

SOIL SURVEY

Paulding County Ohio



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
OHIO DEPARTMENT OF NATURAL RESOURCES
and
OHIO AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY of Paulding County will help you plan the kind of farming system that will maintain and protect your soils and provide good yields. It describes the soils, shows their location, and tells what they will do under different kinds of management.

Find your property on the map

To use this survey, start by finding your farm on the soil map that is at the back of this report. This is a large map of the county, on which you can see roads, streams, towns, and other landmarks. The index to map sheets will help you locate your acreage; it shows what part of the county is on each sheet of the soil map. The guide to mapping units at the end of the report will simplify the use of the map and the report. The guide gives the map symbol for each soil, the name of the soil, the page on which the soil is described, the capability unit in which the soil has been placed, and the page where the capability unit is described.

Know about your soils

Each kind of soil mapped in the county is identified on the soil map by a symbol.

Suppose you have found an area marked with the symbol Pa. You learn the name of the soil this symbol represents by looking at the map legend. The symbol Pa identifies Paulding clay. To learn how this soil looks in the field and what it can be used for, turn to the section, Descriptions of the Soils, and read the description of Paulding clay.

After you have read the description of the

soil, you may want to know what should be done to take care of the soil and get good yields. This problem is discussed in the section, Use and Management of Soils. This section also suggests some methods for general management of the soils, and lists groups of soils for special purposes. There is a short section on use of soils for roads and buildings. To find out the yields that can be expected on each soil, turn to table 7, under the heading, Estimated Yields.

Make a farm plan

Study your soils to see whether you have been cultivating any that do not give good yields or may be damaged by cropping or allowed to deteriorate. Then decide whether you need to change your methods. The choice, of course, must be yours. This report is planned to help you, but it does not offer a plan of management for any particular farm. Technical help in planning a conservation program can be obtained from representatives of the Soil Conservation Service and the county agricultural agent. Members of your State experiment station staff and others familiar with farming in your county will also be glad to help you.

This soil survey was made as part of the technical assistance furnished to the Paulding Soil Conservation District. Most of the field survey work was done by the Division of Lands and Soils of the Ohio Department of Natural Resources.

Fieldwork for the survey was finished in 1954. Unless otherwise specified, all statements in the report refer to conditions in the county at the time the fieldwork was in progress.

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SOIL SURVEY OF PAULDING COUNTY, OHIO

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General Nature of the County

Location and Extent

Paulding County is in the northwestern part of Ohio (fig. 1). Its western border is formed by the State of Indiana. It consists of 12 sectionalized townships, most of which are 6 miles square. The county is in the nearly level lake plain of northwest Ohio. Most of the soils are clayey and poorly drained. The county has an approximate area of 416 square miles, or 266,240 acres. Paulding, the county seat, is near the center of the county.

Agriculture

Prior to the coming of the white man, Indian tribes occupied some of the better drained sites along the streams. They practiced very limited and crude agriculture and lived primarily by hunting and fishing. The first white family settled on the east bank of the Auglaize River in 1819. Later, a few settlements were made along the major drainageways, but vast areas remained in forest for many years (4).¹

Agriculture was not developed extensively in Paulding County until methods were devised for draining the extensive areas of wet, level land. As late as 1874, about 89 percent of the county was classified as "uncultivated or woodland" (19). In 1886 it was considered the "wildest" (most uninhabited) county in the State (4).

Through the latter half of the nineteenth century many of the settlers were engaged in manufacturing lumber and in smelting iron ore. In 1880 the population reached a total of 13,485. It has varied little from that time; the United States Census recorded 15,047 inhabitants in 1950.

In the 1880-90 period, the farmers began to build drainage ditches and to install tile drains. This practice freed the last major virgin areas of land for cultivation.

¹ Numbers in parentheses indicate Literature Cited, p. 93.



Figure 1.—Location of Paulding County in Ohio.

The clearing and draining of land continued for several decades, or until a large part of the county was in crops. Even today, some woodlots are being cleared, drained, and brought under cultivation for the first time, but these areas are small in extent.

The dominant trees in the original forest consisted of water-tolerant species, such as oak, elm, hickory, eastern cottonwood, red and silver maple, ash, and American basswood. Vast quantities of timber were sawed into barrel staves and lumber or were burned to produce charcoal for the two iron furnaces located in the county. Very little good timber now remains.

Paulding County is classified as rural. It has no cities over 2,500 population. It is in an area of the State where there are few large cities; consequently, the markets for milk and poultry are limited. The lack of suitable markets has resulted in a trend away from livestock farming toward production of grain, which is more convenient to market. According to the 1949 census, 60.9 percent of the farms are cash-grain units.

More than 95 percent of the land in Paulding County is suited to the production of crops if suitable drainage is provided and the land is well managed. According to the 1954 census, 89 percent of the cropland harvested was in corn, wheat, oats, or soybeans, and 11 percent was in meadow or rotation pasture. Tables 1 and 2, based on data from the Federal census, show the trends in crop production.

TABLE 1.—*Acreage of the principal crops in stated years*

Crop	1939	1949	1954
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
Corn for all purposes.....	57, 653	42, 435	44, 541
Wheat threshed or combined.....	15, 144	36, 715	26, 304
Oats threshed or combined.....	28, 123	29, 950	22, 444
Soybeans grown for all purposes.....	36, 441	49, 274	61, 043
Alfalfa hay.....	9, 123	5, 245	6, 804
Other hay.....	10, 133	8, 724	12, 932
Other crops.....	9, 193	10, 828	9, 101
Cropland harvested.....	165, 810	183, 171	183, 169

TABLE 2.—*Acreages in farms, by use, in stated years*

Use	1939	1949	1954
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
Cropland, total.....	183, 757	206, 919	203, 631
Cropland harvested.....	165, 810	183, 171	183, 169
Cropland not harvested and not pastured.....	14, 766	14, 752	12, 837
Cropland used only for pasture.....	(¹)	8, 996	7, 625
Woodland.....	13, 973	19, 695	17, 220
Woodland pastured.....	(¹)	11, 110	8, 890
Woodland not pastured.....	(¹)	8, 585	8, 330
Other land (house lots, roads, waste- land).....	20, 459	10, 711	10, 688
Other pasture (not cropland and not woodland).....	27, 249	8, 624	7, 383
Land in farms.....	245, 438	245, 949	238, 922

¹ Not reported.

With the change to more cash-grain farming, the number of livestock raised has shown a general decrease since 1940. The number of turkeys raised, however, has increased considerably. The trends in livestock production on farms in Paulding County are shown in table 3.

Many farms are being combined with other farms to form larger units. The number of farms decreased from 1,509 in 1949 to 1,357 in 1954. The average acreage per farm unit increased from 163 in 1949 to 176 in 1954. Nearly all of the county is well suited to heavy power machinery. With machines, one or two men can operate many acres under a cash-grain system.

TABLE 3.—*Number of livestock on farms in stated years*

Livestock	1940	1950	1954
	<i>Number</i>	<i>Number</i>	<i>Number</i>
Cattle and calves.....	¹ 10, 564	9, 504	9, 479
Hogs and pigs.....	² 14, 468	11, 142	7, 704
Sheep and lambs.....	³ 9, 102	5, 629	5, 763
Chickens.....	² 138, 530	² 93, 867	² 96, 377
Turkeys raised.....	6, 015	15, 481	22, 747

¹ Over 3 months old.

³ Over 6 months old.

² Over 4 months old.

In places some part-time farming is combined with industrial employment. This practice is most common among farmers who have had crop failures on the very fine textured soils.

Climate

The continental climate is characterized by moderately cold winters and warm summers. The winters are often cold with considerable snowfall. In summer there are oppressive, hot, humid periods, usually of short duration. Moderate amounts of rain are fairly well distributed during the year. During the growing season less precipitation occurs late in summer and early in fall, and droughts sometimes occur in these seasons.

Temperature, precipitation, and sunshine are climatic factors that control crop production. Data on the normal monthly, seasonal, and annual temperature and precipitation at the United States Weather Bureau Station at Paulding are given in table 4.

Temperatures are much the same over the county. Almost every summer the temperature ranges between 90° and 100° F. for several days. Usually the temperature change from one season to another is gradual. Crops are seldom damaged by frosts late in spring or early in fall. A 15-year record shows that the average date of the last killing frost in spring is May 7 and that of the first killing frost is October 5. This record shows an average frost-free period of 151 days, with the latest and earliest dates of killing frost on May 25 and September 11, respectively.

The growing season is usually long enough for field crops to mature. The grazing period begins in April and continues into September.

The average annual rainfall is 34.12 inches, about half of which falls during the growing season. The distribution of rain, particularly in the spring, has a marked effect on seedbed preparation and the subsequent crop. Most of the soils are clays that can be cultivated only in a rather narrow range of moisture content. Thus, excessive spring rains and poor drying conditions can result in poor stands or complete crop failure. Normally, during the rest of the growing season droughts and excessive rainfall are not common. Nevertheless, near-drought conditions may be approached during late summer and early fall. This stimulates some interest in irrigation.

Often the snowfall is enough to protect the soil from severe freezes. Under snow cover, the injurious effects of severe freezing and heaving are reduced. Fall-sown small grains, clover, and alfalfa are particularly subject

TABLE 4.—*Temperature and precipitation at Paulding, Paulding County, Ohio*

[Elevation, 720 feet]

Month	Temperature ¹			Precipitation ²			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1953)	Wettest year (1929)	Average snow-fall
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	29.0	67	-24	2.54	1.54	3.38	5.5
January.....	26.2	70	-23	2.44	2.36	4.36	6.2
February.....	26.5	69	-20	1.85	1.15	1.21	5.7
Winter.....	27.2	70	-24	6.83	5.05	8.95	17.4
March.....	38.0	85	-13	3.14	3.38	3.04	3.6
April.....	48.9	91	10	3.11	3.24	6.06	.8
May.....	59.5	99	24	3.58	2.80	5.50	.1
Spring.....	48.8	99	-13	9.83	9.42	14.60	4.5
June.....	68.9	106	34	3.84	2.69	4.66	.0
July.....	73.6	111	41	3.04	1.88	3.58	0
August.....	71.7	106	34	2.61	2.06	2.07	0
Summer.....	71.4	111	34	9.49	6.63	10.31	0
September.....	65.5	102	24	2.98	1.82	3.25	0
October.....	53.0	92	7	2.46	.63	5.57	.2
November.....	40.3	80	-3	2.53	1.28	2.76	1.9
Fall.....	52.9	102	-3	7.97	3.73	11.58	2.1
Year.....	50.1	111	-24	34.12	24.83	45.44	24.0

¹ Average temperature based on a 60-year record, through 1955; highest temperature on a 56-year record and lowest temperature on a 57-year record, through 1952.

² Average precipitation based on a 65-year record, through 1955; wettest and driest years based on a 57-year record, in the period 1894-1955; snowfall based on a 52-year record, through 1952.

to heaving if the soil freezes and is not covered with snow.

Hailstorms occur occasionally during the summer, but the damage to crops, as a rule, is not severe over large areas. Hailstorms usually are local.

The prevailing winds and weather fronts move across the county from the southwest to the northeast. These fronts move with considerable frequency and cause many changes in the weather.

Water Supply

Paulding County is in the glacial lake plain of northwestern Ohio (14). The county is underlain by limestone or dolomite bedrock, most of which contains only a fair supply of potable water. The Tymochtee and Greenfield formations of dolomitic stone form the bedrock under more than half of the southern part of the county. They yield fair supplies of water at shallow depths. All the deep-seated waters are charged with hydrogen sulfide or pyritic compounds.

Along the northern edge of the county, the underlying formation of Delaware limestone is too hard and

dense to provide a good source of water. It is highly charged with pyrite, which causes the small amount of water in it to be of poor quality.

Columbus limestone is the bedrock south of the Delaware limestone and north of the Tymochtee dolomite. Its southern edge crosses the county in an east-west direction just north of Paulding, Charloe, and Oakwood. Columbus limestone yields a fair amount of good water.

The moderately thick deposits of glacial drift contain water-bearing lenses of sand and gravel in some places. In these areas the water may be enough for local use but not for irrigation and industrial purposes. The supply is not dependable for extended use.

The Maumee and Auglaize Rivers, and several of the larger tributary streams, can provide enough water for the present and future needs of the neighboring towns, as well as for irrigation and industrial uses. The flow of water in the streams is irregular, however, and storage basins or tanks should be built on the higher ground to impound the water during periods of heavy flow along Flatrock Creek, Blue Creek, Gordon Creek, the Little Auglaize River, and other tributary streams. With a well-developed storage system, these streams would furnish large quantities of water for many uses.

Practically all needs for water (exclusive of irrigation) on farms and in small villages can be supplied by wells and cisterns. These sources are usually adequate for year-round household use, except during extremely dry weather.

There are a few artesian wells in the northwestern part of Carryall Township. In this area there is an abundant source of water in the gravel strata in the lower part of the glacial drift.

For those who cannot obtain an adequate water supply from cisterns, wells, or streams, a small pond or reservoir will furnish a potential source. For the farmer who wants to irrigate, the farm pond or reservoir may be the only solution to his problem. These storage basins can be constructed (1) in natural sites where water can be caught from a watershed located above the pond, or (2) on level tracts where water from heavy rains can be pumped from a nearby stream or tile mains into a shallow depression.

Table 5 gives the present and potential sources of water available to towns in the county.

Transportation

The county has a complete network of county, State, and Federal highways. Several railroads cross the county and provide facilities for shipping freight. There are no waterways suitable for shipping, and at present there are no scheduled airline services. Several small landing strips are available for private planes and crop-dusting work.

Industries

The county has several small industries, such as the manufacturing of tile and the quarrying of limestone. These industries do not employ large numbers of people. There is some opportunity, however, for industrial employment in several nearby counties.

TABLE 5.—Water supply of towns in Paulding County, Ohio

Town	Population in 1950	Thickness of glacial drift	Water in glacial drift	Underlying rock formation	Supply of water in underlying rock	Present source	Potential source
		<i>Feet</i>					
Antwerp-----	1,162	40-----	Little-----	Columbus-----	Fair-----	Untreated ground water-----	Maumee River.
Briceton-----	50	30-----	(¹)-----	Tymochtee (Monroe group)-----	Fair-----	Wells-----	Drift and rock.
Broughton-----	128	35 to 45-----	Some-----	Tymochtee (Monroe group)-----	Fair-----	Wells-----	Drift and rock.
Cecil-----	266	40 to 50-----	Some-----	Columbus and Delaware-----	Fair-----	Wells-----	Drift and Maumee River.
Grover Hill-----	463	20 to 25-----	(¹)-----	Greenfield and Tymochtee-----	Fair-----	Wells-----	Underlying rock.
Haviland-----	235	20 to 30-----	(¹)-----	Greenfield (Monroe)-----	Fair-----	Wells-----	Greenfield dolomites.
Junction-----	100	30 to 50-----	(¹)-----	Delaware-----	Poor-----	Wells-----	Columbus limestone and the Auglaize River.
Latty-----	272	25 to 30-----	(¹)-----	Tymochtee (Monroe)-----	Fair-----	Wells-----	Tymochtee dolomites.
Melrose-----	237	40-----	(¹)-----	Tymochtee-----	Fair-----	Wells-----	Tymochtee dolomite and the Little Auglaize River.
Oakwood-----	542	40 to 50-----	(¹)-----	Tymochtee-----	Fair-----	One- to six-inch well, 50 feet deep in drift.	Underlying rock, drift, and the Auglaize River.
Paulding-----	2,352	25 to 45-----	Little-----	Tymochtee-----	Fair-----	Three- to eight-inch wells, 320 to 616 feet deep in dolomite.	Underlying rock and Flat Rock Creek.
Payne-----	1,062	33 to 40-----	(¹)-----	Tymochtee-----	Fair-----	Untreated ground water-----	Underlying rock and Flat Rock Creek.
Scott ² -----	347	20-----	(¹)-----	Greenfield (Monroe group)-----	Fair-----	Wells-----	Underlying rock.

¹ No information.² Located in Van Wert and Paulding Counties.

Community Facilities

The quality of housing is generally good. Most homes have a telephone, electricity, radio, television, and bathrooms. Churches, schools, and granges are well distributed throughout the county.

General Soil Patterns

For convenience in planning community or county programs as they affect land use, conservation practices, and other fieldwork, a general soil map (fig. 2) has been prepared, showing the four major soil areas in the county. Each area has been named for the predominant soil, although it includes other soils than the one for which it is named. The minor soils may be similar to the extensive one, or they may differ from it in many respects. On a map of the scale used, it is not possible to show the smaller areas. Figure 2, therefore, is intended to show only the broad distribution of the soils. It does not provide information for planning a farm layout, soil conservation measures, or similar fieldwork. The

purpose of the general soil map thus differs from that of the detailed soil map in the back of this report.

All four areas are dominated by dark-colored soils, although soils in the Paulding area are somewhat lighter colored than those in the other three areas. The dominant soils in all areas are very poorly drained, and minor soils in each area are imperfectly drained. Thus, the problems of drainage and the maintenance of tilth are important in all four areas.

Production of cash-grain crops is the major type of farming. The principal crops are corn, soybeans, and wheat or oats. If the soil and other conditions are favorable, wheat is planted in fall; otherwise, oats are planted in spring. In the Paulding soil area, less corn and more soybeans are grown than in the other three areas. A few livestock farms are in each area. A discussion of each area follows.

(1) *Hoytville soil area*.—The dominant soils in this area have 40 to 50 percent of clay in the subsoil and underlying till. Most of the land in this area responds well to tile drains. Although the subsoil is fine textured, the soil structure is good and water passes through the solum fairly well. Nevertheless, lateral drains of tile

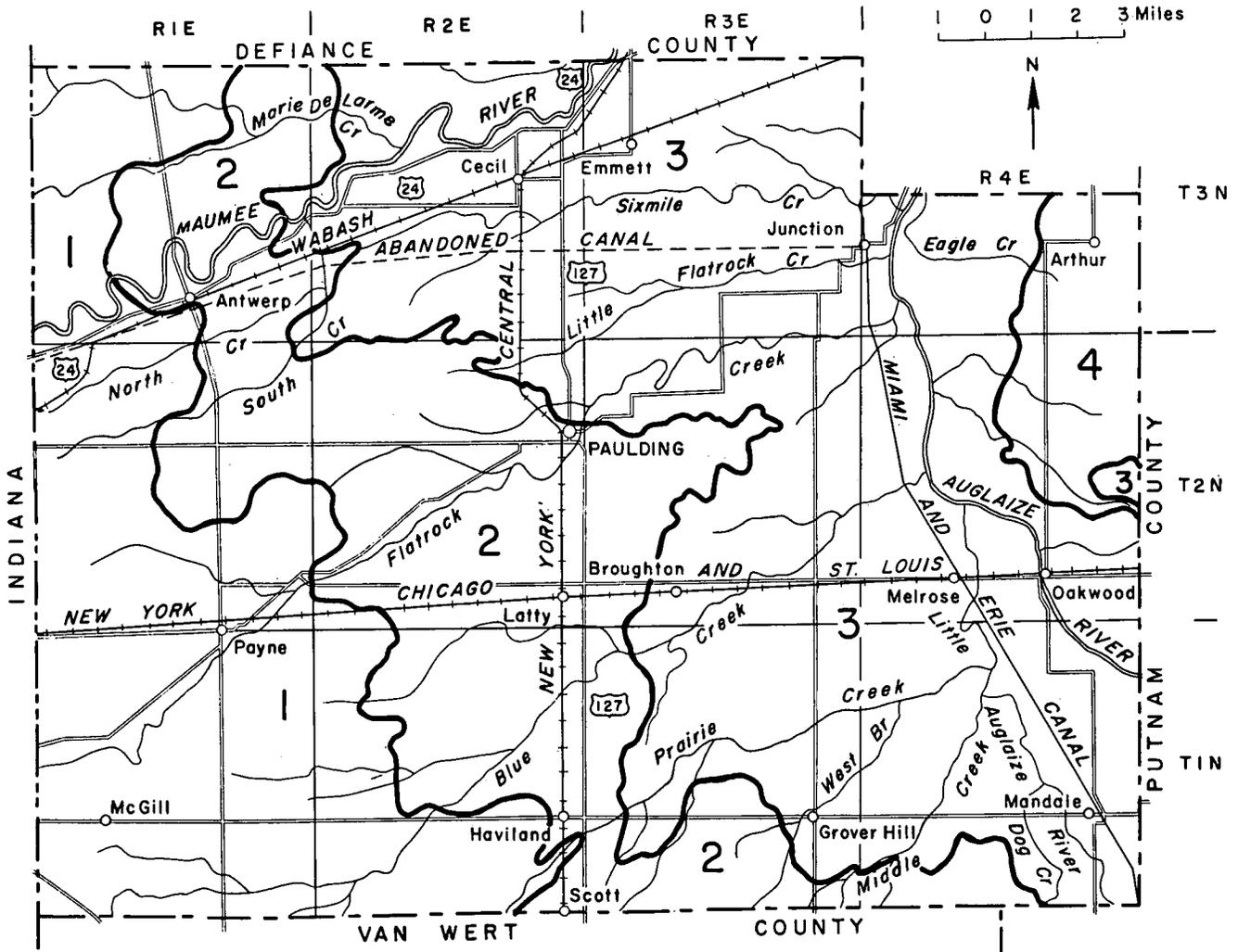


Figure 2.—General soil map: (1) Hoytville soil area, (2) Latty soil area, (3) Paulding soil area, and (4) Toledo soil area.

should be placed fairly close together to remove the large amount of water that stands in the fine-textured Hoytville soils when they become saturated. On the bottom lands near the streams are the Eel, Shoals, Sloan, and Genesee soils. On the sloping areas, particularly along the streams, are the St. Clair and Nappanee soils.

