pekin soil, and wetness is the major limitation to use. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. Such deep-rooted plants as alfalfa are not suited, because the slowly permeable fragipan in the subsoil restricts penetration of roots. Capability unit IIw–5; woodland group 9.

Pekin silt loam, 2 to 6 percent slopes, eroded (PeB2).—This soil is on terraces along streams next to areas of recent alluvial soils. The profile is similar to that described as representative of the series, except that part of the original surface layer has been lost through erosion, and yellowish-brown material formerly in the subsoil is mixed with the remaining surface layer.

Included with this soil in mapping are small areas of well-drained soils that have a surface layer of loam. Also included are a few small areas of slightly eroded to severely eroded soils that have a surface layer of silt loam.

Runoff is slow or medium on this Pekin soil, and further erosion is a hazard. Most crops commonly grown in the county are suited. Such deep-rooted crops as alfalfa are not well suited, because the fragipan in the subsoil restricts penetration of roots. Capability unit IIe–7; woodland group 9.

Philo Series

In the Philo series are deep, moderately well drained, medium-textured, nearly level soils on flood plains. These acid soils formed in mixed alluvium, mainly from weathered shale and sandstone. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is yellowish-brown silt loam about 8 inches thick. The subsoil, about 14 inches thick, is friable silt loam that is yellowish brown to dark yellowish brown. The underlying material is friable silt loam. It is light yellowish brown to pale brown and yellowish brown and has light brownish-gray, gray, and pale-brown mottles.

Philo soils are moderately permeable and have high available moisture capacity.

These soils are used intensively for crops, and corn is the principal crop. A few small areas, however, are used as pasture and as woodland.

Representative profile of Philo silt loam (in a cultivated field 1½ miles southwest of Buffaloville and 680 feet west and 60 feet north of the southeast corner of NW¼ sec. 17, T. 5 S., R. 5 W.):

Ap—0 to 8 inches, yellowish-brown (10YR 5/4) silt loam; weak, very fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

B—8 to 22 inches, yellowish-brown (10YR 5/4) to dark yellowish-brown (10YR 4/4) silt loam; weak, very thick, platy structure in upper part and weak, fine, granular below; friable when moist; strongly acid; clear, smooth boundary.

C1—22 to 28 inches, light yellowish-brown (10YR 6/4) to pale-brown (10YR 6/3) silt loam; many, fine, faint, light brownish-gray (10YR 6/2) mottles; massive; friable when moist; a few, fine, dark-brown (7.5YR 4/4) manganese and iron concretions and stains; a few sandstone fragments; strongly acid; gradual, smooth boundary.

C2—28 to 42 inches, light yellowish-brown (10YR 6/4) to pale-brown (10YR 6/3) silt loam; many, medium, faint, gray (10YR 6/1) mottles; massive; friable when moist; a few, fine, dark-brown (7.5YR 4/4) manganese and iron concretions and stains; a few, fine, dark reddish-brown (2.5YR 3/4) specks from sandstone fragments; very strongly acid; gradual, smooth boundary.

C3—42 to 52 inches, yellowish-brown (10YR 5/6) silt loam; many, medium, distinct, gray (10YR 6/1) mottles and many, fine, faint, pale-brown (10YR 6/3) mottles; massive; friable when moist; a few, fine, yellowish-red (5YR 5/6 to 5/8) stains; a few, fine, very dark brown (10YR 2/2), soft manganese concretions; very strongly acid.

Depth to gray mottles ranges from 20 to 30 inches.

These soils have a lower content of sand than is defined for the series, but this difference does not alter their usefulness and behavior.

Philo silt loam (0 to 2 percent slopes) (Ph).—This is the only Philo soil mapped in the county. It is on flood plains along small streams. Included in mapping are a few small areas of Cuba soils and a few small areas of Stendal soils.

Runoff is slow on this soil. The areas are subject to occasional flooding, but this soil otherwise has few limitations to use. Most crops commonly grown in the county are suited, and the main crops are corn and soybeans. Capability unit I–2; woodland group 8.

Princeton Series

The Princeton series consists of deep, well-drained, moderately coarse textured, gently sloping to strongly sloping soils on sandy knolls and ridges. These soils have a moderately permeable subsoil underlain by rapidly permeable loamy fine sand.

In a representative profile the surface layer is dark-brown fine sandy loam about 9 inches thick. The subsoil is about 48 inches thick. It is dark-brown, friable loam in the upper 31 inches. Below are alternate bands of dark yellowish-brown, loose loamy fine sand and dark-brown, friable fine sandy loam. The underlying material is dark yellowish-brown, loose loamy fine sand to a depth of more than 100 inches.

Princeton soils have moderate available moisture capacity. Permeability is moderate. The content of organic matter is low.

Areas of these soils are used mainly for crops, though a few small areas are used as pasture and as woodland.

Representative profile of Princeton fine sandy loam, 2 to 6 percent slopes, eroded (in a fescue pasture 1,175 feet north and 92 feet east of the southwest corner of SE¼ sec. 11, T. 7 S., R. 7 W.):

Ap—0 to 9 inches, dark-brown (10YR 4/3) fine sandy loam; weak, thick and medium, platy structure; very friable when moist; slightly acid; abrupt, smooth boundary.

B21t—9 to 26 inches, dark-brown (7.5YR 4/4) loam; moderate, medium, subangular blocky structure; friable when moist; reddish-brown (5YR 5/4) clay films; a few worm casts; slightly acid; clear, wavy boundary.

B22t—26 to 40 inches, dark-brown (7.5YR 4/4) light loam; weak, coarse, subangular blocky structure; friable when moist; a few reddish-brown (5YR 5/4) clay films; a few worm casts; strongly acid; clear, smooth boundary.

B3—40 to 57 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; single grain; loose when moist; dark-brown (7.5YR 4/4) fine sandy loam bands ½ to 1½ inches thick; weak, medium and coarse, subangular blocky structure; friable when moist; a few reddish-brown (5.YR 5/4) clay films; a few, very dark brown (10YR 2/2) manganese stains; very fine mica flakes strongly evident; medium acid; abrupt, smooth boundary.

C—57 to 110 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; single grain; loose when moist; very fine mica flakes; medium acid.

The Ap horizon ranges from dark brown to brown in color. In places this horizon overlies a dark yellowish-brown to yellowish-brown fine sandy loam A2 horizon. In other places the Ap horizon is in direct contact with the dark-brown B horizon. The B horizon ranges from fine sandy loam to sandy clay loam in texture and from strongly acid to slightly acid in reaction. The banded layer ranges from about 12 to 30 inches in thickness. The C horizon is at a depth of about 36 to 60 inches and ranges from medium acid to mildly alkaline in reaction.

Princeton fine sandy loam, 2 to 6 percent slopes, eroded (PrB2).—This soil is on low ridges and knolls. It has the profile described as representative of the series. Part of the original surface layer has been lost through erosion. In places the material formerly in the subsoil has been mixed with the remaining surface layer by plowing.

Included with this soil in mapping are areas of nearly level to gently sloping Princeton soils that are slightly eroded. Also included are a few small areas of severely eroded soils.

Runoff is slow on this Princeton soil, and further erosion is the major hazard. Low available moisture capacity during long periods of low rainfall also is a limitation. Most crops commonly grown in the county are suited. Deep-rooted plants, such as alfalfa, and fruits and vegetables are especially well suited. Capability unit IIe-3; woodland group 2.

Princeton fine sandy loam, 6 to 18 percent slopes, eroded (PrD2).—This soil is on hillsides next to deep loess uplands. A moderate amount of the original surface layer has been lost through erosion, and the present surface layer includes some material formerly in the subsoil.

Included with this soil in mapping are a few small areas of severely eroded soils and of steeper soils on bluffs.

Runoff is medium on this Princeton soil, and further erosion is a hazard. Low available moisture capacity during long periods of low rainfall also is a limitation. Most crops commonly grown in the county are suited. Such deep-rooted crops as alfalfa are especially well suited. Most areas of the strongly sloping and extremely steep soils are suitable for use as pasture and as woodland, and they are used for these purposes. Capability unit IIIe-3; woodland group 2.

Ragsdale Series

In the Ragsdale series are deep, very poorly drained, medium-textured, nearly level soils in depressions on uplands. These soils formed in loess. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is heavy silt loam about 13 inches thick. It is very dark grayish-brown to very dark brown in the upper 9 inches and very dark gray with pale-olive mottles below. The subsoil, about 39 inches thick, is friable to firm silty clay loam. It is olive gray, very dark gray, and gray and has olive-gray, pale-brown, olive, and yellowish-brown mottles. The underlying material is gray, friable silt loam that has yellowish-brown mottles.

Permeability is slow in these Ragsdale soils, and available moisture capacity is high. Most areas are used for crops.

Representative profile of Ragsdale silt loam (in a cultivated field 2½ miles west of Rockport and 1,172 feet south and 85 feet west of the northeast corner of NW¼ sec. 20, T. 7 S., R. 6 W.):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) to very dark brown (10YR 2/2) heavy silt loam, grayish brown (10YR 5/2) when dry; moderate, medium, subangular blocky structure in upper part and weak, thick, platy structure in lower part; friable when moist; neutral; abrupt, smooth boundary.

A1—9 to 13 inches, very dark gray (10YR 3/1) heavy silt loam, gray (10YR 5/1) when dry; common, fine, pale-olive (5Y 6/3) mottles; moderate, medium, subangular blocky structure; friable when moist; a few, fine, very dark brown (10YR 2/2) manganese concretions; neutral; gradual, irregular boundary.

B21tg—13 to 19 inches, mottled olive-gray (5Y 5/2), very dark gray (N 3/0), and pale-brown (10YR 6/3) silty clay loam; weak, fine, prismatic structure that parts to medium and coarse subangular blocky; friable to firm when moist; olive-gray (5Y 5/2) and dark-gray (10YR 4/1) clay films on ped faces; neutral; diffuse, irregular boundary.

B22tg—10 to 36 inches, gray (N 5/0) light silty clay loam; many, fine, distinct, olive (5Y 5/6) mottles; moderate, medium, prismatic structure that parts to medium subangular blocky; friable to firm when moist; olive-gray (5Y 5/2) and dark-gray (10YR 4/1) clay films on ped faces; a few, fine, very dark brown (10YR 2/2) manganese concretions; neutral; diffuse, irregular boundary.

B3g—36 to 52 inches, gray (N 5/0) light silty clay loam; many, prominent, fine, yellowish-brown (10YR 5/8) mottles and a few, fine, distinct, olive (5Y 5/6) mottles; weak, very coarse, prismatic structure; friable when moist; a few, fine, very dark brown (10YR 2/2) manganese concretions; mildly alkaline.

Cg—52 to 72 inches, gray (N 5/0) silt loam; common, medium, prominent, yellowish-brown (10YR 5/8) mottles; massive; friable when moist; a few yellowish-brown (10YR 5/8) streaks; mildly alkaline.

The A horizon ranges from 6 to 15 inches in thickness. The B horizon ranges from heavy silt loam to heavy silty clay in texture. Depth to friable silt and silt loam in the C horizon ranges from 45 to 60 inches.

Ragsdale silt loam (0 to 2 percent slopes) (Ra).—This is the only Ragsdale soil mapped in the county. It is in depressions on deep loess uplands. The areas are surrounded by areas of gently sloping to sloping soils.

Included with this soil in mapping are small areas covered by a thin layer of brown silt loam deposited from surrounding higher areas of loess soils and from occasional overflow of drainage ditches.

Runoff is ponded to slow on this soil, and wetness is the major limitation to use. If drained, this soil is suited to most crops commonly grown in the county. Corn and soybeans are the main crops. Both surface and subsurface drainage are needed for good crop growth. Capability unit IIw–1; woodland group 11.

Rahm Series

The Rahm series consists of deep, somewhat poorly drained, medium-textured, nearly level soils on low terraces along flood plains. The upper part of these soils formed in recent neutral to slightly acid alluvium, and the lower part in old acid alluvium of the underlying terraces. The native vegetation was mixed hardwoods.

In a representative profile the surface layer, about 8 inches thick, is dark grayish-brown silt loam mottled with dark yellowish brown. The upper 13 inches of the subsoil is grayish-brown, firm silt loam mottled with yellowish brown. Below is a buried subsoil about 30 inches thick. The upper 3 inches is grayish-brown, firm light silty clay loam that has yellowish-brown mottles. The part below is mainly light brownish-gray, grayish-brown, and yellowish-brown, firm silty clay loam that is mottled with strong brown and light brownish gray. The underlying material is dark-brown and light brownish-gray, firm light silty clay loam.

Rahm soils are slowly permeable and have high available moisture capacity. They are subject to occasional flooding.

Most areas of these soils are used for crops, and soybeans and corn are the main crops. A few acres, however, are used as pasture and as woodland.

Representative profile of Rahm silt loam (in a cultivated field about 3 miles southwest of Rockport and 800 feet north and 110 feet west of the southeast corner of sec. 9, T. 8 S., R. 6 W.):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, faint, dark yellowish-brown (10YR 4/4) mottles; moderate, very fine and fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B—8 to 21 inches, grayish-brown (10YR 5/2) silt loam; many, fine, distinct, yellowish-brown (10YR 5/6 to 5/8) mottles; weak, medium and coarse, subangular blocky structure; firm when moist; light brownish-gray (10YR 6/2) to grayish-brown (10YR 5/2) glossy silt coatings on ped surfaces in the upper part of this horizon and in worm channels; neutral; clear, smooth boundary.

IIB1b—21 to 24 inches, grayish-brown (10YR 5/2) light silty clay loam; many, fine, distinct, yellowish-brown (10YR 5/4–5/6) mottles; weak, medium to coarse, subangular blocky structure; firm when moist; many light brownish-gray (10YR 6/2) silt coatings on ped faces; slightly acid; clear, smooth boundary.

IIB2b—24 to 45 inches, light brownish-gray (10YR 6/2) silty clay loam; many, fine, prominent, strong-brown (7.5YR 5/6) mottles; moderate, coarse, prismatic structure; firm when moist; many light brownish-gray (10YR 6/2) silt coatings on prism faces and in soil voids; medium acid; gradual, smooth boundary.

IIB3b—45 to 51 inches, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) silty clay loam; many, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, coarse, prismatic structure; firm when moist; many light brownish-gray (10YR 6/2) silt coatings on ped faces and in soil voids; many, fine, very dark brown (10YR 2/2) manganese and iron concretions; strongly acid; gradual, smooth boundary.

IIC—51 to 60 inches, dark-brown (7.5YR 4/4) and light brownish-gray (10YR 6/2) light silty clay loam; massive; firm when moist; strongly acid.

In wooded areas the A horizon ranges from very dark brown to dark grayish brown, but in cultivated areas this horizon ranges from dark grayish brown to brown. The recent alluvial overwash ranges from silt loam to light silty clay loam in texture. Depth to the buried subsoil ranges from 20 to 30 inches. The stratified C horizon ranges from silty clay loam to loam in texture.

The profile of these soils is grayer than that defined for the series, but this difference does not alter their usefulness and behavior.

Rahm silt loam (0 to 2 percent slopes) (Rh).—This is the only Rahm soil mapped in the county. It is on low terraces along flood plains. Included in mapping are a few small areas of Lindside soils and Woodmere soils.

Runoff is slow on this soil, and wetness is the major limitation to use. Occasional flooding is a hazard. If drained, this soil is suited to most crops commonly grown in the county. The main crops are corn and soybeans. Capability unit IIw–7; woodland group 13.

Sciotoville Series

In the Sciotoville series are deep, moderately well drained, medium-textured, nearly level and gently sloping soils on terraces. These acid soils formed in old alluvium of mixed origin. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown silt loam about 9 inches thick. The subsoil is about 51 inches thick. It is strong-brown, friable to firm silt loam in the upper 17 inches; light-gray, friable silt loam that has mottles of dark yellowish brown in the next 5 inches; and a dark-brown, firm, silty clay loam fragipan that is mottled with gray below. The pan is underlain by dark yellowish-brown, friable silt loam. Below a depth of 100 inches is stratified fine sand and silt.

Sciotoville soils are very slowly permeable in the fragipan layer. Their available moisture capacity is moderate.

These soils are used mainly for crops, but a few small areas are in pasture and in trees.

Representative profile of Sciotoville silt loam, 0 to 2 percent slopes (in a cultivated field 990 feet south of the northwest corner of SW¼ sec. 32, T. 6 S., R. 5 W.):

Ap—0 to 9 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, granular structure; friable when moist; strongly acid; abrupt, smooth boundary.

B1—9 to 15 inches, strong-brown (7.5YR 5/6) silt loam; weak, medium, subangular blocky structure; friable when moist; very strongly acid; clear, smooth boundary.

B2t—15 to 26 inches, strong-brown (7.5YR 5/6) heavy silt loam; common, fine, distinct, light-gray (10YR 7/2) mottles; moderate, medium, subangular blocky structure; firm when moist; a few, thin, discontinuous, dark-brown (7.5YR 4/4) clay films on some ped faces and in a few voids; very strongly acid; clear, smooth boundary.

IIA'2—26 to 31 inches, light-gray (10YR 7/2) silt loam; common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; weak, medium, subangular blocky structure; friable when moist; many iron and manganese concretions; very strongly acid; clear, irregular boundary.

IIB'x1—31 to 49 inches, dark-brown (10YR 4/3) silty clay loam; a few, medium, distinct, gray (10YR 6/1) mottles; strong, coarse, prismatic structure; very firm when moist, very hard when dry; moderate to strong fragipan; thin, continuous, dark-brown (7.5YR 4/4) clay films on prism faces and in soil voids; a few rounded pebbles; a few iron and manganese concretions; many mica flakes; very strongly acid; diffuse, irregular boundary.

IIB'x2—49 to 60 inches, dark-brown (10YR 4/3) silty clay loam; common, medium, distinct, gray (10YR 6/1) mottles; massive; very firm when moist, very hard when dry; moderate to strong fragipan; gray (10YR 6/1) silt streaks in a few cracks and in soil voids; thin dark-brown (7.5YR 4/4) clay films in a few fine voids; a few rounded pebbles; common mica flakes; common iron and manganese concretions; very strongly acid; gradual, irregular boundary.

IIC1—60 to 100 inches, dark yellowish-brown (10YR 4/4) silt loam; massive; friable when moist; a few light-gray (10YR 7/2) streaks and specks of silt; many mica flakes; a few rounded pebbles; strongly acid to a depth of 90 inches, neutral below; gradual, wavy boundary.

IIC2—100 to 120 inches, dark yellowish-brown (10YR 4/4), stratified silt and fine sand; massive; friable when moist; neutral.

The A horizon ranges from dark brown to yellowish brown in color and from 7 to 18 inches in thickness. The upper part of the B horizon ranges from strong brown to yellowish brown in color and from silt loam to light silty clay loam in texture. Depth to the B'x horizon ranges from 20 to 36 inches. The upper part of the B horizon, the B'x horizon, and the IIC1 horizon contain enough sand to make the material feel gritty when rubbed between the fingers. Depth to the stratified C horizon ranges from about 48 to 72 inches.

Sciotoville silt loam, 0 to 2 percent slopes (ScA).—This soil has the profile described as representative of the series. It is on terraces. Included in mapping are a few small areas of Bartle soils and gently sloping Sciotoville soils.

Runoff is slow on this soil, and wetness is the major limitation to use. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. The very slowly permeable fragipan in the subsoil restricts downward movement of water and confines most plant roots to the soil zone above the fragipan. Capability unit IIw–5; woodland group 9.

Sciotoville silt loam, 2 to 6 percent slopes, eroded (ScB2).—This soil is on terraces. The profile is similar to that described as representative of the series, except that a moderate amount of the original surface layer has been lost through erosion. Strong-brown material formerly in the subsoil has been mixed with the remaining surface layer.

Included with this soil in mapping are a few areas of gently sloping and severely eroded soils on breaks.

Runoff is slow on this Sciotoville soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. The very slowly permeable fragipan in the subsoil limits penetration of most plant roots to the soil zone above the fragipan. Capability unit IIe–7; woodland group 9.

Stendal Series

The Stendal series consists of deep, somewhat poorly drained, medium-textured, nearly level soils on flood plains. These soils formed in mixed alluvium, mainly material weathered from shale and sandstone. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is brown silt loam about 8 inches thick. The subsoil, about 12 inches thick, is light brownish-gray and pale-brown, friable silt loam. The underlying material is light-gray and pale-brown, friable silt loam that has strong-brown and gray mottles.

Permeability is moderate, and available moisture capacity is high. In many places these soils have a seasonal high water table.

If adequately drained, Stendal soils are suited to intensive cropping.

Representative profile of Stendal silt loam (1,460 feet west and 200 feet south of the northeast corner of SW¼ sec. 18, T. 5 S., R. 5 W.):

Ap—0 to 8 inches, brown (10YR 5/3) silt loam; moderate, medium, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

B—8 to 20 inches, light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) silt loam; weak, fine, granular structure; friable when moist; common, fine, soft, dark yellowish-brown (10YR 4/4) manganese and iron concretions and stains; strongly acid; clear, smooth boundary.

C1—20 to 70 inches, light-gray (10YR 7/1) silt loam; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; massive; friable when moist; common, fine, dark-brown (7.5YR 4/4) manganese and iron concretions and stains; common crawfish burrows filled with gray (10YR 5/1) silt throughout the horizon; strongly acid; clear, wavy boundary.

C2—70 to 80 inches, pale-brown (10YR 6/3) stratified silt loam and sand; common, medium, distinct, gray (10YR 6/1) mottles; massive; friable when moist; very strongly acid.

The A horizon ranges from brown to light brownish gray in color. In the B horizon reaction ranges from strongly acid to very strongly acid.

Stendal silt loam (0 to 2 percent slopes) (Sn).—This is the only Stendal soil mapped in the county. It is on flood plains along the small streams of the county.

Included with this soil in mapping are a few small areas near St. Meinrad where the surface layer is loam. Also included are a few small areas of nearly level and gently sloping soils that have a dark surface layer.

Runoff is slow on this soil. Wetness is the major limitation to management, but the seasonal high water table and occasional flooding also are concerns. If drained, this soil is suited to most crops commonly grown in the county. The main crops are corn and soybeans. Capability unit IIw–7; woodland group 13.

Strip Mines

Strip mines (St) are open pits and mounds of mine spoil. A few of the pits contain water, and others are dry. The spoil material consists mainly of a mixture of soil, shale, sandstone, and small quantities of limestone (fig. 7).

The material on the surface of Strip mines generally consists of large pieces of broken rock and coal and fragments of shale. The mounds range from steep to strongly sloping. The spoil material ranges from neutral to extremely acid in reaction.

Strip mines provide a poor environment for plants. They generally cannot be revegetated for at least 3 years after mining is completed. In this way the spoil material is in place long enough for some weathering to occur. Areas of Strip mines are suitable for recreational facilities, for wildlife habitat, and for trees. A few areas provide suitable forage for livestock. Capability unit VIIe-2; woodland group 16.

***Figure 7.*—An area of Strip mines from which coal has been removed.**

Tilsit Series

The Tilsit series consists of deep, moderately well drained, medium-textured, nearly level and gently sloping soils on uplands. These soils formed in silty loess and in material weathered from sandstone and shale. A very slowly permeable fragipan layer is at a moderate depth in the subsoil. The native vegetation was mixed hardwood forest.

In a representative profile the surface layer is dark-brown and dark grayish-brown silt loam about 8 inches thick. The subsoil is about 40 inches thick. It is yellowish-brown to light yellowish-brown, friable heavy silt loam and light silty clay loam in the upper 15 inches. Below is a firm silty clay loam fragipan that is yellowish-brown and has mottles of light brownish-gray, dark brown, and dark yellowish-brown. The underlying material is friable silty clay loam that is yellowish brown and has mottles of light brownish gray.

Fertility and content of organic matter are low in these soils. Permeability of the fragipan layer is very slow. Available moisture capacity is moderate.

Most areas of Tilsit soils are used for row crops, small grains, and pasture plants.

Representative profile of Tilsit silt loam, 0 to 2 percent slopes (in a cultivated field about 2 miles north of Dale and 1,120 feet west and 100 feet south of the northeast corner of NW¼ sec. 4, T. 4 S., R. 5 W.):

Ap—0 to 6 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

A2—6 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; weak, thick, platy structure; friable when moist; a few, fine, dark yellowish-brown (10YR 3/4) spots; neutral; abrupt, smooth boundary.

B21t—8 to 18 inches, yellowish-brown (10YR 5/6) to light yellowish-brown (10YR 6/4) heavy silt loam; weak, medium and coarse, subangular blocky structure; friable when moist; a few pale-brown (10YR 6/3) silt coatings and dark-brown (7.5YR 4/4) clay films on ped surfaces; medium acid; clear, smooth boundary.

B22t—18 to 23 inches, yellowish-brown (10YR 5/6) to light yellowish-brown (10YR 6/4) light silty clay loam; a few, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; friable when moist; a few pale-brown (10YR 6/3) silt coatings, dark-brown (7.5YR 4/4) and strong-brown (7.5YR 5/6) clay films on ped surfaces; very strongly acid; clear, wavy boundary.

B'x1—23 to 42 inches, yellowish-brown (10YR 5/4 to 5/6) silty clay loam; many, fine, distinct, light brownish-gray (10YR 6/2) and dark-brown (7.5YR 4/4) mottles; moderate to strong, very coarse, prismatic structure; firm when moist; many pale-brown (10YR 6/3) clay films on ped surfaces; common, thick, light-gray (10YR 7/1) silt coatings on prism surfaces and in cracks; a few, very dark brown (10YR 2/2) and very dark grayish-brown (10YR 3/2) manganese concretions; very strongly acid; clear, wavy boundary.

IIB'x2—42 to 48 inches, yellowish-brown (10YR 5/6) silty clay loam; many, medium, distinct, light brownish-gray (10YR 6/2) and dark yellowish-brown (10YR 4/4) mottles; moderate to strong, very coarse, prismatic structure; firm when moist; brown (7.5YR 5/4) and yellowish-red (5YR 4/8) clay films in soil voids and on ped surfaces; light brownish-gray (10YR 6/2) silt coatings; a few dark yellowish-brown (10YR 4/4) concretion stains; a few very small shale and sandstone fragments; very strongly acid; clear, wavy boundary.

IIC—48 to 90 inches, brownish-yellow (10YR 6/6 to 6/8) silty clay loam; common, fine, distinct, light brownish-gray (10YR 6/2) mottles; massive; friable when moist; light brownish-gray (10YR 6/2) silt coatings formed by old roots are in voids; a few black (10YR 2/1) organic stains; a few very dark brown (10YR 2/2) manganese concretion stains; a few shale and sandstone fragments that increase in number at a depth below 80 inches; very strongly acid.

The loess mantle ranges from 24 to 48 inches in thickness. In wooded areas the A1 horizon is very dark grayish-brown (10YR 3/2) silt loam, about 2 inches thick, and overlies a dark grayish-brown (10YR 4/2) to dark-brown (10YR 4/3) silt loam A2 horizon. The A2 horizon is about 6 to 8 inches thick. Depth to the fragipan ranges from 20 to 30 inches.

Tilsit silt loam, 0 to 2 percent slopes (TsA).—This soil has the profile described as representative of the series. It occurs on upland ridgetops.

Included with this soil in mapping are a few areas of nearly level soils that are well drained. Also included are a few small areas of soils that have a dark surface layer.

Runoff is slow on this Tilsit soil, and wetness is the major limitation to use. Most crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. The moderately deep and very slowly permeable fragipan in the subsoil keeps this soil wet for short periods in spring in years when rainfall is heavy. Drought damage is likely in years when rainfall is below average or is poorly distributed. Capability unit IIw-5; woodland group 9.

Tilsit silt loam, 2 to 6 percent slopes, eroded (TsB2).—This soil is on ridgetops on sandstone and shale uplands. Part of the original surface layer has been lost through erosion, and the present surface layer contains yellowish-brown material formerly in the subsoil.

Included with this soil in mapping are areas of slightly eroded Tilsit soil. Also included are a few small areas of soils that have a dark surface layer.

Runoff is slow on this Tilsit soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. The very slowly permeable fragipan in the subsoil moderately restricts penetration of most plant roots. Capability unit IIe-7; woodland group 9.

Tilsit silt loam, 2 to 6 percent slopes, severely eroded (TsB3).—This soil is on uplands. Some areas are on side slopes below ridgetops, and others are along the head of drainageways. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion and the present surface layer is mainly yellowish-brown material formerly in the subsoil. In many places the subsoil is exposed.

Included with this soil in mapping are a few areas of well-drained Tilsit soil. Also included are a few gullies.

Runoff is medium on this Tilsit soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. Capability unit IIIe-7; woodland group 9.

Uniontown Series

In the Uniontown series are deep, medium-textured, moderately well drained and well drained, nearly level to steep soils. These soils are on lacustrine terraces throughout most of the county. They are underlain by stratified calcareous material. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown silt loam about 5 inches thick. The subsoil is 36 inches thick. It is yellowish-brown, friable silt loam in the upper 3 inches and dark yellowish-brown and yellowish-brown, firm silty clay loam below. The underlying material is yellowish-brown, firm light silty clay loam to silt loam to a depth of 102 inches. Below is stratified dark yellowish-brown clay and yellowish-brown silt loam.

Uniontown soils are moderately slowly permeable and have high available moisture capacity.

These soils are used for cultivated crops, as pasture, and as woodland. Most areas of the steep soils are in pasture and in trees.

Representative profile of Uniontown silt loam, 2 to 6 percent slopes, eroded (in a cultivated field 2 miles west of Midway and 1,450 feet west and 1,060 feet north of the southeast corner of sec. 10, T. 6 S., R. 7 W.):

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam; moderate, medium, platy structure; friable when moist; slightly acid; abrupt, smooth boundary.

B1—5 to 8 inches, yellowish-brown (10YR 5/4) silt loam; weak, fine, subangular blocky structure; friable when moist; slightly acid; clear, smooth boundary.

B21—8 to 14 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; moderate, fine, subangular blocky structure; firm when moist; a few patchy dark-brown (7.5YR 4/4) clay films; strongly acid; clear, smooth boundary.

IIB22t—14 to 24 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate, fine to medium, prismatic structure that parts to strong, medium, angular blocky; firm when moist; dark-brown (10YR 4/3 and 7.5YR 4/4) clay films on ped surfaces; common, fine, very dark brown (10YR 2/2) manganese stains on some peds in lower part of horizon; strongly acid; gradual, smooth boundary.

IIB23t—24 to 41 inches, yellowish-brown (10YR 5/4) light silty clay loam; moderate, coarse, angular blocky structure; firm when moist; dark-brown (10YR 4/3) continuous clay films on ped surfaces and within small pores; neutral; clear, smooth boundary.

IIC1—41 to 55 inches, yellowish-brown (10YR 5/4) light silty clay loam to heavy silt loam; massive; firm when moist; brown (10YR 5/3) streaks and coatings; dark yellowish-brown (10YR 4/4) clay films along cracks and in crevices; many, soft, gray (5Y 5/1 to 6/1) lime coatings; mildly alkaline; calcareous; clear, smooth boundary.

IIC2—55 to 102 inches, yellowish-brown (10YR 5/6) silt loam; massive; firm; common, light brownish-gray (10YR 6/2) streaks; lime nodules and very fine mica flakes throughout the horizon; mildly alkaline; clear, smooth boundary.

IIIC3—102 to 118 inches, stratified dark yellowish-brown (10YR 4/4) clay and yellowish-brown (10YR 5/6) silt loam; massive; firm; streaks of gray (10YR 5/1) and light brownish-gray (10YR 6/2); lime nodules and very fine mica flakes throughout the horizon; mildly alkaline.

The A horizon generally ranges from dark grayish brown to pale brown in color, but in wooded areas it ranges to dark gray. The B horizon ranges from dark yellowish brown to pale brown in color and from silt loam to silty clay in texture. The upper part of the solum formed in a capping of silty loess about 12 to 40 inches thick. In a few areas a small amount of silty clay is in the lower part of the subsoil, and the underlying material consists of stratified sediment that ranges from clay to sand in texture. In most places the underlying material is mainly silt that has only thin strata of calcareous clay. The underlying material ranges from neutral to mildly alkaline in reaction.

Uniontown silt loam, 0 to 2 percent slopes (UnA).—This soil is on lacustrine terraces along the edges of large broad areas of nearly level and somewhat poorly drained soils on terraces. The areas are likely to be small in size and irregular in shape. The profile is similar to that described as representative of the series, except that the surface layer is about 10 inches thick.

Runoff is slow on this soil, and limitations to use are few. This soil is suitable for intensive cropping. Because the areas are small and irregular in shape, they generally are used and managed the same as areas of surrounding soils. Capability unit I-1; woodland group 1.

Uniontown silt loam, 2 to 6 percent slopes, eroded (UnB2).—This soil has the profile described as representative of the series. It is on lacustrine terraces between broad areas of nearly level soils on terraces and areas of soils formed in alluvium on bottom lands. Included in mapping are small areas that are slightly eroded.

Runoff is slow to medium on this soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. Alfalfa and other deep-rooted plants are well suited. Capability unit IIe–3; woodland group 1.

Uniontown silt loam, 2 to 6 percent slopes, severely eroded (UnB3).—This soil is on lacustrine terraces between broad areas of nearly level soils on terraces and areas of soils formed in alluvium on bottom lands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. The present surface layer consists mainly of yellowish-brown material formerly in the subsoil.

Included with this soil in mapping are a few small areas of moderately eroded soils.

Runoff is medium on this Uniontown soil, and further erosion is the major hazard. Most crops commonly grown in the county are well suited. The main crops are corn, soybeans, small grains, and meadow. Mixtures of alfalfa and grass are especially well suited. Capability unit IIIe–3; woodland group 1.

Uniontown silt loam, 6 to 12 percent slopes, eroded (UnC2).—This soil is on lacustrine terraces between broad areas of nearly level soils on terraces and areas of soils formed in alluvium on bottom lands.

Included with this soil in mapping are a few small areas that are slightly eroded. Most of these areas are wooded.

Runoff is medium on this Uniontown soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited, and the main crops are corn, soybeans, small grains, and meadow. Mixtures of alfalfa and grass are well suited to this soil. Capability unit IIIe–3; woodland group 1.

Uniontown silt loam, 6 to 12 percent slopes, severely eroded (UnC3).—This soil is on lacustrine terraces between broad areas of nearly level soils on terraces and areas of soils formed in alluvium on bottom lands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion, and the present surface layer consists mainly of yellowish-brown material formerly in the subsoil.

Included with this soil in mapping are a few small areas of soils that are moderately eroded.

Runoff is medium to rapid on this Uniontown soil, and further erosion is the major hazard. Small grains, mixtures of legumes and grass, and a few row crops are suited. Capability unit IVe–3; woodland group 1.

Uniontown silt loam, 12 to 25 percent slopes, eroded (UnE2).—This soil is on laacustrine terraces. The areas are narrow and steep and are on breaks next to soils formed in alluvium on bottom lands.

Included with this soil in mapping are a few small areas of strongly sloping soils that are slightly eroded to severely eroded. Also included are a few areas of steep soils that are slightly eroded.

Runoff is rapid on this Uniontown soil, and further erosion is a hazard. Permanent plants, such as grasses and trees, are suited. Capability unit VIe–1; woodland group 2.

Vincennes Series

The Vincennes series consists of deep, poorly drained, nearly level soils that are medium textured. These soils occupy depressional areas on terraces of the Ohio River. The native vegetation was mixed hardwoods.

In a representative profile the surface layer, about 10 inches thick, is grayish-brown silt loam that is mottled with pale brown in the lower 4 inches. The subsoil is about 26 inches thick. It is gray, firm clay loam that has yellowish-brown, strong-brown, and pale-brown mottles in the lower 18 inches. The underlying material is gray, firm clay loam mottled with strong brown and yellowish-brown.

Permeability is slow in these soils, and available moisture capacity is high. These soils have a seasonal high water table.

Vincennes soils are used for crops, though a few low sloughs are in trees and a few other areas are used as pasture. The main crops are corn and soybeans.

Representative profile of Vincennes silt loam (in a cultivated field 1 mile east and one-half mile south of Hatfield and 100 feet north and 65 feet west of the southeast corner of NE¼ sec. 20, T. 7 S., R. 7 W.):

Ap1—0 to 6 inches, grayish-brown (10YR 5/2) silt loam; fine to very fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

Ap2—6 to 10 inches, grayish-brown (10YR 5/2) silt loam; a few, fine, faint, pale-brown (10YR 6/3) mottles; weak, very thick, platy structure; friable when moist; dark-gray (10YR 4/1) to dark grayish-brown (10YR 4/2) worm casts and coatings; neutral; abrupt, smooth boundary.

B21g—10 to 18 inches, gray (5Y 5/1) light clay loam; weak, coarse, subangular blocky structure; firm when moist; a few dark yellowish-brown (10YR 4/4) stains and manganese concretions; strongly acid; clear, smooth boundary.

B22g—18 to 33 inches, gray (5Y 5/1) clay loam; a few, fine, distinct, yellowish-brown (10YR 5/6 to 5/8) mottles; weak, very coarse, subangular blocky structure; firm when moist; a few, dark yellowish-brown (10YR 4/4) stains and manganese concretions; strongly acid; clear, smooth boundary.

B3g—33 to 36 inches, gray (5Y 5/1) heavy clay loam; a few, fine, prominent, strong-brown (7.5YR 5/6) mottles and a few, fine, faint, pale-brown (10YR 6/3) mottles; weak, very coarse, subangular blocky structure; firm when moist; a few, medium, yellowish-red (5YR 5/6) concretion stains; strongly acid; clear, smooth boundary.

C1—36 to 54 inches, gray (N 5/0) clay loam; a few thin streaks of waterlaid light-gray (10YR 6/1) fine sand in lower part of horizon; common, fine, prominent, yellowish-brown (10YR 5/6 to 5/8) mottles; massive; firm when moist; a few, reddish-brown (5YR 4/3) stains and a few, fine, black (10YR 2/1) manganese concretions; strongly acid; clear, smooth boundary.

C2—54 to 72 inches, gray (2.5Y 6/0) clay loam; many, fine, prominent, strong-brown (N 6/0) mottles; many manganese and iron concretions, some of which are as much as 2 centimeters in diameter; massive; medium acid.

The A horizon ranges from dark gray to grayish brown in color. The B horizon ranges from gray to dark gray in color and from light clay loam to clay in texture. This horizon has mottles and concretion stains. The stratified C horizon is at a depth of about 36 to 60 inches. A few very fine mica flakes occur throughout the profile.

Vincennes silt loam (0 to 2 percent slopes) (Vn).—This is the only Vincennes soil mapped in the county. It is on terraces of the Ohio River. The areas are long and narrow and are in depressions.

Included with this soil in mapping are a few small areas of a soil that has a surface layer of silty clay loam or loam. Also included are a few small areas of a soil that has a dark surface layer and an acid to neutral subsoil. These soils are near Richland City.

Runoff is slow to ponded on this soil, and wetness is the major limitation. If drained, this soil is suited to most crops commonly grown in the county, and the main crops are corn and soybeans. It is also well suited to woodland and to pasture. Capability unit IIw-1; woodland group 11.

Wakeland Series

The Wakeland series consists of deep somewhat poorly drained soils. These soils are medium textured and nearly level. They formed in neutral to slightly acid alluvium from nearby loess uplands. The native vegetation was mixed hardwoods.

In a representative profile the surface layer, about 8 inches thick, is brown silt loam that has mottles of grayish-brown. The subsoil, about 11 inches thick, is grayish-brown, friable silt loam mottled with brown and light yellowish brown. The underlying material is light brownish-gray and yellowish-brown, friable silt loam that has yellowish-brown and grayish-brown mottles.

Permeability is moderate, and available moisture capacity is high. These soils generally have a seasonal high water table. Wakeland soils are suited to intensive cropping if they are adequately drained.

Representative profile of Wakeland silt loam (in a cultivated field 400 feet west and 100 feet north of the southeast corner of SW¼ sec. 34, T. 7 S., R. 7 W.):

Ap—0 to 8 inches, brown (10YR 5/3) silt loam; common, fine, faint, grayish-brown (10YR 5/2) mottles; weak, thick, platy structure; friable when moist; a few, very fine, dark yellowish-brown (10YR 4/4) manganese stains; neutral; abrupt, smooth boundary.

B—8 to 19 inches, grayish-brown (10YR 5/2) silt loam; many, fine, faint, brown (10YR 5/3) mottles and a few, light yellowish-brown (10YR 6/4) mottles; weak, fine, granular structure; friable when moist; a few dark yellowish-brown (10YR 4/4) manganese and iron concretions and stains; neutral; clear, smooth boundary.

C1—19 to 30 inches, light brownish-gray (10YR 6/2) silt loam; many, fine, distinct, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles; massive; friable when moist; a few, dark yellowish-brown (10YR 4/4) manganese and iron concretions and stains; neutral; clear, smooth boundary.

C2—30 to 60 inches, yellowish-brown (10YR 5/6) silt loam; many, fine, distinct, grayish-brown (10YR 5/2) mottles; massive; friable when moist; a few, fine, very dark brown (10YR 2/2) and dark yellowish-brown (10YR 4/4) manganese and iron concretions and stains; neutral.

The Ap horizon ranges from brown to grayish brown in color. The C horizon ranges from silt loam to silt in texture. Reaction ranges from neutral to slightly acid throughout the profile.

Wakeland silt loam (0 to 2 percent slopes) (Wa).—This is the only Wakeland soil mapped in the county. It is on flood plains along the small streams of the county.

Included with this soil in mapping are small areas of Stendal soil. Also included are small areas of Wilbur soil.

Runoff is slow on this soil, and wetness is the major limitation to use. This soil is subject to flooding in winter and early in spring. If it is drained, it is suited to most crops commonly grown in the county. The main crops are corn and soybeans, and damage to these crops from flooding is small. Capability unit IIw-7; woodland group 13.

Weinbach Series

The Weinbach series consists of deep, somewhat poorly drained, medium-textured soils. These soils are nearly level and are on terraces of the Ohio River. They formed in old acid alluvium of mixed origin. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The subsurface layer, about 4 inches thick, is grayish-brown, friable silt loam mottled with yellowish brown and pale brown. The subsoil is about 55 inches thick. It is light brownish-gray, friable silt loam that is mottled with yellowish brown in the upper 11 inches. Below this is a dark-brown, firm clay loam fragipan that has clay films of gray and light brownish gray. The underlying material is dark-brown, friable silt loam.

Permeability is very slow in these soils, and available moisture capacity is moderate. Fertility and content of organic matter are low. Reaction is strongly acid.

Most areas of Weinbach soils are used for corn, soybeans, small grains, and meadow plants. Small areas, however, are used as pasture and as woodland.

Representative profile of Weinbach silt loam, 0 to 2 percent slopes (in a cultivated field 2½ miles north of Rockport and 460 feet north and 525 feet west of the southeast corner of NE¼ sec. 11, T. 7 S., R. 6 W.):

Ap—0 to 7 inches, brown (10YR 5/3) silt loam; moderate, fine, granular structure in the upper part and weak, thick, platy in the lower part; friable when moist; neutral; abrupt, smooth boundary.

A2—7 to 11 inches, grayish-brown (10YR 5/2) silt loam; a few, fine, distinct, yellowish-brown (10YR 5/6) and pale-brown (10YR 6/3) mottles; weak, thick, platy structure; friable when moist; very strongly acid; clear, wavy boundary.

B—11 to 22 inches, light brownish-gray (10YR 6/2) silt loam; a few, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, subangular blocky structure; friable when moist; a few light yellowish-brown (10YR 6/4) clay films on cleavage surfaces; very strongly acid; clear, irregular boundary.

B'x1—22 to 51 inches, dark-brown (7.5YR 4/4) clay loam; strong, very coarse, prismatic structure; firm when moist; many, continuous, distinct, gray (10YR 6/1) clay films and silt coatings on prism faces; a few, fine, pale-brown (10YR 6/3) splotches in soil mass; strong fragipan; very strongly acid; gradual, wavy boundary.

B'x2—51 to 66 inches, dark-brown (7.5YR 4/4) light clay loam; common, medium, distinct, yellowish-red (5YR 4/6) mottles; weak, coarse, subangular blocky structure to massive; firm when moist; many light brownish-gray (10YR 6/2) clay films in soil voids; concentrated zone of many very dark brown (10YR 2/2) manganese and iron concretions; weakly cemented; very strongly acid; gradual, wavy boundary.

C—66 to 88 inches, dark-brown (7.5YR 4/4) silt loam; massive; friable when moist; a few, light brownish-gray (10YR 6/2) streaks; medium acid.

The A horizon is very dark grayish brown in wooded areas, but it ranges from grayish brown to dark brown in cultivated areas. It ranges from silt loam to loam in texture. The B horizon ranges from pale brown to strong brown in color and from heavy silt loam to silty clay loam in texture. The

B'x horizon is at a depth of 18 to 30 inches. The matrix color hue of this horizon ranges from 10YR to 7.5YR. The stratified C horizon is at a depth of 45 to 70 inches. It is silty clay loam, silt loam, loam, and fine sand in texture. Very fine mica flakes occur throughout the profile.

Weinbach loam, 0 to 2 percent slopes (WbA).—This soil is on terraces of the Ohio River. The profile is similar to that described as representative of the series, except that the surface layer has a greater content of sand. In places the areas are as large as about 100 acres in size. A fragipan layer is at a moderate depth in the subsoil.

Included with this soil in mapping are scattered small areas east of Hatfield that have a surface layer of fine sandy loam.

Runoff is slow on this Weinbach soil, and wetness is the major limitation. If drained, this soil is suited to most crops commonly grown in the county, and the main crops are corn, soybeans, small grains, and meadow. The very slowly permeable fragipan in the subsoil restricts penetration of most plant roots. This soil dries out earlier in spring than Weinbach silt loam, 0 to 2 percent slopes, and tillage and seeding therefore can be done earlier in the spring. Capability unit IIw–3; woodland group 5.

Weinbach silt loam, 0 to 2 percent slopes (WcA).—This soil has the profile described as representative of the series. It is on terraces of the Ohio River. A fragipan layer is at a moderate depth in the subsoil. Included in mapping are a few small areas of Sciotoville soils.

Runoff is slow on this Weinbach soil. Wetness is the major limitation to use and management. If drained, this soil is suited to most crops commonly grown in the county. The main crops are corn and soybeans. Shallow-rooted plants and plants that tolerate acidity are better suited to this soil than other kinds of plants. Capability unit IIw–3; woodland group 5.

Wellston Series

The Wellston series consists of moderately deep and deep, well-drained, medium-textured soils that are gently sloping to steep. These soils are on uplands. They formed in material weathered from shale and sandstone. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown and brown silt loam about 11 inches thick. The subsoil is about 29 inches thick. It is yellowish-red, firm silty clay loam in the upper 10 inches; strong-brown, firm silty clay loam in the next 15 inches; and strong-brown to reddish-yellow, friable silt loam below. Sandstone bedrock is at a depth of 40 inches.

Permeability is moderate in these soils, and available moisture capacity is high. Fertility is low.

Most areas of Wellston soils are in pasture and in woodland.

Representative profile of Wellston silt loam, 12 to 18 percent slopes, eroded (in a wooded area 1¾ miles southeast of Mariah Hill and 350 feet north and 1,120 feet east of the southwest corner of NE¼ sec. 19, T. 4 S., R. 4 W.):

A1—0 to 2 inches, dark-brown (10YR 4/3) silt loam; moderate, fine, granular structure; friable when moist; medium acid; clear, wavy boundary.

A2—2 to 11 inches, brown (10YR 5/3) silt loam; weak, medium, platy structure; friable when moist; very strongly acid; clear, smooth boundary.

B21t—11 to 21 inches, yellowish-red (5YR 5/6) silty clay loam; moderate, fine, subangular blocky structure; firm when moist; common, yellowish-red (5YR 4/6) clay films; very strongly acid; gradual, wavy boundary.

IIB22t—21 to 36 inches, strong-brown (7.5YR 5/6) silty clay loam; moderate, medium, angular blocky structure; firm when moist; many yellowish-red (5YR 4/6) clay films; common sandstone fragments at a depth of 26 to 32 inches; very strongly acid; clear, smooth boundary.

IIB3—36 to 40 inches, strong-brown (7.5YR 5/6) to reddish-yellow (7.5YR 6/6) silt loam; weak, medium, angular blocky structure; friable when moist; a few, thin, yellowish-red (5YR 4/6) clay films on sandstone fragments; very strongly acid; abrupt, smooth boundary.

IIR—40 inches, sandstone bedrock.

The A horizon ranges from dark grayish brown to yellowish brown in color. The B horizon ranges from yellowish red to dark yellowish brown in color, from 18 to 36 inches in thickness, and from silt loam and silty clay loam to clay loam in texture. In places the lower part of this horizon consists of silt loam that contains enough sand to make it feel gritty when rubbed between the fingers. Also, in places this horizon lacks shale and sandstone to a depth of about 36 inches, but channery fragments generally are within a depth of 24 inches. Depth to bedded sandstone and shale ranges from 36 to 60 inches.

Wellston silt loam, 2 to 6 percent slopes (WeB).—This soil occurs in small areas on ridges and foot slopes on shale and sandstone uplands that have a capping of silt. Most of the areas on foot slopes contain variable amounts of shale and sandstone fragments throughout the profile. In places the surface layer is channery and feels gritty when rubbed between the fingers.

Included in mapping with this soil are a few areas of gently sloping and moderately eroded Wellston soil on narrow ridgetops.

Runoff is slow on this Wellston soil, and erosion is the major hazard. Most crops commonly grown in the county are suited. In many places the areas are inaccessible and are used as pasture and as woodland. Capability unit IIe–3; woodland group 10.

Wellston silt loam, 6 to 12 percent slopes, eroded (WeC2).—This soil occurs in scattered small areas on hillsides and foot slopes of uplands. About three-fifths of the unit is on foot slopes near the base of steep to very steep hillsides. Part of the original surface layer has been lost through erosion and material formerly in the subsoil has been mixed with the remaining surface layer. Where this soil occurs on foot slopes, varying amounts of shale and sandstone fragments occur throughout the profile. In places the surface layer is channery and feels gritty when rubbed between the fingers.

Included with this soil in mapping are small areas that are slightly eroded. Most of these areas are in trees.

Runoff is medium on this Wellston soil, and further erosion is the main hazard. Most crops commonly grown in the country are suited. The areas are used mainly as pasture and as woodland. Capability unit IIIe–3; woodland group 10.

Wellston silt loam, 6 to 12 percent slopes, severely eroded (WeC3).—This soil occurs in scattered small areas on hillsides of uplands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. The present surface layer consists mainly of material formerly in the subsoil. In places a few sandstone and shale fragments are scattered on the surface of the soil, and depth to sandstone rock generally is no more than 40 inches.

Included with this soil in mapping are a few small areas of moderately eroded soils.

Runoff is medium to rapid on this Wellston soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited, and the main crops are small grains, hay, and pasture. Capability unit IVe-3; woodland group 10.

Wellston silt loam, 12 to 18 percent slopes, eroded (WeD2).—This soil is on hillsides of uplands. It has the profile described as representative of the series. Included in mapping are a few small areas of severely eroded soils.

Runoff is medium on this soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited. The main crops are small grains, hay, and pasture. Capability unit IVe-3; woodland group 10.

Wellston silt loam, 12 to 18 percent slopes, severely eroded (WeD3).—This soil is on hillsides of uplands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. The present surface layer consists mainly of material formerly in the subsoil. In places a few shale and sandstone fragments occur on the surface of this soil and through the profile, and depth to sandstone is no more than 36 to 40 inches.

Included in mapping with this soil are a few small areas of moderately eroded soils. A few gullies are also included.

Runoff is rapid on this Wellston soil, and further erosion is the major hazard. Pasture plants and trees are suited. Capability unit VIe-1; woodland group 10.

Wellston silt loam, 18 to 25 percent slopes, eroded (WeE2).—This soil occurs on hillsides on uplands. Part of the original surface layer has been lost through erosion. The present surface layer contains a moderate amount of material formerly in the subsoil. Shale and sandstone fragments occur within a depth of 24 inches, and in places a few fragments are on the surface of the soil.

Included with this soil in mapping are slightly eroded areas that are in trees.

Runoff is rapid on this Wellston soil, and further erosion is a hazard. This soil is suited to pasture plants and to trees, and most areas are used for these purposes. Capability unit VIe-1; woodland group 10.

Wellston silt loam, 18 to 25 percent slopes, severely eroded (WeE3).—This soil occurs on hillsides on uplands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion and the present surface layer is mainly material formerly in the subsoil. A few gullies cut the areas, and most areas have scattered shale and sandstone fragments on the surface. Many sandstone fragments generally are in the subsoil at a depth of less than 24 inches.

Included with this soil in mapping are a few small areas of soils that are moderately eroded. Also included are a few small areas of Gullied land, shale .

Runoff is rapid on this Wellston soil, and further erosion is the major hazard. This soil is suited to pasture plants and to trees, and most areas are used for these purposes. Capability unit VIe-1; woodland group 10.

Wheeling Series

The Wheeling series consists of deep, well-drained, nearly level to sloping soils that are medium textured. These soils are on terraces of the Ohio River. They formed in old acid alluvium of mixed origin. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown loam about 10 inches thick. The subsurface layer is yellowish-brown, friable loam about 7 inches thick. The subsoil, about 51 inches thick, is strong-brown to dark-brown sandy clay loam that is firm and friable. The underlying material is brown to dark-brown, friable fine sandy loam and dark yellowish-brown to dark-brown, loose loamy fine sand.

Permeability is moderate in these soils, and available moisture capacity is high. Most of these soils are used intensively for crops.

Representative profile of Wheeling loam, 0 to 2 percent slopes (in a cultivated field 90 feet north and 420 feet east of the southwest corner of NE¼ sec. 13, T. 6 S., R. 7 W.):

Ap—0 to 10 inches, dark-brown (10YR 4/3) loam; weak, very thick, platy structure; friable when moist; slightly acid; abrupt, smooth boundary.

A2—10 to 17 inches, yellowish-brown (10YR 5/4) loam; strong, medium and thick, platy structure; friable when moist; medium acid; clear, wavy boundary.

B21t—17 to 54 inches, strong-brown (7.5YR 5/6) sandy clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist, hard when dry; common, reddish-brown (5YR 4/4) clay films on cleavage surfaces; a small amount of yellowish-brown (10YR 5/4) fine sandy loam in cracks and in old root channels; a few, small, rounded pebbles less than 5 millimeters in diameter; a few, fine, very dark brown (10YR 2/2) manganese stains in lower part of horizon; very fine mica flakes; very strongly acid; gradual, irregular boundary.

B22t—54 to 68 inches, brown (7.5YR 5/4) to dark-brown (7.5YR 4/4) sandy clay loam; moderate, coarse, subangular blocky structure; friable when moist; common, reddish-brown (5YR 4/4) clay films on cleavage surfaces; a few, fine, very dark brown (10YR 2/2) iron and manganese stains; very fine mica flakes; very strongly acid; clear, irregular boundary.

C1—68 to 75 inches, brown (7.5YR 5/4) to dark-brown (7.5YR 4/4) sandy loam; massive; very friable when moist; a few, scattered accumulations of reddish-brown (5YR 4/4) clay; a few, fine specks of very dark brown (10YR 2/2), soft manganese concretions; very fine mica flakes; very strongly acid; clear, smooth boundary.

C2—75 to 82 inches, dark yellowish-brown (10YR 4/4) to dark-brown (7.5YR 4/4) loamy fine sand; single grain; loose; very fine mica flakes; very strongly acid.

The A horizon ranges from dark brown and brown to dark yellowish brown in color, from loam to silt loam in texture, and from 7 to 18 inches in thickness. The B horizon ranges from reddish brown to yellowish brown in color, from light sandy clay loam to silty clay loam in texture, and from strongly acid to extremely acid in reaction. The C horizon is at a depth of 45 to 70 inches. The underlying micaceous material in this horizon is stratified sandy loam, loamy fine sand, loam, and silt loam. This material ranges from very strongly acid to medium acid in reaction. In places iron and manganese concretions are in the lower part of the B horizon and in the C horizon.

Wheeling loam, 0 to 2 percent slopes (WhA).—This soil has the profile described as representative of the series. It is on old alluvial terraces. The areas range from a few acres to more than 100 acres in size.

Included in mapping are a few areas of Wheeling fine sandy loam. Also included are a few areas of moderately well drained soils that have a surface layer of loam.

Runoff is slow on this Wheeling soil, and limitations to use are few. All crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. Tobacco is also well suited, and most of the tobacco produced in the county is grown on this soil. Capability unit I–1; woodland group 1.

Wheeling loam, 2 to 6 percent slopes, eroded (WhB2).—This soil is on breaks and low ridges of old alluvial terraces. The profile is similar to that described as representative of the series, except that a part of the original surface layer has been lost through erosion. Also, material formerly in the subsoil has been mixed with the remaining surface layer.

Included with this soil in mapping are a few small areas of nearly level soils. Also included are a few small areas of moderately well drained soils.

Runoff is slow on this Wheeling soil, and further erosion is a hazard. All crops commonly grown in the county are well suited. The main crops are corn, soybeans, small grains, and meadow. Special crops such as tobacco are also well suited. Capability unit IIe–3; woodland group 1.

Wheeling loam, 2 to 6 percent slopes, severely eroded (WhB3).—This soil is on old alluvial terraces along drainageways and next to terraces. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. The present surface layer consists mainly of material formerly in the subsoil.

Included with this soil in mapping are a few small areas of soils that are moderately eroded.

Runoff is medium on this Wheeling soil, and further erosion is the major hazard. All crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. Capability unit IIIe–3; woodland group 1.