(2) *Latty soil area.*—The principal soils in this area have 50 to 60 percent of clay in the subsoil and are underlain by clay till. The Latty soils are intermediate between soils of the Paulding and Hoytville series. Consequently, their surface soils are somewhat thinner, and they have more clay in the subsoil than soils of the Hoytville series; and the surface soils of the Latty series are thicker and have less clay in the subsoil than those of the Paulding soils. Soils in the Latty area respond fairly well to tile drains, but the maintenance of good soil tilth is a serious problem. Water is removed through drains somewhat more slowly in the Latty area than in the Hoytville area, but a little faster than in the Paulding area. Other included soils are the Eel, Shoals, Sloan, and Genesee soils on the bottom lands, and the St. Clair and Nappanee near the streams just above the flood plains.

(3) *Paulding soil area.*—The dominant soils in this area have 60 to 80 percent of clay in the subsoil and are underlain by lacustrine clay. The soils drain very slowly because of the large amount of clay in the subsoil and the level to nearly level relief. Tile will drain these soils, however, if lateral ditches or drains are placed close together. Soil tilth is also a problem. Paulding soils often become hard and cloddy if they are cropped too intensively or if they are tilled when too wet or cultivated when they are dry and compact. Good rotations help to maintain drainage and to improve the structure of the soil. Surface drains can be used to advantage with tile. Soils on the bottom lands are those of the Eel, Shoals, Defiance, and Wabash series, and on the sloping areas, particularly near the streams, are the Broughton and Roselms soils. Some areas of Rimer soils occur where sand was deposited over the clay.

(4) *Toledo soil area.*—The dominant soils in the Toledo area have 40 to 60 percent of clay in the subsoil and are underlain by lacustrine clay. The dark-colored, very poorly drained Toledo soils that are dominant in this area developed on lacustrine clay; other soils that occupy about a fourth of the area developed in sandy deposits over clay. Some of the soils developed locally in very deep sands. The Toledo soils drain as readily as the Hoytville soils, and the sandy soils in the area drain better. The sandy soils do not need the tile drains spaced so closely if they occur in large areas that can be drained separately from the finer textured soils. A small amount of truck farming is done in this area.

Some of the Fulton and Lucas soils are underlain by lacustrine clay; some Fulton soils, however, have a sandy substratum. The Rimer and Wauseon soils are sandy. The Millgrove soils developed on medium-textured materials over clay till or lacustrine clay.

How a Soil Survey Is Made

The scientist who makes a soil survey examines soils in the field, classifies the soils in accordance with facts

that he observes, and maps their boundaries on aerial photographs or other base maps. A detailed survey of this kind provides the necessary information for comparing the soils of a county with similar soils in a State on which field experiments have been made to test new agricultural practices.

FIELD STUDY.—The soil surveyor bores or digs many holes to see what the soils are like. The holes are not spaced in a regular pattern but are located according to the lay of the land. Normally they are not more than a quarter of a mile apart, and sometimes they are much closer. In most soils each boring or hole reveals several distinct layers, called *horizons*, which collectively are known as the *soil profile*. Each horizon is studied to see how it differs (fig. 3) from others in the profile and

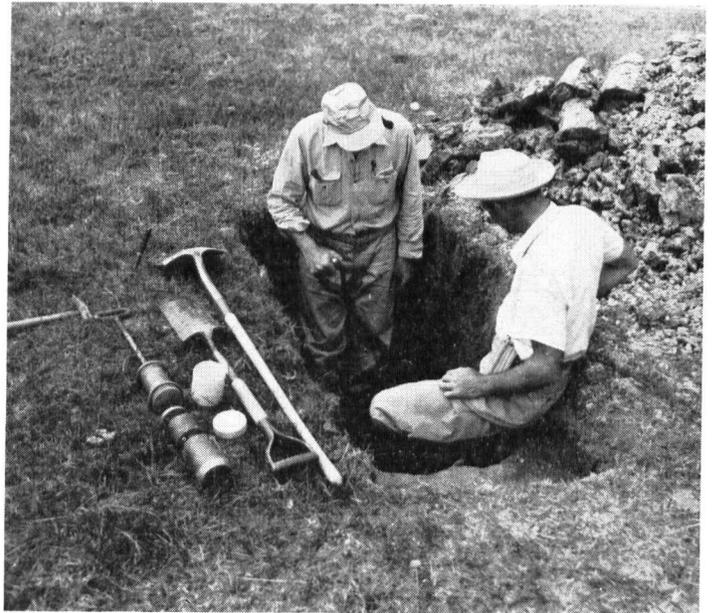


Figure 3.—Profiles of the important soils are studied and sampled. The tool at the left is a core sampler. It is used to take relatively undisturbed samples of the horizons for measurements of pore space and percolation rate.

to learn the things about this soil that influence its capacity to support plant growth.

Color is affected by the amount of organic matter present. The darker the surface soil, as a rule, the more organic matter it contains. Streaks and spots of gray, yellow, and brown in the lower layers generally indicate poor drainage and poor aeration.

Texture, or the amount of sand, silt, and clay, is determined by the way the soil feels when rubbed between the fingers, and it is later checked by laboratory analyses. Texture helps determine how susceptible the soil is to wind erosion; how well it retains moisture, plant nutrients, and fertilizer; and whether it is easy or difficult to cultivate.

Structure, which is the way the individual soil particles are arranged in larger grains, or aggregates, and the amount of pore space between the grains, gives us clues to the ease or difficulty with which the soil is penetrated by water and by plant roots.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation.

Reaction, or the acidity or alkalinity of a soil, is one measure of the need for lime. The reaction is usually expressed as a pH value. Strict neutrality is pH 7.0; higher values indicate alkalinity and lower values acidity (13). The terms that correspond to ranges in pH are as follows:

	<i>pH</i>		<i>pH</i>
Extremely acid.....	Below 4.5.	Mildly alkaline.....	7.4 to 7.8
Very strongly acid..	4.5 to 5.0	Moderately alkaline..	7.9 to 8.4
Strongly acid.....	5.1 to 5.5	Strongly alkaline....	8.5 to 9.0
Medium acid.....	5.6 to 6.1	Very strongly alka-	9.1 and
Slightly acid.....	6.1 to 6.5	line.	higher.
Neutral.....	6.6 to 7.3		

Other characteristics observed in the course of the field study and considered in classifying the soil include the following: The depth of the soil over bedrock or compact layers; the presence of gravel or stones in amounts that will interfere with cultivation; the steepness and pattern of the slopes; the degree of erosion; the height of the water table; and the nature of the material beneath the soil profile.

CLASSIFICATION.—On the basis of the characteristics observed by the soil surveyors or determined by laboratory tests, soils are classified into phases, types, and series. The soil type is the basic classification unit. A soil type may consist of several mapping units. Types that resemble each other in most of their characteristics are grouped into soil series.

Soil type.—Soils similar in kind, thickness, and arrangement of soil layers are classified as one soil type.

Soil phase.—Because of differences other than those of kind, thickness, and arrangement of layers, some soil

types are divided into two or more phases. Slope variations, degree of erosion, or depth of soil over the substratum are examples of characteristics that suggest dividing a soil type into phases.

The soil phase (or the soil type if it has not been subdivided) is the unit shown on the soil map. It is the unit that has the narrowest range of characteristics. Use and management practices, therefore, can be specified more precisely than for soil series or broader groups that contain more variation.

Soil series.—Two or more soil types that differ in texture of the surface layer, but are otherwise similar in kind, thickness, and arrangement of soil layers, are normally designated as a soil series. In a given area, some of the soil series may be represented by only one soil type. Each series is named for a place near which it was first mapped.

Miscellaneous land types.—Areas, such as rough, stony land, that contain little soil are not classified into types and series. Such areas are identified by descriptive names such as Pits, Dumps, and Made land.

Other technical terms.—Definitions of many terms used in the soil survey of Paulding County are given in the glossary at the back of this report.

Soils of the County

The soils of Paulding County are listed in table 6, and the approximate acreage and proportion of the land area of the county covered by each soil are shown. General information about each soil series and detailed information about each of the mapping units are given in the section, Descriptions of the Soils.

TABLE 6.—Acreage and proportionate extent of the soils mapped in Paulding County, Ohio

Soil	Area	Extent	Soil	Area	Extent
	<i>Acres</i>	<i>Percent</i>		<i>Acres</i>	<i>Percent</i>
Belmore loam, 2 to 6 percent slopes, slightly eroded.....	40	(1)	Eel silt loam.....	1,570	0.6
Broughton clay, 6 to 12 percent slopes, severely eroded.....	116	(1)	Eel silty clay loam.....	538	.2
Broughton clay, 12 to 18 percent slopes, severely eroded.....	266	0.1	Fulton fine sandy loam, 0 to 2 percent slopes....	33	(1)
Broughton silty clay loam, 2 to 6 percent slopes, slightly eroded.....	100	(1)	Fulton loam, 0 to 2 percent slopes.....	270	.1
Broughton silty clay loam, 2 to 6 percent slopes, moderately eroded.....	163	.1	Fulton silt loam, 0 to 2 percent slopes.....	780	.3
Broughton silty clay loam, 6 to 12 percent slopes, moderately eroded.....	1,035	.4	Fulton silt loam, 2 to 6 percent slopes, slightly eroded.....	43	(1)
Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded.....	1,584	.6	Fulton silt loam, 2 to 6 percent slopes, moderately eroded.....	42	(1)
Broughton silty clay loam, 18 to 35 percent slopes, moderately or severely eroded.....	1,057	.4	Fulton silt loam, sandy substratum, 0 to 2 percent slopes.....	1,730	.6
Defiance silty clay loam.....	1,921	.7	Fulton silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.....	314	.1
Digby fine sandy loam, 0 to 2 percent slopes....	34	(1)	Fulton silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.....	89	(1)
Digby loam, 0 to 2 percent slopes.....	191	.1	Fulton silty clay loam, 0 to 2 percent slopes....	136	.1
Digby loam, 2 to 6 percent slopes, slightly or moderately eroded.....	48	(1)	Fulton silty clay loam, sandy substratum, 0 to 2 percent slopes.....	201	.1
Digby silt loam, 0 to 2 percent slopes.....	413	.2	Genesee fine sandy loam.....	39	(1)
Digby silt loam, 2 to 6 percent slopes, slightly or moderately eroded.....	119	(1)	Genesee loam.....	186	.1
Eel loam.....	103	(1)	Genesee silt loam.....	670	.3
			Granby fine sandy loam.....	8	(1)
			Haney silt loam and loam, 0 to 2 percent slopes..	22	(1)
			Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded.....	64	(1)

¹ Less than 0.1 percent.

TABLE 6.—*Acreage and proportionate extent of the soils mapped in Paulding County, Ohio—Continued*

Soil	Area	Extent	Soil	Area	Extent
	<i>Acres</i>	<i>Percent</i>		<i>Acres</i>	<i>Percent</i>
Haney silt loam and loam, 6 to 15 percent slopes, moderately eroded.....	27	(¹)	Roselms clay, 0 to 2 percent slopes.....	2,660	1.0
Haskins loam.....	91	(¹)	Roselms fine sandy loam, 0 to 2 percent slopes.....	227	.1
Haskins silt loam.....	166	0.1	Roselms loam, 0 to 2 percent slopes.....	865	.3
Hoytville clay.....	44,015	16.6	Roselms loam, 2 to 6 percent slopes, slightly eroded.....	95	(¹)
Hoytville silt loam.....	38	(¹)	Roselms silt loam, 0 to 2 percent slopes.....	6,944	2.6
Hoytville silty clay loam.....	4,584	1.7	Roselms silt loam, 2 to 6 percent slopes, slightly eroded.....	930	.3
Latty clay.....	51,332	19.4	Roselms silt loam, 2 to 6 percent slopes, moderately eroded.....	615	.2
Latty silty clay loam.....	2,957	1.1	Roselms silty clay loam, 0 to 2 percent slopes.....	13,628	5.1
Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded.....	27	(¹)	Roselms silty clay loam, 2 to 6 percent slopes, slightly eroded.....	524	.2
Lucas silt loam, 6 to 12 percent slopes, moderately eroded.....	42	(¹)	Roselms silty clay loam, 2 to 6 percent slopes, moderately eroded.....	391	.1
Lucas silt loam, 12 to 25 percent slopes, moderately eroded.....	30	(¹)	Ross silt loam.....	45	(¹)
Lucas silt loam, sandy substratum, 0 to 2 percent slopes.....	92	(¹)	Seward fine sandy loam, 0 to 2 percent slopes.....	99	(¹)
Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.....	140	.1	Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded.....	106	(¹)
Lucas silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.....	101	(¹)	Seward fine sandy loam, 6 to 15 percent slopes, slightly eroded.....	10	(¹)
Lucas silt loam, sandy substratum, 6 to 12 percent slopes, moderately eroded.....	130	.1	Seward sandy loam, 2 to 6 percent slopes, slightly eroded.....	78	(¹)
Lucas silt loam, sandy substratum, 12 to 25 percent slopes, moderately or severely eroded.....	180	.1	Shoals silt loam.....	2,092	.8
Mermill loam.....	40	(¹)	Sloan silt loam.....	105	(¹)
Mermill silt loam.....	80	(¹)	Sloan silty clay loam.....	4,364	1.6
Mermill silty clay loam.....	54	(¹)	St. Clair clay, 6 to 12 percent slopes, severely eroded.....	92	(¹)
Millgrove loam.....	259	.1	St. Clair clay, 12 to 18 percent slopes, severely eroded.....	26	(¹)
Millgrove silt loam.....	491	.2	St. Clair clay, 25 to 35 percent slopes, severely eroded.....	231	.1
Millgrove silty clay loam.....	124	.1	St. Clair silt loam, 2 to 6 percent slopes, slightly eroded.....	45	(¹)
Nappanee fine sandy loam, 0 to 2 percent slopes.....	267	.1	St. Clair silt loam, 2 to 6 percent slopes, moderately eroded.....	180	.1
Nappanee loam, 0 to 2 percent slopes.....	337	.1	St. Clair silt loam, 6 to 12 percent slopes, moderately eroded.....	432	.2
Nappanee silt loam, 0 to 2 percent slopes.....	8,489	3.2	St. Clair silt loam, 12 to 18 percent slopes, moderately eroded.....	454	.2
Nappanee silt loam, 2 to 6 percent slopes, slightly eroded.....	595	.2	St. Clair silt loam, 18 to 25 percent slopes, moderately eroded.....	245	.1
Nappanee silt loam, 2 to 6 percent slopes, moderately eroded.....	537	.2	Tedrow loamy fine sand.....	131	.1
Nappanee silty clay loam, 0 to 2 percent slopes.....	9,323	3.5	Toledo loam.....	149	.1
Nappanee silty clay loam, 2 to 6 percent slopes, slightly eroded.....	163	.1	Toledo silt loam.....	565	.2
Nappanee silty clay loam, 2 to 6 percent slopes, moderately eroded.....	174	.1	Toledo silty clay.....	3,027	1.1
Ottokee loamy sand, 0 to 2 percent slopes.....	50	(¹)	Toledo silty clay loam.....	4,253	1.6
Ottokee loamy sand, 2 to 6 percent slopes, slightly eroded.....	25	(¹)	Wabash silty clay.....	3,503	1.3
Paulding clay.....	71,638	27.0	Wauseon fine sandy loam.....	939	.4
Paulding loam.....	34	(¹)	Wauseon loam.....	240	.1
Paulding silty clay loam.....	2,107	.8	Wetzel clay.....	724	.3
Rimer fine sandy loam, 0 to 2 percent slopes.....	2,115	.8	Wetzel silty clay loam.....	1,865	.7
Rimer fine sandy loam, 2 to 6 percent slopes, slightly eroded.....	169	.1			
Rimer sandy loam, 0 to 2 percent slopes.....	292	.1			
Rimer sandy loam, 2 to 6 percent slopes, slightly eroded.....	121	.1			
			Total.....	266,240	100.0

¹ Less than 0.1 percent.

Descriptions of the Soils

This section describes the soil series and mapping units of Paulding County.

The soil series is described first, in detail. The information in this part applies generally to each of the soils in a particular series.

Each of the mapping units, or individual soils, is described under its series. A soil profile is part of the description of one or more of the typical soils in a series. It is a record of the soil layers and their characteristics

as they occur in the field. Each profile was studied at some location within the mapping unit. Profiles observed at other locations in the same kind of soil will vary only slightly from the one given. In many respects, profiles of other mapping units in the same soil series will be similar to the profile described. The mapping units in one series are likely to differ in texture of surface soil, degree of erosion, slope, or depth. Usually the differences are evident from the names of the mapping units and are not otherwise indicated in these descriptions.

Descriptions of the soils were distributed by the Ohio Department of Natural Resources (6, 7, 8) prior to publication of this survey.

Many areas shown on the map as one kind of soil include small spots or streaks of a different kind of soil. It is not possible to identify all of the small spots separately on the soil map in the back of this report. Where these inclusions are numerous, they are mentioned in the soil descriptions; elsewhere they are not important to soil management.

Following the name of each soil mapping unit is the symbol that identifies it on the map. The first two letters of the map symbol identify the soil series and type.

The third letter of the symbol shows the dominant slope of the soil, as follows: A=Nearly level, 0 to 2 percent slopes; B=Undulating or gently sloping, 2 to 6 percent slopes; C=Sloping, 6 to 12 percent slopes; D=Hilly, 12 to 18 percent slopes; and E=Steep, 18 to 25 percent slopes. A slope of 2 percent means a fall of 2 feet in 100 feet of horizontal distance. A few spots in a soil mapping unit may be steeper or more nearly level than the name or symbol indicates, but the range given is that most common.

The number at the end of the mapping symbol identifies the degree of erosion that is most common, as follows: 1=Slight erosion; 2=Moderate erosion; and 3=Severe erosion. A soil mapping unit is not likely to be uniformly eroded.

The number of the capability unit in which the soil is included follows the map symbol. A capability unit is a group of similar soils, or may consist of a single soil. In the section, Use and Management of Soils, suggestions for the management of the soils in each capability unit are made, with particular reference to cultivated crops, pasture, forestry, and engineering practices to conserve the soil.

The mapping units and the map symbol and capability unit of each are given in the list at the back of the report.

Belmore series

Belmore soils are the brown, well-drained soils that occur on the crests and upper parts of slopes on the beach ridges of the glacial lakes. These Gray-Brown Podzolic soils developed from loamy materials on calcareous gravelly and sandy beach ridges. Small areas are in the extreme southwestern corner of the county.