Wheeling loam, 6 to 12 percent slopes, eroded (WhC2).—Some areas of this soil are on old alluvial terraces next to drainageways, and others are on bottom lands. The profile is similar to that described as representative of the series, except that part of the original surface layer has been lost through erosion and material formerly in the subsoil has been mixed with the remaining surface layer.

Included with this soil in mapping are a few small areas of soils that have a surface layer of silt loam.

Runoff is medium on this Wheeling soil, and further erosion is a hazard. Most crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. Capability unit IIIe–3; woodland group 1.

Wheeling loam, 6 to 12 percent slopes, severely eroded (WhC3).—This soil occurs on breaks on old alluvial terraces next to drainageways and bottom lands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. The present surface layer is mainly material formerly in the subsoil.

Included with this soil in mapping are small areas of a soil that has a surface layer of silt loam. Also included are strongly sloping soils on breaks that are moderately eroded and severely eroded.

Runoff is medium or rapid on this Wheeling soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited. The main crops are small grains and hay and pasture plants. Capability unit IVe–3; woodland group 1.

Wheeling silt loam, 0 to 2 percent slopes (WlA).—This soil is on terraces along the Ohio River. The profile is similar to that described as representative of the series, except that the surface layer is silt loam. This soil dries later in spring than Wheeling loam, 0 to 2 percent slopes, and spring tillage and planting generally are delayed.

Included with this soil in mapping are a few small areas of soils that are moderately well drained. Also included are a few small areas of soils where the surface layer is loam.

Runoff is slow on this Wheeling soil. Limitations to use are few. All crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. Capability unit I–1; woodland group 1.

Wilbur Series

The Wilbur series consists of deep, moderately well drained soils that are nearly level and medium textured. These soils are on flood plains next to loess uplands. They formed in neutral to slightly acid alluvium. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown to brown silt loam about 8 inches thick. The subsoil, about 1 9inches thick, is dark-brown and dark grayish-brown silt loam. It is friable, and the lower part has mottles of gray and yellowish brown. The underlying material is dark grayish-brown, friable silt loam that is mottled with gray and yellowish brown.

Permeability is moderate in these soils, and available mosture capacity is high.

Wilbur soils are used intensively for crops, and corn is the main crop. A few small areas that are irregular in shape are used as pasture or are in trees.

Representative profile of Wilbur silt loam (in a cultivated field about ¾ mile south of Eureka and 1,000 feet east and 700 feet north of the southwest corner of NW¼ sec. 32, T. 7 S., R. 7 W.):

Ap—0 to 8 inches, dark-brown to brown (10YR 5/3) silt loam; weak, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21—8 to 20 inches, dark-brown (10YR 4/3) silt loam; weak, fine, granular structure; friable when moist; a few, thin, horizontal streaks that are light yellowish brown (10YR 6/4); neutral; clear, smooth boundary.

B22—20 to 27 inches, dark grayish-brown (10YR 4/2) silt loam; many, fine, faint, gray (10YR 5/1) mottles and a few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, granular structure; friable when moist; a few, thin, horizontal bands that are very pale brown (10YR 7/4); neutral; clear, smooth boundary.

C—27 to 60 inches, dark grayish-brown (10YR 4/2) silt loam; many, fine, faint, gray (10YR 5/1) mottles and a few fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; friable when moist; slightly acid to neutral.

The A horizon ranges from brown to dark grayish brown in color. Depth to gray mottles ranges from 20 to 30 inches. Reaction generally is neutral throughout the profile, but in places it ranges to slightly acid.

Wilbur silt loam (0 to 2 percent slopes) (Wr).—This is the only Wilbur soil mapped in the county. It is on flood plains along small streams.

Included with this soil in mapping are a few small areas of soils that have formed in alluvium and are medium acid. Also included are a few small areas of soils that have formed in alluvium and are well drained.

Runoff is slow on this soil. Except for occasional flooding in winter and early in spring, limitations to use are few. Most crops commonly grown in the county are suited. The main crops are corn and soybeans. Capability unit I-2; woodland group 8.

Woodmere Series

The Woodmere series consists of deep, moderately well drained to well drained, nearly level silt loams. These soils are on low terraces next to flood plains. The upper part formed in recent alluvium that is neutral or slightly acid, and the lower part formed in old acid alluvium. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown to dark grayish-brown silt loam about 8 inches thick. The subsoil is about 39 inches thick. The upper 18 inches is dark-brown, friable silt loam, and below is dark-brown, firm silty clay loam. The underlying material is dark-brown to brown light silty clay loam. It is firm and has mottles of gray.

Permeability is moderate in these soils, and available moisture capacity is high. Occasional flooding is a hazard.

Woodmere soils are used mainly for crops, but a few areas are pastured or are in trees. The main crops are corn and soybeans.

Representative profile of Woodmere silt loam (in a cultivated field 660 feet north and 200 feet west of the southeast corner of NW¼ sec. 17, T. 8 S., R. 6 W.):

Ap—0 to 8 inches, dark-brown (10YR 3/3) to dark grayish-brown (10YR 4/2) silt loam, pale brown (10YR 6/3) when dry; very fine granular structure; friable when moist; neutral; abrupt, smooth boundary.

B—8 to 22 inches, dark-brown (10YR 3/3) silt loam, pale brown (10YR 6/3) when dry; fine, granular structure to weak, medium, subangular blocky; friable when moist; dark-brown (10YR 3/3) silt coatings in worm channels; neutral; clear, wavy boundary.

IIB1b—22 to 26 inches, dark-brown (10YR 4/3) silt loam; weak, coarse, subangular blocky structure; friable when moist; common, brown (10YR 5/3) silt coatings in soil voids and on ped surfaces; strongly acid; clear, wavy boundary.

IIB2b—26 to 47 inches, dark-brown (7.5YR 4/4) light silty clay loam; strong, very coarse, prismatic structure; firm when moist; common, pale-brown (10YR 6/3) silt coatings and many, continuous, reddish-brown (5YR 5/4) to yellowish-red (5YR 5/6) clay films on cleavage surfaces; a few, fine, very dark brown (10YR 2/2) manganese concretion stains; very fine mica flakes; strongly acid; clear, wavy boundary.

IIC—47 to 63 inches, dark-brown (7.5YR 4/4) to brown (7.5YR 5/4) light silty clay loam; common, fine and medium, distinct, gray (10YR 6/1) mottles; massive; firm when moist; many very fine mica flakes; very strongly acid.

The Ap horizon ranges from dark brown (10YR 3/3) to dark grayish brown (10YR 4/2) in color. In most places the recent alluvium is 20 to 30 inches thick. Reaction ranges from neutral to slightly acid in the recent alluvium part of the profile and from strongly acid to very strongly acid in the buried B horizon. In places gray mottles are lacking in the solum, or they occur at a depth of about 24 inches or more. The buried B horizon ranges from silt loam to silty clay loam in texture. Hues are redder in the buried solum and in the underlying material than they are in the upper part of the profile.

Woodmere silt loam (0 to 2 percent slopes) (Ws).—This is the only Woodmere soil mapped in the county. It is on low terraces along flood plains.

Included with this soil in mapping are a few small areas of Huntington soils. Also included are a few small areas of Lindside soils.

Runoff is slow on this Woodmere soil. Except for occasional flooding, limitations to use are few. Most crops commonly grown in the county are suited. The main crops are corn and soybeans. Capability unit I-2; woodland group 8.

Zanesville Series

The Zanesville series consists of deep, well-drained, gently sloping to strongly sloping silt loams on uplands. These soils formed in silty loess and in material weathered from sandstone and shale. A fragipan is at a moderate depth in the subsoil. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is dark-brown and brown silt loam about 6 inches thick. The subsoil is about 51 inches thick. The upper 18 inches is strong-brown, friable light silty clay loam. Below this is a fragipan of yellowish-brown, firm silty clay loam. The underlying material is interbedded shale and sandstone.

Available moisture capacity is moderate in these soils. Permeability of the fragipan is very slow. Fertility and content of organic matter are low.

Zanesville soils are used mainly for crops, pasture plants, and trees. A few areas are idle.

Representative profile of Zanesville silt loam, 12 to 18 percent slopes, eroded (in a wooded area 1 mile south of Dale and 140 feet east of the southwest corner of SE¼ sec. 21, T. 4 S., R. 5 W.):

A1—0 to 2 inches, dark-brown (10YR 3/3) silt loam; moderate, medium, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

A2—2 to 6 inches, brown (10YR 5/3) silt loam; weak, very thick, platy structure; friable when moist; very strongly acid; clear, smooth boundary.

B21t—6 to 24 inches, strong-brown (7.5YR 5/6) light silty clay loam; strong, medium, subangular blocky structure; friable when moist; a few, thin, strong-brown (7.5YR 5/6) clay films on ped surfaces and in soil voids; very strongly acid; gradual, wavy boundary.

B'x1—24 to 33 inches, yellowish-brown (10YR 5/4) silty clay loam; moderate, coarse, prismatic structure that parts to moderate, coarse, angular blocky; firm when moist; common, thin, strong-brown (7.5YR 5/6) clay films on cleavage surfaces and prominent, light brownish-gray (10YR 6/2) silt coatings on prism faces and in cracks; very strongly acid; gradual, wavy boundary.

IIB'x2—33 to 57 inches, yellowish-brown (10YR 5/4) silty clay loam; weak, coarse, prismatic structure that parts to moderate, fine and medium, angular blocky; firm when moist; strong-brown (7.5YR 5/6) clay films on cleavage surfaces and on a few sandstone fragments; light brownish-gray (10YR 6/2) silt in cracks and in soil voids; very strongly acid; abrupt, smooth boundary.

In cultivated areas the Ap horizon ranges from dark grayish brown to dark brown and overlies an A2 horizon that is yellowish brown or dark yellowish brown. The B horizon ranges from yellowish brown (10YR) to strong brown (7.5YR) in color. The loess mantle ranges from 24 to 48 inches in thickness. The B'x horizon is at a depth of 20 to 30 inches. Bedrock generally is at a depth of 48 to 72 inches.

Zanesville silt loam, 2 to 6 percent slopes, eroded (ZaB2).—This soil is on ridgetops on sandstone and shale uplands. Part of the original surface layer has been lost through erosion. The present surface layer is mainly brown, friable silt loam that is mixed with a moderate amount of strong-brown material formerly in the subsoil. Depth to the upper part of the fragipan layer is about 30 inches.

Included with this soil in mapping are a few small areas of gently sloping Zanesville soils that are slightly eroded.

Runoff is slow on this Zanesville soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow (fig. 8). The very slowly permeable fragipan layer in the subsoil restricts penetration of most plants to the soil above the fragipan. Capability unit IIe-7; woodland group 9.

Zanesville silt loam, 6 to 12 percent slopes, eroded (ZaC2).—This soil is on side slopes on sandstone and shale uplands. Part of the original surface layer has been lost through erosion. The present surface layer is mainly brown silt loam that is mixed with a moderate amount of strong-brown material formerly in the subsoil.

Included with this soil in mapping are a few small areas of Zanesville soils that are slightly eroded.

Runoff is medium on this Zanesville soil, and further erosion is the main hazard. Most crops commonly grown in the county are suited. The main crops are corn, soybeans, small grains, and meadow. The very slowly permeable fragipan layer in the subsoil limits penetration of most plants to the soil above the fragipan. Capability unit IIIe-7; woodland group 9.

Zanesville silt loam, 6 to 12 percent slopes, severely eroded (ZaC3).—This soil is on side slopes on sandstone and shale uplands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion. The present surface layer consists mainly of material formerly in the subsoil. It is yellowish-brown to strong-brown loam. The upper part of the fragipan layer generally is at a depth of less than 24 inches.

Included with this soil in mapping are a few gullies and a few small areas of gullied land.

Runoff is rapid on this Zanesville soil, and further erosion is the major hazard. Most crops commonly grown in the county are suited. The main crops are small grains, meadow, and trees. Preparing a good seedbed is difficult in this soil, and in most places seed germination and stands are poor. The very slowly permeable fragipan layer in the subsoil limits penetration of most plants to the soil above the fragipan. Capability unit IVe-7; woodland group 9.

Zanesville silt loam, 12 to 18 percent slopes, eroded (ZaD2).—This soil occurs on side slopes on sandstone and shale uplands. It has the profile described as representative of the series.

Included with this soil in mapping are a few areas of Zanesville soils that are slightly eroded.

Runoff is medium to rapid on this Zanesville soil, and further erosion is the major hazard. Limitations to use are severe, but most crops commonly grown in the county are suited. The main crops are small grains, meadow, and trees. The very slowly permeable fragipan layer in the subsoil limits penetration of most plant roots to the soil above the fragipan. Capability unit IVe-7; woodland group 9.

Figure 8.—**Hay harvested from an area of Zanesville silt loam, 2 to 6 percent slopes, eroded.**

Zanesville silt loam, 12 to 18 percent slopes, severely eroded (ZaD3).—This soil occurs on side slopes on sandstone and shale uplands. The profile is similar to that described as representative of the series, except that most of the original surface layer has been lost through erosion and the present surface layer consists mainly of material formerly in the subsoil. In many places strong-brown material from the subsoil and scattered sandstone and shale fragments are exposed.

Included with this soil in mapping are a few gullies and scattered small spots of gullied areas.

Runoff is rapid on this Zanesville soil, and further erosion is the major hazard. This soil is suitable for pastures and trees. Most areas are used for these purposes, though many areas formerly used for crops and as pasture are now idle. The very slowly permeable fragipan layer in the subsoil limits penetration of most plant roots to the soil above the fragipan. Capability unit VIe-1; woodland group 9.

Zipp Series

The Zipp series consists of deep, very poorly drained, nearly level soils that are moderately fine textured. These soils are in depressions on slack water terraces. They formed in neutral and calcareous lacustrine clay and silt. The native vegetation was mixed hardwoods.

In a representative profile the surface layer is heavy silty clay loam about 9 inches thick. In this layer the soil is dark grayish brown and is mottled with yellowish brown and dark gray. The subsoil, about 54 inches thick, is dark-gray, firm heavy silty clay that has mottles of olive and yellowish brown. The underlying material is yellowish-brown, firm clay that has mottles of gray and olive.

Permeability is very slow in these soils, and available moisture capacity is high.

Zipp soils can be used for crops year after year if they are drained.

Representative profile of Zipp silty clay loam (in a cultivated field 3 miles north of Midway and 600 feet east of the southwest corner of NW¼ sec. 31, T. 5 S., R. 6 W.):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam; common, fine, distinct, yellowish-brown (10YR 5/6) mottles and a few, fine, faint dark-gray (5Y 4/1) mottles; moderate, very fine, angular blocky structure; firm when moist; slightly acid; abrupt, smooth boundary.

B21g—9 to 29 inches, dark-gray (5Y 4/1) heavy silty clay; many, fine, distinct, yellowish-brown (10YR 5/6) mottles and a few, fine, faint, olive (5Y 5/4) mottles; strong, medium, prismatic structure that parts to strong, medium, angular blocky; firm when moist; a few, lustrous, shiny gray (5Y 5/1) to dark gray (5Y 4/1) slickensides; neutral; gradual, wavy boundary.

B22g—29 to 63 inches, dark-gray (5Y 4/1) heavy silty clay; many, fine, distinct, yellowish-brown (10YR 5/6) mottles and a few, fine, faint, olive (5Y 5/4) mottles; moderate, medium to coarse, angular blocky structure; firm when moist; common, lustrous, gray (5Y 5/1) slickensides; neutral; gradual, wavy boundary.

C1—63 to 74 inches, yellowish-brown (10YR 5/6) clay; many, medium, distinct, gray (5Y 5/1) mottles and a few, fine, faint, olive (5Y 5/4) mottles; massive; firm when moist; a few, soft, very dark brown (10YR 2/2) iron and manganese concretions; neutral; gradual, boundary.

C2—74 to 80 inches, yellowish-brown (10YR 5/6) clay; many, medium, distinct, gray (5Y 5/1) mottles and a few, fine, faint, olive (5Y 5/4) mottles; massive; firm when moist; a few, soft, very dark brown (10YR 2/2) iron and manganese concretions; a few lime nodules; calcareous; mildly alkaline.

The A horizon ranges from dark gray to gray to dark grayish brown in color and from 7 to 18 inches in thickness. The B horizon ranges from gray to dark gray in color and from silty clay to clay in texture. The C horizon is stratified clay and silt. It ranges from neutral to mildly alkaline in reaction.

Zipp silty clay loam (0 to 2 percent slopes) (Zp).—This is the only Zipp soil mapped in the county. It is in depressions on lacustrine terraces. In places the areas are as much as 2 miles wide.

Included with this soil in mapping are areas of Zipp soil where the surface layer is silt loam. These areas receive overwash from drainage ditches and from nearby uplands.

Runoff is slow to ponded on this soil, and wetness is the major limitation. This soil generally has a seasonal high water table. If drained, it is suited to most crops commonly grown in the county. The main crops are corn and soybeans. Capability unit IIIw-2; woodland group 11.

Use and Management of the Soils

This section explains the system of capability classification used by the Soil Conservation Service and describes the management of the soils by capability units. In addition, predicted average acre yields of the principal crops grown in the county are given, and management of the soils for woodland, wildlife, recreation, and engineering purposes is discussed.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils (none in Spencer County) are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms (none in Spencer County) have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capibility unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3 or IIIe-7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Spencer County are described, and suggestions for the use and management of the soils are given.

Management by Capability Units

About 65 percent of the total area of Spencer County is used for grain and hay crops, and about 12 percent is in permanent pasture. The main crops are corn, soybeans, small grains, grasses, and legumes, but small areas of tobacco are also grown.

If cultivated, the sloping soils in the county are likely to erode unless practices are used to protect them. Contour farming, diversion terraces, grassed waterways, the use of crop residue, and planting mixtures of grass and legumes in the cropping system are measures that help to control erosion, to reduce runoff, and to conserve moisture.

A few of the soils are too wet for good crop growth unless they are drained. Suitable drainage systems include tile and open ditches.

Lime and fertilizer should be added to the soils in accordance with the needs indicated by tests and field trials.

In the pages that follow each of the capability units in Spencer County is described, and suggestions for the use and management of the soils in each unit are given. The units are not numbered consecutively, because not all of the units in the statewide system are represented in the county.

The names of soil series represented in a capability unit are mentioned in the description of each unit, but this does not mean that all soils in a given series are in the unit. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

Capability unit I-1

This unit consists of deep, moderately well drained and well drained, nearly level soils of the Alford, Iona, Uniontown, and Wheeling series. These soils are medium textured. They have a friable surface layer.

The Alford and Wheeling soils are moderately permeable, and the Iona and Uniontown soils are moderately slowly permeable. All of the soils have high available moisture capacity. The structure of the subsoil is favorable for penetration of plant roots and for movement of air and moisture.

These soils are suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow. Tobacco, the chief special crop, is grown mostly on the soils of the Wheeling series (fig. 9).

The soils of this unit can be cropped year after year. They are easy to till and respond well to good management. The chief concerns of management are maintaining the content of organic matter and avoiding compaction of the subsurface layer of the soils that are used intensively for row crops. Growing green manure crops and returning crop residue to the soils help to maintain the content of organic matter and to maintain good tilth.

Capability unit I-2

In this unit are deep, moderately well drained and well drained, nearly level soils of the Cuba, Haymond, Huntington, Huntington sandy variant, Lindside, Philo, Wilbur, and Woodmere series. These soils are medium textured and moderately coarse textured. They have a friable surface layer.

Except for the Huntington sandy variant, these soils are moderately permeable and have high available moisture capacity. The Huntington sandy variant is moderately rapidly permeable and has moderate available moisture capacity. On all of the soils, runoff is slow. Reaction ranges from strongly acid to neutral.

The main crops are corn and soybeans. A few small areas, however, are used for small grains and meadow plants.

Soils of this unit are easy to till and can be cropped intensively. Flooding generally is a hazard in winter and early in spring, but excess water remains on the surface for a short time. Late planting and tillage are necessary in some years because of flooding late in spring, but annual crops are seldom damaged. Controlling invading johnsongrass in fields on flood plains of the Ohio River is a major concern of management. Growing green manure crops and using crop residue help to maintain the content of organic matter and to maintain good tilth on soils that are used for row crops year after year.

Capability unit IIe-3

This unit consists of deep, moderately well drained and well drained, gently sloping soils of the Alford, Iona, Princeton, Uniontown, Wellston, and Wheeling series. All of these soils have a friable surface layer. The surface layer in the Princeton soils is moderately coarse textured, but it is medium textured in the other soils.

Permeability is moderate or moderately slow in these soils. Available moisture capacity is high in all except the Princeton soils, which have moderate available moisture capacity. Wellston soils are slightly eroded, but all the other soils are moderately eroded. The structure of the subsoil is favorable for penetration of roots and for movement of air and moisture.

These soils are suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains (fig. 10), and meadow.

Figure 9.—Tobacco on a nearly level Wheeling soil.

Figure 10.—Wheat growing on an area of Alford silt loam, 2 to 6 percent slopes, eroded.

The soils of this unit are easy to till, and they respond well to good management. Further erosion is the major hazard to use. Using crop residue and growing cover crops in winter help to reduce runoff, to control further erosion, and to maintain the content of organic matter. Contour tillage and grassed waterways also help to control further erosion.

Capability unit IIe-7

This unit consists of deep, moderately well drained and well drained, gently sloping silt loams of the Hosmer, Pekin, Sciotoville, Tilsit, and Zanesville series. These soils have a friable surface layer. A very slowly permeable fragipan is at a moderate depth in the subsoil. All of these soils are moderately eroded.

Available moisture capacity is moderate in these soils. The soils are acid, and fertility is low. The fragipan in the subsoil restricts penetration of plant roots.

The soils in this unit are suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

These soils are easy to till, and they respond to good management. Further erosion is the major hazard, and the moderate available water capacity limits use. Adding manure, growing cover crops in winter, and using plant residue are ways of reducing runoff and controlling further erosion. These practices only help to maintain the content of organic matter and to improve tilth. In areas used for cultivated crops, contour tillage and grassed waterways are needed to help to reduce runoff and to control further erosion.

Capability unit IIw-1

This unit consists of deep, poorly drained and very poorly drained, nearly level silt loams of the Algiers, Ragsdale, and Vincennes series. These soils have a seasonal high water table.

The Algiers soils are moderately permeable, but the other soils in this unit are slowly permeable. Available moisture capacity is high in all of the soils. Runoff is slow.

If drained, these soils are suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

Controlling wetness is the chief concern of management. Because of the seasonal high water table, winter grains on these soils are likely to be damaged.

Capability unit IIw-2

Henshaw silt loam is the only soil in this unit. It is deep, somewhat poorly drained, and nearly level. This soil has a friable surface layer.

Permeability is moderately slow in this soil. Available moisture capacity is high. The structure of the subsoil is favorable for penetration of plant roots.

If drained, Henshaw silt loam is suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

Wetness is the major limitation to use of this soil. The soil is easy to till. It can be cropped intensively, but it is subject to loss of organic matter, surface crusting, and formation of a plowpan. Keeping tillage to a minimum and use of green manure crops and crop residue help to maintain the content of organic matter and to improve tilth. Surface and subsurface drainage systems help to reduce wetness.

Capability unit IIw-3

This unit consists of deep, somewhat poorly drained, nearly level, medium-textured soils of the Bartle, Johnsburg, and Weinbach series. These soils have a friable surface layer. A very slowly permeable fragipan is at a moderate depth in the subsoil.

Permeability is very slow in these soils. Available moisture capacity is moderate. Fertility is low in these acid soils. The fragipan in the subsoil restricts penetration of roots and movement of air and water.

If drained, these soils are suited to most crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

The soils in this unit are easy to till, and tillage and planting can be done early in spring. Wetness is a major limitation, and the surface layer and the upper part of the subsoil are likely to be saturated in winter and early in spring. If these soils are used intensively for crops, they are subject to loss of organic matter, surface crusting, and formation of a plowpan. Keeping tillage to a minimum and use of green manure crops and crop residue help to maintain the content of organic matter and to improve tilth.

Capability unit IIw–5

In this unit are deep, moderately well drained, nearly level silt loams of the Pekin, Sciotoville, and Tilsit series. These soils have a friable surface layer. A very slowly permeable fragipan is at a moderate depth in the subsoil.

Available moisture capacity is moderate in these soils. The soils are acid, and fertility is low. The fragipan in the subsoil restricts penetration of roots mainly to the surface layer and the upper part of the subsoil.

The soils in this unit are suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

The soils in this unit are easy to till. The surface layer and the upper part of the subsoil are likely to be saturated with water in winter and early in spring. Also, damage to crops is likely during extended dry periods in summer. If these soils are used intensively for crops, they are subject to loss of organic matter, surface crusting, and formation of a plowpan. Keeping tillage to a minimum and use of green manure crops and crop residue help to maintain the content of organic matter and to improve tilth. In places random tile lines and grassed waterways are needed to dispose of excess water received from seeps and from adjacent higher areas.

Capability unit IIw–7

This unit consists of deep, somewhat poorly drained, nearly level silt loams of the Newark, Rahm, Stendal, and Wakeland series. These soils have a friable surface layer. They have a seasonal high water table.

The Rahm soils in this unit are moderately slowly permeable, and the others are moderately permeable. Available moisture capacity is high in all of these soils. The structure of the subsoil is favorable for deep penetration of plant roots. Reaction ranges from strongly acid to neutral.

If drained, these soils are suited to intensive cropping. They are used mainly for corn and soybeans, but a few small areas are used for small grains and meadow plants.

The soils in this unit are easy to till. Occasional flooding is a hazard, and controlling wetness is the chief concern of management. The use of green manure crops and crop residue helps to maintain the content of organic matter and to keep the soils in good tilth.

Capability unit IIIe–3

This unit consists of deep, well-drained, gently sloping to strongly sloping soils of the Alford, Princeton, Uniontown, Wellston, and Wheeling series. These soils have a friable surface layer. In most of the soils the surface layer is medium textured, but in the Princeton soils the surface layer is moderately coarse textured. The gently sloping soils are severely eroded, and the sloping and strongly sloping soils are eroded.

The Alford, Wellston, and Wheeling soils are moderately permeable and have high available moisture capacity. Princeton soils are moderately permeable and have moderate available moisture capacity. Uniontown soils are moderately slowly permeable and have high available moisture capacity. In all of the soils, the structure of the subsoil is favorable for penetration of plant roots and for movement of air and moisture. The severely eroded soils are low in content of organic matter and are in poor tilth.

Soils in this unit are suited to the crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

The soils of this unit are easy to till, except for the severely eroded ones. The main concerns of management are the low content of organic matter, poor tilth, and the hazard of further erosion. In many places stands are poor because a good seedbed is difficult to establish. Growing cover crops in winter and returning crop residue to the soils help to reduce runoff and to control further erosion. The use of green manure crops helps to increase the content of organic matter and to improve tilth. Farming on the contour, terracing, stripcropping, and using grassed waterways also help to reduce runoff and to control further erosion.

Capability unit IIIe–7

This unit consists of deep, moderately well drained and well drained, gently sloping and sloping silt loams of the Hosmer, Tilsit, and Zanesville series. These soils have a friable surface layer. A very slowly permeable fragipan is at a moderate depth in the subsoil. The gently sloping soils are severely eroded, and the sloping soils are eroded.

Available moisture capacity is moderate in these soils. The fragipan restricts penetration of plant roots. The severely eroded soils have a low content of organic matter and are in poor tilth. They have lower available moisture capacity than the moderately eroded soils because the fragipan in the subsoil is nearer the surface.

The soils in this unit are suited to crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

These soils are easy to till, and they respond well to good management. Further erosion is the major hazard, and the moderate available moisture capacity limits use for crops. For good growth of crops, the severely eroded soils need more careful management than the moderately eroded soils. Growing cover crops in winter, returning plant residue to the soils, and adding manure help to reduce runoff and to control further erosion. These practices also help to maintain the content of organic matter and to improve tilth. Farming on the contour, stripcropping, and use of grassed waterways also are needed.

Capability unit IIIe–11

Markland silt loam, 2 to 6 percent slopes, eroded, is the only soil in this unit. It is deep and well drained. The surface layer is friable, and the subsoil is clayey.

Available moisture capacity is high in this soil, and permeability is slow. The structure of the subsoil is favorable for deep penetration of plant roots.

This soil is suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow. Meadow plants, such as grass and alfalfa and other legumes, are well suited.

This soil is easy to till, but the clayey subsoil causes it to crack when dry. Controlling further erosion and increasing the content of organic matter are the main concerns of management. Farming on the contour, growing cover crops in winter, adding manure, and using crop residue all help to reduce runoff and to control erosion.

Capability unit IIIw-2

This unit consists of deep, very poorly drained, moderately fine textured, nearly level soils. These soils are of the Montgomery and Zipp series. They have a seasonal high water table.

Permeability is very slow in these soils, and available moisture capacity is high. Runoff is slow to ponded.

If drained, these soils are suited to the crops commonly grown in the county. The main crops are corn and soybeans, but small grains and meadow are also grown (fig. 11).