The beach ridges on which these and similar soils developed occur as long, narrow bands of sandy and gravelly materials that rise 10 to 15 feet above the surrounding area. They denote the outer limits of glacial lakes that existed during and immediately after the Wisconsin stage of glaciation. These ridges are made up of a mixture of materials from limestone, shale, and some sandstone and igneous rocks. The limestone material is dominant. In this heterogeneous mixture of sand and gravel are appreciable amounts of silty and clayey material that make up about 20 to 30 percent of the total volume.

Belmore soils are associated with the moderately well drained, light-colored Haney soils and the somewhat poorly drained, light-colored Digby soils.

The native vegetation was a deciduous forest of sugar maple, black walnut, oak, black cherry, and beech.

Nearly all of the Belmore soil areas are now cleared and used for crops or pasture.

These soils, which occur on high areas, provided excellent places for Indian campsites and trails. Here, the early settlers built their houses and roads. Many farmsteads and roads are still located on these old beach ridges.

Belmore loam, 2 to 6 percent slopes, slightly eroded (BaB1) (Capability unit IIe-2).—This soil is the only member of the Belmore series in Paulding County. The following profile characteristics are typical of a cultivated area:

Surface soil—

A_p 0 to 8 inches, dark-brown (10YR 3/3,² moist) loam; breaks to weakly developed granules up to 0.125 inch in diameter; very friable when moist; approximately 10 percent of mass is a coarse skeleton of fine and medium gravel; slightly acid to neutral; 7 to 9 inches thick.

A₂ 8 to 12 inches, dark-brown (7.5YR 4/3, moist), gravelly loam; breaks to weakly developed granules up to 0.125 inch in diameter; very friable when moist; contains approximately 25 percent of coarse skeleton; medium to slightly acid; 2 to 5 inches thick.

Subsoil—

B₂ 12 to 34 inches, dark-brown (7.5YR 4/3, moist) to yellowish-brown (10YR 5/4, moist), gravelly, coarse clay loam; breaks to weakly to moderately developed blocky structural units about 0.25 inch across; firm when moist, slightly plastic when wet; contains about 20 percent of coarse skeleton; gravel increases with depth; medium to slightly acid; 20 to 30 inches thick.

Substratum (parent material)—

D₁ 34 to 45 inches, brown (7.5YR 4/2), gravelly, loose, coarse sandy loam; separates into single-grain structure having a few thin clay lenses; calcareous.

D₂ 45 inches+, loose, fine gravelly and sandy material composed of limestone, black shale, and granitic materials; calcareous.

Belmore loam is droughty during long dry periods. Most of the rainfall is absorbed, and water moves through the solum at a moderately rapid rate. Because it is easy to work and warms up early in the spring, this soil is well suited to early truck crops, wheat, and alfalfa. The small amount of water held during the latter part of the growing season limits the growth of long-season crops such as corn and soybeans.

This soil does not require artificial drainage. Its capacity to absorb surface water rapidly restricts erosion. It is very well suited to irrigation and is very productive if irrigated. Medium yields for general farm crops are common, and good response to fertilizer can be expected.

Broughton series

Broughton soils are light-colored, moderately well drained soils that developed on very fine textured, calcareous, water-laid clays of the glacial lake plain. These Gray-Brown Podzolic soils occupy the long, narrow, sloping areas along the bottom land in the eastern and northern parts of the county. These are extensive, but the size of the individual areas is small.

Broughton soils occur in association with the somewhat poorly to poorly drained, light-colored Roselms soils and the very poorly drained, moderately dark colored Paulding soils. They differ from the Lucas soils

² These symbols designate colors according to the Munsell system of notation, which is explained in the Soil Survey Manual (13).

in having more clay in the B and C horizons. Broughton soils have very little material coarser than silt. The surface soil of this series is more shallow and the profiles are less permeable than in soils of the Lucas series. The Broughton soils differ from St. Clair soils in having a shallower surface soil and more clay in the B and C horizons. The St. Clair soils are more permeable in the B and C horizons; they developed on glacial clay till.

Broughton soils occur on irregular slopes that range from less than 50 feet long to more than 150 feet. They are also on short, steep, slopes along the small lateral drainageways that cut the glacial lake plain to the bottom land.

The parent material was deposited on the bottom of the glacial lake that existed at the close of the Wisconsin age. These lacustrine materials contain 60 to 80 percent of clay. In many areas the content of fine clay (less than 0.2 micron) is between 15 and 25 percent. The sand content is usually less than 7 percent and often less than 2 percent in some areas. These fine clays contain 15 to 20 percent of carbonates.

The parent material is varved or weakly laminated. In most areas it is devoid of pebbles and rock fragments. Locally, slight stratifications occur that contain thin lenses of silty material. This condition is frequently observed just above the glacial clay till that underlies the lacustrine clays at depths of 4 to nearly 15 feet.

The native forests consisted of scarlet, white, and bur oaks, hickory, ash, and occasionally American elm and black maple. Some of the moderately sloping areas are tilled, but erosion has been very destructive. Many areas, once cultivated, are now used for pasture or are idle. Many local areas, particularly on the steeper slopes, remain wooded.

Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded (BcD2) (Capability unit VIe-1).—Part of the surface soil has been lost; therefore, the plow layer is a mixture of the remaining surface soil and subsoil. A representative sample was taken from a cultivated field:

Surface soil—

A_p 0 to 6 inches, dark grayish-brown (10YR 4/2 to 5/3, moist) friable silt loam; breaks to weakly developed granules up to 0.125 inch in diameter; moderate amount of organic matter; slightly acid to neutral; 4 to 6 inches thick.

Subsoil—

B₂₂ 6 to 16 inches, yellowish-brown (10YR 5/4, moist) very fine clay; some of the ped surfaces and faces of the cracks are coated with pale-brown (10YR 6/3, moist) clay; a few, fine, faint mottles of gray (10YR 5/1, moist) in the lower part; extremely firm when moist, sticky and plastic when wet, extremely hard when dry; breaks to weakly developed blocky structural units 0.25 to 0.75 inch across; roots are common; lower horizon boundary is clear; slightly acid to neutral in the lower part; 7 to 14 inches thick.

Substratum—

C 16 inches+, gray (10YR 5/1, moist), calcareous very fine clay mottled with grayish brown (10YR 5/2, moist) and brown (10YR 5/3, moist); the mottles are few, faint, and fine; in the upper few inches breaks to weakly developed, blocky structural units 0.25 to 1 inch across; grades rapidly to massive structure; extremely firm when moist, sticky and plastic when wet, extremely hard when dry; very few roots present.

VARIATIONS: This soil differs from one area to another in thickness and color of the different horizons. In some wooded areas that have not been pastured, the A horizon has not been eroded extensively. The depth to calcareous clay ranges from

about 12 to 18 inches. In some areas this soil occurs on the same slopes with St. Clair soils. It occupies the upper part of the slope, whereas the St. Clair soils are below the level of the water-laid clays. These two soils have been mapped together except on those areas where the St. Clair soils are dominant.

Because this soil occurs on slopes and the solum and substratum are impervious, runoff is medium to rapid. Internal drainage is very slow. This soil holds adequate amounts of water once it is saturated, but much of the supply is not available to crops because the moisture is held securely within the solum. As a result, crops may be damaged by lack of moisture during dry weather.

This soil is subject to severe sheet and gully erosion if it is tilled. Erosion rapidly reduces its capacity to absorb and hold water. As the thin layer of friable surface soil is lost, increasing amounts of the very fine textured subsoil are worked into the plow layer during cultivation.

Small, slightly eroded areas of Broughton silty clay loam, 12 to 18 percent slopes, have been included with these moderately eroded soils. Most of the included slightly eroded areas are used for forestry, although some are in pasture.

Generally, where the stronger slopes of Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded, have been cultivated, erosion has removed a major part of the original surface soil. This soil is naturally low in fertility. As erosion progresses and more surface soil is removed, much of the available plant nutrients and much of the organic matter are lost. The fertility drops sharply to very low levels. The plow layer becomes too cloddy to form a desirable seedbed. This eroded condition causes poor stands of crops. Thus, with low fertility and insufficient available water, these poor stands give low yields. This soil is suited to pasture or forest.

Broughton clay, 12 to 18 percent slopes, severely eroded (BbD3) (Capability unit VIIe-1).—Practically all of the original surface soil has been removed by erosion. In some areas where a large part of the subsoil has been lost, calcareous lacustrine clays now make up the surface layer. Originally, this soil was similar to Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded. Where this soil is cultivated, the present surface layer is composed of the impervious clay subsoil that has a brown to yellowish-brown color. The plow layer has a clay texture and is very plastic and impermeable. Gullies have cut into the substratum in places. These areas are hard to cross with farm machinery.

Runoff is very rapid, which tends to increase the intensity of erosion. The loss of the original surface soil has reduced the capacity of this soil to hold water for plant growth. This soil is very low in organic matter and plant nutrients. Because seedbeds are very hard to prepare on this very fine textured soil, good stands of crops are exceptional.

This severely eroded soil occurs where cultivation has continued for long periods. Many areas are now idle or in pasture, although some are used for crops.

In small local areas, Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded, is included with this soil.

Broughton silty clay loam, 6 to 12 percent slopes, moderately eroded (BcC2) (Capability unit IVe-1).—This soil is similar to Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded, except that it occu-

pies more gentle slopes. It has lost about three-fourths of the original surface soil. The surface soil consists of the upper part of the B horizon mixed with the remainder of the original A horizon.

The texture of the grayish-brown to yellowish-brown surface soil ranges from a silty clay loam to coarse clay. Because some of the impermeable subsoil has been mixed with the plow layer, water penetrates the solum very slowly. Runoff is rapid, and crops are frequently damaged by the lack of water.

The surface soil is difficult to cultivate and does not make a desirable seedbed. As a result, many stands of crops are poor. Low fertility, lack of available water, and scanty crops account for the frequent low yields.

Much of this soil is now in pasture, but it has been cultivated in the past. Where it is cultivated, erosion is likely to be serious. Erosion should be controlled to prevent further damage.

Included are many small slightly eroded areas of Broughton silty clay loam, 6 to 12 percent slopes, that occur in a complex pattern with this soil.

Broughton clay, 6 to 12 percent slopes, severely eroded (BbC3) (Capability unit VIe-1).—This soil has lost all of its original surface soil through erosion. From 6 to 16 inches of the surface soil and subsoil have been washed away. The present plow layer consists of an impervious mixture of subsoil and substratum that is brown to yellowish brown in color. The texture varies from silty clay loam to coarse clay, and the clay material is dominant. The profile of this soil is similar to Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded, except that the upper part of the solum has been removed by erosion. In places gullies are actively cutting into the substratum. These areas are difficult to cross with farm machinery.

Because runoff is rapid, erosion is actively removing more soil materials. In places where all of the original solum has been lost, the calcareous clay substratum is at the surface. Loss of the natural surface soil reduces crop yields because the soil lacks organic matter and available water for crops. Tilth is also poor.

Many of the cultivated areas should be planted to pasture or forest to prevent additional damage from erosion. It is not economically feasible to till this soil.

Broughton silty clay loam, 2 to 6 percent slopes, slightly eroded (BcB1) (Capability unit IIIe-1).—This is the best of the Broughton soils for agriculture, but its extent is small. The individual areas are small. They occur only on gentle slopes that do not receive water from higher areas. The general features of the soil profile are similar to those of Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded, except that the solum is slightly thicker. The depth to calcareous material is 20 to 26 inches. The A horizon is usually 6 to 7 inches thick and consists of a friable, grayish-brown to pale-brown silt loam or silty clay loam.

This soil has a fair capacity to hold water for plants because it has a deeper A horizon than other Broughton soils on stronger slopes. Less water is lost by runoff than from areas of other Broughton soils. The movement of water within the profile is very slow, although a large amount of moisture enters and moves through the solum.

This soil is fairly easy to work, but its supply of or-

ganic matter and plant nutrients is low. With good management, which includes liberal applications of fertilizer, it will produce good yields of crops. Measures to control erosion should be used.

Broughton silty clay loam, 2 to 6 percent slopes, moderately eroded (BcB2) (Capability unit IIIe-1).—This soil has a deeper solum than Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded. Erosion has removed some of the friable surface soil, as well as much of the organic matter and natural fertility. Originally, the solum was 20 to 26 inches thick. The present surface soil consists of the remainder of the A horizon plus several inches of the upper subsoil. Its color ranges from grayish brown to pale brown. The texture of the surface soil varies from a silty clay loam to coarse clay in places where erosion has removed patches of the original surface soil.

Because much of the original surface soil has been removed, this soil has a moderately low capacity to hold water for growing plants. Runoff is medium to rapid. Crop yields are low because of poor stands, low fertility, and not enough water during dry weather. Nearly all of this soil is tilled, and erosion control is needed.

Small local areas of Broughton silty clay loam, 2 to 6 percent slopes, slightly eroded, are included with this soil.

Broughton silty clay loam, 18 to 35 percent slopes, moderately or severely eroded (BcE2) (Capability unit VIIe-1).—This soil occurs on stronger slopes than Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded; it is also more shallow and has a less well developed profile. In areas that are only slightly eroded, calcareous material occurs within 12 inches of the surface. Because erosion has removed part or all of the surface soil, the solum is about 6 to 12 inches thick. This soil occupies the stronger slopes that border the bottom land of the major drainageways in areas of Paulding soils.

In its original state the surface soil was very shallow (2 to 4 inches thick). It was underlain with a thin, fine-textured clay subsoil.

Runoff is very rapid because of the strong slopes and the very slow penetration of water into the surface soil. The available moisture-holding capacity is low, and the water moves very slowly within the soil. Most of this soil is idle or in trees. To prevent further damage from erosion, it is best to use this soil for pasture or trees.

Included with this soil are local areas of Broughton silty clay loam, 18 to 35 percent slopes, that are severely eroded. These areas are less favorable with respect to tilth, fertility, erosion, and water supply than the moderately eroded areas. These severely eroded areas are best suited to pasture or trees.

This mapping unit also includes a few areas that have been slightly eroded. These areas are wooded and not pastured extensively.

Defiance series

These light-colored, imperfectly drained Alluvial soils occupy low, nearly level to level bottom lands where the water table fluctuates widely from wet to dry periods. Defiance soils occur mainly along the tributary streams of the Maumee and Auglaize Rivers in association with the fine-textured Wabash soils. Other commonly asso-

ciated soils are Eel silt loam, Shoals silt loam, and Sloan silty clay loam.

The Defiance soils are the somewhat poorly drained member of the soil catena that includes the dark-colored, very poorly drained Wabash soils. They differ from the Shoals soils in being derived principally from fine-textured alluvium rather than medium to moderately fine textured alluvium.

The Defiance soils are on recent alluvium consisting of fine sediments from calcareous glacial clay till and lacustrine clay and soils derived from them. The clay content in most of the profile exceeds 40 percent. In many places stratified sandy materials frequently underlie the finer materials at depths of 4 feet or more.

A deciduous forest of swamp white oak, white oak, beech, American basswood, and hickory originally grew on these soils. Large areas have been cleared, but many are now used for pasture or are idle owing to frequent overflow. Where these soils are tilled, corn and soybeans are the principal crops. Lesser amounts of wheat and meadow crops are grown.

Defiance silty clay loam (Da) (Capability unit IIw-1).—A following representative profile was examined in a pastured area that had never been cultivated:

Surface soil—

0 to 5 inches, dark-gray (10YR 4/1, moist) silty clay loam; breaks to moderately developed granules less than 0.125 inch in diameter; friable when moist; high in organic matter; slightly acid to neutral.

5 to 9 inches, gray to grayish-brown (10YR 5/1 to 5/2, moist), fine silt loam to silty clay loam; breaks to moderately developed granules that are less than 0.125 inch in diameter; friable when moist; content of organic matter moderate; slightly acid to neutral.

Substratum—

9 to 15 inches, light brownish-gray to pale-brown (10YR 6/2 to 6/3, moist) silty clay loam distinctly marked with many, medium, yellowish-brown (10YR 5/6, moist) mottles; breaks to weakly developed angular and sub-angular blocky structural units 0.5 to 0.75 inch across; firm when moist; slightly acid to neutral.

15 to 24 inches, silty clay loam to silty clay mottled brown (7.5YR 5/4, moist) and yellowish brown (10YR 5/4 to 5/6, moist); ped surfaces coated with light yellowish-brown (2.5Y 6/3, moist) clay; breaks to strongly developed angular blocky structural units 0.25 to 0.75 inch across; firm when moist; slightly acid to neutral.

24 to 45 inches, yellowish-brown (10YR 5/6, moist), stratified clay with thin lenses of silty clay loam; ped surfaces coated with grayish brown (10YR 5/2, moist); breaks to weakly developed angular blocky structural units 0.5 to 2 inches across; firm when moist; slightly acid to neutral.

45 inches+, silty clay mottled yellowish brown (10YR 5/6, moist) and grayish brown (10YR 5/2, moist) massive; firm when moist; in places overlies silty clay loam, silt loam, loam, or sandy loam sediments at 4 feet or more; slightly acid to neutral.

VARIATIONS: Many variations in the depth, sequence, and texture of the different layers occur in this soil. The dominant texture of the underlying material is silty clay or clay, but lenses of silt loam, clay loam, and silty clay loam are common. These lenses may occur at any depth and in any sequence.

Defiance silty clay loam may be severely flooded at any time. Consequently, the soil is hard to manage. Water does not stand on the surface for long spells, except during periods of overflow. Water moves through the profile very slowly. A high water table causes this soil to be wet and cold in spring; wheat and meadow crops are often damaged by heaving due to freezing.

If suitable outlets are available, tile helps to remove excess water, although drainage takes place slowly. Additional drainage ditches are helpful.

Defiance silty clay loam is low in its supply of organic matter and plant nutrients. It works into a cloddy seedbed if it is cultivated when too wet. In many areas the tilth has been seriously damaged by excessive production of grain and the return of very little organic material to the soil. Where tilth is poor, thin stands of crops are obtained and low yields often result.

Digby series

Digby soils are light-colored, imperfectly drained Gray-Brown Podzolic soils developed from loamy material that is underlain by poorly sorted sand and gravel. These soils occur in small areas over most of the county.

Digby soils occupy the relatively level to gently sloping areas on remnants of the beach ridges of the glacial lake plain and on the glaciofluvial outwash of Wisconsin age. Nearly half of the areas are on remnants of the low beach ridges in Benton Township. These beach ridges rise a few inches to several feet above the level of the neighboring glacial lake plain. They occur in narrow bands parallel to the main beach ridges. The outwash areas are local shallow tracts on the glacial lake plain, or they occur as stream terraces near the bottom lands. Where these soils are on sloping areas, the slopes are usually short and fairly uniform.

The Digby soils are the light-colored, imperfectly drained member of the soil catena that includes the light-colored, moderately well drained Haney soils and the dark-colored, very poorly drained Millgrove soils. The Digby soils have profiles similar to those of the Sleeth series (in northwestern and western Ohio), but they are underlain with less well assorted sandy and gravelly materials. Digby soils differ from those of the Haskins series in having developed on outwash or on remnants of beach ridges where the gravelly and sandy materials are more than 42 inches in depth. The Haskins soils developed on shallow, gravelly, and sandy or loamy deposits less than 42 inches deep over calcareous clay.

Digby soils developed mainly from loamy material over gravelly sandy loam. Silt and clay constitute 25 to 50 percent of all the soil, including the gravel. The fine material may occur as thin lenses in the sand and gravel or it may be mixed uniformly throughout the profile. Thus, the presence of silt and clay somewhat retards the downward movement of water. In most areas gravel comprises 10 to 25 percent of all the soil.

The entire deposit of sandy and gravelly material rests on calcareous clay at depths of 42 inches or more. In areas where the deposit is fairly shallow, the sandy and gravelly material is not calcareous above the clay, although its reaction is about neutral or above. The coarse deposits consist largely of limestone, with some black shale and igneous materials. The deposits vary widely within short horizontal distances and range from nearly clean sand and gravel to poorly assorted materials. Large boulders are rare, although a few cobbles occur in places. Calcareous glacial clay till is commonly present within 4 to 6 feet of the surface.

Beech, sugar maple, white oak, red oak, elm, white ash, and hickory were the dominant trees in the original cover. Nearly all of these soils have been cleared and

are used for corn, soybeans, wheat, and some meadow crops.

Digby loam, 0 to 2 percent slopes (DcA) (Capability unit IIw-2).—This soil occurs throughout the county in small areas. The surface soil is friable and generally light colored. A typical profile of a cultivated soil is described as it occurs on low beach ridges:

Surface soil—

- A_p 0 to 8 inches, dark grayish-brown (10YR 4/2, moist) loam; breaks to weakly developed granules up to 0.125 inch in diameter; friable when moist; about 5 percent of material is fine gravel; neutral to slightly acid; 7 to 9 inches thick.
- A₂ 8 to 11 inches, light-gray (2.5Y 7/2, moist) to pale-brown (10YR 6/3, moist) loam; many, medium, prominent, strong-brown (7.5YR 5/6, moist) mottles; breaks to weakly developed platy structural units 0.125 to 0.25 inch thick; friable when moist; coarse skeleton of fine gravel makes up about 5 percent of material; neutral to slightly acid; 1 to 4 inches thick.

Subsoil—

- B₂₁ 11 to 16 inches, light-gray (10YR 7/2, moist) to grayish-brown (10YR 5/2, moist) coarse clay loam; common, medium, and distinct mottles of yellowish brown (10YR 5/4, 5/6, moist); breaks to weakly developed subangular blocky structural units 0.125 to 0.75 inch across; firm when moist; coarse skeleton of fine gravel makes up about 5 percent of layer; slightly acid; 4 to 6 inches thick.
- B₂₂ 16 to 31 inches, clay loam mottled grayish brown (10YR 5/2, moist), yellowish brown (10YR 5/6, moist), and strong brown (7.5YR 5/6, moist); breaks to moderately developed subangular blocky structural units 0.5 to 0.75 inch across; firm when moist; coarse skeleton of fine gravel makes up about 5 percent of layer; slightly acid to neutral; 12 to 20 inches thick.

Substratum (parent material)—

- C 31 to 54 inches, loose, gray, poorly sorted, coarse sandy and fine gravelly material; contains small but significant quantities of silt and clay; neutral to calcareous.

Substratum—

- D 54 inches+, yellowish-brown and gray, calcareous glacial clay till; firm when moist; contains pebbles and fragments of limestone, black shale, and granitic materials.

VARIATIONS: The texture of the B horizon varies within short horizontal distances from clay loam to sandy clay loam or fine loam. The amount of coarse skeleton, gravel, and other coarse materials ranges from less than 5 percent to about 10 percent in the solum.

Internal drainage ranges from medium in the upper part of the profile to slow in the lower part. If adequate tile drains are installed, however, the excess water is readily removed. Because this soil is nearly level and water penetrates it easily, runoff is slow. The perched water table is usually high during spring and during heavy rains. On flat areas crops are sometimes damaged by excess moisture. Normally, this soil holds adequate supplies of moisture for crop growth.

If Digby loam, 0 to 2 percent slopes, is not properly drained, it is slow to warm up in the spring. Because the surface soil is porous and aeration is good in adequately tiled areas, this soil will respond well to irrigation.

This soil is low in plant nutrients and generally has moderate natural fertility. Response to applications of complete fertilizer is excellent.

Included with this soil are small areas of Haskins loam. Haskins loam is mapped separately where it occurs in large tracts.

Digby loam, 2 to 6 percent slopes, slightly or moderately eroded (DcB1) (Capability unit IIw-2).—This soil occupies gentle to undulating slopes of the glacial lake

beach ridges and outwash areas. It is very similar in most respects to Digby loam, 0 to 2 percent slopes, except that it frequently receives seepage from higher areas. It occurs in small inextensive areas, nearly two-thirds of which are in Benton and Harrison Townships.

The upper part of the subsoil is not so light a gray as that of Digby loam, 0 to 2 percent slopes, and the mottling, which is somewhat less intense throughout the profile, occurs at slightly lower depths. Otherwise, the two soils are similar.

On the moderately eroded areas the plow layer consists of the remaining part of the surface mixed with several inches of the upper subsoil. In large part, the organic matter and plant nutrients have been lost during erosion. The color of the surface soil in the moderately eroded areas ranges from grayish brown to pale brown.

Digby silt loam, 0 to 2 percent slopes (DdA) (Capability unit IIw-2).—This soil is similar to Digby loam, 0 to 2 percent slopes, except that it has a higher content of silt and a lower content of sand in the surface soil and the upper subsoil. Apparently, a silty layer was deposited over the more sandy and gravelly parent material. The solum contains very little or no gravelly material above the substratum. This soil occurs in small areas throughout the county; more than half of it is in Benton Township near the low beach ridges.

The surface soil is a grayish-brown, friable silt loam that is 9 to 12 inches thick. It is underlain by a gray to grayish-brown clay loam subsoil mottled yellowish brown. In some areas the upper subsoil layer is a silty clay loam that overlies clay loam. The substratum consists of poorly sorted sandy and gravelly material that is neutral to calcareous.

Runoff is slow. The perched high water table may damage the crops early in spring or during other very wet periods. This soil responds well to tile drainage. It has a good capacity to hold water that plants can use. If adequate drainage is provided, it is fairly well suited to irrigation. Like many other imperfectly drained soils, this soil warms up slowly in spring if it is not properly drained. Like Digby loam, 0 to 2 percent slopes, it has a low supply of all plant nutrients and its natural productivity is only moderate. This soil responds to good management, particularly to, application of fertilizer.

Practically all of this soil has been cleared and is now tilled. Small local areas of the Haskins soils and of the loamy textured Digby soils are within this unit.

Digby silt loam, 2 to 6 percent slopes, slightly or moderately eroded (DdB1) (Capability unit IIw-2).—This soil is similar to Digby loam, 0 to 2 percent slopes, except that it has a silt loam surface soil and is more gently sloping. On both soils the silty deposits may extend into the upper part of the subsoil, and a silty clay loam texture results. The upper part of the B horizon is slightly less gray than that of the Digby loam, 0 to 2 percent slopes. The colors of the matrix of the subsoil are grayish brown rather than gray.

The slightly eroded areas have lost from 2 to 5 inches of surface soil, and the moderately eroded areas, from 5 to 8 inches. This thinning of surface soil has reduced its capacity to hold water and has depleted it of plant nutrients and organic matter. The surface soil in the moderately eroded areas is grayish brown to pale brown.

Runoff is slow to medium. This soil responds to good management that includes the addition of lime and fertilizer. The danger of moderate erosion should be considered in any management program. In local areas, seepage from higher areas requires special attention.

Digby fine sandy loam, 0 to 2 percent slopes (DbA) (Capability unit IIw-4).—This inextensive soil occurs with other sandy soils in the eastern part of the county. The general profile characteristics are like those of Digby loam, 0 to 2 percent slopes, except that the solum contains very little gravel. This soil apparently formed from fine sandy loam material deposited over sandy clay loam to clay loam. Poorly assorted sandy materials underlie the subsoil. The fine sandy loam surface layer, 9 to 12 inches thick, overlies a clay loam or sandy clay loam subsoil. The subsoil is usually a little brighter colored than that of Digby loam, 0 to 2 percent slopes.

Permeability is moderate, and tile drains are ordinarily needed to remove excess water. The heavy infiltration of water reduces the amount of runoff. The available moisture-holding capacity is moderate, and the soil may be somewhat droughty during extremely dry periods. If adequate drainage is provided, Digby fine sandy loam, 0 to 2 percent slopes, responds well to irrigation.

The natural fertility is low, but the response to fertilizer is very good. With good management, this soil is well suited to irrigation and the production of truck crops. Practically all of this soil is tilled. Its texture normally varies within short horizontal distances and approaches that of the Rimer fine sandy loams. It differs from the Rimer soils in having a subsoil of sandy clay loam to clay loam rather than sandy loam and in having developed on sandy deposits more than 42 inches deep over clay. This soil differs from Tedrow soils in having a definitely noticeable amount of silt and clay in the profile and in having a texture of sandy clay loam or clay loam in the B horizon.

Eel series

Soils of the Eel series are the moderately well drained, medium-textured Alluvial soils that developed in recent alluvium washed mainly from highly calcareous glacial drift of the Wisconsin age. These soils are on flood plains of the streams; they differ from most soils in not having a definite sequence of A, B, and C horizons. The most extensive areas are along the Maumee and Auglaize Rivers. Many small tracts occur locally along the smaller streams. These areas are often flooded, and new materials are deposited on their surfaces almost every year.

The Eel soils occupy the nearly level to gently undulating areas on the flood plain. They receive little or no seepage from higher areas. Many shallow channels have been scoured across the flood plain.

The Eel soils are moderately well drained soils of the catena that includes the well-drained Genesee soils; the light-colored, imperfectly drained Shoals soils; and the dark-colored, very poorly drained Sloan soils. Eel soils have a dark-gray to grayish-brown surface soil and are mottled at depths of 20 to 30 inches, whereas Genesee soils have a brown surface color and are relatively free from mottling.

The texture of the alluvium ranges from loam or silt loam to silty clay loam. In most areas the alluvium is stratified, and the lower strata vary from medium-textured

material to stratified fine sand and sand materials. The profile is usually free of gravel except for occasional thin lenses at the lower depths.

Along such streams as Flatrock Creek, Blue Creek, and the Little Auglaize River, the channels have silted badly and caused the streams to change their course. In many areas the original bottom soils have been covered with 2 to 4 feet of very recent alluvium that has been deposited since the upland was cleared.

The native cover included oak, black walnut, sugar maple, hickory, hackberry, sycamore, elm, and white ash. Most of these soils have been cleared, and they are tilled along the major streams. Along the secondary streams, however, many areas are used for pasture or are idle because of the possibility of floods. A number of small areas along secondary streams remain in forest.

Eel silt loam (Eb) (Capability unit I-2).—This is the dominant soil in the Eel series. It is moderately well drained and medium textured. A typical profile was taken from a sparsely wooded area:

Surface soil—

0 to 5 inches, friable silt loam; very dark gray (10YR 3/1, moist) to very dark grayish brown (10YR 3/2, moist); separates into strongly developed granules up to 0.125 inch across; high content of organic matter; lower horizon boundary is gradual; neutral.

5 to 9 inches, friable silt loam; dark gray (10YR 4/1, moist) to dark grayish brown (10YR 4/2, moist); high content of organic matter; breaks to strongly developed granules up to 0.125 inch across; lower boundary is gradual; neutral to mildly alkaline.

Substratum—

9 to 17 inches, silt loam to silty clay loam; dark grayish brown (10YR 4/2, moist) to brown (10YR 5/3, moist); breaks to moderately to strongly developed blocky structural units 0.125 to 0.25 inch across; firm when moist; lower horizon boundary is clear; neutral to mildly alkaline.

17 to 24 inches, dark yellowish-brown (10YR 4/4, moist) silt loam to silty clay loam distinctly mottled yellowish brown (10YR 5/6, moist) and strong brown (7.5YR 5/6, moist); peds have thin coat of pale-brown (10YR 6/3, moist) clay; breaks to strongly developed angular blocky structural units 0.125 to 0.5 inch across; firm when moist; lower horizon boundary is gradual; slightly acid to mildly alkaline.

24 to 35 inches, silt loam to silty clay loam mottled yellowish brown (10YR 5/6, moist), pale-brown (10YR 6/3, moist), and strong brown (7.5YR 5/6, moist); peds have thin, pale-brown (10YR 6/3, moist) coatings; breaks to strongly developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist; slightly acid to slightly alkaline.

35 inches+, stratified materials consisting of silty clay loam, silt loam, or loam, that in places overlies stratified silts and sands; mottled yellowish brown (10YR 5/6, moist), light gray (10YR 6/1, moist), and grayish brown (10YR 5/2, moist); massive; firm when moist; neutral to alkaline.

VARIATIONS: Eel silt loam differs in texture and color from one area to another and within short horizontal distances within any given area. These variations are caused by the manner in which sediments were deposited as water flowed over the flood plain. The texture of the layers of these sediments ranges from fine sandy loam to fine silty clay loam. These sediments may contain an occasional thin lens of silty clay. The mottling occurs at depths of 18 to 30 inches. Under cultivation the color of the surface soil ranges from dark grayish brown to brown.

Because of nearly level relief, runoff is slow. Internal drainage is medium in the upper part of the profile, but it is restricted by a high intermittent water table in the lower part. During wet periods early in spring, this high water table sometimes damages young crops. Eel silt loam has a good capacity to hold water that plants can use.

Overflow causes damage to crops on this soil, especially along Flatrock Creek, Blue Creek, the Little Auglaize River, and other tributary streams. Flooding may occur at any time, thus many areas of bottom lands are not cultivated. Along the Maumee and Auglaize Rivers overflow may occur early in spring or late in fall, but the damage to crops is usually not extensive.

This soil is moderately fertile, and it often receives additional plant nutrients from upland soils (fig. 4). It



Figure 4.—Eel silt loam, a soil of the bottom lands, is subject to floods that leave some silt.

responds well to applications of complete fertilizer. It warms up fairly early in the spring and is well suited to irrigation if enough water is available. Where it is cultivated, Eel silt loam often becomes badly infested with weeds. This soil is easy to work, and good stands of crops are easily obtained.

Small areas of Genesee and Shoals soils are mapped with Eel silt loam.

Eel loam (Ea) (Capability unit I-2).—Eel loam contains more fine sand and less silt than Eel silt loam. It is also coarser textured throughout the profile. It occurs along the Maumee River. Where it is cultivated the surface soil is a grayish-brown to dark grayish-brown, gritty, friable loam that is underlain by a gritty, friable, brown to yellowish-brown loam, sandy clay loam, or coarse clay loam substratum.

Runoff is very slow, and nearly all the rain enters the solum. Water moves through the profile easily, and an adequate supply is retained for plant growth. In all other respects this soil is similar to Eel silt loam and responds to similar treatments.

Eel silty clay loam (Ec) (Capability unit I-2).—This soil contains more clay throughout the profile than Eel silt loam and is a little harder to work. On many areas these moderately fine textured alluvial materials were deposited over the original soil after the watershed had been cleared and tilled. The depths of the recent sediments range from less than 1 foot to more than 3 feet. In local areas thin layers of silty clay occur in the substratum, but these layers do not dominate the profile.

Eel silty clay loam is confined mostly to bottom lands along the tributary streams.

Runoff is slow to medium, and internal drainage is slow. During heavy rainfall, the soil surface may puddle moderately. Crops are sometimes damaged by the ponded water and the temporary high water table. The danger of flooding is severe along Flatrock Creek, Blue Creek, and many of the secondary streams. Flooding may occur at any time of the year.

The maintenance of good tilth on Eel silty clay loam becomes a problem if the soil is not managed properly. Areas along Flatrock Creek, Blue Creek, the Little Auglaize River, and other streams have been cut by shallow channels so that cultivation is difficult.

Natural fertility is moderate. Crops respond well to fertilizers on areas that can be tilled. The soil warms up moderately early in spring. Weeds are a serious pest on many areas.

Fulton series

These light-colored, imperfectly drained soils developed in fine-textured lacustrine materials of the glacial lake plain. The most extensive areas are in Brown and Auglaize Townships, although some occur locally in most parts of the county. Areas of these Gray-Brown Podzolic soils are generally 5 to 25 acres in size.

Fulton soils are the somewhat poorly drained member of the soil catena that includes the light-colored, moderately well drained to well drained Lucas soils; the dark-colored, very poorly drained Toledo soils; and the very dark colored, very poorly drained Bono soils. (There are no Bono soils in Paulding County.) Fulton soils occur in a soil pattern where they occupy the slightly raised ridges and knolls in broad level areas of Toledo soils. They are also on the level to gently sloping areas near the breaks along drainageways. Slopes are short and nearly uniform in length.

The Fulton soils differ from the Roselms soils in having developed from lacustrine deposits that contain less than 60 percent of clay. Fulton soils also have deeper and less acid surface soils, have better developed structure in the B horizon, and are more permeable throughout the profile. The lacustrine parent material of Fulton soils differs from that of Nappanee soils, which developed from calcareous fine silty clay loam to clay till.

The calcareous materials in which Fulton soils developed contain between 40 and 60 percent of clay. This material was deposited on the bottom of the glacial lake in quiet water. It is very smooth and relatively free from sand. The sand content usually ranges from 5 percent to less than 1 percent. Thin lenses of fine sand or silt, less than 0.125 inch thick, may be present in some places. Near the areas of sandy soils, the subsoil locally contains enough sand to make its texture somewhat gritty in places. In these areas sand is mixed uniformly through the subsoil and substratum (parent material), but the quantity decreases rapidly with depth. Rocks seldom occur in the parent material.

In their original state, Fulton soils were covered with a hardwood forest that included white oak, red oak, hickory, elm, white ash, and hard maple. Most of the soil areas have been cleared and are now used for corn, soybeans, wheat, and other cash crops, and to some extent for meadow.

Sandy substratum phases of Fulton soils occupy most of the high terraces along the Auglaize and Maumee Rivers. They differ from the normal Fulton soils in being underlain with coarse-textured materials at depths of 3 to 5 feet. Their subsoil is finer textured and not so permeable as that of the Digby soils. These sandy substratum soils occur on nearly level to gently sloping relief in association with Toledo soils; however, the Toledo soils usually are not underlain with coarse-textured materials. The size of the areas ranges from 5 to 20 acres.

The sandy substratum soils developed in stratified clays, silts, and sands. The thickness of lacustrine materials over glacial clay till is usually about 8 to 10 feet. Between 3 and 5 feet of the upper part of this lacustrine mantle is silty clay or clay that contains between 50 and 65 percent of clay. A silt loam or silty clay loam A horizon has developed in these materials. At greater depths, the texture of the substratum is silty clay loam or clay loam, then silt loam or loam and sandy loam. The lower substratum ranges from calcareous sandy loam to clean sand and fine gravel. Lime concretions, 1 to 2 inches in diameter, are common in the upper part of the calcareous materials.

Fulton silt loam, 0 to 2 percent slopes (FcA) (Capability unit IIIw-2).—This light-colored, friable soil is the most extensive soil of the Fulton series. The following is a description of a typical profile in a cultivated area:

Surface soil—

A_p 0 to 6 inches, grayish-brown (10YR 5/2, moist), friable silt loam; breaks to weakly developed granules less than 0.125 inch in diameter; slightly acid to neutral; 6 to 8 inches thick.

A₂ 6 to 8 inches, pale-brown (10YR 6/3, moist), friable silt loam; common, faint, fine mottles of yellowish brown (10YR 5/4, moist); separates into weakly developed platelike structural units 0.125 to 0.25 inch thick; lower horizon boundary is clear; slightly to medium acid; 1 to 3 inches thick.

Subsoil—

B_{1c} 8 to 11 inches, pale-brown (10YR 6/3, moist) silty clay loam; many, medium to coarse, distinct mottles of light gray (10YR 7/2, moist) and yellowish brown (10YR 5/4 to 5/6, moist); breaks to moderately developed angular and subangular blocky structural units 0.5 to 0.75 inch across; firm when moist, slightly plastic when wet; lower horizon boundary is clear; medium to strongly acid; 2 to 4 inches thick.

B_{21c} 11 to 16 inches, silty clay; distinct mottles of light brownish gray (10YR 6/2, moist) and yellowish brown (10YR 5/6, moist); ped surfaces coated with thin, pale-brown (10YR 6/3, moist) clay; breaks to moderately to strongly developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist, plastic but not sticky when wet; lower horizon boundary is gradual; medium to strongly acid; 4 to 7 inches thick.

B_{22c} 16 to 30 inches, brown to yellowish-brown (10YR 5/3 to 5/4, moist) silty clay; thin coatings of light brownish-gray (10YR 6/2, moist) and grayish-brown (10YR 5/2, moist) clay; breaks to moderately to strongly developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist, plastic but not sticky when wet; lower horizon boundary is clear and wavy; medium to strongly acid in upper part of horizon to neutral in lower part; 10 to 18 inches thick.

Substratum (parent material)—

C 30 inches+, lacustrine silty clay mottled with grayish brown and yellowish brown (10YR 5/2 to 5/4, moist); calcareous; material in upper 3 to 5 inches breaks to weakly developed angular blocky structural units 0.25 to 0.5 inch across; firm to very firm when moist and very smooth.