Wetness is the major limitation to use of these soils. The clay in the subsoil and the high available moisture capacity cause these soils to crack when dry. Because of the seasonal high water table winter grain crops are likely to be damaged. Surface and subsurface drainage systems help to reduce wetness. Turning under green manure crops and crop residue helps to improve tilth.

Capability unit IIIw-6

McGary silt loam is the only soil in this unit. It is deep, somewhat poorly drained, and nearly level. The surface layer is friable, and the subsoil is clayey.

Permeability is slow in this soil. Available moisture capacity is high.

If drained, this soil is suited to the crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

This soil is easy to till, but the clay in the subsoil causes it to crack when dry. If it is cultivated, however, loss of organic matter, surface crusting, and poor tilth are likely to result. Surface and subsurface drainage systems help to reduce wetness. Turning under green manure crops and crop residue helps to maintain the content of organic matter and to improve tilth.

Capability unit IIIw-10

Atkins silt loam is the only soil in this unit. It is deep, poorly drained, and nearly level. The surface layer is friable. This soil has a seasonal high water table.

Permeability is moderate in this soil, and available moisture capacity is high. This soil is strongly acid. Fertility is low. Runoff is slow.

If Atkins silt loam is adequately drained, it is suited to the crops commonly grown in the county. The main crops are corn and soybeans.

This soil is easy to till. Wetness and the hazard of flooding are the main limitations to use. Improving drainage is difficult because of the high water table and poor outlets. Surface and subsurface drainage systems help to control wetness.

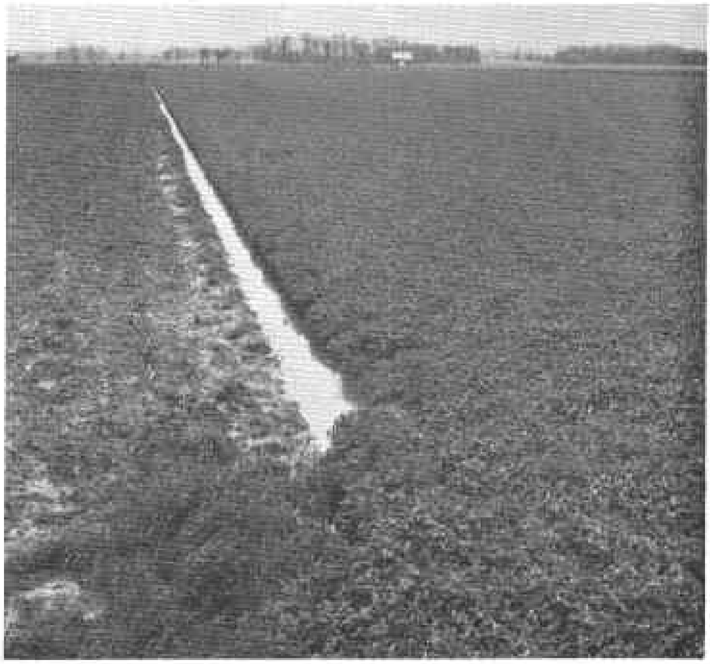

Figure 11.—Meadow on poorly drained Zipp soil.

Capability unit IIIw-12

Ginat silt loam is the only soil in this unit. It is deep, poorly drained, and nearly level. The surface layer is friable. A very slowly permeable fragipan is at a moderate depth in the subsoil. This soil has a seasonal high water table.

Available moisture capacity is moderate in this soil. The fragipan in the subsoil restricts penetration of the roots of most plants to the soil above the fragipan. Runoff is slow on this soil.

If this soil is adequately drained, it is suited to most crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

Ginat silt loam is easy to till. Wetness is the major limitation to use. If this soil is used intensively for crops, loss of organic matter, crusting of the surface, and poor tilth are likely to result. Using a surface drainage system that is supplemented by a subsurface drainage system helps to control wetness. Turning under green manure crops and crop residue helps to maintain the content of organic matter and to improve tilth.

Capability unit IVe-3

In this unit are deep, well-drained, medium-textured soils of the Alford, Uniontown, Wellston, and Wheeling series. These soils are sloping and strongly sloping and have a friable surface layer. The sloping soils are severely eroded, and the strongly sloping soils are moderately eroded.

Permeability is moderate, and available moisture capacity is high in most of these soils. The Uniontown soil, however, is moderately slowly permeable and has high available moisture capacity. In all of the soils, the structure is favorable for penetration of roots and movement of air and moisture. On the severely eroded soils, runoff is medium to rapid, the content of organic matter is low, and tilth is poor.

The soils in this unit are suited to all crops commonly grown in the county. The main crops are corn, soybeans, small grains, and meadow.

These soils are easy to till, except for the severely eroded ones. Because the severely eroded soils are in stands are likely to be poor. Controlling further erosion. poor tilth and a good seedbed is difficult to establish. reducing runoff, maintaining the content of organic matter, and improving tilth are the main concerns of management. Adding manure and turning under crop residue help to maintain the content of organic matter and to improve tilth. Farming on the contour, terracing, stripcropping, and using grassed waterways help to reduce runoff and to control further erosion.

Capability unit IVe-7

This unit consists of deep, well-drained, sloping and strongly sloping silt loams of the Hosmer and Zanesville series. A very slowly permeable fragipan is at a moderate depth in the subsoil. The sloping soils are severely eroded, and the strongly sloping soils are eroded.

Available moisture capacity is moderate in most of these soils. The severely eroded soils, however, have lower available moisture capacity than the eroded ones because the fragipan is nearer the surface. In all of the soils, reaction is strongly acid and fertility is low. Runoff is medium to rapid. The fragipan in the subsoil restricts penetration of plant roots.

These soils are easy to till. The severely eroded soils need careful management for good crop growth. Controlling erosion, maintaining the content of organic matter, reducing runoff, and improving tilth are the chief concerns of management. Adding manure and turning under crop residue help to maintain the content of organic matter and to improve tilth. Farming on the contour, terracing, stripcropping, and using waterways (fig. 12) help to reduce runoff and to control further erosion.

Capability unit IVe-11

This unit consists of deep, well-drained, gently sloping and sloping soils of the Markland series. The surface layer is medium textured and moderately fine textured, and the subsoil is fine textured.

Permeability is slow in these soils, and available moisture capacity is high. The gently sloping soils are severely eroded, and the sloping soils are eroded. The severely eroded soils have a low content of organic matter. In all of the soils, the structure of the subsoil is favorable for deep penetration of plant roots.

The soils in this unit are suited to all crops commonly grown in the county. The main crops are small grains and meadow, but a few row crops are grown.

The severely eroded soils are in poor tilth, and stands on them are likely to be poor because a good seedbed is difficult to prepare. Controlling further erosion, reducing runoff, maintaining the content of organic matter, and improving tilth are the main concerns of management. Turning under crop residue and adding manure help to improve tilth and to maintain the content of organic matter. Farming on the contour, terracing, stripcropping, and using grassed waterways are ways to reduce runoff and to control further erosion.

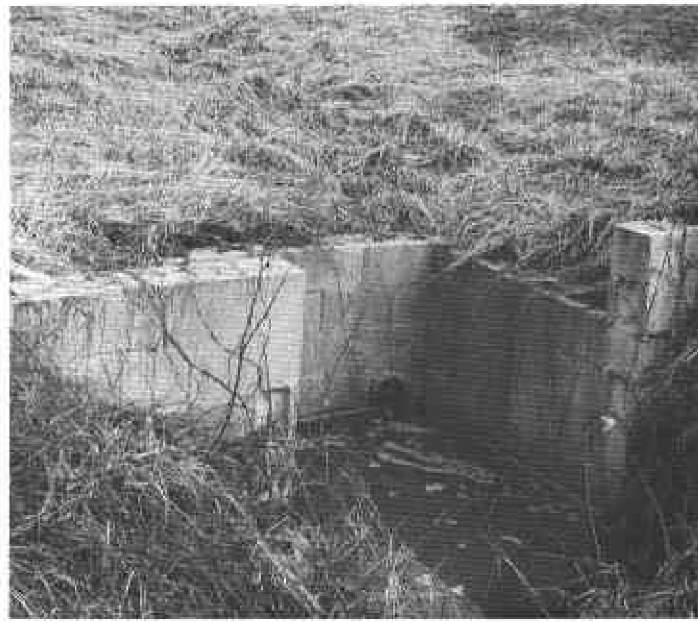

***Figure 12.*—Use of grassed waterway and structural outlet to reduce runoff and to control further erosion on a sloping Zanesville soil.**

Capability unit VIe-1

In this unit are deep, well-drained, sloping to steep soils of the Alford, Markland, Uniontown, Wellston, and Zanesville series. The surface layer is medium textured and moderately fine textured and is friable.

Permeability is slow on the Markland soils, moderately slow on the Uniontown, moderate on the Alford and Wellston, and very slow on the Zanesville. Most of these soils have high available moisture capacity, but the Zanesville soils have moderate available moisture capacity. Runoff is rapid on the severely eroded soils, and these soils have a low content of organic matter.

The soils in this unit are suited to pasture. Preparing a seedbed is more difficult on the severely eroded soils than on the slightly eroded and moderately eroded soils, and stands are likely to be poor. Farm machinery is more difficult to use on the steep soils than on the sloping and strongly sloping soils. Controlling further erosion, reducing runoff, and maintaining the content of organic matter are the chief concerns of management. Farming on the contour and constructing diversion terraces are ways of helping to reduce runoff and to control erosion. Use of crop residue on the severely eroded soils helps to increase the content of organic matter and serves as mulch for new seedlings.

Capability unit VIIe-1

This unit consists of moderately deep and deep, well-drained, strongly sloping to very steep soils of the Gilpin, Markland, and Wellston series. These soils are medium textured and moderately fine textured. The very steep soils are slightly eroded, and the strongly sloping soils are severely eroded.

The Gilpin and Wellston soils in this unit are moderately permeable, and the Markland soils are slowly permeable. Markland and Wellston soils have high available moisture capacity. Gilpin soils have low to moderate available moisture capacity. Runoff is rapid on all of these soils.

These soils are suitable for use as pasture and as woodland. Reducing runoff and controlling further erosion are the chief concerns of management.

Capability unit VIIe-2

This unit consists of the miscellaneous land types Made land and Pits; Gullied land, loess; Gullied land, shale; and Strip mines.

Most of these areas are infertile, and the content of organic matter is very low. Runoff is very rapid on Gullied land, loess, and Gullied land, shale. Strip mines contain pits of impounded water and very steep mounds of spoil that consist of rocks, soil, and other material.

Areas of these land types are suitable for wildlife habitats and for recreational purposes (fig. 13). Most of them can be revegetated by planting trees.

Figure 13.—An area of Strip mines being developed for wildlife habitat and for recreation.

Predicted Yields

Table 2 shows for each soil in the county the average yield per acre of the principal crops under two levels of management. The figures in column A represent yields that can be expected under an average or medium level of management. Those in column B represent yields that can be expected under a high level of management.

The following are assumed to be part of an average management system:

1. Using cropping systems that maintain tilth and content of organic matter.
2. Use of management practices that control erosion sufficiently to prevent serious reduction in the quality of the soil.
3. Applying fertilizer and lime in moderate amounts if need is indicated by soil tests.
4. Returning most of the crop residue to the soil.
5. Using conventional plowing and tillage methods.
6. Using crop varieties that are generally adapted to the climate and to the soils.
7. Controlling weeds fairly well by tillage and spraying.
8. Draining wet areas enough for cropping, but not always enough to prevent lower yields.

The following are assumed to be part of a high-level management system:

1. Using cropping systems that maintain tilth and content of organic matter.
2. Controlling erosion to the maximum extent feasible, so that the quality of the soil is maintained or improved rather than reduced.
3. Maintaining a high level of fertility by means of frequent soil tests and use of fertilizers in accordance with the recommendations of the State Agricultural Experiment Station.
4. Liming the soils in accordance with the results of soil tests.
5. Using crop residue to the fullest extent practicable to protect and to improve the soil.
6. Keeping tillage to a minimum.
7. Using only crop varieties that are best adapted to the climate.
8. Controlling weeds carefully by tillage and spraying.
9. Draining wet areas well enough so that wetness does not restrict yields of adapted crops.

The yields shown in table 2 are estimated averages for a period of 5 to 10 years. They are based on farm records; on interviews with farmers, members of the staff of the Purdue Agricultural Experiment Station, and others familiar with farming in the county; and on observation of soil scientists and of soil conservationists. Considered in making the estimates were the prevailing climate of the county, the characteristics of the soils, and the influence of different kinds of management on the soils.

The yield figures are not intended to apply directly to specific tracts of land for any particular year, because the soils vary somewhat from place to place, management practices differ slightly from farm to farm, and weather conditions vary from year to year. Nevertheless, these estimates appear to be as accurate a guide as can be obtained without detailed and lengthy investigation. They are useful in showing the relative productivity of the soils and the response of the soils to different levels of management.

Woodland [2]

The geographic location of Spencer County is favorable for producing wood crops. The county is in a transition belt, where northern hardwoods commonly are mixed with southern hardwoods. The many kinds of trees in the county, a growing season of about 190 days, and the favorable rainfall contribute to the production of good timber crops. In addition to their value for wood crops, the woodlands of the county have value for

[2] JOHN O. HOLWAGER, woodland conservationist, Soil Conservation Service, assisted in preparing this section.

TABLE 2.—*Predicted average yields per acre of principal crops under two levels of management*

[Yields in columns A can be expected under an average level of management; those in columns B can be expected under a high level of management. Dashes indicate that the crop generally is not grown or is not suited to the soil specified. Gullied land, loess; Gullied land, shale; Made land and Pits; and Strip mines are not included in this table]

Soil	Corn		Soybeans		Wheat		Clover and grass mixture		Alfalfa and grass mixture for hay	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Alford silt loam, 0 to 2 percent slopes	75	110	25	45	32	45	2.5	3.5	3.5	5
Alford silt loam, 2 to 6 percent slopes, eroded	70	100	25	38	32	45	2.5	3.5	3.5	5
Alford silt loam, 2 to 6 percent slopes, severely eroded	55	80	20	28	26	36	2	2.8	3	4.5
Alford silt loam, 6 to 12 percent slopes, eroded	55	80	20	28	26	36	2	2.8	3	4.5
Alford silt loam, 6 to 12 percent slopes, severely eroded	45	60	15	21	19	27	1.5	2.1	2.5	4.5
Alford silt loam, 12 to 18 percent slopes, eroded	40	50	15	20	15	25	1.5	2.1	2.5	4.5
Alford silt loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	15	25	1.2	2	2	4
Alford silt loam, 18 to 25 percent slopes	----	----	----	----	12	20	1.2	2	2	3.5
Alford silt loam, 25 to 35 percent slopes	----	----	----	----	----	----	1.2	2	2	2.5
Algiers silt loam	85	110	30	50	30	50	2.5	3.5	3	4.5
Atkins silt loam	45	85	18	30	15	25	1	2.5	----	----
Bartle silt loam	60	90	21	30	28	40	1.8	2.5	----	----
Cuba silt loam	75	110	30	44	25	40	2	3	2.5	4.5
Gilpin-Wellston silt loams, 25 to 35 percent slopes	----	----	----	----	----	----	----	----	----	----
Ginat silt loam	40	70	20	30	15	35	1	2.5	----	----
Haymond silt loam	75	100	30	40	32	40	2	3	2.5	4
Henshaw silt loam	75	100	25	35	30	44	2	3	3	4.5
Hosmer silt loam, 2 to 6 percent slopes, eroded	40	70	20	35	20	35	1.5	3	2	3
Hosmer silt loam, 2 to 6 percent slopes, severely eroded	35	65	16	22	15	28	1.3	2.5	2	3
Hosmer silt loam, 6 to 12 percent slopes, eroded	35	60	15	23	20	33	1.4	2.5	2	3
Hosmer silt loam, 6 to 12 percent slopes, severely eroded	30	45	15	20	12	25	1.2	2	1.5	2.5
Huntington silt loam	77	100	30	40	25	35	2	3	----	----
Huntington fine sandy loam, sandy variant	60	80	20	35	----	----	----	----	----	----
Iona silt loam, 0 to 2 percent slopes	75	110	31	40	32	45	2.5	3.5	3.5	5
Iona silt loam, 2 to 6 percent slopes, eroded	70	110	25	40	30	45	2.3	3.3	3.5	5
Johnsburg silt loam, 0 to 2 percent slopes	50	100	20	28	25	35	2	3	----	----
Lindside silt loam	77	100	31	40	25	35	2	3	----	----
Markland silt loam, 2 to 6 percent slopes, eroded	50	80	20	30	25	35	2	3	3.5	5
Markland silt loam, 6 to 12 percent slopes, eroded	36	55	15	25	23	32	1.8	2.7	3.5	5
Markland silt loam, 12 to 18 percent slopes, eroded	----	----	----	----	15	25	1.3	2.5	3	4.5
Markland silt loam, 18 to 25 percent slopes	----	----	----	----	10	20	.8	2	2	4
Markland silty clay loam, 2 to 6 percent slopes, severely eroded	35	50	15	25	20	30	1.8	3	3	5
Markland silty clay loam, 6 to 12 percent slopes, severely eroded	----	----	----	----	15	25	1.3	2.5	3	4.5
Markland silty clay loam, 12 to 18 percent slopes, severely eroded	----	----	----	----	10	23	1	2.5	2.5	4
McGary silt loam	60	85	20	30	20	40	1.8	2.8	3	4
Montgomery silty clay loam	80	110	30	50	30	40	2	3	3	4.5
Newark silt loam	70	90	25	35	----	----	----	----	----	----
Pekin silt loam, 0 to 2 percent slopes	55	75	20	37	25	35	2	3	2	3
Pekin silt loam, 2 to 6 percent slopes, eroded	55	70	25	35	26	33	1.5	3	2	3
Philo silt loam	75	100	28	40	75	30	2	3	2.5	4
Princeton fine sandy loam, 2 to 6 percent slopes, eroded	50	68	15	22	15	40	1	2.5	3.5	5
Princeton fine sandy loam, 6 to 18 percent slopes, eroded	35	54	15	18	15	24	1	2	3.5	5

TABLE 2.—*Predicted average yields per acre of principal crops under two levels of management*—Continued

Soil	Corn		Soybeans		Wheat		Clover and grass mixture		Alfalfa and grass mixture for hay	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Ragsdale silt loam	80	110	30	50	30	45	2	3.5	3	4.5
Rahm silt loam	70	90	25	40						
Sciotoville silt loam, 0 to 2 percent slopes	40	75	25	33	25	35	2	3	2	3
Sciotoville silt loam, 2 to 6 percent slopes, eroded	40	75	25	32	23	32	1.5	3	2	3
Stendal silt loam	65	100	28	40	15	30	1.5	2.5	1.5	3.5
Tilsit silt loam, 0 to 2 percent slopes	50	75	22	30	25	35	2	3	2	3
Tilsit silt loam, 2 to 6 percent slopes, eroded	40	70	20	28	23	32	1.8	3	2	3
Tilsit silt loam, 2 to 6 percent slopes, severely eroded	35	52	16	25	15	28	1.3	2.5	2	3
Uniontown silt loam, 0 to 2 percent slopes	75	110	25	45	32	45	2.5	3.5	3.5	5
Uniontown silt loam, 2 to 6 percent slopes, eroded	70	100	25	35	32	45	2.5	3.5	3.5	5
Uniontown silt loam, 2 to 6 percent slopes, severely eroded	55	72	20	32	25	35	2	2.8	3	5
Uniontown silt loam, 6 to 12 percent slopes, eroded	60	70	18	25	20	28	2	3	3.5	5
Uniontown silt loam, 6 to 12 percent slopes, severely eroded	45	60	15	21	19	27	1.5	2.1	3	4.5
Uniontown silt loam, 12 to 25 percent slopes, eroded					15	25	1.3	1.8	2.5	4
Vincennes silt loam	65	95	25	38	28	40	2.5	3.5		
Wakeland silt loam	65	100	28	40	15	25	2	2.5	1.5	3.5
Weinbach loam, 0 to 2 percent slopes	60	90	21	35	28	40	1.8	2.5		
Weinbach silt loam, 0 to 2 percent slopes	60	90	21	35	28	40	1.8	2.5		
Wellston silt loam, 2 to 6 percent slopes	60	90	24	35	30	42	2	3.1	2.5	4
Wellston silt loam, 6 to 12 percent slopes, eroded	55	75	19	26	25	36	1.8	2.8	2.5	4
Wellston silt loam, 6 to 12 percent slopes, severely eroded	50	70	17	23	22	34	1.5	2.2	2	3.5
Wellston silt loam, 12 to 18 percent slopes, eroded	52	72	18	24	23	35	1.5	2.2	2	3
Wellston silt loam, 12 to 18 percent slopes, severely eroded					15	25	1.3	2	1.5	3
Wellston silt loam, 18 to 25 percent slopes, eroded					15	25	1.3	2	1.5	3
Wellston silt loam, 18 to 25 percent slopes, severely eroded					10	25	1	1.7	1	3
Wheeling loam, 0 to 2 percent slopes	75	100	25	45	32	47	2.4	3.4	3	4.5
Wheeling loam, 2 to 6 percent slopes, eroded	70	100	25	38	32	45	2.4	3.4	3	4.5
Wheeling loam, 2 to 6 percent slopes, severely eroded	55	80	20	28	26	36	1.9	2.7	2.5	4
Wheeling loam, 6 to 12 percent slopes, eroded	55	80	20	28	26	36	2	2.8	2.5	4
Wheeling loam, 6 to 12 percent slopes, severely eroded	45	60	15	21	19	27	1.5	2.1	2.5	3.5
Wheeling silt loam, 0 to 2 percent slopes	75	105	25	45	32	45	2.4	3.4	3	4.5
Wilbur silt loam	75	110	31	44	28	40	2	3	2.5	4.5
Woodmere silt loam	77	100	30	40	25	45	1.5	2.5		
Zanesville silt loam, 2 to 6 percent slopes, eroded	40	70	20	25	20	35	1.5	3	2	3
Zanesville silt loam, 6 to 12 percent slopes, eroded	35	65	15	25	15	28	1.4	2.5	2	3
Zanesville silt loam, 6 to 12 percent slopes, severely eroded	30	45	15	20	12	25	1.2	2	1.5	2.5
Zanesville silt loam, 12 to 18 percent slopes, eroded	32	48	15	25	18	30	1.4	2.4	1.5	2.5
Zanesville silt loam, 12 to 18 percent slopes, severely eroded					12	25	1.2	2	1	2.5
Zipp silty clay loam	80	110	30	50	30	40	2	3	3	4.5

erosion control, watershed protection, wildlife habitat, and recreation sites. They also have value for the scenic beauty they provide in the landscape.

In 1958, according to the "Indiana Soil and Water Conservation Needs Inventory," Spencer County had 38,600 acres of woodland. This inventory predicted that by 1975 the acreage in woodland would total 44,700 acres, or 20 percent of the total acreage of the county.

The soils of Spencer County vary widely in their suitability for wood crops, and wooded areas are distributed uniformly throughout the county. Among the major soil characteristics that affect growth of trees are available moisture capacity and depth of root zone. Other important characteristics are thickness of surface layer, natural supply of plant nutrients, texture and consistence of the soil material, aeration, and depth to water table.

Four major types of woodland are in Spencer County. The most important of these is the mixed upland oak type. The major species are white oak, red oak, black oak, hickory, and white ash.

Another major forest type is tulip-poplar. This tree generally grows in coves and on the lower part of slopes that face north and northeast where the aspect is cool. Other trees common in the stands are white ash, red oak, white oak, hickory, beech, black walnut, and black cherry.

Of minor importance in the county is the pin oak type. The kinds of trees that commonly grow along with pin oak are red maple, ash, swamp white oak, red river birch, sweetgum, and hickory.

Also of minor importance are shortleaf pine and Virginia pine. These trees generally are planted, and they grow mainly in gullied areas.

Woodland groups

The soils in Spencer County have been placed in 12 woodland groups to assist landowners in planning management of their soils for producing timber. Each group is made up of soils that are similar in potential productivity, use suitability, and management needs. The groups are not numbered consecutively, because not all of the units in the statewide system are represented in the county.

The potential productivity of a soil for a specified kind of tree is expressed as site index. The site indexes for upland oaks, tulip-poplar, pin oak, and pine are given for each group of soils on which these trees grow. The site index is the average height of the dominant trees in a stand at age 50. The site indexes for upland oaks given in the groups are based on data in USDA Technical Bulletin 560 (*3*), and those for tulip-poplar on data assembled by W. T. Doolittle in 1957 and published by the U.S. Forest Service. For pin oak, the growth data for sweetgum in the Forestry Handbook (*5*) were used. These site indexes can be translated into estimates of yield and annual growth by the use of yield data developed by the Soil Conservation Service from data in USDA publications (*3, 9*). Site indexes for shortleaf pine and for Virginia pine are estimated.

For each woodland group ratings are given for the factors that affect the limitations and hazards of the soils for woodland use. The factors considered are seedling mortality, erosion hazard, windthrow hazard, and equipment limitations, and these are discussed in the paragraphs that follow.

Seedling mortality is the expected loss of natural seedlings or planted stock, as influenced by kinds of soil, degree of potential soil erosion, and direction of soil slope. The rating is *slight* if natural regeneration is adequate; *moderate* if natural regeneration is not always adequate for restocking within a reasonable length of time; and *severe* if special preparation of the seedbed and use of superior planting techniques are needed for satisfactory stands.

Erosion hazard is the degree of potential erosion that is likely to occur following cutting operations or where soil is exposed along roads, skid trails, firelanes, and log decking areas. Among the characteristics of the soil that affect erosion are slope, stability of the soil, infiltration, and permeability. The rating is *slight* if the hazard of erosion is negligible; *moderate* if special attention and practices are needed to control erosion; and *severe* if intensive management is needed to control erosion.

Windthrow hazard is the danger of trees being blown over by wind. It depends on soil characteristics that control development of tree roots and affect stability. The rating is *slight* if no special problems exist and trees are not expected to be blown down in woodland by commonly occurring winds; *moderate* if root development is adequate for stability except during periods of excessive wetness and high winds; and *severe* if roots do not give adequate stability and many trees are blown down during periods of wetness and moderate or high winds.

Equipment limitations are based on soil characteristics and features of relief that restrict or prevent use of conventional equipment for planting and harvesting wood crops, for constructing roads, and for controlling fires. The rating is *slight* if no restrictions exist relative to the kind of equipment that can be used or to the time of year that the equipment can be used; *moderate* if there are seasonal restrictions of less than 3 months or if other restrictions caused by slope, wetness, stones, or other soil characteristics moderately limit use of equipment; and *severe* if a period of 3 months or more exists when equipment cannot be used or if there are other severe restrictions caused by steep slopes or extreme wetness. This type of hazard is likely to require detailed scheduling of logging and special equipment.

In the paragraphs that follow, each of the 12 woodland groups recognized in Spencer County are rated according to management hazards and limitations based on the soils, and estimated site indexes and yearly growth rate, by wood crop, are provided. The names of the soils in each woodland group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

WOODLAND GROUP 1

This group consists of deep, well drained and moderately well drained soils. The surface layer is loam and silt loam, and the subsoil is silt loam to silty clay loam. Permeability is moderate and moderately slow, and available moisture capacity is high. Many of the soils are severely eroded.

Seedling mortality is slight or moderate on these soils. Generally, as much as 50 percent of the seedlings are lost if they are planted on severely eroded soils that have slopes that face south. The hazard of erosion is slight or moderate, and the hazard of windthrow is slight. Equipment limitation is slight on soils that have slopes of less than 12 percent and moderate on soils that have slopes of more than 12 percent.

The soils in this group are among the best in the county for producing timber. Trees that commonly grow on these soils are red oak, white oak, tulip-poplar, black walnut, black oak, and hickory. The site index for upland oaks is about 85 to 95, and the yearly growth rate per acre is 300 to 375 board feet. For tulip-poplar, the site index is 90 to 105, and the yearly growth rate per acre is 335 to 450 board feet.

WOODLAND GROUP 2

In this group are deep, well drained and moderately well drained soils. The surface layer is fine sandy loam to silt loam, and the subsoil is loam to silty clay loam. Permeability is moderate to moderately slow, and available moisture capacity is moderate to high. Some areas are eroded.

Seedling mortality is moderate on the soils in this group that are steep, that have slopes that face south, and on the fine sandy loams. The hazard of erosion is moderate on soils that have slopes of 18 to 35 percent. Equipment limitations are moderate or severe. Special logging equipment is needed on soils that have slopes of 18 percent or more.

Trees that commonly grow on the soils in this group are upland red oak, white oak, tulip-poplar, black walnut, and hickory. The site index for upland oaks is 85 to 95, and the yearly growth rate per acre is 300 to 375 board feet. The site index for tulip-poplar is 95 to 105, and the yearly growth rate per acre is 375 to 450 board feet.

WOODLAND GROUP 3

Only Gullied land, loess, is in this group. It consists of deep, very severely eroded land that has a series of closely spaced V-shaped gullies that erode into deep silt.