VARIATIONS: The mottling is more intense and has more gray color in level areas than in gently sloping ones. In wooded tracts the top 2 or 3 inches are dark gray to dark grayish brown and contain a large amount of organic matter. This layer is underlain with light brownish-gray to pale-brown silt loam. The thickness of the A horizon of the uneroded soil ranges from 7 to about 10 inches. The depth to calcareous material is 27 to 40 inches.

Only a small amount of water is lost through runoff. Permeability ranges from moderately slow in the upper part of the subsoil to slow in the lower part. A fairly high water table late in winter and early in spring or during other excessively wet periods often damages the growing crops. In nearly level areas, water frequently stands in shallow depressions and drowns out the crops. If Fulton silt loam, 0 to 2 percent slopes, is wet in the spring, freezing and thawing injure the wheat crop and damage the meadows. Under these wet conditions, this soil is slow to warm up in spring. It has a good capacity to hold water for plant growth if it is adequately drained.

To prevent damage from water during wet weather, tile drains are needed. This soil is moderately easy to work. It is low in its supply of available plant nutrients, but it responds well to fertilizer and lime. Satisfactory stands of crops can be obtained with little difficulty so long as good tilth is maintained.

Under poor management this soil becomes compact and absorbs water very slowly. It is very slow to dry out, and tile drains are not very effective unless the general management is improved.

Several small areas of poorly drained soils, occurring in level or depressed positions, have been included with this soil and other Fulton silt loams and Fulton silty clay loams. These occur south of Oakwood, on the east side of the Auglaize River:

These inclusions have a plow layer about 6 inches thick of grayish-brown (10YR 5/2, moist) silt loam that is underlain by 8 to 10 inches of light-gray (5YR 7/2, moist) silty clay loam to silty clay materials. This layer has little structural development. It is underlain with mottled very pale brown and yellowish-brown (10YR 7/3 to 5/8, moist), firm, silty clay material that has weakly developed fine to medium blocky structure. This soil is calcareous to depths of 4 to 5 feet. It is strongly acid throughout the upper part of the profile.

Fulton silt loam, 2 to 6 percent slopes, slightly eroded (FcB1) (Capability unit IIIw-4).—The chief differences between this soil and Fulton silt loam, 0 to 2 percent slopes, are that it occurs on more gently undulating slopes and has a less intensive mottling in the upper subsoil. The upper part of the B horizon is usually free from mottling or only slightly mottled to depths of 10 to 14 inches. Less damage to crops is caused by water standing on the surface.

Runoff is slow to medium. A number of small uneroded wooded areas on gentle slopes are mapped with this soil.

Fulton silt loam, 2 to 6 percent slopes, moderately eroded (FcB2) (Capability unit IIIw-4).—Between 50 and 100 percent of the original surface soil has been lost from this soil. The plow layer consists of the remaining 2 to 4 inches of the former A horizon mixed with several inches of the upper part of the B horizon. The texture of the plow layer ranges from silt loam to silty clay

loam. The surface soil is grayish brown where erosion has not been severe but is brown or yellowish brown where most of the original A horizon has been removed.

Because much of the organic matter and original surface soil have been lost, runoff is now medium and the risk of erosion has been intensified. To prevent further damage and the loss of valuable nutrients, this soil should be protected from erosion. It may be droughty during extremely dry periods.

This soil is somewhat hard to manage, owing to the combination of erosion and poor drainage. Good stands of crops are not easily obtained. This soil is low in fertility, but it responds readily to heavy applications of a complete fertilizer.

Small areas of slightly eroded Fulton soils and of moderately to slightly eroded Lucas soils are mapped with this soil.

Fulton loam, 0 to 2 percent slopes (Fb8) (Capability unit IIIw-2).—This soil differs from Fulton silt loam, 0 to 2 percent slopes, in having a shallow deposit of loamy materials less than 18 inches thick over lacustrine clay. The soil occurs in association with the sandy soils in Brown and Auglaize Townships. The lower part of the B horizon and the parent material are similar to comparable layers in Fulton silt loam, 0 to 2 percent slopes.

This soil differs from Rimer soils in having less than 18 inches of sandy or loamy materials over the clayey substratum. The following is typical of a profile of Fulton loam, 0 to 2 percent slopes, in Brown Township:

Surface soil—

A_p 0 to 8 inches, grayish-brown, friable loam; slightly acid to neutral.

Subsoil—

B₁ 8 to 12 inches, pale-brown, firm clay loam mottled yellowish brown and light gray; medium to strongly acid.

B₂₁ 12 to 21 inches, firm clay mottled with yellowish brown, brown, and brownish gray; medium to strongly acid.

B₂₂ 21 to 30 inches, firm clay peds are yellowish-brown thinly coated with grayish-brown clay; slightly acid.

Substratum (parent material)—

C 30 inches+, calcareous clayey material mottled grayish brown and yellowish brown.

VARIATIONS: The thickness of the surface soil ranges from 7 to about 12 inches. The texture of the upper part of the subsoil ranges from sandy clay loam to clay loam. In places the depth of the loamy material is more than 18 inches, but these areas of deeper soil are small and form a complex pattern in larger areas of the normal Fulton soil.

Runoff is slow, and the soil holds enough water for crop growth. Permeability in the upper part of the solum is more rapid than in the Fulton soils of silt loam texture, and the response to tile drainage is slightly better. The soil is low in fertility but responds readily to fertilizer. In other respects it is similar to Fulton silt loam, 0 to 2 percent slopes.

Fulton fine sandy loam, 0 to 2 percent slopes (FcA) (Capability unit IIIw-2).—The layers of fine sandy loam over lacustrine clayey materials distinguish this soil from the Fulton silt loams and loams. The sandy material, less than 18 inches thick, is very friable. It contains more sand and less silt and clay than the material on which Fulton loam, 0 to 2 percent slopes, developed. The grayish-brown to brown surface soil is from 10 to 14 inches thick.

The texture of the B₁ horizon ranges from loam to

clay loam. It grades rapidly to silty clay or clay in the B₂ horizon. This soil differs from the Rimer fine sandy loams because the mantle of sandy loam is less than 18 inches deep over clay; in the Rimer soils the sandy mantle is 18 to 48 inches deep.

Although runoff is slow, this soil has only a moderate capacity to hold water for plant growth. It becomes droughty during very dry periods. It is very permeable in the A and upper B horizons and responds well to tile drains. It is easy to work, and good stands of crops are common. Because of a favorable environment, weeds become a serious problem at times.

In other respects the profile characteristics and management problems of this soil are like those of the Fulton silt loams and loams.

Fulton silty clay loam, 0 to 2 percent slopes (FeA) (Capability unit IIIw-2).—This soil has more clay in the surface layer than the Fulton silt loams. It occupies level areas and shallow depressions within the Toledo soil area. The A horizon, 6 to 7 inches thick, is slightly thinner than that of Fulton silt loam, 0 to 2 percent slopes. Because it has a greater content of clay, the surface layer is fairly difficult to work into a good seedbed.

Runoff is slow, and crops are likely to be damaged if water stands in the depressions during wet weather. Internal drainage is slow in the upper part of the subsoil and very slow in the lower part. This soil is slow to respond to tile drains; it warms up very slowly in spring.

Wheat and meadow crops may be damaged extensively by frost heaving early in spring. With good drainage and favorable tilth, this soil responds well to fertilizer.

Fulton silt loam, sandy substratum, 0 to 2 percent slopes (FdA) (Capability unit IIIw-2).—This light-colored, somewhat poorly drained soil is the dominant soil on the terraces. The following description is typical of a cultivated area:

Surface soil—

A_p 0 to 7 inches, grayish-brown to dark grayish-brown (10YR 5/2 to 4/2, moist) silt loam; separates into weakly developed granules less than 0.125 inch in diameter; friable when moist, slightly hard when dry; slightly acid to neutral; 6 to 8 inches thick.

A₂ 7 to 10 inches, light brownish-gray (2.5Y 6/2, moist) to pale-brown (10YR 6/3, moist) silt loam; separates into weakly developed granules less than 0.125 inch in diameter, or into weakly developed platelike units about 0.25 inch thick; friable when moist, slightly hard when dry; contains a few iron concretions about 0.25 inch in diameter; slightly acid to medium acid; 1 to 4 inches thick.

Subsoil—

B₁ 10 to 13 inches, pale-brown (10YR 6/3, moist) silty clay loam; many, medium, distinct mottles of very pale brown (10YR 7/3, moist), yellowish brown (10YR 5/4 to 5/6, moist), and, occasionally, light gray (10YR 6/1, moist); breaks to moderately developed platelike structural units 0.25 to 0.5 inch thick, or to moderately developed subangular blocky structural units 0.25 to 0.5 inch across; moderately friable to firm when moist, hard when dry; medium to strongly acid; 2 to 4 inches thick.

B₂₁ 13 to 22 inches, brown (7.5YR 5/4 to 10YR 5/3, moist) silty clay; common, fine, faint to distinct mottles of strong brown (7.5YR 5/6, moist), yellowish brown (10YR 5/6, moist), and grayish brown (10YR 5/2, moist); breaks to moderately to strongly developed angular blocky structural units 0.25 to 1 inch across; firm when moist, very hard when dry; medium to strongly acid; 8 to 12 inches thick.

B₂₂ 22 to 40 inches, yellowish-brown (10YR 5/4 to 5/6, moist) silty clay or clay spotted with common, fine to medium, distinct mottles of brown (7.5YR 5/4, moist) and pale brown (10YR 6/3, moist); contains moderately developed medium prismatic structural units that break to weakly to moderately developed blocky structural units 0.25 to 0.75 inch across; firm when moist, very hard when dry; slightly acid to medium acid; 10 to 20 inches thick.

B₃ 40 to 48 inches, silty clay loam or clay loam; mottled light brownish gray (10YR 6/2, moist), pale brown (10YR 6/3, moist), yellowish brown (10YR 5/4 to 5/6, moist), and strong brown (7.5YR 5/6, moist); breaks to weakly to moderately developed angular blocky structural units about 0.25 to 0.5 inch across; firm when moist; neutral to slightly acid; 10 to 15 inches thick.

Substratum—

D₁ 48 to 60 inches, sandy clay loam, loam, or sandy loam with silt lenses; mottled light brownish gray (10YR 6/2, moist), yellowish brown (10YR 5/6, moist), pale brown (10YR 6/3, moist), and brownish yellow (10YR 6/8, moist); massive; calcareous; firm to friable when moist; lime concretions are common.

D₂ 60 inches+, calcareous, stratified sandy loam, loamy sand, or well-assorted sand and gravel.

VARIATIONS: From one area to another, and within any given area, this soil varies in color, depth to the sandy substratum, thickness of various horizons, degree of mottling, and kind and color of substratum.

The thickness of the A horizon ranges from about 7 to more than 10 inches. The uncultivated soil has an A₁ horizon that contains a large amount of organic matter. This 2- to 3-inch layer is dark gray to dark grayish brown (10YR 4/1 to 4/2, moist). It is underlain by an A₂ horizon (4 to 8 inches thick) that is a light brownish-gray (2.5Y 6/2) silt loam faintly mottled with yellowish brown (10YR 5/6, moist).

The upper part of the B horizon is more intensely mottled with light gray than the corresponding layer in the gently sloping Fulton soils with a sandy substratum. In the more sloping areas of this mapping unit, the dominant colors are mottled grayish brown and yellowish brown with small amounts of gray.

This soil needs some drainage if the best yields are to be obtained. It is nearly level; consequently, runoff is slow. During heavy storms water may stand on the surface for short periods. Occasionally the young growing crops are seriously damaged. Permeability is moderately slow to slow in the upper part of the solum. This soil has a good capacity to hold water that plants can use. It is slow to warm up in spring. If the excess water is not removed, crops are sometimes injured by the high water table in spring or during other wet periods. During periods of freezing and thawing, wheat and meadow crops may be seriously damaged by heaving if the soil is too wet.

This soil is low in its supply of plant nutrients, but it responds well to good management that includes fertilization; it also responds fairly well to tile drains. The surface soil is fairly easy to work, and good stands of crops can be obtained. If the soil is continuously planted to grain, the surface layer tends to become compact. These hardened areas absorb water slowly and are slow to dry out.

Included with this soil are several small areas of Fulton loam, 0 to 2 percent slopes, which are not large enough to be mapped separately.

Fulton silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded (FdB1) (Capability unit IIIw-4).—This soil is more sloping than Fulton silt loam, sandy substratum, 0 to 2 percent slopes. It occupies gently sloping areas along drainageways or areas that slope gently toward the streams. Some of the original

surface soil (from 1 to 4 inches) has been lost. The intensity of the mottling in the upper subsoil is not so great as in the soil on 0 to 2 percent slopes.

Runoff is slightly greater than on Fulton silt loam, sandy substratum, 0 to 2 percent slopes; thus, the damage to crops from ponding of the surface water and from freezing of wet soil is not so great. Tile may be needed to drain seep areas and other wet places. In other respects, the two soils are similar and should be handled in the same manner.

Fulton silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded (FdB2) (Capability unit IIIw-4).—The loss of more than half of the original surface soil and the greater slope distinguishes this soil from Fulton silt loam, sandy substratum, 0 to 2 percent slopes. Erosion has removed about 5 to 10 inches of the original surface soil. The plow layer consists of the remainder of the original surface soil mixed with the upper 2 to 4 inches of the B horizon. The color of the plow layer is characteristically grayish brown, yellowish brown, or brown. Because of differences in amount of past erosion, the present surface soil forms a spotted pattern of these colors and of silty clay loam and silt loam textures.

This soil has a low supply of organic matter and plant nutrients. The loss of so much of the original absorbent A horizon by erosion has reduced the capacity of the soil to hold water for plant growth. The present plow layer puddles easily, and much water is lost by runoff. It is difficult to prepare a good seedbed, and poor seedbeds frequently result in poor stands of crops. The combination of poor stands, low fertility, inadequate water, and poor aeration results in low to medium yields.

Included with this soil are some areas only slightly eroded, on which a surface soil of silt loam remains. They are too small and form a pattern too complex to be shown on a map of the scale used in this soil survey.

Fulton silty clay loam, sandy substratum, 0 to 2 percent slopes (FfA) (Capability unit IIIw-2).—This soil has more clay in the surface layer than Fulton silt loam, sandy substratum, 0 to 2 percent slopes. The A horizon is thinner, 7 to 8 inches thick, and somewhat more difficult to work. This soil occupies shallow swales and drainageways, and crops are damaged if water stands on the surface.

In other respects the physical characteristics and management problems of this soil are similar to those of Fulton silt loam, sandy substratum, 0 to 2 percent slopes.

Genesee series

These are brown, well-drained, medium-textured alluvial soils. They developed in recent alluvium derived from highly calcareous Wisconsin glacial drift and from soils developed in such materials. They occur in large bodies along the Auglaize and Maumee Rivers and in smaller areas along secondary streams. They do not have a sequence of A, B, and C horizons. Because they are on the bottom lands, they are often flooded. New soil materials may be deposited on them with each recurrent flood.

Other soils in the soil catena with the Genesee soils are the moderately well-drained Eel soils, the somewhat poorly drained Shoals soils, and the dark-colored, very poorly drained Sloan soils. The Genesee soils have a

lighter brown color in the surface soil than the Ross soils, and are somewhat lower in organic matter.

Genesee soils are gently undulating or nearly level and have good runoff and internal drainage. The alluvium from which they developed ranges in texture from fine sandy loam to silty clay loam. In many areas the substratum is stratified fine sand and sand at depths below 3 feet. Gravelly materials are present in some places as thin lenses in the lower part of the profile. The texture of the alluvial materials may vary greatly within a short horizontal distance.

The native vegetation consists of black walnut, hard maple, elm, bur oak, sycamore, and buckeye. Along the Maumee and Auglaize Rivers nearly all of the acreage of these soils has been cleared and is now cultivated. Along the smaller streams about half the acreage is tilled and the rest is in pasture, in trees, or is idle.

Genesee silt loam (Gc) (Capability unit I-2).—This is the most extensive mapping unit of the Genesee series. Most areas occur in Carryall, Crane, Brown, and Washington Townships.

Genesee silt loam occupies the high, nearly level to undulating knolls and ridges of the flood plains. A typical profile is described:

Surface soil—

A_p 0 to 8 inches, dark-brown or brown (10YR 4/3 to 5/3, moist) to dark grayish-brown (10YR 4/2, moist), friable silt loam; breaks to moderately developed granules up to 0.125 inch in diameter; slightly acid to neutral; high content of organic matter.

Substratum—

8 to 16 inches, dark-brown (7.5YR 4/3, moist) to yellowish-brown (10YR 5/4, moist), friable silt loam to loam; breaks to weakly developed angular and subangular blocky structural units 0.25 to 0.5 inch across; slightly acid to slightly alkaline.

16 to 48 inches, dark-brown (10YR 4/3, moist) to yellowish-brown (10YR 5/4, moist) stratified loam, silt loam, or silty clay loam; breaks to weakly developed angular blocky structural units about 0.25 inch across; very friable to slightly firm when moist; frequently the lower part of the profile consists of stratified fine sands and silts; neutral to slightly alkaline.

48 inches+, yellowish-brown to pale-brown, stratified fine sand, silt, and silty clay loam material; neutral to calcareous.

Genesee silt loam is occasionally flooded along the Maumee and Auglaize Rivers. The overflow usually occurs during winter or early in spring, and the damage to crops generally is not serious. Along the smaller streams floods are more common and hazardous.

Runoff is slow, permeability is moderate, and internal drainage is medium. This soil holds a good supply of water for crops.

Genesee silt loam warms up early in spring, which permits early planting of crops if flooding does not interfere. Maintenance of tilth is not a serious problem, unless grain has been planted too often. Plant roots readily penetrate the solum. This soil is easy to work and produces good stands of crops. Good supplies of plant nutrients are available, although the crops respond to fertilizer.

Genesee silt loam is well suited to irrigation. Its permeable surface soil and substratum absorb water readily, and poor drainage is not a problem.

Genesee loam (Gb) (Capability unit I-2).—This soil has more sand in the surface soil than Genesee silt loam

and has more sand and less silt and clay in the rest of the profile. It is on the higher nearly level to undulating areas of the flood plain, but in Paulding County only along the Maumee River. It occupies the natural levees along the present stream and the banks along abandoned stream channels. A typical profile in a cultivated area:

Surface soil—

A_p 0 to 9 inches, brown (10YR 4/3, moist) very friable loam; slightly acid to neutral.

Substratum—

9 to 45 inches, brown (10YR 4/3, moist) to yellowish-brown (10YR 5/4, moist) very friable silt loam, loam, or fine sandy loam; neutral to slightly alkaline.

Very little runoff occurs, and permeability is moderate to moderately rapid. This soil is very well suited to irrigation. Where it is intricately associated with Genesee silt loam, small areas of the two soils are mapped together.

Genesee fine sandy loam (Gc) (Capability unit I-2).—This soil differs from Genesee silt loam and Genesee loam in having a fine sandy loam surface soil and in occurring on alluvium that is much coarser textured throughout the profile. Along the Maumee River, this soil developed in alluvium composed chiefly of fine sandy loam materials.

Genesee fine sandy loam has fair capacity to hold water that plants can use and is droughty during dry periods. It has a low supply of plant nutrients and organic matter but gives good response to fertilizer if adequate moisture is available. This soil is very easy to work. It is generally treated like Genesee silt loam.

Included with Genesee fine sandy loam are several small areas that are similar to it except that the subsoil is mottled below 18 to 24 inches. These areas would have been mapped as Eel fine sandy loam if they had been of large enough extent.

Granby series

Soils of the Granby series are very dark gray, very poorly drained Humic Gley soils that developed in deep, slightly acid to calcareous sand and loamy sand. The one mapping unit in Paulding County is of small extent and occurs only in Brown Township.

Granby soils occupy depressional areas on deep sands of the glacial lake plain. They are the dark-colored, very poorly drained member of the soil catena that includes the well-drained Oakville soils; the moderately well drained Ottokee soils; the somewhat poorly drained Tedrow soils; and the very dark colored, very poorly drained Maumee soils. (Oakville and Maumee soils do not occur in Paulding County.) Wauseon soils are also closely associated with Granby soils, but they developed in sands less than 48 inches thick over calcareous clay.

The deep sand deposits in which Granby soils developed occur in an intricate pattern in association with shallow deposits of sand over lacustrine clay. These sandy areas are erratically distributed in the eastern and northeastern parts of the county. Soils of the Ottokee, Tedrow, and Granby series are in areas where the sand is more than 4 feet in depth. In some areas of Granby soil, the sand is more than 6 feet deep over calcareous clay.

The native cover included swamp white oak, elm, basswood, sycamore, and red maple. All of the Granby soil in this county has been cleared and is now cultivated.

Granby fine sandy loam (Gd) (Capability unit IIw-5).—The following description is typical:

Surface soil—

A_p 0 to 8 inches, very dark gray (10YR 3/1, moist), loose, fine sandy loam; separates into single-grain or weak, medium, granular structure; very high organic-matter content; slightly acid to neutral; 8 to 10 inches thick.

A₁ 8 to 15 inches, very dark gray (10YR 3/1, moist), loose, fine sandy loam; separates into single-grain or weak, medium, granular structure; very high organic-matter content; slightly acid to neutral; 6 to 12 inches thick.

Subsoil—

B_{2a} 15 to 60 inches, gray (10YR 5/1, moist), loose loamy fine sand; separates into single-grain structure; slightly acid to neutral.

Substratum—

D 60 inches+, gray and yellowish-brown, calcareous, lacustrine clay; massive.

VARIATIONS: In some areas iron concretions are in the upper part of the B horizon. The texture of the B horizon (subsoil) ranges from loose fine sand to loamy sand. Thin lenses of sandy loam to sandy clay loam, 1 to 3 inches thick, are at various depths in the subsoil.

Practically no runoff takes place on this soil. Because of its sandy texture, the soil holds a moderate quantity of water for plant growth. The clay substratum prevents water from moving out of the soil rapidly and thus allows the soil to hold enough moisture for plants, except during extremely dry periods. Permeability is moderately rapid to rapid within the soil after tile drains have been installed. In its original state large supplies of organic matter accumulated in the surface soil where the high water table prevented decomposition.

Granby fine sandy loam responds readily to artificial drainage, but sand may enter the tile lines and clog them. With good drainage this soil warms up quickly in spring; it is very easy to work and is very productive. Because of favorable soil, weeds sometimes flourish. If water is available, this soil is very well suited to irrigation.

Granby fine sandy loam occurs in such a complex pattern with Ottokee and Tedrow soils that many small areas of any one soil are mapped with the others.

Haney series

Soils of the Haney series are light-colored, moderately well drained soils developed from loamy material over poorly assorted gravelly sand to sandy loam. These Gray-Brown Podzolic soils occur in small bodies throughout most of the county. They occupy level to sloping areas on low beach ridges, gravel bars, and glaciofluvial outwash of the glacial lake plain. Calcareous glacial clay till is commonly present within 4 to 6 feet of the surface.

The Haney soil series is the moderately well drained member of the soil catena that also contains the light-colored, imperfectly drained Digby soils and the dark-colored, very poorly drained Millgrove soils.

The Haney soils contain enough silt and clay to give them good available moisture-holding capacity. The combined silt and clay make up 25 to nearly 50 percent of the volume of soil, exclusive of gravel; gravel usually comprises between 10 and 25 percent of all the parent material. Most of the sand and gravel particles are composed of limestone materials; igneous rocks, sandstone, and black shale (Ohio shale) are also present.

Within short horizontal distances, the upper substratum varies considerably in the amount of silt and clay present. The underlying materials range from nearly clean sand and gravel to those containing a moderate amount of silt and clay. Usually, the silt and clay are mixed uniformly throughout the sand and gravel, although these materials occur as lenses in places. Where the silt and clay lenses are mixed with sand and gravel, they have a definite unassorted appearance and are slightly sticky and coherent. Large glacial boulders seldom occur in Haney soils, but cobbles 3 to 6 inches in diameter are present in some places.

Hard maple, beech, white oak, red oak, and elm were the dominant species in the original deciduous forests.

Most of these soils have been cleared and are tilled. Corn, wheat, soybeans, and meadow hay are the principal crops.

Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded (HcB1) (Capability unit IIe-2).—Most of this mapping unit has lost less than 50 percent of the surface soil through erosion, but the moderately eroded areas have lost more than half. In the moderately eroded areas the color of the surface soil is brown to grayish brown and the texture is a silt loam, silty clay loam, or clay loam.

A typical profile is described of a Haney silt loam, slightly eroded, in a cultivated area on a slope of 6 percent:

Surface soil—

A_p 0 to 7 inches, dark grayish-brown (10YR 4/2, moist) to dark-brown (10YR 3/3, moist), friable silt loam or loam; breaks to moderately developed granules less than 0.125 inch in diameter; a few small pieces of gravel present; slightly acid to medium acid; 7 to 9 inches thick.

A₂ 7 to 10 inches, grayish-brown (10YR 5/2, moist) to brown (10YR 4/3, moist), friable silt loam; breaks to moderately developed granules about 0.125 inch across; slightly acid to medium acid; 2 to 5 inches thick.

Subsoil—

B₂₁ 10 to 18 inches, brown (10YR 4/3, moist), gritty, firm, coarse clay loam; breaks to moderately developed angular blocky structural units 0.125 to 0.25 inch across; a few pieces of gravel present; slightly to medium acid; 6 to 10 inches thick.

B₂₂ 18 to 35 inches, dark grayish-brown (10YR 4/2, moist), gritty, coarse loam; common, medium, and faint mottles of dark brown (7.5YR 3/2, moist) and brown (10YR 4/3, moist); very weakly developed prismatic structural units break to weakly to moderately developed angular blocky structural units 0.125 to 0.25 inch across; slightly firm when moist, slightly plastic and slightly sticky when wet; from 5 to 10 percent of soil material is a coarse skeleton consisting of gravel 0.5 to 0.75 inch in diameter; slightly acid to medium acid; 12 to 20 inches thick.

B₃ 35 to 42 inches, dark-gray (10YR 4/1, moist) to grayish-brown (10YR 5/2, moist) gravelly clay loam; a few, fine and distinct mottles of yellowish brown (10YR 5/6, moist); massive; slightly sticky and slightly plastic when wet; about 10 to 15 percent of soil material is coarse skeleton; slightly acid to medium acid; 5 to 8 inches thick.

Substratum—

D₁ 42 to 56 inches, dark-gray, stratified, calcareous sand; contains silt lenses 2 to 3 inches thick.

D₂ 56 inches+, gray and yellowish-brown, calcareous glacial clay till.

VARIATIONS: These soils differ from one area to another in depth to sand and gravel, in thickness and texture of the various horizons, in depth to calcareous till, and in composition of the underlying sandy material. The depth to calcareous sandy and

gravelly material ranges from about 35 to 45 inches. The sand and gravel are assorted to various degrees, but the content of the fine-textured materials is usually sufficient to cause the soil mass to be slightly coherent when moist. In some areas the material is composed mostly of sand, with very little gravel.

This soil has a permeable A horizon, and little surface water is lost. The rate of internal drainage ranges from medium in the upper part of the subsoil to slow in the lower part. Movement of water in the lower part of the solum is restricted during wet weather by a temporary water table. This soil has good capacity to hold water that plants can use, and crops seldom need additional moisture except during very dry spells.

This soil has moderate natural fertility. It works easily and, under good management, responds well to fertilizer. It needs tile drains only in the occasional seep areas. It can be used for truck crops because it is permeable and warms up fairly early in spring. It is also suited to irrigation.

Haney silt loam and loam, 6 to 15 percent slopes, moderately eroded (HcC2) (Capability unit IIIe-2).—Erosion has removed from half to all of the original A horizon from this soil. The texture of the surface soil at any place depends on the amount of the upper subsoil that has been mixed with the remaining surface soil. In most places the surface soil is a fine silt loam, but in the more eroded spots it is clay loam. In most other respects the profile of this soil is similar to the one described under Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded, except that the depth is less to calcareous sands and gravels.

This soil has a low supply of organic matter and plant nutrients. Good response to fertilizer can be expected. Owing to strong slopes and the loss of original surface soil, much runoff occurs. Thus, the capacity to hold water that plants can use is reduced somewhat, and growing crops may be damaged by lack of water during dry periods.

Measures to control erosion should be considered in a soil-management program. A seedbed is somewhat more difficult to prepare on this soil than on the less eroded Haney soils.

Erosion has been fairly uniform, but small areas of Haney soils that are only slightly eroded are included in the mapping unit.

Haney silt loam and loam, 0 to 2 percent slopes (HcA) (Capability unit I-1).—This soil is very similar to Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded. Runoff is very slow and good supplies of water are held for crops. Movement of water in the lower part of the subsoil is slow during wet periods, but tile drains are not usually needed for general farm crops. The soil is well suited to irrigation.

This fertile soil is usually easy to work. It is lacking in plant nutrients but, with good management, crop yields can be increased if fertilizer is used.

Haskins series

Soils of the Haskins series are light-colored, imperfectly drained Gray-Brown Podzolic soils developed in shallow deposits of medium-textured materials over calcareous clays. These soils are scattered in small areas over much of the county. They occupy nearly level or gently sloping beach ridges and outwash areas where the

deposits of medium-textured materials are 18 to 42 inches thick over fine-textured materials. These beach ridges and outwash areas usually are 1 to 3 feet above the level of the glacial lake plain.

The Haskins soils are associated with the dark-colored very poorly drained Mermill soils. They are not so deep over clay as the Digby soils, which developed in sandy and gravelly materials more than 42 inches deep over calcareous clay. The Haskins soils are finer textured than the Rimer soils, which developed in shallow deposits of sands or loamy sands over calcareous clay.

The Haskins soils are two-storied soils. The upper part of the profile developed in loam, sandy clay loam, or coarse clay loam, ranging from 18 to 42 inches in depth. The lower part of the profile is either calcareous glacial clay till or calcareous lacustrine clays. In places a thin layer of sandy or gravelly material less than 6 inches thick occurs just above the clay.

Native deciduous forests were dominated by white oak, beech, hard maple, red oak, and elm. Nearly all of these soils have been cleared and are tilled.

Haskins silt loam (Hc) (Capability unit IIw-2).—This soil is the dominant member of the Haskins series. A representative profile is described:

Surface soil—

A_p 0 to 8 inches, very dark grayish brown to dark grayish brown (10YR 3/2 to 4/2, moist) silt loam; breaks to fine granules less than 0.125 inch across; slightly acid to neutral; 7 to 9 inches thick.

A₂ 8 to 11 inches, grayish-brown (10YR 5/2, moist), friable, fine silt loam to coarse silty clay loam; a few, fine, yellowish-brown (10YR 5/6, moist) mottles; breaks to platelike structural units 0.25 to 0.5 inch thick; slightly to medium acid; 2 to 6 inches thick.

Subsoil—

B₂ 11 to 30 inches, grayish-brown (10YR 5/2, moist), coarse silty clay loam or coarse clay loam; common, distinct mottles of yellowish-brown (10YR 5/6, moist), strong brown (7.5YR 5/6, moist), and light brownish gray (10YR 6/2, moist); breaks to weakly developed sub-angular blocky structural units 0.5 to 0.75 inch across; firm when moist; slightly acid; 10 to 30 inches thick.

Substratum—

D 30 inches+, mottled gray to grayish-brown and yellowish-brown, calcareous glacial clay till or lacustrine clay.

VARIATIONS: This soil varies in depth to the underlying clay, in texture of the subsoil, and in thickness of the horizons. Where the clay material is fairly shallow, the lower part of the B horizon normally has developed in the upper 2 to 6 inches of the clay substratum. In some areas the outwash contains some gravel. The texture of the subsoil ranges from fine loam or sandy clay loam to coarse clay loam or coarse silty clay loam. Small local areas where depth to clay exceeds 42 inches are included with Haskins silt loam.

Most of the rainfall is absorbed by this soil, and there is only a small amount of runoff. Where the substratum is glacial clay till, permeability ranges from moderately slow in the upper part of the profile to slow in the lower part. If the substratum consists of fine-textured lacustrine clays, the movement of water in the lower part of the profile is very slow. Good supplies of water are available for plant growth.

Excess water within the soil can be removed successfully with tile drains. This soil warms up rather slowly in spring. Haskins silt loam has moderate natural fertility, and, with good management, which includes applications of fertilizer, the yields improve.

Haskins loam (Hb) (Capability unit IIw-2).—The surface layer of this soil contains more sand and less silt

than that of Haskins silt loam. This soil also contains somewhat more coarse materials throughout the upper part of the profile.

Runoff is slow, and permeability ranges from moderately slow in the upper part of the profile to slow in the lower part. In the spring Haskins loam warms up rather slowly. Under good management, it responds well to tile drainage. It is seldom droughty because it holds adequate supplies of water. It has moderate natural fertility, and under good management fertilizer will improve crop yields.

Included with Haskins loam in the northern part of Carryall Township are several small areas of loamy-textured Kibbie and Tuscola soils,³ as well as narrow bands of loamy Nappanee soils. The Kibbie and Tuscola soils are not extensive and are not mapped separately in Paulding County.

Hoytville series

These dark-colored, level, very poorly drained soils are among the most productive in Paulding County. They belong to the Humic Gley great soil group; they developed on calcareous fine silty clay loam or clay till of Wisconsin age. They occur in large continuous areas between the principal drainageways on the broad flats of the glacial lake plain in the southwestern, western, and northwestern parts of the county. They contain isolated bodies of Nappanee and other associated soils. The slope of these broad flats ranges from 5 to 10 feet per mile.

Hoytville soils are the dark-colored, very poorly drained member of a soil catena that includes the light-colored, moderately well drained St. Clair soils; the light-colored, imperfectly drained Nappanee soils; and the moderately dark colored, poorly drained Wetzel soils.

Hoytville soils are similar to soils of the Toledo series, but they developed from fine silty clay loam to clay till instead of lake-laid clay. Their parent material also differs from that of the Latty soils, which developed on a shallow deposit (usually less than 42 inches thick) of very fine textured lacustrine clay over glacial till, or on a mixture of these two materials.

The amount of clay in the B horizon (subsoil) of Hoytville soils is less than 50 percent, whereas that in the B horizon of Latty soils ranges from 50 to 60 percent. The till in which the Hoytville soils have developed¹ contains more clay than the clay loam or silty clay loam till that is the parent material of the Pewamo soils in west-central Ohio.

All the soils named in the catena with Hoytville series developed on similar parent material. The differences in the several soil series resulted from variations in the natural drainage. The parent material of calcareous fine silty clay loam, fine clay loam, silty clay, or glacial clay till contains about 38 to nearly 50 percent of clay and 12 to 18 percent of sand. The carbonate content varies from 15 to 25 percent. It is generally considered that the till plain areas in the glacial lake plain were reworked and leveled by the action of waves in the old glacial lakes. The small amount of coarse material consists of numerous fragments and pebbles of black shale (Ohio shale), lime-

³ Tuscola soil is the well-drained member and Kibbie the imperfectly drained member of the same catena. These medium to moderately fine textured soils developed on calcareous stratified silts, clays, and sands.

stone, and igneous materials, and an occasional glacial boulder.

In local areas thin lenses of sandy or gravelly materials occur within the till mantle. These sand lenses were probably caused by the local sorting of the till as the melt waters flowed from the glacier.

The parent material is usually light gray and yellowish brown to depths of 5 or 6 feet. Below this point the color commonly is brown (10YR 5/3, moist). The glacial till is compact and firm and is slowly permeable to water. In many areas the upper part of the parent material has developed a very coarse blocky structure. The structural development, usually 6 to 12 inches thick, decreases rapidly with depth.

The original cover consisted of swamp white oak, bur oak, American basswood, elm, hickory, sycamore, cottonwood, and silver maple. In places coarse water-loving grasses, sedges, and low swamp bushes formed the ground cover under the forest canopy.

More than 95 percent of the acreage of Hoytville soils has been cleared and is used for corn, soybeans, small grain, and other crops.

Hoytville clay (Hd) (Capability unit IIw-3).—This soil occupies more than 90 percent of the acreage covered by Hoytville soils in this county. The following describes a profile in a cultivated area:

Surface soil—

A_p 0 to 8 inches, very dark gray to very dark grayish brown (10YR 3/1 to 3/2, moist), coarse clay to silty clay; breaks to moderately developed blocky structural units 0.25 to 0.5 inch across or to moderately developed granules up to 0.125 inch across; firm when moist, sticky and slightly plastic when wet; high in organic matter; neutral to slightly acid; 7 to 9 inches thick.

Subsoil—

B_{21g} 8 to 15 inches, dark-gray (10YR 4/1 to 5Y 4/1, moist) clay; common, fine to medium, distinct, reddish-brown (5YR 4/3, moist), yellowish-brown (10YR 5/6, moist), or dark yellowish-brown (10YR 4/4, moist) mottles; breaks to strongly developed blocky structural units 0.25 to 0.5 inch across; firm to very firm when moist, slightly sticky and plastic when wet; lower horizon boundary is diffuse; neutral; 6 to 10 inches thick.

B_{22k} 15 to 40 inches, gray (5Y 5/1, moist) to grayish-brown (2.5Y 5/2, moist) clay; many, medium to coarse, distinct, dark yellowish-brown (10YR 4/4, moist) and yellowish-brown (10YR 5/6, moist) mottles; breaks to moderately to strongly developed blocky structural units that are 0.5 to nearly 2 inches across; very firm when moist, slightly sticky and plastic when wet; lower boundary is gradual; neutral to slightly alkaline; 20 to 30 inches thick.

Parent material—

C 40 inches+, calcareous glacial till, gray (5Y 5/1 to 6/1, moist) or light olive-gray (5Y 6/2, moist), dark yellowish-brown (10YR 4/4, moist), and yellowish-brown (10YR 5/6, moist) mottles; texture varies from fine silty clay loam to clay; in many areas material has weakly to moderately developed blocky structural units, 1 to 4 inches across, in the upper 6 to 12 inches of layer; contains fragments of black shale and limestone and a few igneous pebbles; firm to very firm when moist, slightly sticky and plastic when wet.

VARIATIONS: Waves and water probably reworked the parent material and caused differences in texture. In some areas very few pebbles are on the surface and the profile is about as smooth as that of the Toledo soils. The depth to calcareous till ranges from about 32 inches to 48 inches but is commonly between 36 and 45 inches.

The B horizons frequently break to a primary structure of weakly to moderately developed coarse prismatic units 1 to 3

inches across. These units break down to strongly developed angular blocky structure.

In wooded areas the surface soil is covered with 0.5 inch to 2 inches of organic matter in varying stages of decomposition. The very dark gray clay surface soil has very strongly developed granular structural units that are about 0.125 inch in diameter and have a very high content of organic matter.

Typically, Hoytville clay is level or nearly level, and runoff is slow. Local areas are ponded late in winter and early in spring and for short periods after heavy rains. If the soil is in fairly good tilth and the tile drains are adequate, these ponds usually disappear before the crops are damaged seriously.

Permeability is moderately slow in the upper part of the subsoil and slow in the lower part. Originally, the water table was at or near the surface throughout much of the spring and early summer. This high water table helped preserve large amounts of organic matter in the upper layers of the soil. A good supply of water that plants can use is available.

Although Hoytville clay was originally very wet, it responds well to tile drainage. Tile is necessary for removing excess water. Many ditches have been built to provide adequate outlets for the tile systems. After suitable drainage is provided, the soil warms up quickly in spring.

The surface soil becomes cloddy and hard to work if it is cultivated too intensively under poor management. In many areas, soil tilth has been damaged seriously by excessive tillage in preparing seedbeds.

Poor drainage, the lack of good tilth, poor stands of crops, and excessive working of the soil depress yields below the potential of this soil.

Hoytville clay is naturally very fertile. It is well supplied with plant nutrients but responds to a complete fertilizer if tilth is good. In recent years soybeans have needed additional manganese. Hoytville clay is only moderately suited to irrigation because the texture of the surface soil and subsoil is too fine.

On areas where grain has been grown extensively for years, weeds are becoming serious. Among the most common are Canada-thistle, Indian-hemp, burdock, mustard, and yellow dock.

Included with Hoytville clay in the southern part of Benton Township are several hundred acres that have a very dark gray to black surface soil and very gray subsoil. Originally the surface was covered with a thin layer of muck. The two dark-colored layers in these included soils are more than 24 inches thick. This area is on the edge of an old, wet prairie swamp that was in northwestern Van Wert County.