This land type is suited to shortleaf pine and to Virginia pine. Few hardwoods are in the existing stands. Adequate stands of pines can be obtained only through planting, and the pines are planted mainly to help to control further erosion. Seedling mortality is moderate or severe. More than 50 percent of planted seedlings are likely to be lost.

The hazard of erosion is severe on this land, and the hazard of windthrow is slight. Equipment limitations are severe because the gullied areas are severely eroded, and further erosion is a major hazard.

The potential for growth of hardwoods on this land is very low, but the growth potential of Virginia pine and shortleaf pine is estimated to be higher. The site index for shortleaf pine is 72 to 85, and the yearly growth rate per acre is 200 to 300 board feet. For Virginia pine the site index is 53 to 72, and the growth rate per acre is 100 to 200 board feet.

WOODLAND GROUP 5

In this group are deep, somewhat poorly drained soils. The surface layer is silt loam and loam, and the subsoil is silt loam to silty clay. Permeability is moderately slow to very slow, and available moisture capacity is moderate to high.

Seedling mortality is slight on these soils. Generally, less than 25 percent of planted seedlings are lost. In years of exceptional wetness, seedlings are likely to be difficult to plant. Also stands are likely to be poor because of excess surface water. The hazard of erosion is slight. The hazard of windthrow is severe because these soils have a seasonal high water table that impedes root development. Equipment limitations are moderate. Logging is not feasible late in winter and early in spring because of the wetness. If logging is done at these times, the roots of trees and the soil structure are damaged.

Trees that commonly grow on the soils in this group are sweetgum, pin oak, soft maple, sycamore, red river birch, and swamp white oak. The site index for upland oaks is 80 to 92, and the yearly growth rate per acre is 260 to 350 board feet. The site index for tulip-poplar is 90 to 100, and the yearly growth rate per acre is 335 to 415 board feet. For pin oak, the site index is 85 to 100, and the yearly growth rate per acre is 300 to 415 board feet.

WOODLAND GROUP 8

This group consists of deep soils that are well drained and moderately well drained. The surface layer is fine sandy loam to silt loam, and the subsoil is dominantly silt loam. Permeability is moderate and moderately rapid, and available moisture capacity is high to moderate.

For the soils in this group, seedling mortality, the hazard of erosion and of windthrow, and equipment limitations are slight. Occasional flooding is likely to be helpful in establishing stands of seedlings, especially of cottonwood, sycamore, and soft maple. Most of the trees grow on narrow soil areas on the edges of the larger streams of the county, because most of the acreage of the soils in this group is used for grain crops.

Trees that commonly grow on these soils are cottonwood, sycamore, tulip-poplar, black walnut, and white ash. For tulip-poplar, the site index is 95 to 105, and the yearly growth rate per acre is 375 to 450 board feet.

WOODLAND GROUP 9

In this group are deep, well drained and moderately well drained soils. The surface layer is silt loam, and the subsoil is silt loam and silty clay loam. Permeability is very slow, and available moisture capacity is moderate. Most of the soils are eroded or severely eroded.

Seedling mortality is slight on the soils in this group. Generally, less than 25 percent of planted seedlings are lost. The hazard of erosion is slight to severe. The hazard of windthrow is moderate on these soils because a fragipan in the subsoil restricts deep penetration of roots. Equipment limitations are slight. The severely eroded soils are suited to pine trees and are used for this purpose.

Trees that commonly grow on the soils in this group are white oak, white ash, tulip-poplar, black oak, and hickory. The site index for upland oaks is 75 to 85, and the yearly growth rate per acre is 220 to 300 board feet. For tulip-poplar the site index is 90 to 100, and the yearly growth rate per acre is 335 to 415 board feet.

WOODLAND GROUP 10

This group consists of moderately deep and deep, well-drained soils. The surface layer is silt loam, and the subsoil is loam to silty clay loam. Permeability is moderate, and available moisture capacity is low to high. Most of these soils are eroded or severely eroded.

Seedling mortality is slight on the soils in this group. Generally, less than 25 percent of planted seedlings are lost. The hazard of erosion is moderate. Logging trails constructed on ridgetops along narrow areas of bottom lands and along the contour help to control further erosion. If skid trails are constructed up and down the slope, cutoff ditches are needed to keep gullies from forming. Where the soils are shallow to bedrock, the windthrow hazard is moderate or severe. Equipment limitations are moderate or severe. Special logging equipment is needed to harvest trees that grow on the steep soils.

Trees that commonly grow on the soils in this group are white oak, black oak, red oak, tulip-poplar, beech, and hickory. The site index for upland oaks on slopes that face south is 69 to 82, and the yearly growth rate per acre is 180 to 280 board feet. The site index for upland oaks on slopes that face north is 75 to 85, and the yearly growth rate per acre is 220 to 300 board feet. The site index for tulip-poplar is 90 to 100, and the yearly growth rate per acre is 335 to 415 board feet.

WOODLAND GROUP 11

In this group are deep, poorly drained and very poorly drained soils. The surface layer is silt loam and silty clay loam, and the subsoil is silt loam to silty clay. Permeability is moderate to very slow, and available moisture capacity is high to moderate.

Seedling mortality is moderate on the soils in this group. As much as 50 percent of planted seedlings are likely to be lost because of excessive moisture in spring. The erosion hazard is slight. The hazard of windthrow is moderate or severe because these soils have a seasonal high water table that impedes root development. Equipment limitations are severe, and logging is impractical late in winter and early in spring because of extreme wetness. If logging is done at these times, it is likely to cause damage to roots and to the structure of the soils.

Trees that commonly grow on the soils in this group are sweetgum, pin oak, soft maple, white ash, tulip-poplar, and sycamore. The site index for tulip-poplar is 90 to 105, and the yearly growth rate per acre is 335 to 450 board feet. The site index for pin oak is 85 to 105, and the yearly growth rate per acre is 300 to 450 board feet.

WOODLAND GROUP 13

This group consists of deep, somewhat poorly drained soils. The surface layer is silt loam, and the subsoil is silty clay loam and silt loam. Permeability is moderate and moderately slow, and available moisture capacity is high.

Seedling mortality is slight on these soils. Generally, less than 25 percent of planted seedlings are lost. The hazard of erosion is slight. The hazard of windthrow is moderate because these soils have a seasonal high water table that impedes root development. Equipment limitations are moderate. If logging is done during wet seasons, it is likely to cause damage to shallow roots and to the structure of the soils.

Trees that commonly grow on the soils in this group are sweetgum, pin oak, soft maple, sycamore, and cottonwood. The site index for pin oak is 90 to 105, and the yearly growth rate per acre is 335 to 450 board feet.

WOODLAND GROUP 14

Only Gullied land, shale, is in this group. It consists of very severely eroded land. The exposed soil material ranges from loam to clay. Many shale and sandstone fragments generally are on the surface, and in places the underlying shale and sandstone are exposed.

Few hardwoods are in the existing stands. Pines are planted mainly to help control further erosion.

Seedling mortality on this land is slight or moderate. As much as 50 percent of the seedlings are lost if planted on the very severely eroded areas that have slopes that face the south. The hazard of erosion is severe, and the hazard of windthrow is moderate because the soil material is shallow to bedrock. Equipment limitations are severe because of gullied areas and exposed bedrock, and further gullying is a limitation.

The site index for shortleaf pine on this land is 53 to 72, and the yearly growth rate per acre is 100 to 200 board feet. For Virginia pine the site index is 45 to 53, and the yearly growth rate per acre is 75 to 100 board feet.

WOODLAND GROUP 16

This group consists of old sand pits, where the dug-over area has been partly smoothed, and of areas that have been strip mined.

Most of these areas are suited to wood crops. Seedling mortality is slight. Generally, less than 25 percent of planted seedlings are lost. The rough relief helps to hold seeds on the areas until germination takes place. The hazard of erosion is slight or moderate. During the first few years after the areas of mines and pits are abandoned, erosion helps to level the steep ridges.

Penetration of roots is deep in these areas, and the hazard of windthrow is slight. Equipment limitations are severe because of the rough broken relief. Special logging equipment is needed to harvest wood crops, and in many places logging roads must be constructed on many of the ridges.

Hardwoods commonly growing on the areas in this group are cottonwood, sycamore, soft maple, green ash, and red oak. The site index and potential productivity data for these trees are not available. Trees that commonly grow around areas of gravel pits are shortleaf pine and Virginia pine. The site index for the shortleaf pine is 72 to 85, and the yearly growth rate per acre is 200 to 300 board feet. The site index for Virginia pine is 53 to 72, and the yearly growth rate per acre is 100 to 200 board feet. Trees that commonly grow in strip mine dumps are shortleaf pine and Virginia pine. The site index for the shortleaf pine is 53 to 72, and the yearly growth rate per acre is 100 to 200 board feet. The site index for the Virginia pine is 45 to 53, and the yearly growth rate per acre is 75 to 100 board feet.

WOODLAND GROUP 18

This group consists of deep, well-drained soils. The surface layer is silt loam and silty clay loam, and the subsoil is silty clay and clay. Permeability is slow, and available moisture capacity is high.

Seedling mortality is slight on the soils in this group. Generally, less than 25 percent of planted seedlings are lost. The hazard of erosion is moderate on the steep soils on short breaks, and equipment limitations are moderate or severe for these soils. The hazard of windthrow is slight.

Trees commonly growing on the soils in this group are white oak, black oak, basswood, red oak, and hickory. For upland oaks the site index is 70 to 80, and the yearly growth rate per acre is 185 to 260 board feet.

Wildlife [3]

The soil, relief, climate, and a wide variety of native and other plants are among the features of Spencer County that are favorable for developing wildlife habitats. These features provide a high potential for managing the soils of the county to maintain and to increase various kinds of wildlife.

[3] JAMES MCCALL, biologist, Soil Conservation Service, assisted in preparing this section.

Three major kinds of wildlife are recognized in the county: open-land, woodland, and wetland. The potential is high throughout the county for developing open-land and woodland wildlife habitats. Only small local areas are suited to habitats for wetland wildlife.

In table 3 the soils in Spencer County are rated according to their suitability for providing habitats for the three kinds of wildlife. For ratings other than well suited, the degree of the limitations is given.

A rating of well suited means that the habitat generally is easy to form, improve, and maintain, and the soil has few or no limitations that affect management. A rating of suited means that the habitat generally can be formed, improved, and maintained, but the soil has moderate limitations to management. A rating of poorly suited means that habitats generally can be formed, improved, and maintained, but the soil has severe limitations. A rating of unsuited means that limitations are severe, and use of the soil for wildlife habitat generally is not feasible.

TABLE 3.—*Suitability of soils for kinds of wildlife*

Soil series and symbols	Open-land	Woodland	Wetland
Alford: AfA, AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, AfE, AfF.	Well suited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 25 percent, erosion hazard; poorly suited or not suited for growing grains and seed crops, and suited for growing grasses and legumes. Poorly suited: if slopes are 25 to 35 percent, erosion hazard; not suited for growing seed and grain crops, and poorly suited for growing grasses and legumes.	Well suited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 35 percent, erosion hazard; suited for growing grasses and legumes.	Unsuited: well drained; not suited for growing wetland plants for food and cover and for shallow-water developments and excavated ponds.
Algiers: Ag	Poorly suited: poorly drained; not suited for growing seed and grain crops, and poorly suited for grasses and legumes and wild herbaceous upland plants.	Well suited	Well suited.
Atkins: Ak	Suited: poorly drained; poorly suited for growing seed and grain crops, and suited for grasses and legumes and wild herbaceous upland plants.	Well suited	Well suited.
Bartle: Ba	Well suited	Suited: somewhat poorly drained; suited for growing grasses and legumes and poorly suited for conifers because of their rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover and suited for shallow-water developments and excavated ponds.
Cuba: Cu	Well suited	Well suited	Unsuited: well drained; not suited for growing wetland plants for food and cover and for shallow-water developments and excavated ponds.
Gilpin: GmF (For properties of Wellston soil in this unit, refer to the Wellston series in this table.)	Suited: erosion hazard; not suited for growing seed and grain crops and suited for grasses and legumes.	Suited: erosion hazard; suited for growing grasses and legumes and poorly suited for conifers because of their rapid growth rate and canopy closure.	Unsuited: well drained; not suited for growing wetland plants for food and cover and for shallow-water developments and excavated ponds.
Ginat: Gn	Suited: poorly drained; poorly suited for growing seed and grain crops and suited for grasses and legumes, wild herbaceous upland plants, and hardwoods.	Suited: poorly drained; suited for growing grasses and legumes, wild herbaceous upland plants, hardwoods, and conifers.	Well suited.

TABLE 3.—*Suitability of soils for kinds of wildlife*—Continued

Soil series and symbols	Open-land	Woodland	Wetland
Gullied land, loess: Go and Gullied land, shale: Gs.	Poorly suited: erosion hazard; not suited for growing seed and grain crops and grasses and legumes and poorly suited for wild herbaceous upland plants.	Poorly suited: erosion hazard; unsuited for growing grasses and legumes and poorly suited for conifers because of their rapid growth rate and canopy closure.	Unsuited: well drained; not suited for growing wetland plants for food and cover and for shallow-water developments and excavated ponds.
Haymond: Ha	Well suited	Well suited	Unsuited: well drained; not suited for growing wetland plants for food and cover and for shallow-water developments and excavated ponds.
Henshaw: He	Well suited	Suited: somewhat poorly drained; suited for growing grasses and legumes and poorly suited for conifers because of their rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.
Hosmer: HoB2, HoB3, HoC2, HoC3.	Well suited	Well suited	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Huntington: Ht and Huntington sandy variant: Hu.	Well suited	Well suited	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Iona: IoA, IoB2	Well suited	Well suited	Poorly suited or unsuited: moderately well drained; 0 to 2 percent slopes—poorly suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds; 2 to 6 percent slopes—not suited for growing wetland plants for food and cover and for shallow-water developments and severe for excavated ponds.
Johnsburg: JoA	Well suited.	Suited: somewhat poorly drained; suited for growing grasses and legumes and poorly suited for conifers because of their rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.
Lindside: Ls	Well suited	Well suited	Poorly suited: moderately well drained; poorly suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Made land and Pits: Md	Poorly suited: for growing seed and grain crops and grasses and alfalfa.	Poorly suited: poorly suited for growing grasses and legumes and suited for conifers.	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Markland: MkB2, MkC2, MkD2, MkE, MlB3, MlC3, MlD3.	Suited: clayey material to a depth of 30 inches; suited or poorly suited for growing seed and grain crops, and suited for grasses and legumes and wild herbaceous upland plants.	Suited: clayey material to a depth of 30 inches; suited for growing grasses and legumes, and poorly suited for conifers because of their rapid growth rate and canopy closure.	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
McGary: Mr	Suited: somewhat poorly drained and clayey material to a depth of 30 inches; suited for growing seed and grain crops, grasses and legumes, and wild herbaceous upland plants.	Well suited	Poorly suited: clayey material to a depth of 30 inches; poorly suited for growing wetland plants for food and cover, and suited for shallow-water developments, for excavated ponds, and for seed and grain crops.

TABLE 3.—*Suitability of soils for kinds of wildlife*—Continued

Soil series and symbols	Open-land	Woodland	Wetland
Montgomery: Ms	Poorly suited: very poorly drained; not suited for growing seed and grain crops, and poorly suited for grasses and legumes and wild herbaceous upland plants.	Well suited	Suited: clayey material to a depth of 30 inches; poorly suited for growing wetland plants for food and cover.
Newark: Ne	Well suited	Suited: somewhat poorly drained; suited for growing grasses and legumes, and poorly suited for conifers because of the rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.
Pekin: PeA, PeB2	Well suited	Well suited	Poorly suited or unsuited: moderately well drained; 0 to 2 percent slopes—poorly suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds; 2 to 6 percent slopes—not suited for growing wetland plants for food and cover and for shallow-water developments, and severe for excavated ponds.
Philo: Ph	Well suited	Well suited	Poorly suited: moderately well drained; poorly suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Princeton: PrB2, PrD2	Well suited	Well suited	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Ragsdale: Ra	Poorly suited: very poorly drained; not suited for growing seed and grain crops, and poorly suited for grasses and legumes and wild herbaceous upland plants.	Well suited	Well suited.
Rahm: Rh	Well suited	Suited: somewhat poorly drained; suited for growing grasses and legumes, and poorly suited for conifers because of their rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.
Sciotoville: ScA, ScB2	Well suited	Well suited	Poorly suited or unsuited: moderately well drained; 0 to 2 percent slopes—poorly suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds; 2 to 6 percent slopes—not suited for growing wetland plants for food and cover and for shallow-water developments; severe for excavated ponds.
Stendal: Sn	Well suited	Suited: somewhat poorly drained; suited for growing grasses and legumes, and poorly suited for conifers because of their rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.
Strip mines: St	Unsuited: not suited for growing seed and grain crops and grasses and legumes, and poorly suited for wild herbaceous upland plants.	Suited: not suited for growing grasses and legumes, poorly suited for wild herbaceous upland plants, and suited for conifers because of their moderate growth rate and canopy closure.	Unsuited: not suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.

TABLE 3.—*Suitability of soils for kinds of wildlife*—Continued

Soil series and symbols	Open-land	Woodland	Wetland
Tilsit: TsA, TsB2, TsB3.	Well suited	Well suited	Poorly suited or unsuited: moderately well drained; if slopes are 0 to 2 percent—poorly suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds; if slopes are 2 to 6 percent—not suited for growing wetland plants for food and cover and for shallow-water developments, and poorly suited for excavated ponds.
Uniontown: UnA, UnB2, UnB3, UnC2, UnC3, UnE2.	Well suited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 25 percent, erosion hazard; poorly suited for growing seed and grain crops, and suited for grasses and legumes.	Well suited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 25 percent, erosion hazard; suited for growing grasses and legumes, and poorly suited for conifers because of their rapid growth rate and canopy closure.	Unsuited: moderately well drained and well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Vincennes: Vn	Poorly suited: poorly drained; not suited for growing seed and grain crops, and poorly suited for grasses and legumes and wild herbaceous upland plants.	Well suited	Well suited.
Wakeland: Wa	Well suited	Suited: somewhat poorly drained; suited for growing grasses and legumes, and poorly suited for conifers because of their rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.
Weinbach: WbA, WcA	Well suited	Suited: somewhat poorly drained; suited for growing grasses and legumes; poorly suited for conifers because of their rapid growth rate and canopy closure.	Suited: somewhat poorly drained; suited for growing wetland plants for food and cover, for shallow-water developments, for excavated ponds, and for seed and grain crops.
Wellston: WeB, WeC2, WeC3, WeD2, WeD3, WeE2, WeE3.	Well suited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 25 percent, erosion hazard; poorly suited or not suited for growing seed and grain crops, and suited for grasses and legumes.	Well suited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 25 percent, erosion hazard; suited for growing grasses and legumes, and poorly suited for conifers because of their rapid growth rate and canopy closure.	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Wheeling: WhA, WhB2, WhB3, WhC2, WhC3, WlA.	Well suited	Well suited	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Wilbur: Wr	Unsuited	Well suited	Poorly suited: moderately well drained; poorly suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Woodmere: Ws	Unsuited	Well suited	Unsuited: moderately well drained to well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.
Zanesville: ZaB2, ZaC2, ZaC3, ZaD2, ZaD3.	Unsuited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 18 percent, erosion hazard; poorly suited for growing seed and grain crops, and suited for grasses and legumes.	Well suited: if slopes are 0 to 12 percent. Suited: if slopes are 12 to 18 percent, erosion hazard; suited for growing grasses and legumes, and poorly suited for conifers because of their rapid growth rate and canopy closure.	Unsuited: well drained; not suited for growing wetland plants for food and cover, for shallow-water developments, and for excavated ponds.

TABLE 3.—*Suitability of soils for kinds of wildlife*—Continued

Soil series and symbols	Open-land	Woodland	Wetland
Zipp: Zp	Poorly suited: very poorly drained; not suited for growing seed and grain crops, and poorly suited for grasses and legumes and wild herbaceous upland plants.	Well suited	Suited: very poorly drained; clayey material to a depth of 30 inches; poorly suited for growing wetland plants for food and cover, and very severe for growing seed and grain crops.

The three kinds of wildlife are defined in the paragraphs that follow:

OPEN-LAND WILDLIFE. Open-land wildlife are birds, mammals, and reptiles that generally frequent cropland, pasture, and hayland that are overgrown by grasses, herbs, and shrubs. Examples of open-land wildlife are rabbits, red foxes, skunks, quails, and meadowlarks. Suitability of a soil for these kinds of wildlife is determined by its capability for growing seed and grain crops, grasses and legumes, wild herbaceous upland plants, and hardwoods.

WOODLAND WILDLIFE. Woodland wildlife are mammals and birds that frequent areas of hardwoods, conifers, shrubs, or a combination of these types of vegetation. Examples of woodland wildlife are squirrels, deer, raccoons, woodpeckers, and nuthatches. Suitability of a soil for these kinds of wildlife is determined by its capability for growing grasses and legumes, wild herbaceous upland plants, hardwoods, and conifers.

WETLAND WILDLIFE. Wetland wildlife are mammals, birds, and reptiles that frequent such wet areas as ponds, marshes, and swamps. Examples of wetland wildlife are muskrats, wild ducks, geese, kingfishers, and redwinged blackbirds. Suitability of a soil for these kinds of wildlife is determined by its capability for growing seed and grain crops and wetland plants for food and cover and by its usefulness for shallow-water developments and excavated ponds.

Recreation

Spencer County has high potential for many kinds of recreation, and many recreational developments are underway. Communities that have large populations, such as Evansville and Owensboro, are less than 50 miles away from the county. Recreational facilities generally are directed toward family and group activities, such as camping, picnicking, and hiking.

Watershed developments in upland areas offer potential for multipurpose impoundments of various areas of water. A few well-drained soils on uplands are well suited to picnic grounds, to intensive play areas, to campsites for tents and trailers, and to recreational buildings. The Ohio River offers opportunities for boating, water skiing, and swimming.

In table 4 the soils in Spencer County are rated according to their limitations for recreational buildings, campsites for tents and trailers, picnic grounds, parks, and other extensive play areas; playgrounds, athletic fields, and other intensive play areas; and paths and trails. Limitations for septic systems were not considered in determining the ratings for recreational buildings. The ratings are based on soil features only and do not include other items that may be important in selecting an area for the purpose stated. The ratings used in table 4 are *slight*, *moderate*, and *severe*. For ratings other than slight the degree of limitations of the soil is also given.

A rating of *slight* means that the facility is easily formed, improved, and maintained. A rating of *moderate* means that the facility generally can be formed, improved, and maintained, but moderate soil limitations affect design and management. A rating of *severe* means that limitations are extreme enough to make use questionable, and careful planning and intensive management are needed to overcome the limitations.

In the paragraphs that follow, each recreation use is defined, and the properties important in rating the limitations for such purposes are given. The information can be used, along with table 4, with information in other parts of the survey as a guide in planning the use of the soils for recreation. Before beginning any construction projects, however, an investigation should be made at the site being considered.

Recreational buildings are those that are constructed for use as seasonal or year-round cottages, washrooms and bathhouses, picnic shelters, and service buildings. Soil properties most important in rating the soils for such uses are wetness and the hazard of flooding, slopes, the content of rocks and stones, and depth to hard rock. Other factors that need to be considered are shrink-swell potential, bearing capacity, possibility of frost and of hillside slippage, and suitability of the soil for use as filter fields for septic tanks. In making the final evaluation of a soil for use as a site for recreational buildings, the capability of the soil to support vegetation should be considered, as well as the need for basements or underground utilities.

Campsites for tents and trailers are areas suitable for tents and for small camp trailers and the activities that accompany outdoor living. It is assumed that the areas require little site preparation. The soils must be able to support heavy traffic by horses and vehicles, as well as by people. Factors most important in rating the soils for such use are wetness and the hazard of flooding, permeability of the soil, slope, texture of the surface soil, and content of stones and rocks. Capability of the soil to support vegetation also should be considered.

TABLE 4.—*Ratings and limitations of the soils for recreational purposes*

[Not included in this table, because their characteristics are too variable to be rated are the land types Gullied land, loess (Go), Gullied land, shale (Gs), Made land and Pits (Md), and Strip mines (St). An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and mapping symbols	Recreational buildings	Campsites for tents and trailers	Picnic grounds, parks, and other extensive play areas	Playgrounds, athletic fields, and other intensive play areas	Paths and trails
Alford: AfA, AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, AfE, AfF.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 35 percent.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 35 percent.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 35 percent.	Slight if slope is 0 to 2 percent, moderate if slope is 2 to 6 percent, severe if slope is 6 to 35 percent.	Slight if slope is 0 to 12 percent, moderate if slope is 12 to 25 percent, severe if slope is 25 to 35 percent.
Algiers: Ag	Severe: poorly drained; seasonal high water table.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained.	Severe: poorly drained; seasonal high water table.
Atkins: Ak	Severe: poorly drained; subject to flooding.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; subject to flooding.	Severe: poorly drained; seasonal high water table.
Bartle: Ba	Moderate: somewhat poorly drained; seasonal high water table.	Severe: somewhat poorly drained; very slowly permeable; wet and soft after rains.	Moderate: somewhat poorly drained.	Severe: somewhat poorly drained; very slowly permeable; wet and soft after rains.	Moderate: somewhat poorly drained; seasonal high water table.
Cuba: Cu	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
*Gilpin: GmF (For properties of Wellston soils in this unit, refer to the Wellston series in this table.)	Severe if slope is 25 to 35 percent; bedrock at a depth of 20 to 36 inches.	Severe if slope is 25 to 35 percent.	Severe if slope is 25 to 35 percent.	Severe if slope is 25 to 35 percent; bedrock at a depth of 20 to 36 inches.	Severe if slope is 25 to 35 percent.
Ginat: Gn	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; very slow permeability; wet and soft after rains.	Severe: poorly drained.	Severe: poorly drained; very slow permeability; wet and soft after rains.	Severe: poorly drained; seasonal high water table.
Haymond: Ha	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Henshaw: He	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; moderately slow permeability.	Moderate: somewhat poorly drained.
Hosmer: HoB2, HoB3, HoC2, HoC3.	Slight if slope is 2 to 6 percent, moderate if slope is 6 to 12 percent.	Severe: very slow permeability.	Slight if slope is 2 to 6 percent, moderate if slope is 6 to 12 percent.	Severe: very slow permeability.	Slight if slope is 2 to 12 percent.
Huntington: Hu	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Huntington sandy variant: Ht.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Iona: IoA, IoB2	Slight	Moderate: moderately slow permeability; slow to dry after rains.	Slight	Moderate: moderately slow permeability; slow to dry after rains.	Slight.

TABLE 4.—*Ratings and limitations of the soils for recreational purposes*—Continued

Soil series and mapping symbols	Recreational buildings	Campsites for tents and trailers	Picnic grounds, parks, and other extensive play areas	Playgrounds, athletic fields, and other intensive play areas	Paths and trails
Johnsburg: JoA	Moderate: somewhat poorly drained; seasonal high water table.	Severe: very slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained.	Severe: very slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained; seasonal high water table.
Lindside: Ls	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Markland: MkB2, MkC2, MkD2, MkE.	Slight if slope is 2 to 6 percent; moderate if slope is 6 to 12 percent; severe if slope is 12 to 25 percent.	Moderate if slope is 2 to 12 percent; severe if slope is 12 to 25 percent; slow permeability.	Slight if slope is 2 to 6 percent; moderate if slope is 6 to 12 percent; severe if slope is 12 to 25 percent.	Moderate if slope is 2 to 6 percent; severe if slope is 6 to 25 percent; slow permeability.	Slight if slope is 2 to 12 percent; moderate if slope is 12 to 25 percent.
MlB3, MlC3, MlD3.	Slight if slope is 2 to 6 percent; moderate if slope is 6 to 12 percent; severe if slope is 12 to 18 percent.	Moderate if slope is 2 to 12 percent; severe if slope is 12 to 18 percent; slow permeability; sticky surface layer.	Moderate if slope is 2 to 12 percent; severe if slope is 12 to 18 percent; sticky surface layer.	Moderate if slope is 2 to 6 percent; severe if slope is 6 to 18 percent; slow permeability; sticky surface layer.	Moderate: sticky surface layer.
McGary: Mr	Moderate: somewhat poorly drained; seasonal high water table.	Moderate: somewhat poorly drained; slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained; slow permeability; wet and soft after rains.	Moderate: somewhat poorly drained.
Montgomery: Ms	Severe: very poorly drained; seasonal high water table; subject to ponding.	Severe: very poorly drained; very slow permeability; soft and sticky when wet; subject to ponding.	Severe: very poorly drained; soft and sticky when wet; subject to ponding.	Severe: very poorly drained; very slow permeability; soft and sticky when wet; subject to ponding.	Severe: very poorly drained; soft and sticky when wet; subject to ponding.
Newark: Ne	Severe: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.
Pekin: PeA, PeB2.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight.
Philo: Ph	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Princeton: PrB2, PrD2.	Slight if slope is 2 to 6 percent; moderate to severe if slope is 6 to 18 percent.	Slight if slope is 2 to 6 percent; moderate to severe if slope is 6 to 18 percent.	Slight if slope is 2 to 6 percent; moderate to severe if slope is 6 to 18 percent.	Moderate if slope is 2 to 6 percent; severe if slope is 6 to 18 percent.	Slight to moderate if slope is 2 to 18 percent.
Ragsdale: Ra	Severe: very poorly drained; seasonal high water table; subject to ponding.	Severe: very poorly drained; subject to ponding.	Severe: very poorly drained; subject to ponding.	Severe: very poorly drained; subject to ponding.	Severe: very poorly drained; subject to ponding.
Rahm: Rh	Severe: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.