Hoytville silt loam (He) (Capability unit IIw-3).—This dark-colored, very poorly drained soil developed in a thin deposit of silty material over glacial clay till. The silty materials are about 8 to 15 inches thick. This soil usually occupies slight elevations that rise from a few inches to a foot above the surrounding area (usually above Hoytville clay or Hoytville silty clay loam). Hoytville silt loam occurs in small areas in Carryall Township.

The surface soil is a very dark gray, very friable silt loam. It has a large supply of organic matter. In many places it contains some fine sand. It is from 10 to 12 inches thick.

Beneath the surface is a layer of very dark gray silty clay loam that overlies silty clay or clay at a depth of

less than 15 inches. The underlying subsoil and substratum are similar to those of Hoytville clay.

Very little runoff occurs on this permeable soil. The excess water within the soil can be removed easily with tile drains, and water seldom stands on the surface. Hoytville silt loam is very productive and responds well to fertilizer. It is easy to work and can be cultivated more easily than Hoytville clay. In other respects the two soils are similar.

Hoytville silty clay loam (Hf) (Capability unit IIw-3).—This soil has more sand and silt and less clay in the surface soil than Hoytville clay. With the exception of one small gently sloping area in the northern part of Harrison Township, Hoytville silty clay loam occupies level areas on the glacial lake plain. The areas are ordinarily less than 20 acres in size; they occur in association with areas of Hoytville clay. Most of this soil is in Benton and Carryall Townships.

The surface soil is a very dark gray, moderately friable silty clay loam to clay loam, 8 to 10 inches thick. It has a very high content of organic matter. The subsoil and parent material are similar to those described for Hoytville clay.

Runoff is very slow. Permeability ranges from moderately slow in the upper part of the subsoil to slow in the lower part. Because this soil is slightly higher than Hoytville clay, water seldom stands on the surface.

This soil responds slightly better to tile drains than Hoytville clay. After the excess water is removed, the soil warms up rapidly in spring. It is very productive and is fairly easy to work. Because water filters into the surface fairly well, Hoytville silty clay loam responds somewhat better to irrigation than Hoytville clay; otherwise, the characteristics of the two soils are similar and their management problems are the same.

Latty series

These dark-colored, very poorly drained soils developed in calcareous glacial clay till mixed with fine-textured, lake-laid clay. They occur in a belt 2 to 5 miles wide extending from the southeast through the west-central area to the northwestern part of the county.

Latty soils are Humic Gley soils that intergrade to the Low-Humic Gley great soil group. They are also intermediate between Hoytville soils that developed from calcareous fine silty clay loam to clay glacial till and the Paulding soils that developed from very fine textured lacustrine clays.

The soils of the Latty series are in broad, level to nearly level areas between the major drainageways. In most places the general slope is 3 to 6 feet per mile. These soils occur in very large continuous bodies, although locally within these bodies small tracts of light-colored Nappanee and St. Clair soils occupy the slight ridges or knolls. In places, where the clay content of the B horizon is more than 60 percent, Roselms soils, rather than Nappanee soils, occupy the somewhat poorly drained positions.

Latty soils are not quite so permeable as the Toledo soils, which developed on calcareous lacustrine clays and silts and have better developed structure in the B horizon.

Latty soils differ from Paulding soils in having less than 60 percent of clay in their B and C horizons, slightly thicker surface soil, and somewhat stronger development

of structure in the lower part of the B horizon. They differ from Hoytville soils in having a thinner surface soil, more than 50 percent of clay in the B horizon, and somewhat weaker development of structure in the lower part of the B horizon and in being somewhat less permeable.

The parent material in which Latty soils developed consists of less than 42 inches of fine-textured, lake-laid clay (containing between 50 and 60 percent of the clay fraction), which was deposited over calcareous glacial clay till. In places the two kinds of materials were mixed, apparently by wave action, until a heterogeneous mixture formed that contains 50 to 60 percent of clay. The parent material also contains a small amount of scattered gravel. The sand content ranges from a little less than 10 percent to 15 percent. The carbonate content varies from 15 to about 25 percent.

The trees in much of the original deciduous forest included swamp white oak, bur oak, American elm, silver maple, and, occasionally, sycamore and American basswood. Much of the ground cover consisted of coarse swampgrasses, sedges, and water-tolerant shrubs.

More than 90 percent of the acreage occupied by Latty soils has been cleared for crops. Corn, soybeans, wheat, and other crops are grown.

Latty clay (lc) (Capability unit IIIw-1).—More than 90 percent of the Latty series is composed of Latty clay. A profile in a cultivated area is described:

Surface soil—

A_p 0 to 6 inches, dark-gray to very dark gray (10YR 4/1 to 3/1, moist) clay; breaks into moderately to strongly developed granules 0.125 to 0.25 inch across, or into moderately to strongly developed blocky structural units that are 0.25 to 0.5 inch across; firm when moist, hard when dry, sticky and slightly plastic when wet; high in organic matter; slightly acid to neutral; 6 to 8 inches thick.

Subsoil—

B_{21g} 6 to 9 inches, gray to dark-gray (10YR 5/1 to 4/1, moist) fine clay; contains a few, fine, distinct, dark-brown and yellowish-brown (10YR 4/3 to 5/6, moist) mottles; breaks into moderately to strongly developed blocky structural units 0.25 to 0.5 inch across; very firm to extremely firm when moist, very hard when dry, sticky and plastic when wet; lower boundary is diffuse; slightly acid to neutral; 2 to 5 inches thick.

B_{22g} 9 to 20 inches, gray (10YR 6/1 to 5Y 5/1, moist) fine clay; common, medium, distinct, yellowish-brown (10YR 5/4 to 5/6, moist) and dark yellowish-brown (10YR 4/4, moist) mottles; breaks into strongly developed blocky structural units 0.25 to 0.75 inch across; very firm to extremely firm when moist, sticky and plastic when wet; lower boundary is diffuse; slightly acid to slightly alkaline; 6 to 11 inches thick.

B_{23g} 20 to 42 inches, olive-gray (5Y 5/2, moist), gray, or grayish-brown (10YR 6/1 to 5/2, moist) fine clay; many, medium, prominent, yellowish-brown (10YR 5/6 to 5/8, moist) mottles; breaks into weakly developed prismatic units 2 to 5 inches in diameter which, in turn, break into moderately developed blocky structural units 0.5 to 2 inches across; very firm to extremely firm when moist, sticky and plastic when wet; lower boundary is clear; neutral to slightly alkaline; 16 to 30 inches thick.

Substratum (parent material)—

C 42 inches+, gray (5Y 6/1, moist) to grayish-brown (10YR 5/2, moist), calcareous glacial clay till; many, medium, prominent, yellowish-brown and dark-brown (10YR 5/6 to 4/3, moist) mottles; massive to very weakly developed blocky structural units more

than 2 inches across; very firm when moist; some black shale (Ohio shale) and igneous and limestone pebbles.

VARIATIONS: The amount of clay in the surface soil ranges from 40 to slightly more than 50 percent. The B horizon contains from 50 to 60 percent clay, and the parent material, from 40 to more than 50 percent. The depth to the calcareous materials is 34 to about 54 inches. In places the boundary between the lacustrine material over the glacial till is well defined; in other areas the boundary is more gradual. A few pebbles occur throughout the profile.

Latty clay is nearly level, and runoff is very slow. Internal drainage is slow to very slow, and artificial drainage is needed. Many ditches have been built. Tile drainage systems have been installed, and they give good results if they are constructed properly and the soil is kept in good tilth. In many areas where bad management has caused poor tilth, the tile drains remove the excess water very slowly. Water frequently stands on the surface in these areas, and the crops are damaged by ponding and floods during wet springs and other wet periods. In these areas, replanting is necessary if good stands of crops are to be obtained. If good tilth is maintained, Latty clay holds enough water for plant growth. Planting time must be several days later on this soil than on Hoytville clay, which dries out earlier.

Latty clay is well supplied with most plant nutrients. Soybeans are damaged at times by the lack of available manganese. The poor tilth of this soil often prevents the crops from fully utilizing its natural fertility. A complete fertilizer may increase crop yields, but results have not been consistent. The unsatisfactory yields are caused by poor tilth and inadequate aeration of the soil, meager stands of crops, bad weather, and excessive working of the soil in preparing the seedbed.

Latty clay is hard to work, especially if it is plowed when too wet or too dry. During dry weather many cracks develop that extend to depths of 12 to 24 inches. Weeds, especially Indian-hemp which grows from an underground root system, are a major problem in many fields. Where soybeans and oats are disked in, Indian-hemp, also called dogbane, comes up quickly and competes with the growing crop. Other troublesome weeds are Canada-thistle, milkweed, burdock, yellow dock, and bindweed.

Because Latty clay is a transitional soil between Hoytville soils and Paulding soils, it includes small areas of each along its outer boundaries.

Latty silty clay loam (lb) (Capability unit IIIw-1).—This very dark gray soil occurs on areas where a thin (6- to 12-inch) layer of silty material has been deposited over the fine-textured clay. Except for more sand and silt and less clay in the surface soil, the profile is generally like that of Latty clay.

Latty silty clay loam occupies very slight ridges and knolls of the glacial lake plain. These elevated areas ordinarily rise only a few inches above the surrounding soils.

The dark-colored surface soil is moderately friable, high in organic matter, and 7 to 10 inches thick. The upper subsoil overlies fine clay materials similar to those in the B horizon of Latty clay.

Runoff is slow on this soil. Since it generally occupies slightly elevated positions, water does not remain on the surface for such extended periods as on Latty clay. As

a result, less crop damage occurs from ponding. This soil is easier to work than Latty clay, and it produces better stands of crops. In other respects the two soils are similar and respond to the same management.

Included with Latty silty clay loam are small local areas of Hoytville silty clay loam. The included soils occur as small islands where the till is not covered by the finer materials.

Lucas series

The Lucas soils are the light-colored, moderately well drained to well-drained soils that developed on calcareous lacustrine clay material of the glacial lake plain. These Gray-Brown Podzolic soils are in small areas in the eastern and northern parts of the county. They occupy short slopes on the gently sloping to steep areas along drainageways that cut through Toledo soils, as well as other scattered areas. The slopes are fairly uniform and follow the meanderings of the bottom land. They range from about 60 to more than 100 feet long.

The Lucas soils are the moderately well drained to well-drained soils in the catena that includes the light-colored, imperfectly drained Fulton soils, the dark-colored, very poorly drained Toledo soils, and the very dark colored, very poorly drained Bono soils. (No Bono soils occur in Paulding County.)

Lucas soils differ from Broughton soils in having developed on lacustrine clayey material that contains less than 60 percent of clay, in having a deeper surface soil, and in being more permeable throughout the solum. They differ from St. Clair soils in having developed on lacustrine clay instead of glacial till of fine silty clay loam to clay texture.

The Lucas soils developed from calcareous lacustrine clays and silts that contain from 40 to about 60 percent of clay. In some places very thin lenses of fine sand are in the parent material. As a rule the substratum, except in these sandy lenses, contains less than 5 percent of sand. As the great ice sheet receded northward, the clayey parent material of the Lucas soils was laid down in the quiet waters of the glacial lake at the front of the ice sheet. Boulders and gravel are almost nonexistent.

Maple, beech, white oak, red oak, and hickory dominated in the native forest.

Some of the gently sloping and sloping soils of the Lucas series are tilled, but most of the strongly sloping soils are used for pasture or forestry. Unless very good management is practiced, all the Lucas soils are subject to serious erosion, which rapidly reduces their natural fertility.

The sandy substratum phases of the Lucas soils occupy the nearly level to steep areas on high terraces along the Auglaize and Maumee Rivers. Most of the areas are from 2 to 10 acres in size. They differ from the normal Lucas soils in being underlain with coarse-textured materials at depths of 2 to 4 feet. Their subsoil is not so permeable as that of the Haney soils.

The material from which these Lucas soils developed is stratified clays, silts, and sands. The depth of water-laid materials over glacial clay till is generally about 8 to 9 feet. The upper 2 to 4 feet are silty clay in which an A horizon of silt loam has developed. At greater depth, texture of the substratum is silty clay loam or clay loam, then silt loam or loam, and sandy loam. The

lower substratum ranges from calcareous sandy loam to clean sand and fine gravel. Lime concretions are common in the lower part of the profile.

Unlike the Fulton soils, sandy substratum phases, Lucas soils, sandy substratum phases are on steeper slopes and are affected by the many different textures of the soil-forming materials overlying the substrata. On some of the moderate to strong slopes, the sandy substratum phase of Lucas soils often occurs as a complex with St. Clair soils. Lucas soils occupy the upper part of the slope, and St. Clair soils are on the lower part below the sandy deposits on the terrace formation. In such locations the dominant soil has been mapped and the others are inclusions within it. In most of those places the dominant soils are Lucas silt loam, sandy substratum phases on slopes of 2 to 6 percent.

The native forest consisted mostly of white oak, red oak, hickory, and hard maple with some black walnut, beech, and wild cherry. The more nearly level areas have been cleared and are used for corn, soybeans, wheat, and meadow crops. The steeper areas are mostly in pasture or trees. Locally, steep areas are idle.

Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded (tCB1) (Capability unit IIIe-1).— This soil occurs in several small bodies in Crane, Jackson, and Brown Townships. The following profile is one in a slightly eroded area:

Surface soil—

A_p 0 to 8 inches, grayish-brown to brown (10YR 5/2 to 5/3, moist) silt loam; breaks into weakly developed granules up to 0.125 inch in diameter; friable when moist; slightly acid to neutral; low in organic matter; 7 to 10 inches thick.

Subsoil—

B₁ 8 to 11 inches, pale-brown (10YR 6/3, moist) silty clay loam; common, medium, faint mottles of yellowish brown (10YR 5/4, moist); breaks into moderately developed angular blocky structural units that are 0.25 to 0.5 inch across; firm when moist; very smooth when crushed; medium acid to neutral; 1 to 4 inches thick.

B₂ 11 to 22 inches, brown to pale-brown (10YR 5/3 to 6/3, moist) silty clay; breaks into strongly developed angular blocky structural units about 0.25 inch across; very firm when moist, plastic when very moist; very smooth when crushed; slightly acid to medium acid; 10 to 20 inches thick.

Substratum (parent material)—

C₁ 22 to 28 inches, grayish-brown (10YR 5/2, moist), calcareous, fine silty clay; breaks into weakly developed angular blocky structural units 0.5 to 1 inch in diameter; very firm when moist, plastic when very moist; very smooth when crushed.

C₂ 28 inches+, grayish-brown (10YR 5/2, moist) calcareous silty clay; very firm when moist; water-laid material may have an occasional thin lens of very fine sand.

VARIATIONS: The slightly eroded areas of this soil have lost less than half of their surface soil. In the moderately eroded areas more than 50 percent of the surface soil (usually about three-fourths) has been lost. The resulting surface soil is a mixture of remaining surface soil and upper subsoil. Its texture tends to be a fine silt loam or a silty clay loam. These more eroded areas occur in a spotty land pattern that is usually colored brown to yellowish brown.

In some areas on the more gentle slopes, light-gray to grayish-brown mottles occur in the lower part of the B horizon. In other areas the B horizon is free of mottling above 24 inches. Calcareous material is present at depths of 20 to 28 inches. Rocks or gravel seldom occur in this soil.

In uneroded forested areas the A₁ horizon is 1 to 3 inches thick. It consists of a dark-gray to dark grayish-brown, friable silt loam that has a high content of organic matter. This layer is covered with a thin layer of organic residue formed from decayed leaves and twigs of deciduous trees. Below the A₁ is a friable silt loam

A₂ horizon that is 5 to 8 inches thick. The A₂ horizon is brown to grayish brown. Below this level, the profile is like that of the cultivated soil.

Because of the fairly compact fine-textured subsoil, permeability ranges from moderately slow in the upper part of the solum to slow in the lower part. Loss of rainfall from the soil surface is medium, and, unless measures are taken to control erosion, serious damage may result. Crops are seldom damaged by lack of available moisture.

This soil is fairly easy to work, but it is only moderately well supplied with plant nutrients. Good management that includes use of fertilizer will normally improve crop yields.

Lucas silt loam, 6 to 12 percent slopes, moderately eroded (LcC2) (Capability unit IVE-1).—The combination of strong slopes and medium to rapid runoff has caused half or all of the original surface soil to be eroded. The individual areas are normally very small. They occupy the short, narrow, sloping breaks near drainageways. Usually the depth to calcareous clays is somewhat less than that in Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded.

Most of the surface layer consists of the upper part of former subsoil mixed with the remaining surface soil. It varies in color from grayish brown or brown to yellowish brown and in texture from fine silt loam to silty clay loam. This soil is hard to work, and good stands of crops are difficult to obtain at times. During dry periods, the crops need additional water. Most of the surface soil has been eroded and much of the fertility and organic matter have been lost. Successful management for improved yields requires use of lime and fertilizer, as well as measures to control erosion.

In most respects this soil is like Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded. Small areas of slightly eroded or uneroded Lucas soils are included with this mapping unit where erosion has caused such a complex pattern that it is impossible to separate the soils on a map of the scale used.

Lucas silt loam, 12 to 25 percent slopes, moderately eroded (LcD2) (Capability unit VIIe-1).—This soil occupies moderately strong slopes along the breaks near drainageways. In places it is on short steep slopes near areas of Fulton or Toledo soils. Much of the original surface soil has been lost through erosion. This soil is like Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded, but its horizons are thinner. Very little or no mottling is in the lower part of the subsoil. The original depth to calcareous lacustrine clay was about 12 to 20 inches and the thickness of the A horizon was about 5 to 6 inches.

Where this soil has been cultivated for a long time, the present surface soil is composed of the small remaining amount of original surface soil and 3 to 5 inches of former subsoil. The texture of the cultivated layer is a heavy silt loam to silty clay loam, and its color is brown to yellowish brown.

Runoff is rapid to very rapid, and erosion has reduced the capacity of this soil to hold water that plants can use.

This soil is low in organic matter and natural fertility and is likely to be severely eroded if it is tilled

continuously. Included with it are small slightly eroded and severely eroded areas of Lucas silt loam.

Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded (LdB1) (Capability unit IIIe-1).—This soil is the most extensive member of the sandy substratum phases of Lucas silt loam. It occurs throughout the Auglaize and Maumee River areas. Up to 50 percent of the original surface soil has been eroded. A good part of the organic matter and some of the natural fertility were removed when surface soil was washed away.

A representative profile from a tilled area:

Surface soil—

A_p 0 to 8 inches, dark grayish-brown (10YR 4/2, moist) friable silt loam; breaks into weakly developed granules less than 0.125 inch in diameter; slightly acid; 6 to 9 inches thick.

Subsoil—

B₁ 8 to 11 inches, brown (10YR 5/3 to 4/3, moist) silty clay loam to coarse silty clay; breaks into moderately developed angular blocky structural units about 0.25 inch across; firm when moist; slightly to moderately acid; 2 to 4 inches thick.

B₂₁ 11 to 24 inches, dark-brown (7.5YR 4/4, moist) to brown (10YR 5/3, moist) fine silty clay; breaks into moderately to strongly developed angular blocky structural units that are 0.25 to 0.5 inch across; firm when moist; slightly to moderately acid; 8 to 14 inches thick.

B₂₂ 24 to 38 inches, fine silty clay mottled grayish brown, brown, and yellowish brown (10YR 5/2, 5/3, 5/6, moist); breaks into moderately developed angular blocky structural units that are 0.25 to 0.75 inch across; firm when moist; slightly acid to neutral.

B₃ 38 to 45 inches, grayish-brown silty clay that, with depth, grades to sandy clay loam, silty clay loam, silt loam, or loam; neutral.

Substratum—

D 45 inches+, gray to grayish-brown, calcareous fine sandy loam; becomes loamy sand and fine gravel in some areas; contains large quantities of lime concretions, 1 to 2 inches across.

VARIATIONS: In some places the fine silty clay above the sandy substratum is calcareous.