TABLE 4—*Ratings and limitations of the soils for recreational purposes*—Continued

Soil series and mapping symbols	Recreational buildings	Campsites for tents and trailers	Picnic grounds, parks, and other extensive play areas	Playgrounds, athletic fields, and other intensive play areas	Paths and trails
Sciotoville: ScA, ScB2.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight.
Stendal: Sn	Severe: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.
Tilsit: TsA, TsB2, TsB3.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight	Severe: very slow permeability; wet and soft after rains.	Slight.
Uniontown: UnA, UnB2, UnB3, UnC2, UnC3, UnE2.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 25 percent.	Moderate to severe: moderately slow permeability; steep slopes.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 25 percent.	Moderate if slope is 0 to 6 percent, severe if slope is 6 to 25 percent; moderately slow permeability.	Slight if slope is 0 to 12 percent, moderate if slope is 12 to 25 percent.
Vincennes: Vn	Severe: poorly drained; seasonal high water table.	Severe: poorly drained; subject to ponding.	Severe: poorly drained; subject to ponding.	Severe: poorly drained; subject to ponding.	Severe: poorly drained; subject to ponding.
Wakeland: Wa	Severe: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.	Severe: subject to flooding; somewhat poorly drained.	Moderate: subject to flooding; somewhat poorly drained.
Weinbach: WbA, WcA.	Moderate: somewhat poorly drained.	Severe: very slow permeability; somewhat poorly drained; wet and soft after rains.	Moderate: somewhat poorly drained.	Severe: very slow permeability; somewhat poorly drained; wet and soft after rains.	Moderate: somewhat poorly drained.
Wellston: WeB, WeC2, WeC3, WeD2, WeD3, WeE2, WeE3.	Slight if slope is 2 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 25 percent.	Slight if slope is 2 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 25 percent.	Slight if slope is 2 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 52 percent.	Moderate if slope is 2 to 6 percent, severe if slope is 6 to 25 percent.	Slight if slope is 2 to 12 percent, moderate if slope is 12 to 25 percent.
Wheeling: WhA, WhB2, WhB3, WhC2, WhC3, WlA.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent.	Slight if slope is 0 to 6 percent, moderate if slope is 6 to 12 percent.	Slight if slope is 0 to 2 percent, moderate if slope is 2 to 6 percent, severe if slope is 6 to 12 percent.	Slight if slope is 0 to 12 percent.
Wilbur: Wr	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Woodmere: Ws	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.
Zanesville: ZaB2, ZaC2, ZaC3, ZaD2, ZaD3.	Slight if slope is 2 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 18 percent.	Severe: very slow permeability.	Slight if slope is 2 to 6 percent, moderate if slope is 6 to 12 percent, severe if slope is 12 to 18 percent.	Severe: very slow permeability.	Slight if slope is 2 to 12 percent, moderate if slope is 12 to 18 percent.
Zipp: Zp	Severe: very poorly drained; seasonal high water table; soft and sticky when wet; subject to ponding.	Severe: very poorly drained; very slow permeability; soft and sticky when wet; subject to ponding.	Severe: very poorly drained; soft and sticky when wet; subject to ponding.	Severe: very poorly drained; very slow permeability; soft and sticky when wet; subject to ponding.	Severe: very poorly drained; soft and sticky when wet; subject to ponding.

Picnic grounds, parks, and other extensive play areas are used for pleasure outings at which a meal can be eaten, outdoor games can be played, and hikes can be taken. The soils must be suitable for heavy foot traffic. Factors considered in rating the soils for picnic grounds, parks, and other extensive play areas are wetness and the hazard of flooding, slope, texture of the surface soil, and content of stones and rocks. The ratings do not take into account the presence of trees or ponds that would affect the desirability of a site. The capability of the soils to support vegetation also should be considered.

Playgrounds, athletic fields, and other intensive play areas are used for various forms of play; for baseball, football, tennis, and badminton; and for other organized games. The areas are used frequently and intensively and should withstand heavy foot traffic. Good drainage and a level and firm surface generally are required. It is assumed that a good cover of vegetation can be established and maintained on the soils where needed.

Path and trails are areas used for cross-country hiking, bridle paths, and other nonintensive uses that allow for the random movement of people. It is assumed that all such areas will be used as they occur in nature and that little soil will have to be moved to make the area suitable for use.

The most desirable soils for bridle paths and trails are loamy, well drained, and nearly level to sloping. Such soils have good stability and are not subject to erosion. They are free of stones and other coarse fragments and of rock outcrops. Paths and trails on sloping soils should be placed on the contour to help control erosion. The slope should not exceed 12 percent for prolonged distances.

Engineering Uses of the Soils [4]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, and pipelines; the foundations of buildings; facilities for storing water; structures for controlling erosion; drainage systems; and systems for disposing of sewage. Among the properties most important to the engineer are permeability, shear strength, compaction characteristics, soil drainage, shrink-swell characteristics, grain size, plasticity, frost potential, and reaction. Also important are depth to seasonal high water table, depth to bedrock or to sand and gravel, flooding hazard, and relief. Such information is available in this section. Engineers can use it to—

1. Make studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational areas.
2. Make estimates of the engineering properties of soils for use in the planning of agricultural drainage systems, grassed waterways, farm ponds, irrigation systems, terraces and diversions, and other structures for conserving soil and water.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, cables, and sewage disposal fields and in planning more detailed surveys of the soils at the selected locations.
4. Locate probable sources of sand, gravel, and other materials for use in construction.
5. Correlate the performance of engineering structures with the soil mapping units to develop information for overall planning that will be useful in designing and maintaining new structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and of construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be readily used by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

[4] Reviewed by PETER FORSYTHE, assistant State conservationist.

Used with the soil map to identify the soils, the engineering interpretations in this section are useful for many purposes. It should be emphasized, however, that these interpretations are not a substitute for the sampling and testing needed at a site chosen for a specific engineering work that involves heavy loads or at a site where excavations are to be deeper than the depths of the layers here reported. Nevertheless, by using this survey, an engineer can select and concentrate on those soils most important for his proposed kind of construction, and in this manner reduce the number of soil samples taken for laboratory testing and complete an adequate soil investigation at minimum cost.

The soil mapping units shown on the maps in this survey may include small areas of a different soil material. These included soils may be as much as 2 acres in size. They are too small to be mapped separately and generally are not significant to the farming in the area, but they may be important in engineering planning.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used in this publication have a special meaning to soil scientists and a different meaning to engineers. The Glossary defines many such terms as they are used in soil science.

Much of the information in this section is given in tables. Table 5 gives engineering test data, table 6 gives engineering properties of the soils, and table 7 gives engineering interpretations.

Engineering classification systems

Soil scientists of the United States Department of Agriculture (USDA) classify soils according to texture (*7*). In some ways this system of naming textural classes is comparable to the systems most commonly used by engineers for classifying soils. These are the systems of the American Association of State Highway Officials (AASHO (*1*) and the Unified system developed by the U.S. Department of Defense (*10*).

TABLE 5.—*Engineering*

[Tests performed by Purdue University in cooperation with Indiana State Highway Commission and U.S. Department of Commerce,

Soil name and location	Depth from surface	Moisture-density data [1]	
		Maximum dry density	Optimum moisture
	Inches	*Lb./cu. ft.*	*Percent*
Atkins silt loam: NW¼ sec. 32, T. 4 S., R. 5 W. (Modal.)	0–9	95	24
	25–53	101	21
Gilpin silt loam: NW¼ sec. 21, T. 4 S., R. 4 W. (Modal.)	2–7	108	15
	13–23	112	15
Hosmer silt loam: NE¼ sec. 27, T. 6 S., R. 6 W. (Modal.)	0–9	101	21
	18–29	102	20
	33–55	103	20
Montgomery silty clay loam: SW¼ sec. 20, T. 5 S., R. 4 W. (Modal.)	8–18	92	25
	18–50	102	20
	50–80	103	20
Pekin silt loam: NW¼ sec. 26, T. 4 S., R. 4 W. (Modal.)	0–9	105	19
	12–26	113	15
	44–75	106	18
Sciotoville silt loam: SW¼ sec. 32, T. 6 S., R. 5 W. (Modal.)	0–9	97	23
	31–49	107	17
	60–100	102	20
Stendal silt loam: SW¼ sec. 18, T. 5 S., R. 5 W. (Modal.)	8–20	107	16
	20–70	106	18
Uniontown silt loam: SE¼ sec. 26, T. 6 S., R. 6 W. (Modal.)	4–10	99	20
	25–35	100	21
	48–74	94	25
Wheeling silt loam: SW¼ sec. 7, T. 7 S., R. 7 W. (This profile contains less sand than that described as representative of the series.)	0–9	99	22
	23–34	110	16
	45–65	116	13

[1] Based on AASHO Designation T 99–57, Methods A and D.

[2] Mechanical analyses according to AASHO Designation T 88–57. Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for

Test data

Bureau of Public Roads (BPR), in accordance with standard procedures of the American Association of State Highway Officials (AASHO)*(1)*]

Mechanical analysis [2]								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than—						AASHO [3]	Unified [4]
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.	*Percent*			
100	99	99	91	81	56	18	10	29	6	A-4 (8)	ML-CL
99	98	95	90	81	64	23	16	27	4	A-4 (8)	ML-CL
95	93	92	76	64	45	19	11	24	3	A-4(8)	ML
99	97	96	75	68	53	35	26	34	15	A-6(10)	CL
		100	98	94	63	25	17	31	8	A-4(8)	ML-CL
			100	98	69	32	26	37	12	A-6(9)	ML-CL
		100	97	93	66	25	20	30	8	A-4(8)	ML-CL
		100	98	96	88	65	50	57	26	A-7-5(18)	MH-CH
	100	98	97	96	91	64	50	56	31	A-7-6(19)	CH
	100	99	98	97	91	64	50	53	27	A-7-6(17)	CH
		100	83	76	52	22	14	24	4	A-4(8)	ML-CL
		100	86	74	47	23	17	26	8	A-4(8)	CL
	100	99	91	83	59	30	22	26	7	A-4(8)	ML-CL
	100	99	88	81	64	30	19	32	10	A-4(8)	ML-CL
	100	99	91	86	69	44	34	36	13	A-6(9)	ML-CL
99	99	99	87	79	55	30	23	38	9	A-4(8)	CL
		100	97	91	66	25	18	32	6	A-4(8)	ML
		100	90	80	54	23	15	27	8	A-4(8)	CL
	100	97	94	86	69	26	14	32	6	A-4(8)	ML
100	98	98	97	94	84	51	35	44	17	A-7-6(12)	ML-CL
			100	98	82	21	15	32	7	A-4(8)	ML-CL
	100	99	80	73	55	26	16	25	5	A-4(8)	ML-CL
		100	86	70	54	35	28	35	12	A-6(9)	ML-CL
	100	99	36	28	20	14	11	19	[5]	A-4(0)	SM

use in naming textural classes for soil.

[3] Based on AASHO Designation M 145-49.

[4] SCS and BPR have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification. An example of a borderline classification so obtained is ML-CL.

[5] Nonplastic.

TABLE 6.—*Engineering*

[Not included in this table, because their characteristics are too variable, are the land types Gullied land, loess (Go), Gullied land, shale series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification: Dominant USDA texture
	Feet	*Inches*	
Alford: AfA, AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, AfE, AfF	4+	0–23	Silt loam
		23–57	Silty clay loam
		57–60	Silt loam
Algiers: Ag	0–2	0–7	Silt loam
		7–60	Silt loam
Atkins: Ak	0–2	0–9	Silt loam
		9–60	Silt loam
Bartle: Ba [1]	2–4	0–19	Silt loam
		19–28	Light silty clay loam
		28–64	Light silty clay loam (fragipan)
Cuba: Cu	4+	0–60	Silt loam
*Gilpin: GmF (For properties of Wellston soils in this mapping unit, refer to the Wellston series in this table.)	4+	0–10	Silt loam
		10–28	Silt loam and heavy loam
		28	Sandstone.
Ginat: Gn [1]	0–2	0–18	Silt loam
		18–50	Silty clay loam (fragipan)
		50–65	Silty clay loam
		65–100	Silt loam
Haymond: Ha	4+	0–50	Silt loam
		50–92	Loam
Henshaw: He	2–4	0–13	Silt loam
		13–57	Heavy silty clay loam
		57–80	Silt
		80–93	Clay
Hosmer: HoB2, HoB3, HoC2, HoC3	4+	0–25	Silt loam
		25–65	Silt loam (fragipan)
		65–83	Silt loam
Huntington: Hu	4+	0–80	Silt loam
Huntington, sandy variant: Ht	4+	0–48	Fine sandy loam
		48–62	Silt loam
Iona: IoA, IoB2	4+	0–8	Silt loam
		8–24	Heavy silt loam
		24–35	Light silty clay loam
		35–68	Silt
Johnsburg: JoA [1]	2–4	0–22	Silt loam
		22–48	Silty clay loam (fragipan)
		48–91	Silty clay loam
		91	Sandstone.
Lindside: Ls	4+	0–33	Silt loam
		33–48	Light silty clay loam
Markland: MkB2, MkC2, MkD2, MkE, MlB3, MlC3, MlD3	4+	0–6	Silt loam
		6–12	Silty clay
		12–30	Clay
		30–44	Silty clay
McGary: Mr	2–4	0–9	Silt loam
		9–13	Silty clay loam
		13–65	Silty clay

See footnote at end of table.

properties of the soils

(Gs), Made land and Pits (Md), and Strip mines (St). An asterisk in the first column indicates that at least one mapping unit in this this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Classification—Continued		Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					Inches per hour	*Inches per inch of soil*	*pH value*	
ML	A-4	100	100	90-100	0. 63-2. 00	0. 18-0. 23	6. 0-7. 3	Moderate.
ML or CL	A-7	100	100	90-100	0. 63-2. 00	0. 19-0. 21	4. 5-6. 0	Moderate.
ML	A-6	100	100	90-100	0. 63-2. 00	0. 18-0. 23	4. 5-6. 0	Moderate to low.
ML	A-4	100	100	90-100	0. 63-2. 00	0. 18-0. 23	6. 5-7. 3	Low.
ML or CL	A-4	100	100	90-100	0. 63-2. 00	0. 18-0. 23	6. 0-7. 3	Low.
ML or ML-CL	A-4	100	95-100	90-95	0. 63-2. 00	0. 18-0. 23	6. 5-7. 3	Low.
CL-ML or ML	A-4	100	95-100	85-95	0. 63-2. 00	0. 18-0. 23	4. 5-5. 0	Low.
ML	A-4	100	100	85-100	0. 63-2. 00	0. 18-0. 23	4. 5-7. 0	Low.
ML or CL	A-4	100	90-100	80-95	0. 20-0. 63	0. 19-0. 21	4. 5-7. 0	Moderate.
ML or CL	A-4	100	90-100	85-95	<0. 06	0. 04	4. 5-5. 0	Moderate.
ML	A-4	100	100	90-100	0. 63-2. 00	0. 18-0. 23	4. 5-6. 5	Low.
ML	A-4	90-100	90-100	70-80	0. 63-2. 00	0. 18-0. 23	5. 0-6. 5	Low.
CL	A-6	95-100	95-100	70-80	0. 63-2. 00	0. 14-0. 18	4. 5-5. 0	Moderate.
ML	A-4	95-100	95-100	90-100	0. 63-2. 00	0. 18-0. 23	4. 5-7. 3	Low.
ML or CL	A-6	95-100	95-100	90-100	<0. 06	0. 04	4. 5-5. 0	Low to moderate.
CL	A-6	85-95	80-90	60-80	0. 20-0. 63	0. 19-0. 21	4. 5-5. 5	Moderate.
ML or CL	A-6	90-100	90-95	85-90	0. 63-2. 00	0. 18-0. 23	5. 0-6. 0	Low to moderate.
ML	A-4	100	100	85-95	0. 63-2. 00	0. 18-0. 23	5. 5-6. 5	Low.
ML	A-4	100	100	60-70	0. 63-2. 00	0. 14-0. 18	6. 0-6. 5	Low.
ML	A-4	100	100	85-100	0. 63-2. 00	0. 18-0. 23	4. 5-7. 3	Low.
CL	A-7	100	100	85-100	0. 20-0. 63	0. 15-0. 21	4. 5-5. 5	Moderate to high.
ML	A-4	95-100	95-100	80-95	0. 63-2. 00	0. 18-0. 23	6. 5-7. 3	Low.
CH	A-7	95-100	95-100	80-90	0. 20-0. 63	0. 15-0. 18	7. 3-7. 8	High.
ML or ML-CL	A-4-6	95-100	95-100	90-100	0. 63-2. 00	0. 18-0. 23	4. 5-7. 3	Low.
ML or ML-CL	A-4-6	95-100	95-100	90-100	<0. 06	0. 04	4. 5-5. 0	Moderate.
ML or CL	A-4	95-100	95-100	85-95	0. 63-2. 00	0. 18-0. 23	4. 5-5. 5	Moderate to low.
ML	A-6	100	100	80-100	0. 63-2. 00	0. 18-0. 23	6. 5-7. 3	Low.
SM	A-4	100	100	40-50	2. 00-6. 30	0. 13-0. 15	6. 5-7. 3	Low.
ML	A-4	100	100	80-90	2. 00-6. 30	0. 14-0. 18	6. 5-7. 3	Low.
ML	A-4	100	100	90-100	0. 63-2. 00	0. 18-0. 23	5. 0-5. 5	Low.
CL	A-4	100	100	90-100	0. 63-2. 00	0. 18-0. 23	4. 5-5. 5	Low.
ML or CL	A-6	100	100	90-100	0. 20-0. 63	0. 19-0. 21	4. 5-5. 0	Moderate.
ML	A-4	100	100	80-95	0. 63-2. 00	0. 18-0. 23	6. 0-7. 4	Low.
ML	A-4	100	100	85-100	0. 63-2. 00	0. 18-0. 23	4. 5-6. 0	Low.
CL	A-6	90-100	85-95	80-95	<0. 06	0. 04	4. 5-5. 0	Moderate.
CL	A-6	90-100	85-95	75-95	0. 20-0. 63	0. 19-0. 21	4. 5-5. 0	Moderate.
ML	A-4	100	100	80-100	0. 63-2. 00	0. 18-0. 23	6. 5-7. 3	Low.
ML or CL	A-6	100	100	80-100	0. 63-2. 00	0. 19-0. 21	6. 5-7. 3	Moderate.
ML or CL	A-4	100	100	85-95	0. 63-2. 00	0. 18-0. 23	6. 5-7. 3	Low.
CH	A-7-5	100	100	90-95	0. 06-0. 20	0. 15-0. 18	5. 0-5. 5	High.
CH	A-7-6	100	100	90-100	0. 06-0. 20	0. 15-0. 18	6. 0-7. 8	High.
CH	A-7-5	95-100	95-100	90-95	0. 06-0. 20	0. 15-0. 18	7. 3-7. 8	High.
ML	A-4	100	100	85-100	0. 63-2. 00	0. 18-0. 23	4. 5-5. 5	Low.
CL	A-7	100	100	90-100	0. 20-0. 63	0. 19-0. 21	4. 5-5. 0	Moderate.
CH	A-7-6	100	100	90-100	0. 06-0. 20	0. 15-0. 18	4. 5-7. 8	High.

TABLE 6.—*Engineering*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification
			Dominant USDA texture
	Feet	*Inches*	
Montgomery: Ms	0–2	0–18	Silty clay loam
		18–60	Silty clay
Newark: Ne	2–4	0–9	Silt loam
		9–60	Silty clay loam
Pekin: PeA, PeB2 [1]	4+	0–12	Silt loam
		12–26	Silt loam
		26–44	Silt loam (fragipan)
		44–75	Silt loam
Philo: Ph	4+	0–60	Silt loam
Princeton: PrBr2, PrD2	4+	0–9	Fine sandy loam
		9–40	Loam
		40–110	Loamy fine sand
Ragsdale: Ra	0–2	0–13	Heavy silt loam
		13–52	Light silty clay loam
		52–72	Silt loam
Rahm: Rh	2–4	0–21	Silt loam
		21–51	Silty clay loam
		51–61	Light silty clay loam
Sciotoville: ScA, ScB2 [1]	4+	0–31	Silt loam
		31–60	Silty clay loam (fragipan)
Stendal: Sn	2–4	0–8	Silt loam
		8–70	Silt loam
Tilsit: TsA, TsB2, TsB3 [1]	4+	0–8	Silt loam
		8–18	Silt loam
		18–23	Silty clay loam
		23–48	Silty clay loam (fragipan)
		48–90	Silty clay loam
Uniontown: UnA, UnB2, UnB3, UnC2, UnC3, UnE2	4+	0–8	Silt loam
		8–55	Silty clay loam
		55–60	Silt loam
Vincennes: Vn	0–2	0–10	Silt loam
		10–60	Clay loam
Wakeland: Wa	2–4	0–60	Silt loam
Weinbach: WbA, WcA [1]	2–4	0–11	Silt loam
		11–22	Silt loam
		22–66	Clay loam (fragipan)
		66–88	Silt loam
Wellston: WeB, WeC2, WeC3, WeD2, WeD3, WeE2, WeE3	4+	0–11	Silt loam
		11–36	Silty clay loam
		36–40	Gravelly silt loam
		40	Sandstone.
Wheeling: WhA, WhB2, WhB3, WhC2, WhC3, WlA	4+	0–17	Loam
		17–68	Sandy clay loam
		68–82	Sandy loam and loamy fine sand
Wilbur: Wr	4+	0–60	Silt loam

See footnote at end of table.

properties of the soils—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					Inches per hour	*Inches per inch of soil*	*pH value*	
CH or MH	A–7	100	100	90–100	0.20–0.63	0.19–0.21	6.5–7.3	Moderate to high.
CH	A–7–6	100	100	90–100	<0.06	0.15–0.18	6.5–7.3	High.
ML or CL	A–4	100	100	80–100	0.63–2.00	0.18–0.23	6.5–7.3	Low.
ML or CL	A–7	100	100	90–100	0.63–2.00	0.19–0.21	6.5–7.3	Moderate.
ML or ML–CL	A–4	100	100	80–95	0.63–2.00	0.18–0.23	6.0–7.3	Low.
CL or ML–CL	A–4	100	100	85–95	0.63–2.00	0.18–0.23	4.5–5.0	Low to moderate.
CL–ML or CL	A–4	100	100	80–90	<0.06	0.04	4.5–5.0	Low.
ML or ML–CL	A–4	100	100	80–95	0.63–2.00	0.18–0.23	6.0–6.5	Low.
ML	A–4	95–100	95–100	80–95	0.63–2.00	0.18–0.23	4.5–6.5	Low.
SM	A–4	100	100	40–50	2.00–6.30	0.12–0.16	6.0–6.5	Low.
CL	A–6	100	100	50–70	0.63–2.00	0.12–0.18	5.0–6.5	Low.
SM	A–2–6	100	100	10–35	6.30–20.00	0.04–0.06	5.5–6.0	Low.
ML	A–4	100	100	90–100	0.63–2.00	0.18–0.23	6.5–7.3	Low.
ML or CL	A–6	100	100	90–100	0.06–0.20	0.19–0.21	6.5–7.8	Moderate.
ML	A–4	100	100	90–100	0.63–2.00	0.18–0.23	6.5–7.8	Low.
ML or CL	A–4	100	100	85–95	0.63–2.00	0.18–0.23	6.5–7.3	Low to moderate.
CL	A–7	100	100	80–95	0.20–0.63	0.19–0.21	5.0–6.5	Moderate.
ML–CL	A–7	100	100	80–95	0.20–0.63	0.19–0.21	5.0–5.5	Moderate.
ML or ML–CL	A–4	100	100	85–95	0.63–2.00	0.18–0.23	4.5–5.5	Low.
ML or ML–CL	A–6	95–100	90–100	85–95	<0.06	0.04	4.5–5.0	Moderate.
ML	A–4	100	100	95–100	0.63–2.00	0.18–0.23	5.5–6.0	Low.
ML or CL	A–4	100	100	85–95	0.63–2.00	0.18–0.23	4.5–5.5	Low.
ML	A–4	100	95–100	95–100	0.63–2.00	0.18–0.23	5.0–7.3	Low.
ML or CL	A–4	95–100	90–95	95–100	0.63–2.00	0.18–0.23	4.5–6.0	Low to moderate.
ML or CL	A–6	95–100	90–95	90–100	0.20–0.63	0.19–0.21	4.5–5.0	Moderate.
CL or ML	A–6	95–100	90–95	90–100	<0.06	0.04	4.5–5.5	Moderate.
CL or ML	A–6	95–100	90–95	90–100	0.20–0.63	0.19–0.21	4.5–5.5	Moderate.
ML	A–4	100	100	85–95	0.63–2.00	0.18–0.23	6.0–6.5	Low.
CL or ML–CL	A–6 or A–7	100	95–100	90–100	0.20–0.63	0.19–0.21	5.0–7.8	Moderate.
ML or CL	A–4	95–100	95–100	90–100	0.63–2.00	0.18–0.23	7.3–7.8	Low.
ML	A–4	100	100	85–100	0.63–2.00	0.19–0.21	6.0–7.3	Moderate.
CL	A–6	100	100	75–85	0.06–0.20	0.15–0.18	5.0–7.0	High.
ML	A–4	100	100	80–100	0.63–2.00	0.18–0.23	6.5–7.3	Low.
ML	A–4	100	100	80–100	0.63–2.00	0.18–0.23	4.5–7.3	Low.
ML or CL	A–6	100	100	80–100	0.63–2.00	0.18–0.23	4.5–5.0	Moderate.
CL	A–6	100	100	80–100	<0.06	0.04	4.5–5.0	Moderate.
ML or CL	A–4	100	95–100	80–100	0.63–2.00	0.18–0.23	4.5–5.0	Low.
ML	A–4	95–100	95–100	85–95	0–63–2.00	0.18–0.23	4.5–6.0	Low
ML–CL	A–4 or A–6	85–95	85–95	85–95	0.63–2.00	0.19–0.21	4.5–5.0	Moderate.
ML	A–4	70–85	65–75	50–60	0.63–2.00	0.14–0.18	4.5–5.0	Low.
ML–CL	A–4	100	90–100	75–85	0.63–2.00	0.14–0.18	5.5–6.5	Low.
SC	A–4	85–100	80–100	35–45	0.63–2.00	0.14–0.18	4.5–5.6	Moderate.
SM	A–2–4	85–100	80–100	15–35	6.30–20.00	0.06–0.08	4.5–5.6	Low.
ML	A–4	100	100	90–100	0.63–2.00	0.18–0.23	6.0–7.3	Low.

TABLE 6.—*Engineering*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification: Dominant USDA texture
	Feet	*Inches*	
Woodmere: Ws	4+	0–26	Silt loam
		26–47	Light silty clay loam
		47–63	Light silty clay loam
Zanesville: ZaB2, ZaC2, ZaC3, ZaD2, ZaD3	4+	0–6	Silt loam
		6–24	Light silty clay loam
		24–57	Silty clay loam (fragipan)
Zipp: Zp	0–2	0–9	Silty clay loam
		9–80	Heavy silty clay and clay

[1] The fragipan of these moderately well drained and well drained soils restricts the movement of water and causes the soil above the fragipan to become saturated during wet seasons.

TABLE 7.—*Engineering*

[Not included in this table, because their characteristics are too variable, are the land types Gullied land, loess (Go), Gullied land, shale is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this

Soil series and map symbols	Suitability as source of— Topsoil	Suitability as source of— Road subgrade	Soil features affecting— Highway location	Soil features affecting— Ponds: Reservoir areas
Alford: AfA, AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, AfE, AfF.	Good	Poor in subsoil: moderate shrink-swell potential; fair to poor compaction. Fair in substratum: poor compaction.	Subject to frost heaving; cuts and fills needed.	Slow seepage
Algiers: Ag	Good	Fair in subsoil and substratum: fair to poor shear strength; medium compressibility; fair to poor stability; fair to poor compaction; seasonal high water table.	Subject to flooding and frost heaving; poorly drained.	Seasonal high water table; subject to seepage.
Atkins: Ak	Good	Fair in subsoil and substratum: fair to poor shear strength; medium compressibility; fair to poor stability; fair to poor compaction; seasonal high water table.	Subject to flooding and frost heaving; poorly drained.	Seasonal high water table; subject to seepage.
Bartle: Ba	Fair: low organic-matter content.	Poor in subsoil and substratum: fair to poor stability and compaction; medium to high compressibility; moderate shrink-swell potential.	Seasonal high water table; subject to frost heaving.	Seasonal high water table; subject to seepage.
Cuba: Cu	Good	Fair in subsoil and substratum: subject to frost heaving; poor compaction.	Subject to flooding and frost heaving.	Subject to flooding and seepage.

properties of the soils.—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Shrink-swell potential
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)				
					Inches per hour	*Inches per inch of soil*	*pH value*	
ML	A-4	100	100	85-100	0. 63-2. 00	0. 18-0. 23	5. 0-7. 3	Low.
ML or CL	A-6 or A-7	100	100	85-95	0. 63-2. 00	0. 19-0. 21	5. 0-5. 5	Moderate.
ML or CL	A-6 or A-7	100	100	80-95	0. 63-2. 00	0. 19-0. 21	4. 5-5. 0	Moderate.
ML	A-4	100	95-100	90-100	0. 63-2. 00	0. 18-0. 23	4. 5-6. 0	Low.
ML or ML-CL	A-4	100	95-100	90-100	0. 20-0. 63	0. 19-0. 21	4. 5-5. 0	Low to moderate.
ML or CL	A-6	100	90-100	80-95	<0. 06	0. 04	4. 5-5. 0	Moderate.
CH	A-7-6	100	100	90-100	0. 20-0. 63	0. 19-0. 21	6. 0-6. 5	High.
CH	A-7-6	100	100	95-100	<0. 06	0. 15-0. 18	6. 0-7. 8	High.

interpretations of the soils

(Gs), Made land and Pits (Md), and Strip mines (St). An asterisk in the first column indicates that at least one mapping unit in this series reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil features affecting—Continued					Soil limitations for septic tank filter fields
Ponds—Continued: Embankments	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	
Low permeability when compacted; good resistance to piping.	Not needed	Subject to severe erosion; not suitable where slope is more than 12 percent.	Subject to severe erosion during construction.	Moderate shrink-swell potential; medium compressibility; soft when wet.	Slight where slope is 0 to 6 percent; moderate where slope is 6 to 12 percent; severe where slope is more than 12 percent.
Fair to poor stability; fair resistance to piping; moderate to low permeability when compacted.	Seasonal high water table; subject to flooding; outlets for tile generally inadequate.	Not needed	Not needed	Subject to flooding; seasonal high water table.	Severe: seasonal high water table; subject to flooding.
Fair to poor stability; fair resistance to piping; moderate to low permeability when compacted.	Seasonal high water table; subject to flooding; outlets for tile generally inadequate.	Not needed	Not needed	Subject to flooding; seasonal high water table.	Severe: seasonal high water table; subject to flooding.
Fair to poor stability and compaction; medium to high compressibility; poor to good resistance to piping; moderate to low permeability when compacted.	Seasonal high water table; very slow permeability.	Not needed	Not needed	Medium to high compressibility; seasonal high water table.	Severe: very slow permeability; seasonal high water table.
Fair to poor stability; moderate permeability when compacted; fair resistance to piping.	Not needed	Not needed	Not needed	Subject to flooding; medium compressibility; soft when wet.	Severe: subject to flooding.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road subgrade	Highway location	Ponds: Reservoir areas
*Gilpin: GmF (For properties of Wellston soils refer to the Wellston series.)	Fair: low organic-matter content.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; bedrock at a depth of 20 to 36 inches.	Bedrock at a depth of 20 to 36 inches; steep.	Bedrock at a depth of 20 to 36 inches.
Ginat: Gn	Fair: low organic-matter content.	Fair to poor in subsoil and substratum: fair to poor stability and compaction; medium compressibility; low to moderate shrink-swell potential.	Seasonal high water table; subject to frost heaving.	Seasonal high water table; moderate seepage.
Haymond: Ha	Fair: low organic-matter content.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; low shrink-swell potential.	Subject to flooding and frost heaving.	Moderate seepage; underlying material is stratified sand and silt; subject to flooding.
Henshaw: He	Fair: low organic-matter content.	Poor in subsoil: medium to high compressibility; moderate to high shrink-swell potential. Very poor in substratum: fair to poor stability and compaction; high compressibility; moderate to high shrink-swell potential.	Seasonal high water table; plastic soil material.	Seasonal high water table.
Hosmer: HoB2, HoB3, HoC2, HoC3.	Fair: low organic-matter content.	Fair to poor in subsoil and substratum: fair to poor stability and compaction; medium to high compressibility.	Subject to frost heaving; cuts and fills needed in many places; exposed cuts subject to erosion.	Moderate seepage below fragipan.
Huntington: Hu	Good	Poor in subsoil and substratum: medium compressibility; poor compaction and stability.	Subject to flooding and frost heaving.	Moderate seepage; subject to flooding.
Huntington, sandy variant: Ht	Fair: low organic-matter content.	Fair in subsoil and substratum: fair stability; fair to good compaction.	Subject to flooding	Rapid seepage; subject to flooding.
Iona: IoA, IoB2	Good	Fair in subsoil and substratum: medium to high compressibility; fair compaction and stability.	Moderately well drained; subject to frost heaving.	Slow seepage
Johnsburg: JoA	Fair: low organic-matter content.	Poor in subsoil: medium to high compressibility; moderate shrink-swell potential. Fair in substratum: fair stability and compaction; medium compressibility; moderate shrink-swell potential.	Somewhat poorly drained; subject to frost heaving; seasonal high water table.	Somewhat poorly drained; seasonal high water table.

interpretations of the soils—Continued

Soil features affecting—Continued: Ponds—Continued: Embankments	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Soil limitations for septic tank filter fields
Bedrock at a depth of 20 to 36 inches.	Not applicable; bedrock at a depth of 20 to 36 inches.	Steep; bedrock at a depth of 20 to 36 inches.	Steep; bedrock at a depth of 20 to 36 inches.	Bedrock at a depth of 20 to 36 inches.	Severe: steep.
Fair to poor stability and compaction; medium compressibility; low permeability when compacted; good resistance to piping.	Very slow permeability; seasonal high water table.	Not needed	Not needed	Seasonal high water table; medium compressibility.	Severe: very slow permeability; seasonal high water table.
Poor stability and compaction; medium compressibility; moderate permeability when compacted; poor resistance to piping.	Not needed	Not needed	Not needed	Soft when wet; subject to flooding.	Severe: subject to flooding.
Subsoil—medium to high compressibility. Substratum—fair to poor stability and compaction; high compressibility.	Seasonal high water table; moderately slow permeability.	Not needed	Not needed	Seasonal high water table; moderate to high shrink-swell potential; soft when wet.	Severe: seasonal high water table; moderately slow permeability.
Fair to poor stability and compaction; medium to high compressibility; substratum has poor resistance to piping.	Not needed	Very slowly permeable fragipan at a depth of 24 to 30 inches.	Very slowly permeable fragipan at a depth of 24 to 30 inches.	Low to moderate shrink-swell potential; medium to high compressibility.	Severe: very slowly permeable fragipan at a depth of 24 to 30 inches.
Poor stability and compaction; moderate permeability when compacted; poor resistance to piping.	Not needed	Not needed	Not needed	Subject to flooding.	Severe: subject to flooding.
Fair stability; fair to good compaction; moderate permeability when compacted; poor resistance to piping.	Not applicable; subject to flooding.	Not needed	Not needed	Subject to flooding.	Severe: subject to flooding.
Fair compaction and stability; good resistance to piping; low permeability when compacted.	Not needed	Slow or medium runoff; moderately slow permeability.	Subject to severe erosion during construction.	Soft when wet; fair to poor shear strength.	Severe: moderately slow permeability.
Fair to good stability and compaction; low permeability when compacted; medium to high compressibility; good resistance to piping.	Very slowly permeable fragipan; seasonal high water table.	Not needed	Not needed	Soft when wet; somewhat poorly drained; seasonal high water table.	Severe: very slowly permeable fragipan; somewhat poorly drained; seasonal high water table.

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TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road subgrade	Highway location	Ponds: Reservoir areas
Lindside: Ls	Good	Fair to poor in subsoil and substratum: fair to poor stability and compaction; low to moderate shrink-swell potential.	Subject to flooding and frost heaving.	Moderate seepage; underlying materials are stratified sand, silt, or gravel; subject to flooding.
Markland: MkB2, MkC2, MkD2, MkE, MlB3, MlC3, MlD3.	Fair: surface layer of silt loam; low organic-matter content. Poor: surface layer of silty clay loam; clayey; low organic-matter content.	Very poor in subsoil and substratum: fair to poor stability and compaction; high compressibility; high shrink-swell potential.	Plastic soil material; high shrink-swell potential; cuts and fills needed; erosion hazard on side slopes of cuts.	All features favorable.
McGary: Mr	Fair: low organic-matter content.	Poor to very poor in subsoil and substratum: fair to poor stability and compaction; high compressibility; high shrink-swell potential.	Seasonal high water table; plastic soil material; high shrink-swell potential.	Seasonal high water table.
Montgomery: Ms	Fair: surface layer of silty clay loam.	Very poor in subsoil and substratum: high compressibility; high shrink-swell potential; fair to poor stability and compaction.	Very poorly drained; plastic soil material; high shrink-swell potential; seasonal high water table.	Seasonal high water table.
Newark: Ne	Fair: low organic-matter content.	Fair to poor in subsoil and substratum: fair to poor stability and compaction; moderate shrink-swell potential.	Seasonal high water table; subject to flooding.	Slow seepage; subject to flooding; seasonal high water table.
Pekin: PeA, PeB2	Fair: low organic-matter content.	Poor in subsoil and substratum: fair to good stability and compaction; low to moderate shrink-swell potential.	Subject to frost heaving.	Moderate seepage
Philo: Ph	Good	Fair in subsoil and substratum: poor stability and compaction; low shrink-swell potential; medium compressibility.	Subject to flooding and frost heaving.	Moderate seepage; subject to flooding.
Princeton: PrB2, PrD2	Fair: medium organic-matter content.	Poor in subsoil: fair to good stability and compaction; medium compressibility; fair shear strength. Good in substratum: fair stability; fair to good compaction; slight compressibility; fair shear strength.	Cuts and fills needed in many places; subsoil subject to frost heaving; side slopes subject to erosion.	Rapid seepage

interpretations of the soils—Continued

Soil features affecting—Continued					Soil limitations for septic tank filter fields
Ponds—Continued: Embankments	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	
Fair to poor stability and compaction; moderate to low permeability when compacted; medium compressibility; poor to good resistance to piping.	Subject to flooding.	Not needed	Not needed	Medium compressibility; soft when wet; subject to flooding.	Severe: subject to flooding.
Fair to poor stability and compaction; high compressibility; low permeability when compacted; good resistance to piping.	Well drained	Not suitable where slope is more than 12 percent.	All features favorable.	High shrink-swell potential; high compressibility.	Severe: slow permeability.
Fair to poor stability and compaction; high compressibility; low permeability when compacted; good resistance to piping.	Seasonal high water table; slow permeability.	Not needed	Not needed	High shrink-swell potential; high compressibility; seasonal high water table.	Severe: slow permeability; seasonal high water table.
Fair to poor stability and compaction; low permeability when compacted; high compressibility; good resistance to piping.	Seasonal high water table; very slow permeability.	Not needed	Not needed	Seasonal high water table; high compressibility; high shrink-swell potential.	Severe: seasonal high water table; very slow permeability.
Fair to poor stability and compaction; medium compressibility; moderate to low permeability when compacted; good to poor resistance to piping.	Seasonal high water table.	Not needed	Not needed	Soft when wet; medium compressibility; seasonal high water table; subject to flooding.	Severe: subject to flooding; seasonal high water table.
Fair to good stability and compaction; low permeability when compacted; medium compressibility; good resistance to piping.	Very slow permeability; drainage generally not needed; moderately well drained.	Very slow permeability; fragipan in subsoil.	Very slow permeability; fragipan in subsoil.	Medium compressibility; soft when wet.	Severe: very slow permeability; fragipan in subsoil.
Poor stability and compaction; medium compressibility; moderate permeability when compacted; poor resistance to piping.	Subject to flooding; drainage generally not needed; moderately well drained.	Not needed	Not needed	Medium compressibility; soft when wet; subject to flooding.	Severe: subject to flooding.
Subsoil—fair to good stability and compaction; medium compressibility; low permeability when compacted; good resistance to piping. Substratum—fair stability; fair to good compaction; moderate permeability when compacted; slight compressibility; poor resistance to piping.	Not needed	Irregular slopes; not suitable where slope is more than 12 percent.	All features favorable.	All features favorable.	Slight where slope is 2 to 6 percent; moderate where slope is 6 to 12 percent; severe where slope is more than 12 percent.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road subgrade	Highway location	Ponds: Reservoir areas
Ragsdale: Ra	Good	Poor in subsoil: fair stability and compaction; medium to high compressibility; moderate shrink-swell potential. Fair in substratum: poor stability and compaction; medium compressibility; low shrink-swell potential.	Seasonal high water table; subject to frost heaving.	Seasonal high water table; slow seepage.
Rahm: Rh	Fair: low organic-matter content.	Fair to poor in subsoil and substratum: fair to poor stability and compaction; medium compressibility; moderate shrink-swell potential.	Seasonal high water table; subject to flooding.	Slow seepage; subject to flooding; seasonal high water table.
Sciotoville: ScA, ScB2	Fair: low organic-matter content.	Fair to poor in subsoil and substratum: fair to poor stability and compaction; moderate shrink-swell potential; medium compressibility.	Subject to frost heaving; moderately well drained.	Moderate seepage
Stendal: Sn	Fair: low organic-matter content.	Fair in subsoil and substratum: fair to poor stability and compaction; medium compressibility; low shrink-swell potential.	Seasonal high water table; subject to flooding and frost heaving.	Seasonal high water table; subject to flooding; moderate seepage.
Tilsit: TsA, TsB2, TsB3	Fair: low organic-matter content.	Poor in subsoil and substratum: fair stability and compaction; medium compressibility; moderate shrink-swell potential.	Subject to frost heaving.	Moderate seepage below fragipan.
Uniontown: UnA, UnB2, UnB3, UnC2, UnC3, UnE2.	Fair: low organic-matter content.	Poor in subsoil and substratum: fair to good stability and compaction; medium to high compressibility; moderate shrink-swell potential.	Cuts and fills needed in many places; moderate shrink-swell potential.	All features favorable.

interpretations of the soils—Continued

Soil features affecting—Continued					
Ponds—Continued: Embankments	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	Soil limitations for septic tank filter fields
Subsoil—fair stability and compaction; low to moderate permeability when compacted; medium to high compressibility; good to poor resistance to piping. Substratum—poor stability and compaction; moderate permeability when compacted; medium compressibility; poor resistance to piping.	Seasonal high water table; slow permeability.	Not needed	Not needed	Seasonal high water table; moderate shrink-swell potential; soft when wet.	Severe: seasonal high water table; slow permeability.
Fair to poor stability and compaction; medium compressibility; low to moderate permeability when compacted; good to poor resistance to piping.	Seasonal high water table; moderately slow permeability.	Not needed	Not needed	Moderate shrink-swell potential; medium compressibility; soft when wet; subject to flooding; seasonal high water table.	Severe: seasonal high water table; subject to flooding; moderately slow permeability.
Fair to poor stability and compaction; moderate to low permeability when compacted; medium compressibility; good to poor resistance to piping.	Generally not needed; very slowly permeable fragipan at a depth of 20 to 36 inches.	Very slowly permeable fragipan at a depth of 20 to 36 inches.	Very slowly permeable fragipan at a depth of 20 to 36 inches.	Moderately well drained; subject to frost heaving.	Severe: very slowly permeable fragipan at a depth of 20 to 36 inches.
Fair to poor stability and compaction; medium compressibility; moderate to low permeability when compacted; poor to good resistance to piping.	Subject to flooding; seasonal high water table.	Not needed	Not needed	Medium compressibility; soft when wet; seasonal high water table; subject to flooding.	Severe: seasonal high water table; subject to flooding.
Fair stability and compaction; medium compressibility; moderate to low permeability when compacted; good to poor resistance to piping.	Generally not needed; very slowly permeable fragipan at a depth of 20 to 30 inches.	Very slowly permeable fragipan at a depth of 20 to 30 inches.	Very slowly permeable fragipan at a depth of 20 to 30 inches.	Moderate shrink-swell potential; medium compressibility.	Severe: very slowly permeable fragipan at a depth of 20 to 30 inches.
Fair to good stability and compaction; medium to high compressibility; low permeability in subsoil and moderate permeability in substratum when compacted; good resistance to piping in subsoil; poor in substratum.	Generally not needed.	All features favorable.	All features favorable.	Moderate shrink-swell potential; medium to high compressibility.	Severe: moderately slow permeability.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as source of—		Soil features affecting—	
	Topsoil	Road subgrade	Highway location	Ponds: Reservoir areas
Vincennes: Vn	Good	Poor in subsoil and substratum: fair to good stability and compaction; medium to high compressibility, fair shear strength; high shrink-swell potential.	Poorly drained: plastic soil material; seasonal high water table.	Seasonal high water table; slow seepage.
Wakeland: Wa	Fair: low organic-matter content.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; low shrink-swell potential.	Seasonal high water table; subject to flooding.	Seasonal high water table; subject to flooding; moderate seepage.
Weinbach: WbA, WcA	Fair: low organic-matter content.	Fair to poor in subsoil and substratum: fair to poor stability and compaction; medium to high compressibility; moderate to low shrink-swell potential.	Seasonal high water table.	Seasonal high water table; slow seepage.
Wellston: WeB, WeC2, WeC3, WeD2, WeD3, WeE2, WeE3.	Fair: low organic-matter content.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; low to moderate shrink-swell potential; bedrock at a depth of 36 to 60 inches.	Cuts and fills needed in many places; subject to frost heaving; bedrock at a depth of 36 to 60 inches.	Moderate seepage; bedrock at a depth of 36 to 60 inches.
Wheeling: WhA, WhB2, WhB3, WhC2, WhC3, WlA.	Fair: low organic-matter content.	Fair to good in subsoil and substratum: fair stability; fair to good compaction; slight compressibility.	Cuts and fills needed in many places.	Moderate to rapid seepage.
Wilbur: Wr	Fair: low organic-matter content.	Fair in subsoil and substratum: poor stability and compaction; medium compressibility; low shrink-swell potential.	Subject to frost heaving; subject to flooding.	Moderate seepage; subject to flooding.
Woodmere: Ws	Good	Poor in subsoil and substratum: fair to poor stability and compaction; medium compressibility; moderate shrink-swell potential.	Subject to flooding	Subject to flooding; slow seepage.
Zanesville: ZaB2, ZaC2, ZaC3, ZaD2, ZaD3.	Fair: low organic-matter content.	Fair in subsoil: poor stability and compaction; medium compressibility; low to moderate shrink-swell potential. Poor in substratum: fair stability and compaction; medium compressibility; moderate shrink-swell potential.	Cuts and fills needed in many places; exposed cuts subject to severe erosion; subject to frost heaving.	Moderate seepage below fragipan.
Zipp: Zp	Poor: clayey	Very poor in subsoil and substratum: fair to poor stability and compaction; very high compressibility; high shrink-swell potential.	Seasonal high water table; subject to ponding; clayey and plastic soil material.	Seasonal high water table; very slow seepage.

interpretations of the soils—Continued

Soil features affecting—Continued					Soil limitations for septic tank filter fields
Ponds—Continued: Embankments	Agricultural drainage	Terraces and diversions	Grassed waterways	Foundations for low buildings	
Fair to good stability and compaction; medium to high compressibility; low permeability when compacted; good resistance to piping.	Seasonal high water table; slow permeability.	Not needed	Not needed	Seasonal high water table; medium to high compressibility; high shrink-swell potential.	Severe: seasonal high water table; slow permeability.
Poor stability and compaction; medium compressibility; moderate permeability when compacted; poor resistance to piping.	Subject to flooding; seasonal high water table.	Not needed	Not needed	Seasonal high water table; subject to flooding; medium compressibility.	Severe: seasonal high water table; subject to flooding.
Fair to poor stability and compaction; medium to high compressibility; moderate to low permeability when compacted; poor to good resistance to piping.	Very slowly permeable fragipan at a depth of 18 to 30 inches; seasonal high water table.	Not needed	Not needed	Seasonal high water table; medium to high compressibility.	Severe: seasonal high water table; very slowly permeable fragipan at a depth of 18 to 30 inches.
Poor stability and compaction; medium compressibility; moderate permeability when compacted; poor resistance to piping.	Not needed	Bedrock at a depth of 36 to 60 inches.	Bedrock at a depth of 36 to 60 inches.	Medium compressibility; bedrock at a depth of 36 to 60 inches.	Severe: bedrock at a depth of 36 to 60 inches.
Fair stability, fair to good compaction; slight compressibility; moderate or low permeability when compacted; fair to poor resistance to piping.	Not needed	All features favorable.	All features favorable.	All features favorable.	Slight where slope is 0 to 6 percent; moderate where slope is 6 to 12 percent.
Poor stability and compaction; medium compressibility; moderate permeability when compacted; poor resistance to piping.	Not needed	No needed	Not needed	Medium compressibility; subject to flooding; soft when wet.	Severe: subject to flooding.
Fair to poor stability and compaction; medium compressibility; low to moderate permeability when compacted; poor to good resistance to piping.	Not needed	Not needed	Not needed	Medium compressibility; subject to flooding.	Severe: moderate permeability; subject to flooding.
Fair to poor stability and compaction; medium compressibility; low to moderate permeability when compacted; good to poor resistance to piping.	Not needed	Very slowly permeable fragipan at a depth of 20 to 30 inches.	Very slowly permeable fragipan at a depth of 20 to 30 inches.	Low to moderate shrink-swell potential; medium compressibility.	Severe: very slow permeability; fragipan at a depth of 20 to 30 inches.
Fair to poor stability and compaction; very high compressibility; low permeability when compacted; good resistance to piping.	Seasonal high water table; very slow permeability.	Not needed	Not needed	Very high compressibility; seasonal high water table.	Severe: very slow permeability; seasonal high water table.

Most highway engineers classify soil material in accordance with the AASHO system. In this system soil materials are classified in seven principal groups. The groups range from A–1 (gravelly soils having high bearing capacity, the best soils for subgrade) to A–7 (clayey soils having low strength when wet, the poorest soils for subgrade). If the soil material is near a classification boundary, it is given a symbol showing both classes, for example, A–2 or A–4. Highly organic soils, such as peat and muck, are not included in the AASHO classification, because their use as construction material is not practical.

Within each of the principal groups, the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best materials to 20 for the poorest. The group index numbers for several of the soils of Spencer County are shown in parentheses following the soil group symbol given in table 5.

In the Unified classification system, the soils are grouped on the basis of their texture and plasticity and their performance as material for engineering structures. Soil materials are identified as gravel (G), sand (S), silt (M), clay (C), organic (O), and highly organic (Pt). Clean sands are identified by the symbols SW and SP; silts and clays that have a high liquid limit are identified by the symbols MH and CH.

Table 6 shows the estimated classification of the soils in Spencer County according to all three systems of classification.

Engineering test data

Table 5 gives test data for samples from several soil series in Spencer County. The samples were taken from nine locations in the county. Selected layers were tested by standard procedures in the laboratories of the Joint Highway Research Project at Purdue University, under the sponsorship of the Bureau of Public Roads. These samples neither represent all the soils of the county nor even the entire range of soil characteristics within the series sampled. The results of the tests can be used, however, as a guide in estimating the engineering properties of the soils in the county. Tests were made for moisture-density relationships, grain-size distribution, liquid limit, and plasticity index.

In the moisture-density, or compaction, tests, a sample of the soil material is compacted several times with a constant compactive effort, each time at a successively higher moisture content. The moisture content is increased until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in planning earthwork because generally the soil is more stable if it is compacted to about its maximum dry density when it is at about the optimum moisture content.

The mechanical analyses were made by combined sieve and hydrometer methods. The results were used to determine the relative proportion of the different size particles. The terms "sand," "silt," and "clay" do not mean the same to engineers as to scientists. Therefore, the percentages determined by these tests should not be used as a basis for naming textural classes of soils. For example, "clay" to the soil scientist refers to the mineral grains less than 0.002 millimeter in diameter. The engineer, however, may define "clay" as all mineral grains less than 0.005 millimeter in diameter.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The *plastic limit* is the moisture content at which the soil material passes from a solid to a plastic state. The *liquid limit* is the moisture content at which the material passes from a plastic to a liquid state. The *plasticity index* is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

Engineering properties of the soils

In table 6 the soil series of the county and the symbols for mapping units are listed, and certain properties that are significant to engineering are described. Estimates of properties of the soil samples listed in table 5 are based on laboratory tests. Estimates of the other soils are based on test data for similar soils in Spencer County and in other counties and upon experience gained from working with and observing similar soils in other areas. These estimates provide information that can be used by the engineer. They are not, however, a substitute for detailed testing at a specific site selected for construction.

In general, the information in table 6 applies to a depth of 5 feet or less. Inasmuch as depth to bedrock for most of the soils in the county is more than 6 feet, the depth to bedrock is not given in this table. The depth to bedrock is less than 6 feet only in soils of the Gilpin, Wellston, and Zanesville series. In the Gilpin soils it is 20 to 36 inches, in Wellston soils, 3 to 5 feet, and in Zanesville soils, 4 to 6 feet.

The depth to seasonal high water table is the maximum depth to free ground water during extended wet periods, generally in spring. During extended dry periods, the depth to the water table varies from the depth shown in table 6. The estimates are for soil material that has not been artificially drained.

The depth from the surface generally is given only for the major horizons, but other horizons also are listed if they differ significantly from the major horizons.

The dominant USDA texture is based on the relative amounts of sand, silt, and clay in a soil. The Unified and the AASHO classifications are based on the relative amounts of the various size particles and the liquid limit and plasticity index of the fine material.

The amount of material passing sieves No. 4, No. 10, and No. 200 has been rounded to the nearest 5 percent. If little gravel-size material is present (No. 4 and No. 10 sieves), the percentage of material passing the No. 200 sieve is mainly silt and clay.

Permeability refers to the downward movement of water through undisturbed soil material. The estimates are based largely on texture, structure, and consistence.

Available moisture capacity, expressed in inches per inch of soil depth, is the capacity of a soil to retain water that can be readily absorbed by plants. It is the estimated amount of water held in a soil between field capacity and the permanent wilting point of plants. The capacity of a particular horizon to deliver water to plant roots depends on whether the roots can reach the horizon. The available moisture capacity of soils that have a fragipan is computed to the average depth of the fragipan plus half an inch per foot of material from the top of the fragipan to a depth of 60 inches, or to bedrock. Because the area immediately above the fragipan tends to serve as a reservoir for water in excess of field capacity, this is considered in computing the total available moisture capacity.

Reaction, the degree of alkalinity or acidity of a soil, is expressed in pH values. A pH of 7, for example, indicates a neutral soil, a lower pH value indicates acidity, and a higher value indicates alkalinity. The reaction column in table 6 lists field estimates of pH values for each major horizon.

Shrink-swell potential indicates the volume change to be expected with change in moisture content. The estimates are based primarily on the amount and kind of clay in the soil.

Engineering interpretations of the soils

Table 7 gives ratings of the soils according to their suitability as a source of topsoil and road subgrade. It also lists soil features that affect the suitability of the soils for several engineering practices. In addition, ratings of the limitations of the soils for use as sites for septic tank filter fields are given, and the chief reasons for assigning a severe rating are listed. The interpretations in this table apply to the representative profile of each series described in the section "Descriptions of the Soils."

A soil feature may be helpful in one kind of engineering work but a hindrance in another. For example, a soil that has a permeable substratum is not desirable as a site for a farm pond, but it may be desirable as a location for a highway.

Topsoil refers to soil material, preferably rich in organic matter, that is used as a topdressing on back slopes, embankments, lawns, gardens, and the like. The suitability ratings are based mainly on texture of the soils and on their organic-matter content.

Most of the soils in Spencer County lack a significant amount of sand and gravel suitable for use in engineering works. Underlying strata of the soils of the Weinbach and Wheeling series are possible sources of sand and a few pockets of gravel. The soils of the Wheeling series are most likely to have a large amount of sand. Other possible sources of sand are soils of the Princeton and Huntington series. In addition, a good source of sand and gravel underlies most of the soils on bottom lands along the Ohio River.

The suitability ratings of the soils as a source of road subgrade are based on the performance of the soil material when used to build embankments. Both the subsoil and the substratum are rated if they differ in texture.

Soil features considered in rating the soils for highway locations are those that affect overall performance of the soils. The ratings are based on undisturbed soil without artificial drainage.

The main feature considered in determining the suitability of the soils for reservoir areas is permeability of the undisturbed soil, which affects seepage.

Features considered in rating the soils for farm pond embankments are those that affect the use of disturbed soil material for constructing embankments to impound surface water. Because of the high percentage of silt in the underlying material, the soils on the deep loess uplands in the southern part of the county are not suitable for use in constructing embankments. These silty soils are susceptible to erosion and have poor resistance to piping. In many places it is difficult to obtain sufficient quantities of fine-textured silty clay loam for use in constructing embankments.

Agricultural drainage is influenced by soil features that affect the installation and performance of surface and subsurface drainage systems. Among these features are texture, permeability, relief, seasonal high water table, and restricting layers.

Soil features that affect the layout and construction of terraces and diversions are relief, texture, and depth to soil material unfavorable to good growth of crops. For grassed waterways, the features considered are those that affect the establishment, growth, and maintenance of plants and the layout and construction of waterways. Among these features are runoff, texture, and stones on and in the soil.

Soil features considered for foundations for buildings are those of the undisturbed soil that affect its suitability for supporting buildings up to three stories high. The substratum of the soil was evaluated because these layers generally provide the base for foundations.

Soil features that affect septic tank filter fields are permeability, seasonal high water table, susceptibility to flooding, and relief.

Formation and Classification of Soils

In this section the factors that have affected the formation of soils in Spencer County are discussed, and important processes in the differentiation of soil horizons are briefly described. Then, the current system of soil classification used in the United States is explained, and the soil series represented in the county are placed in some of the categories of this system. The soil series of the county, including a profile representative of each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil at any given point are determined by the interaction of five major factors: (1) parent material, (2) climate, (3) plants and animals, (4) relief, and (5) time.

Climate and plants and animals are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and plants and animals are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of parent material into a soil.

It may be much or little, but some time is always required for differentiation of soil horizons. Generally, a long time is needed for distinct horizons to develop.

Parent material

Parent material (fig. 14) is the unconsolidated mass from which a soil forms. It determines the limits of the chemical and mineral composition of the soil.

In Spencer County the parent material of the soils consists of silty and fine sandy windblown loess, residuum from shale and sandstone, silt and clay sediments of old lakes, alluvium from old stream deposits, and alluvium on present flood plains of streams. These parent materials occur on uplands, on terrace benches, and on flood plains along streams.

Upland soils of the county are strongly influenced by silty loess parent material, as evident by the silty solum of most profiles. Alford and Iona soils, for example, formed entirely in silty loess. A few soils, such as those of the Tilsit and Zanesville series, formed both in silty loess and in the underlying residuum from shale and sandstone. The solum of Gilpin soils, although formed largely in shale and sandstone residuum, is modified by a thin mantle of silty loess.

The parent material of soils on terrace benches consists of stratified silt, clay, and sand. The proportion of the different grain-size sediment greatly influences the soil character. Soils such as those of the McGary and Zipp series are examples of soils that formed in fine clayey sediment of old lakebeds. Soils of the Wheeling and Weinbach series are representative of soils that formed in stratified material on stream terraces. These soils formed in material ranging from sand to clay, though a major part of the parent material was loamy. In most places soils on terraces have a thin mantle of silty loess overlying stream-deposited materials, and in a few places the loess mantle is sufficiently thick that the entire solum formed in loess.

The parent material of alluvial soils that occupy present flood plains of streams consists of mixed alluvium from various upstream sources. Soils of the Wilbur and Wakeland series are examples of soils formed in alluvium from silty loess uplands. Soils of the Cuba and Stendal series are examples of soils that formed in alluvium from loess-capped residual sandstone and shale uplands. Soils of the Huntington and Newark series are representative of soils that formed in mixed loess; in residuum from sandstone, shale, and limestone; and in glacial till.

Figure 14.—**A 20-foot cross section of a site near St. Meinrad showing geologic materials from which most upland soils in Spencer County formed.**

Climate

The mild, moist climate of Spencer County has promoted soil formation. It is believed to be similar to the climate that existed when the soils formed. The climate is uniform throughout the county, although locally its effect is slightly modified by the Ohio River. Differences among the soils are not the result of climate.

Plants and animals

Plants, burrowing animals, insects, bacteria, and fungi are important in the formation of soils. They add to the supply of organic matter, nitrogen, and other plant nutrients and alter the structure and porosity of the soils.

Vegetation, mainly hardwood trees, has affected soil formation in Spencer County more than other kinds of plants and animals. The soils generally have a medium to low content of organic matter.

Relief

Relief influences soil formation through its effect on drainage, plant cover, erosion, and accumulation of parent material. In Spencer County the relief ranges from nearly level to very steep, and this variation in relief has strongly influenced soil formation. Soils of the Johnsburg, Tilsit, and Zanesville series are examples of soils that show the effect of relief in their development. These soils formed in similar parent material, under a similar cover of plants, under a similar climate, and for a similar period. Relief directly affects runoff and erosion, which accelerates as the soil slope increases. Johnsburg soils, which are nearly level, are poorly drained; Tilsit soils, which are nearly level to sloping, are moderately well drained; and Zanesville soils, which are gently sloping to strongly sloping, are well drained.

In Spencer County relief has influenced the accumulation of silty loess. In the northern part of the county, or in the area of the Zanesville-Wellston-Tilsit association, the thickness of the loess mantle generally decreases as the slope increases. The thickness of the silt cap on the ridges is fairly uniform, but on the hillsides the loess mantle is as much as about 36 inches thick. The Gilpin and Wellston soils are steep and very steep and occur where the silty loess mantle is shallow to deep.

Time

A long time is needed for formation of soils that have distinct horizons. The length of time that parent material has been in place generally is reflected in the degree of development of the soil profile.

The soils of Spencer County range from young to old. The young soils have very little profile development, but the older soils have well-expressed soil horizons.

Wilbur soils are an example of young soils. They have a weakly developed profile. Their characteristics are similar to those of the silty loess parent material. Alford soils are an example of older soils that have well developed horizons. They formed in parent materials similar to those of the Wilbur soils, but their subsoil is strongly acid silty clay loam that has moderate, subangular blocky structure.

Processes of Soil Formation

Several processes have been involved in the formation of soils in Spencer County. Among these processes are: (1) accumulation of organic matter, (2) leaching of calcium carbonates and bases, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

Accumulation of organic matter in the upper part of the profile has been important in the formation of an A1 horizon. In this county the soils have a medium to very low content of organic matter.

Leaching of carbonates and bases has occurred in nearly all of the soils. The leaching of bases in soils generally precedes translocation of silicate clay minerals. Most of the soils of the county are strongly leached, and this leaching has contributed to the development of horizons.

Reduction and transfer of iron, a process called gleization, is evident in the poorly drained and very poorly drained soils. The gray color in the subsurface horizon indicates the reduction and loss of iron. Reddish-brown mottles and concretions in some horizons indicate segregation of iron.

In some of the soils, the translocation of clay minerals has also contributed to horizon development. The eluviated A2 horizon, above the B horizon, has platy structure, is lower in content of clay, and generally is lighter in color than the B horizon. In most places the B horizon has an accumulation of clay (clay films) in pores and on the surfaces of peds. These soils were probably leached of carbonates and soluble salts before translocation of silicate clay took place. Leaching of bases and translocation of silicate clays are among the chief processes in horizon differentiation in the soils of Spencer County. Alford soils are examples of soils that have translocated silicate clay films in the B horizon.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about soils; to see their relationship to one another and to the whole environment; and to develop principles that help us understand their behavior and response to kinds of treatment.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. They are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*6*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. It is under continual study. Therefore, readers interested in development of this system should search the latest literature available (*4, 8*). The soil series of Spencer County are placed in some categories of the current system in table 8.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar origin are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available. The categories of the current system are briefly defined in the paragraphs that follow:

ORDERS. Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, the Entisols and the Histosols, occur in many kinds of climate. The five soil orders represented in Spencer County are Alfisols, Entisols, Inceptisols, Mollisols, and Ultisols.

Alfisols are soils that have a clay-enriched B horizon that is high in base saturation.

Entisols are recent soils that do not have genetic horizons or that have only the beginning of such horizons.

Inceptisols generally form on young, but not recent, land surfaces.

Mollisols are mineral soils that have high base saturation and a dark surface horizon that is at least 10 inches thick.

Ultisols are soils that have a clay-enriched B horizon that is low in base saturation.

SUBORDERS. Each order is divided into suborders, primarily on the basis of those soil characteristics that seem

TABLE 8.—*Classification of soil series of Spencer County*

Series	Family	Subgroup	Order
Alford	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Algiers [1]	Fine-loamy, mixed, nonacid, mesic	Aquic Udifluvents	Entisols.
Atkins [2]	Fine-silty, mixed, acid, mesic	Fluventic Haplaquepts	Inceptisols.
Bartle	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols.
Cuba [3]	Fine-silty, mixed, mesic	Fluventic Dystrochrepts	Inceptisols.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Ginat	Fine-silty, mixed, mesic	Typic Fragiaqualfs	Alfisols.
Haymond [4]	Coarse-silty, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Henshaw	Fine-silty, mixed, mesic	Aquic Hapludalfs	Alfisols.
Hosmer	Fine-silty, mixed, mesic	Typic Fragiudalfs	Alfisols.
Huntington	Fine-silty, mixed, mesic	Fluventic Hapludolls	Mollisols.
Huntington, sandy variant.	Coarse-loamy, mixed, mesic	Fluventic Hapludolls	Mollisols.
Iona	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Johnsburg	Fine-silty, mixed, mesic	Aquic Fragiudults	Ultisols.
Lindside	Fine-silty, mixed, mesic	Aquic Fluventic Eutrochrepts	Inceptisols.
Markland	Fine, mixed, mesic	Typic Hapludalfs	Alfisols.
McGary	Fine, mixed, mesic	Aeric Ochraqualfs	Alfisols.
Montgomery	Fine, mixed, noncalcareous, mesic	Typic Haplaquolls	Mollisols.
Newark	Fine-silty, mixed, nonacid, mesic	Aeric Fluventic Haplaquepts	Inceptisols.
Pekin	Fine-silty, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Philo [5]	Coarse-loamy, mixed, mesic	Aquic Fluventic Dystrochrepts	Inceptisols.
Princeton	Fine-loamy, mixed, mesic	Typic Hapludalfs	Alfisols.
Ragsdale	Fine-silty, mixed, noncalcareous, mesic	Typic Argiaquolls	Mollisols.
Rahm [6]	Fine-silty, mixed, mesic	Aquic Fluventic Eutrochrepts	Inceptisols.
Sciotoville	Fine-loamy, mixed, mesic	Aquic Fragiudalfs	Alfisols.
Stendal	Fine-silty, mixed, acid, mesic	Aeric Fluventic Haplaquepts	Inceptisols.
Tilsit	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols.
Uniontown	Fine-silty, mixed, mesic	Typic Hapludalfs	Alfisols.
Vincennes	Fine-loamy, mixed, acid, mesic	Typic Haplaquepts	Inceptisols.
Wakeland	Coarse-silty, mixed, nonacid, mesic	Aeric Fluventic Haplaquepts	Inceptisols.
Weinbach	Fine-silty, mixed, mesic	Aeric Fragiaqualfs	Alfisols.
Wellston	Fine-silty, mixed, mesic	Ultic Hapludalfs	Alfisols.
Wheeling	Fine-loamy, mixed, mesic	Ultic Hapludalfs	Alfisols.
Wilbur	Coarse-silty, mixed, mesic	Aquic Fluventic Eutrochrepts	Inceptisols.
Woodmere	Fine-silty, mixed, mesic	Dystric Fluventic Eutrochrepts	Inceptisols.
Zanesville	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols.
Zipp	Fine, mixed, nonacid, mesic	Typic Haplaquepts	Inceptisols.

[1] In this county the Algiers series is dominantly a member of the fine-silty, mixed, nonacid, mesic family of Aeric Fluventic Haplaquepts.
[2] After this survey and the soil map had been prepared for publication, the soils correlated as Atkins were reclassified as Bonnie.
[3] In this county this soil is borderline coarse-silty.
[4] Along the Anderson River this soil has a higher content of sand than is normal for the series, but this difference does not alter its usefulness and behavior.
[5] In this county this soil is dominantly coarse-silty.
[6] In this county the Rahm series is dominantly a member of the fine-silty, mixed, nonacid, mesic family of Aeric Fluventic Haplaquepts.

to produce classes having the greatest genetic similarity. Suborders narrow the broad climatic range of the orders. The soil properties used to distinguish suborders are mainly those that reflect the presence or absence of waterlogging or soil differences that result from the effects of climate or vegetation.

GREAT GROUPS. The suborders are divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used as a basis for distinguishing between great groups are those in which (1) clay, iron, or humus have accumulated; (2) a pan has formed that interferes with growth of roots, movement of water, or both; or (3) a thick, dark-colored surface horizon has formed. The other features commonly used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), or the dark-red or dark-brown colors associated with soils formed in material weathered from basic rock.

SUBGROUPS. Great soil groups are divided into subgroups. One of these represents the central, or typic, segment of the group. Other subgroups, called intergrades, have properties of the group but have one or more properties of another great group, suborder, or order. Subgroups may also be made for soils that have properties that intergrade outside the range of any other great group, suborder, or order.

FAMILIES. Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and temperature that are used to differentiate families.

SERIES. The series is a group of soils that formed from a particular kind of parent material and have major horizons that, except for the texture of the surface layer, are similar in important characteristics and in arrangement in the profile. The soils are given the name of a geographic location near the place where that series was first observed and mapped.

Additional Facts About the County

This section discusses the climate and the water supply in Spencer County and gives some facts about the farming.

Climate [5]

The climate of Spencer County is fairly mild. Temperatures exceed 90° on a few days in summer and drop below zero on a few days in winter. Nevertheless, on many days the temperature in the county is nearly ideal. The weather changes every few days in spring and, to a lesser extent, late in summer and early in fall because of passing fronts and associated centers of low and high air pressure. Rainfall generally is adequate for the crops grown. Table 9 gives monthly and yearly average temperatures, precipitation data, and other climatic data representative of the county.

Climatic data for Spencer County are based on observations made at Tell City, which is outside the county along the Ohio River. The data are considered representative of Spencer County. The temperature of the bottom lands in the southern part of the county and that of the uplands in the northern part is likely to differ by one or two degrees. Precipitation differences, however, are negligible.

Precipitation is evenly distributed throughout the year, but rainfall in spring and early in summer generally is greater than precipitation in winter. One or two periods of drought occur about every other summer. Nevertheless, enough rain generally falls in spring to insure nearly maximum soil moisture in summer, when evaporation exceeds rainfall, especially in soils that have low available moisture capacity. About one-third of the annual rainfall flows into streams and out of the area. Future needs of the county, however, are likely to make it necessary to apply measures that will conserve this water.

Snowfall varies greatly from year to year. The heaviest snow storms come from the southwest.

[5] By L. A. SCHAAL, State climatologist, National Weather Service, U.S. Department of Commerce.

The prevailing direction of the wind generally is from the southwest, but for one or two months in winter it is from the northwest. Only three tornadoes have been reported in the county since 1916. Thunderstorms accompanied by lightning and thunder occur on about 50 days of the year. Most of these storms are in spring and early in summer, but they seldom cause loss of life or damage to property and crops.

The growing season, or the period between the last 32° F. temperature in spring and the first in fall, averages about 198 days. It is 215 days or longer in 10 percent of the years, 207 days or longer in 25 percent of the years, less than 189 days in 25 percent of the years, and less than 181 days in 10 percent of the years. The probabilities of the last occurrence of specified temperatures in spring and the first in fall are shown in table 10.

Water Supply

More than 60 percent of the acreage of Spencer county has low potential as a source of underground water. The potential is especially low for areas of soil on uplands that are underlain by stratified shale and sandstone. Soils of the Weinbach-Wheeling association on terraces of the Ohio River are the main source of underground water for domestic use. Water collected for domestic use is stored in cisterns and in farm ponds.

Dale Lake is a source of water for the cities and smaller communities in the northern part of the county. The Ohio River is a source of water for industries and municipalities in the southern part of the county.

Water in Strip mines and pits, farm ponds, lakes, and the Ohio River is used for recreational purposes.

Farming

The economy of Spencer County is based mainly on farming. The county has few supporting industries other than those of wood products, petroleum, and coal.

In 1964, according to the U.S. Census of Agriculture, 200,754 acres, or 79.2 percent of the land area of the county, was in farms. Of this, 50.2 percent, or 100,771 acres was cropland, and about 14 percent, or 28,010 acres, was wooded. Wetness in varying degrees is a limitation to use on about 58 percent of the cropland, and erosion is a hazard on a little more than 33⅓ percent. Cropland used only for pasture amounted to 20,443 acres, but 5,440 acres of woodland was used as pasture, and land other than woodland and cropland used as pasture amounted to 15,456 acres. Thus, the total area pastured amounted to 41,339 acres.

In general, high management practices and advances in technology have contributed to increased crop yields. In 1964, the U.S. Census of Agriculture reported that 2,147,916 bushels of corn were harvested from 35,325 acres of cropland, 678,918 bushels of soybeans from 30,195 acres of cropland, and 424,529 bushels of wheat from 13,985 acres of cropland.

Table 9.—*Temperature*

[Based on records kept at

Month	Temperature				
	Average daily maximum	Average daily minimum	Monthly average	Record high	Record low
	°F.	°F.	°F.	°F.	°F.
January	43.3	25.6	34.5	79	−13
February	47.5	28.1	37.8	77	−8
March	55.6	34.9	45.3	88	1
April	67.9	45.2	56.6	91	26
May	78.5	54.3	66.4	97	30
June	87.0	63.8	75.4	102	42
July	94.4	67.1	78.8	105	47
August	89.6	65.5	77.7	104	46
September	83.4	57.7	70.6	106	31
October	74.2	47.2	60.7	96	21
November	57.1	36.1	46.6	86	0
December	46.0	28.0	37.0	74	−3
Year	68.7	46.1	57.3	106	−13

[1] Based on 13-year period.
[2] Based on 10-year period.

Table 10.—*Probability of specified temperatures in spring and in fall*

[Data based on a 25-year period. Average dates on which the specified temperatures occur are those for 1 year in 2 later than and 1 year in 2 earlier than]

Probability	Dates for given probability and temperature				
	32° or lower	28° or lower	24° or lower	20° or lower	16° or lower
Spring:					
1 year in 10 later than	April 23	April 13	March 24	March 23	March 21
1 year in 4 later than	April 17	April 6	March 17	March 14	March 10
1 year in 2 later than	April 11	March 28	March 10	March 3	February 26
3 years in 4 later than	April 5	March 19	March 3	February 20	February 14
9 years in 10 later than	March 30	March 12	February 24	February 11	February 3
Fall:					
1 year in 10 earlier than	October 12	October 21	October 22	November 15	November 20
1 year in 4 earlier than	October 19	October 27	October 30	November 24	November 28
1 year in 2 earlier than	October 26	November 3	November 9	December 3	December 7
3 years in 4 earlier than	November 13	November 9	November 18	December 12	December 16
9 years in 10 earlier than	November 10	November 15	November 26	December 21	December 24

and precipitation data

Tell City, 1939–63]

Temperature—Continued				Precipitation					
Average number of days with—				Average total	Greatest [1] daily	Snow, sleet			Average number of days with precipitation of 0.10 in. or more [2]
Maximum temperature of—		Minimum temperature of—				Average monthly	Maximum monthly	Greatest daily	
90° F. or above	32° F. or below	32° F. or below	0° or below						
					Inches	*Inches*	*Inches*	*Inches*	
0	6	23	1	4.07	2.33	3.2	9.0	7.0	6
0	3	20	(3)	3.86	2.19	2.9	12.2	7.0	8
0	1	14	0	4.91	6.81	1.9	20.0	9.0	7
(3)	0	3	0	3.90	4.05	(4)	(4)	1.0	6
3	0	(3)	0	4.64	3.75	0	0	0	8
12	0	0	0	4.38	4.56	0	0	0	7
18	0	0	0	3.81	2.82	0	0	0	7
17	0	0	0	3.46	6.24	0	0	0	5
8	0	(3)	0	3.04	2.80	0	0	0	4
1	0	1	0	2.21	2.65	0	0	0	5
0	1	12	(3)	3.48	3.62	.6	7.5	5.0	6
0	4	22	(3)	2.99	1.44	2.2	8.6	3.0	5
59	15	95	1	44.75	6.81	10.8	20.0	9.0	74

[3] Less than one-half day.
[4] Trace.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus: The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope. The number of feet of fall per 100 feet of horizontal distance. Expressed as—

	Percent		*Percent*
Nearly level	0 to 2	Strongly sloping	12 to 18
Gently sloping	2 to 6	Steep	18 to 25
Sloping	6 to 12	Very steep	25 or more

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (verical axis of aggregates longer than horizontal, *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular.* Structureless soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit or to a woodland group read the introduction it is in for general information about its management. For facts about recreation turn to the section beginning on p. 49. Other information is given in tables as follows:

Acreage and extent, table 1, p. 6.
Predicted yields, table 2, p. 40.
Wildlife, table 3, p. 45.

Engineering uses of the soils, tables 5, 6, and 7, pp. 54 through 69.

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group	
			Symbol	Page	Number	Page
AfA	Alford silt loam, 0 to 2 percent slopes	7	I-1	34	1	42
AfB2	Alford silt loam, 2 to 6 percent slopes, eroded	7	IIe-3	34	1	42
AfB3	Alford silt loam, 2 to 6 percent slopes, severely eroded	7	IIIe-3	36	1	42
AfC2	Alford silt loam, 6 to 12 percent slopes, eroded	7	IIIe-3	36	1	42
AfC3	Alford silt loam, 6 to 12 percent slopes, severely eroded	7	IVe-3	37	1	42
AfD2	Alford silt loam, 12 to 18 percent slopes, eroded	7	IVe-3	37	1	42
AfD3	Alford silt loam, 12 to 18 percent slopes, severely eroded	7	VIe-1	38	1	42
AfE	Alford silt loam, 18 to 25 percent slopes	8	VIe-1	38	2	43
AfF	Alford silt loam, 25 to 35 percent slopes	8	VIe-1	38	2	43
Ag	Algiers silt loam	8	IIw-1	35	11	44
Ak	Atkins silt loam	9	IIIw-10	37	11	44
Ba	Bartle silt loam	9	IIw-3	35	5	43
Cu	Cuba silt loam	10	I-2	34	8	43
GmF	Gilpin-Wellston silt loams, 25 to 35 percent slopes	10	VIIe-1	38	10	43
Gn	Ginat silt loam	11	IIIw-12	37	11	44
Go	Gullied land, loess	11	VIIe-2	39	3	43
Gs	Gullied land, shale	11	VIIe-2	39	14	44
Ha	Haymond silt loam	12	I-2	34	8	43
He	Henshaw silt loam	12	IIw-2	35	5	43
HoB2	Hosmer silt loam, 2 to 6 percent slopes, eroded	13	IIe-7	35	9	43
HoB3	Hosmer silt loam, 2 to 6 percent slopes, severely eroded	13	IIIe-7	36	9	43
HoC2	Hosmer silt loam, 6 to 12 percent slopes, eroded	13	IIIe-7	36	9	43
HoC3	Hosmer silt loam, 6 to 12 percent slopes, severely eroded	13	IVe-7	38	9	43
Ht	Huntington fine sandy loam, sandy variant	14	I-2	34	8	43
Hu	Huntington silt loam	14	I-2	34	8	43
IoA	Iona silt loam, 0 to 2 percent slopes	15	I-1	34	1	42
IoB2	Iona silt loam, 2 to 6 percent slopes, eroded	15	IIe-3	34	1	42
JoA	Johnsburg silt loam, 0 to 2 percent slopes	16	IIw-3	35	5	43
Ls	Lindside silt loam	16	I-2	34	8	43
Md	Made land and Pits	16	VIIe-2	39	16	44
MkB2	Markland silt loam, 2 to 6 percent slopes, eroded	17	IIIe-11	36	18	44
MkC2	Markland silt loam, 6 to 12 percent slopes, eroded	17	IVe-11	38	18	44
MkD2	Markland silt loam, 12 to 18 percent slopes, eroded	17	VIe-1	38	18	44
MkE	Markland silt loam, 18 to 25 percent slopes	17	VIe-1	38	18	44
MlB3	Markland silty clay loam, 2 to 6 percent slopes, severely eroded	17	IVe-11	38	18	44
MlC3	Markland silty clay loam, 6 to 12 percent slopes, severely eroded	17	VIe-1	38	18	44
MlD3	Markland silty clay loam, 12 to 18 percent slopes, severely eroded	17	VIIe-1	38	18	44
Mr	McGary silt loam	18	IIIw-6	37	5	43
Ms	Montgomery silty clay loam	19	IIIw-2	37	11	44
Ne	Newark silt loam	19	IIw-7	36	13	44
PeA	Pekin silt loam, 0 to 2 percent slopes	20	IIw-5	36	9	43
PeB2	Pekin silt loam, 2 to 6 percent slopes, eroded	20	IIe-7	35	9	43
Ph	Philo silt loam	20	I-2	34	8	43
PrB2	Princeton fine sandy loam, 2 to 6 percent slopes, eroded	21	IIe-3	34	2	43
PrD2	Princeton fine sandy loam, 6 to 18 percent slopes, eroded	21	IIIe-3	36	2	43
Ra	Ragsdale silt loam	22	IIw-1	35	11	44
Rh	Rahm silt loam	22	IIw-7	36	13	44
ScA	Sciotoville silt loam, 0 to 2 percent slopes	23	IIw-5	36	9	43

Map symbol	Mapping unit	Described on page	Capability unit		Woodland group	
			Symbol	Page	Number	Page
ScB2	Sciotoville silt loam, 2 to 6 percent slopes, eroded	23	IIe-7	35	9	43
Sn	Stendal silt loam	23	IIw-7	36	13	44
St	Strip mines	24	VIIe-2	39	16	44
TsA	Tilsit silt loam, 0 to 2 percent slopes	24	IIw-5	36	9	43
TsB2	Tilsit silt loam, 2 to 6 percent slopes, eroded	25	IIe-7	35	9	43
TsB3	Tilsit silt loam, 2 to 6 percent slopes, severely eroded	25	IIIe-7	36	9	43
UnA	Uniontown silt loam, 0 to 2 percent slopes	25	I-1	34	1	42
UnB2	Uniontown silt loam, 2 to 6 percent slopes, eroded	25	IIe-3	34	1	42
UnB3	Uniontown silt loam, 2 to 6 percent slopes, severely eroded	26	IIIe-3	36	1	42
UnC2	Uniontown silt loam, 6 to 12 percent slopes, eroded	26	IIIe-3	36	1	42
UnC3	Uniontown silt loam, 6 to 12 percent slopes, severely eroded	26	IVe-3	37	1	42
UnE2	Uniontown silt loam, 12 to 25 percent slopes, eroded	26	VIe-1	38	2	43
Vn	Vincennes silt loam	26	IIw-1	35	11	44
Wa	Wakeland silt loam	27	IIw-7	36	13	44
WbA	Weinbach loam, 0 to 2 percent slopes	28	IIw-3	35	5	43
WcA	Weinbach silt loam, 0 to 2 percent slopes	28	IIw-3	35	5	43
WeB	Wellston silt loam, 2 to 6 percent slopes	28	IIe-3	34	10	43
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded	28	IIIe-3	36	10	43
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded	28	IVe-3	37	10	43
WeD2	Wellston silt loam, 12 to 18 percent slopes, eroded	29	IVe-3	37	10	43
WeD3	Wellston silt loam, 12 to 18 percent slopes, severely eroded	29	VIe-1	38	10	43
WeE2	Wellston silt loam, 18 to 25 percent slopes, eroded	29	VIe-1	38	10	43
WeE3	Wellston silt loam, 18 to 25 percent slopes, severely eroded	29	VIe-1	38	10	43
WhA	Wheeling loam, 0 to 2 percent slopes	29	I-1	34	1	42
WhB2	Wheeling loam, 2 to 6 percent slopes, eroded	30	IIe-3	34	1	42
WhB3	Wheeling loam, 2 to 6 percent slopes, severely eroded	30	IIIe-3	36	1	42
WhC2	Wheeling loam, 6 to 12 percent slopes, eroded	30	IIIe-3	36	1	42
WhC3	Wheeling loam, 6 to 12 percent slopes, severely eroded	30	IVe-3	37	1	42
WlA	Wheeling silt loam, 0 to 2 percent slopes	30	I-1	34	1	42
Wr	Wilbur silt loam	31	I-2	34	8	43
Ws	Woodmere silt loam	31	I-2	34	8	43
ZaB2	Zanesville silt loam, 2 to 6 percent slopes, eroded	32	IIe-7	35	9	43
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded	32	IIIe-7	36	9	43
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	32	IVe-7	38	9	43
ZaD2	Zanesville silt loam, 12 to 18 percent slopes, eroded	32	IVe-7	38	9	43
ZaD3	Zanesville silt loam, 12 to 18 percent slopes, severely eroded	32	VIe-1	38	9	43
Zp	Zipp silty clay loam	33	IIIw-2	37	11	44

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