Because depths to the coarse-textured material range from less than 30 inches to more than 48 inches, this soil differs widely from one area to another. In the sloping areas calcareous glacial clay till underlies the terrace formation at depths of less than 5 feet to nearly 10 feet. In the steeper areas the till outcrops at the base of some of the longer slopes.

In wooded tracts the top 2 or 3 inches are a very dark grayish brown friable silt loam. This layer is underlain by 6 to 8 inches of pale-brown silt loam. The dark-colored surface layer contains a large supply of organic matter.

Runoff is medium to slow. Permeability ranges from moderately slow to slow through the fine-textured part of the profile and is moderate in the sandy substratum. This soil can hold enough water for good crop growth. Except for an occasional area where seepage occurs, tile drainage is not needed.

This soil is fairly easy to work; it is not well supplied with plant nutrients. If adequate fertilizer is applied, good crop yields can be obtained. A few, small, nearly level areas of Lucas silt loam, sandy substratum phase, 0 to 2 percent slopes, are included.

Lucas silt loam, sandy substratum, 0 to 2 percent slopes (LdA) (Capability unit IIe-1).—This soil is more nearly level than Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded. Runoff is slightly less, and the soil is not seriously eroded. The surface soil is 8 to 10 inches thick. It is fairly easy to work and is moderately productive. It responds well to fertilizers.

The mottled layer, at depths of 18 to 20 inches, is closer to the surface than in Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded. In places this soil has a 2- or 3-inch mottled layer immediately beneath the plow layer.

Lucas silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded (ldB2) (Capability unit IIIe-1).—This soil has lost from 50 to 100 percent of its original surface soil through erosion. Except that more surface soil has been lost, it is like Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded. Its ability to hold water for plant use has been reduced by the loss of much of the absorbent surface soil and organic matter.

This soil occupies the steeper parts of 2- to 6-percent slopes. The present surface soil is brown to yellowish brown, and its texture ranges from fine silt loam to silty clay loam. It is more difficult to work and has lower natural fertility than the surface layer of the uneroded or slightly eroded phases of Lucas silt loam, sandy substratum. Frequently, poor stands of crops, reduced fertility, and lack of adequate soil moisture result in low yields.

Mapped with this soil are very small areas of slightly eroded and severely eroded sandy substratum phases of Lucas silt loam. These areas give a spotted appearance in places. In the severely eroded areas, all of the original surface soil has been lost. Several small spots of the severely eroded soils were included with areas of this soil mapped in Auglaize Township.

Lucas silt loam, sandy substratum, 6 to 12 percent slopes, moderately eroded (ldC2) (Capability unit IVe-1).—The loss of more than half of the original surface soil and stronger slopes distinguish this soil from Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded. Originally, the profiles of these two soils were similar.

Because much of the surface soil and organic matter have been lost, the plow layer is composed of the remaining surface soil and the upper 2 to 5 inches of former subsoil. The texture of the grayish-brown to yellowish-brown surface soil varies from silt loam to silty clay loam.

The texture of the B horizon ranges from fine silty clay or clay to clay loam or silty clay loam. Differences are great within short distances up or down the slope.

Runoff is medium to rapid. This soil is low in its supply of plant nutrients and organic matter and has only a moderate capacity to hold water for plant growth. It is difficult to work into a good seedbed. All of these factors contribute toward poor crop yields. Small areas of uneroded, of slightly eroded, and of severely eroded Lucas soils are included with this soil. The uneroded spots are wooded tracts in narrow, sloping areas.

Lucas silt loam, sandy substratum, 12 to 25 percent slopes, moderately or severely eroded (ldD2) (Capability unit VIe-1).—Stronger slopes and the loss of more than half of the original surface soil distinguish this soil from Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded. From 4 to 6 inches of the original surface soil (more than half of the original A horizon) have been removed through erosion.

In the moderately eroded areas, the present surface

layer consists largely of former subsoil mixed with the remaining surface soil. The texture of the brown surface soil is mainly a silty clay loam. Several severely eroded areas have been mapped with this soil. In these areas all of the original surface soil has been removed and the present surface soil consists largely of the former subsoil. On the stronger slopes, the original solum (A and B horizons) is only 12 to 16 inches thick.

Runoff is medium to rapid. Further erosion will take place if this soil is tilled continuously or grazing is not controlled. The yields will be low because this soil holds a low supply of available moisture; it is low in fertility and in its supply of organic matter.

Uneroded and slightly eroded areas, too small and too complex to separate on a map of the scale used, are mapped with this soil.

Mermill series

These fertile, dark-colored soils developed in shallow, medium-textured, glaciofluvial outwash overlying clay, under very poor natural drainage. They are scattered in small tracts in level to nearly level areas over much of the county. Mermill soils have less than 42 inches of medium-textured material over calcareous clay, and thus differ from the deeper Millgrove soils that are also on remnants of low beach ridges and outwash areas. The clay substratum in most places is glacial clay till, but in the eastern part of the county some of the Mermill soils are underlain by lacustrine clay. They are Humic Gley soils.

The Mermill soils have a subsoil of loam or coarse clay loam over the clay substratum, in contrast to the Wauseon soils, which have a subsoil of sandy loam or loamy sand. Mermill soils have very poor natural drainage; Haskins soils in the same catena are somewhat poorly drained.

The native deciduous forests consisted of swamp white oak, bur oak, silver maple, elm, American basswood, and eastern cottonwood. Most of these soils have been cleared and are used mainly for corn, soybeans, wheat, and other grain crops.

Mermill silt loam (Mb) (Capability unit IIw-3).—Most of this soil is in Carryall Township, although small areas are in other parts of the county. A representative profile follows:

Surface soil—

A_p 0 to 8 inches, very dark gray (10YR 3/1, moist), friable silt loam; breaks into moderately developed granules up to 0.125 inch in diameter; high in organic matter; neutral to slightly acid; 7 to 9 inches thick.

A₁ 8 to 10 inches, very dark gray (10YR 3/1, moist), friable silt loam; breaks into moderately developed granules about 0.125 inch in diameter; high in organic matter; neutral to slightly acid; 2 to 5 inches thick.

Subsoil—

B_{21g} 10 to 20 inches, coarse clay loam, dark gray to dark grayish brown (10YR 4/1 to 4/2, moist); a few, fine, distinct yellowish-brown (10YR 5/4 to 5/6, moist) mottles; breaks into moderately developed blocky structural units 0.25 to 0.5 inch across; firm when moist; neutral to slightly alkaline; 8 to 12 inches thick.

B_{22g} 20 to 36 inches, coarse clay loam mottled dark gray (10YR 4/1, moist), grayish brown (10YR 5/2, moist), and yellowish brown (10YR 5/6, moist); breaks into moderately developed blocky structural units 0.25 to 0.5 inch across; firm when moist; neutral to slightly alkaline; 2 to 20 inches thick.

Substratum—

D 36 inches+, calcareous glacial clay till mottled gray (10YR 5/1, moist) and yellowish brown (10YR 5/6, moist); contains numerous black shale (Ohio shale), granite, and limestone pebbles, or calcareous lacustrine clay.

VARIATIONS: The texture of the B horizon ranges from a fine loam to sandy clay loam or coarse clay loam. If the outwash deposits are fairly shallow, the lower part of the solum is developed in the upper 2 to 8 inches of the clay substratum. This soil contains much gravel. In some areas thin lenses of sandy and gravelly material are just above the clay substratum.

Most of the rainfall is absorbed. Internal drainage ranges from medium through the medium-textured material to slow through the clay substratum. If adequate tile drains are installed, the excess water is easily removed. A large amount of water is available for good crop growth. Originally, the water table was at or near the surface; hence, large supplies of organic matter accumulated in this area.

This soil is fertile. It needs additional organic matter, however, and responds readily to fertilizer. It is easy to work and produces good stands of crops.

The texture of the surface soil differs widely within short distances; thus, small areas of Mermill loam and of Mermill silty clay loam are included with Mermill silt loam. Conversely, small areas of Mermill silt loam are mapped with Mermill loam and with Mermill silty clay loam.

Mermill loam (Mc) (Capability unit IIw-5).—This fertile, dark-colored soil is similar to Mermill silt loam except that the outwash on which Mermill loam developed contains more sand and less silt and clay. It is also somewhat more gritty.

Very little water is lost through runoff. Water moves through the upper part of the profile slightly easier than through Mermill silt loam. Excess water within the solum is easily removed with tile drains.

This soil is easy to work, yields well, and responds well to fertilizer. Most of it is in Carryall Township.

Mermill silty clay loam (Mc) (Capability unit IIw-3).—This fertile soil developed in outwash material, but it contains more clay in the surface soil and slightly more clay in the subsoil than Mermill silt loam. The subsoil is no finer, however, than coarse or medium clay loam. Otherwise, the sequence of soil layers and the characteristics of the two soils are the same. This soil contains less gravel and other coarse material than Mermill silt loam or Mermill loam.

Runoff is very slow on this soil because most of the rainfall is absorbed. In its original state the soil was very poorly drained. Excess water is readily removed if tile drains are installed.

Mermill silty clay loam is fairly easy to work and responds well to fertilizer. Most of this soil is in Washington Township. Small areas that have a clay loam surface soil are mapped with it.

Millgrove series

The fertile, dark-colored, very poorly drained Millgrove soils developed in loamy material over poorly sorted gravelly sand to sandy loam. They are on low beach ridges of the glacial lake plain. These Humic Gley soils usually occupy nearly level to level areas that are generally a few inches below the surrounding till plains. Where they are associated with outwash soils, they normally are in slight depressions. Along the

Maumee River and, locally, along other drainageways, these soils occupy moderately low terraces that are intermediate between the high terraces on which Fulton soils occur and the bottom land.

The Millgrove soils are the dark-colored, very poorly drained member of the soil catena that includes the light-colored, moderately well drained Haney soils, and the light-colored, imperfectly drained Digby soils. Millgrove soils developed from loamy materials over poorly sorted, calcareous sandy and gravelly outwash more than 42 inches thick. In this respect they differ from Mermill soils, which formed in medium-textured materials that are 18 to 42 inches deep over the calcareous clay.

In a few places, a very small acreage of Colwood soils occurs with Millgrove soils in areas too small to be shown separately on the map. Colwood soils developed in calcareous fine sands and silts and are not mapped in this county.

The underlying material is sandy loam or loamy sand that contains 50 to about 75 percent of sand and 8 to 15 percent of clay. Gravel comprises 10 to 25 percent of the solum. Silt and clay may occur as thin lenses in the underlying material or may be mixed with sand and gravel. In most places the gravel and sand are slightly sticky and coherent.

The gravelly and sandy materials consist mostly of limestone. They also contain small amounts of black shale (Ohio shale) and of igneous materials.

Swamp white oak, bur oak, elm, American basswood, sycamore, and hickory were the chief species of the original forest cover. Most of these soils have been cleared and are now used for corn, soybeans, wheat, and some meadow crops.

Millgrove loam (Md) (Capability unit IIw-5).—Millgrove loam is very fertile and easily worked. It occurs in small areas in nearly every township of the county, but the total acreage is small.

A typical profile in a cultivated area is described:

Surface soil—

- A_p 0 to 8 inches, very dark gray (10YR 3/1, moist) very friable loam; breaks into weakly developed granules less than 0.125 inch across; high organic-matter content; slightly acid to neutral; 7 to 9 inches thick.
- A₁ 8 to 14 inches, very dark gray (10YR 3/1, moist) very friable loam; breaks into weakly developed granules about 0.125 inch across; high organic-matter content; slightly acid to neutral; 4 to 6 inches thick.

Subsoil—

- B_{21x} 14 to 24 inches, dark-gray (10YR 4/1, moist) sandy clay loam to clay loam; grayish brown (10YR 5/2, moist) mottles are common, fine, and faint; contains moderately developed prismatic structural units 2 to 4 inches across that break into moderately developed angular and subangular blocky structural units 0.5 to 1 inch across; moderately friable when moist; slightly acid to neutral; 8 to 12 inches thick.
- B_{22x} 24 to 35 inches, sandy clay loam to clay loam mottled with dark grayish brown (10YR 4/2, moist) and light olive brown (2.5Y 5/4, moist); breaks into weakly developed angular and subangular blocky units 0.5 to 2 inches across; firm when moist, slightly sticky and slightly plastic when wet; neutral to slightly alkaline; 6 to 15 inches thick.

Substratum—

- D 35 inches+, grayish brown (10YR 5/2, moist) loose, coarse, sandy loam to loamy sand; weakly calcareous; single-grain structure; contains a small amount of silt and clay; slightly sticky when wet.

VARIATIONS: There are variations from place to place in the depth to the sand and gravel, and in composition of the parent

material and the degree of sorting that it has undergone. The depth of the solum ranges from about 32 inches to more than 40 inches.

Locally, areas of Colwood loam, too small to be mapped separately, are included with this soil and with other Millgrove soils. These areas are in Benton Township, southeast of Payne, and in Brown and Auglaize Townships, in association with soils of the Toledo series and other sandy soils. The Colwood soils are similar to Millgrove loam except that they developed in and are underlain by calcareous fine sands and silts instead of poorly sorted sands and gravels. Colwood loam is gritty throughout the profile, and it lacks the coarse sand and gravel fraction that is commonly present in Millgrove loam.

Millgrove loam has very slow runoff. Originally, a high water table was at or near the surface and, therefore, large quantities of organic matter accumulated in the upper layers of the soil. If tile drains are installed, excess water moves rapidly through the soil. This soil can supply enough water for good crop growth.

Although its natural fertility is very high, Millgrove loam responds well to fertilizer. It works easily and produces good stands of crops. It is well suited to irrigation if an adequate water supply is available.

Several small areas of Millgrove loam in Harrison and Crane Townships are gently sloping rather than nearly level. They occur where ground waters seep in from areas above.

Millgrove silt loam (Me) (Capability unit IIw-3).—This fertile, dark-colored soil is somewhat finer textured than Millgrove loam. The B horizon, as a rule, is clay loam that contains more silt and slightly less sand than the B horizon of Millgrove loam. In some areas, the underlying materials consist mainly of coarse and medium sands instead of sand and gravel.

Several areas of Colwood silt loam, too small to be shown separately, are included with this soil. Colwood soils developed in calcareous fine sands and silts, and in this county do not occupy areas large enough to be shown on the map.

Runoff is slow. Movement of water within the upper part of the B horizon is slightly slower than in Millgrove loam. Millgrove silt loam responds well to tile drains, however. Most of this soil is in the southwestern and eastern parts of Paulding County.

Several areas in Benton Township are on slopes where seepage keeps the solum partially or completely saturated for long periods. In these areas, the runoff is more rapid than on the level places. Also, the lower part of the subsoil is usually a little browner.

Millgrove silty clay loam (Mf) (Capability unit IIw-3).—This fertile soil occurs only on level or nearly level parts of the outwash plains. It has a silty clay loam or clay loam surface soil and slightly finer clay loam in the B horizon than Millgrove loam. In general, the profile and other characteristics of the two soils are the same. As in Millgrove silt loam, the solum at some places is underlain by poorly assorted coarse and medium sands instead of by loamy sand and gravel.

Millgrove silty clay loam is not so easy to work as Millgrove loam. It is not a difficult soil to cultivate, however. Runoff is slow, and internal drainage is a little slower than that in Millgrove loam. Tile drains

are very effective in removing excess water from this soil. The soil has a high capacity to hold water that plants can use, and it responds well to fertilizer.

Nappanee series

The Nappanee soils are light-colored, moderately fertile soils that developed in calcareous, fine clay loam to clay till of Wisconsin age in the glacial lake plain. These imperfectly drained Gray-Brown Podolic soils are extensive in the western half of the county.

Nappanee soils occupy two positions: (1) The very low ridges and knolls that occur in the microrelief of the glacial lake plain; and (2) the level to sloping areas next to the short, sharp slopes along natural water courses. The ridges and knolls in many places rise only a few inches to a foot above the surrounding areas of Hoytville soils.

The Nappanee soils are the imperfectly drained member of a soil catena that also includes the light-colored, moderately well drained St. Clair soils; the moderately dark colored, poorly drained Wetzel soils; and the dark-colored, very poorly drained Hoytville soils. The Nappanee soils also are the somewhat poorly drained member of a catena that includes the very poorly drained Latty soils.

Nappanee, St. Clair, Wetzel, and Hoytville soils developed in the same kind of parent material. Differences in natural drainage caused differences in their respective profiles.

The Nappanee soils differ from the Blount soils (not mapped in Paulding County) in having developed on calcareous, fine silty clay loam to clay glacial till instead of clay loam or silty clay loam glacial till. Nappanee soils resemble Fulton soils but are underlain by till rather than by lacustrine clays.

The till plain on which Nappanee soils developed was inundated by the glacial lakes for a long time following the recession of the last glaciers. During this time the action of the waves modified and leveled the plain.

The clay content of the glacial till varies from 38 percent to nearly 50 percent; the sand content, from about 12 to 18 percent. Small but significant amounts of black shale (Ohio shale), limestone, and igneous pebbles are mixed throughout the glacial till. The till contains from 15 to 25 percent of carbonates. Thin lenses of stratified sandy or gravelly materials occur locally. These lenses are only a few inches thick.

The Nappanee soil is relatively free of boulders except in an area about half a mile wide across Benton, Blue Creek, Paulding, and Jackson Townships. Here the large boulders left by the glaciers do not interfere greatly with tillage.

In many areas, weak to moderate angular blocky structural units, 1 to 3 or 4 inches across, lie immediately beneath the B horizon in the upper 3 to 6 inches of the calcareous glacial till. This structural development decreases rapidly with depth.

Many areas having Nappanee silt loam or silty clay loam textures are mapped in association with Latty soils. They differ from the usual Nappanee soils because they developed in shallow, fine silty clay loam to coarse silty clay over clay till, rather than till only. The deposits over the till range from less than 12 inches to about 20 inches in thickness. The surface soil

in these areas contains a little more silt and less sand than typical Nappanee soils. In these areas the upper 2 to 4 inches of the B horizon is silty clay loam that overlies a silty clay or clay B₂ horizon. Thin lenses of silt or silty clay loam also occur locally in the B₂ horizon.

Nappanee soils contain a perched water table part of the time. The water table is high during spring rains and other wet spells and disappears during dry weather. Thus, organic matter accumulated only in the top 2 or 3 inches of the original soil. A fairly compact, impermeable subsoil causes the slow movement of water within the soil. Although tile drains remove the excess water slowly, they are beneficial if other good management practices are used.

White oak, red oak, white ash, elm, hickory, and some beech and sugar maple made up the greater part of the original forest. These soils are used mainly for corn, soybeans, wheat, and some meadow hay. Some areas are wooded or in pasture.

Nappanee silt loam, 0 to 2 percent slopes (NcA) (Capability unit IIIw-2).—This soil is chiefly near the breaks along natural water courses. It is mostly in the western half of the county and in Latty and Jackson Townships.

A typical cultivated profile:

Surface soil—

A_p 0 to 7 inches, dark grayish-brown to light brownish-gray (10YR 4/2 to 6/2, moist) friable silt loam; breaks into weakly developed granules less than 0.125 inch thick; low in organic matter; slightly acid to medium acid; 6 to 8 inches thick.

A₃ 7 to 9 inches, light brownish-gray (2.5Y 6/2, moist) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/4 to 5/6, moist) mottles; separates into weakly developed platelike units that are 0.125 to 0.25 inch thick; friable to firm when moist; medium acid; 1 to 4 inches thick.

Subsoil—

B_{21g} 9 to 14 inches, grayish-brown (2.5Y 5/2, moist) silty clay or clay; many, medium to coarse, prominent, strong-brown (7.5YR 5/6, moist) and yellowish-brown (10YR 5/4, moist) mottles; breaks into moderately to strongly developed angular blocky structural units 0.25 to 0.5 inch across; very firm when moist, very hard when dry; moderately acid; 4 to 6 inches thick.

B_{22g} 14 to 24 inches, silty clay or clay mottled with grayish brown (10YR 5/2) and yellowish brown (10YR 5/4 to 5/6, moist); breaks into strongly developed angular blocky structural units 0.25 to 0.75 inch across; very firm when moist, very hard when dry; medium acid in upper part, slightly acid in lower part; 6 to 12 inches thick.

Parent material—

C 24 inches+, calcareous, fine silty clay loam to clay glacial till mottled grayish brown and yellowish brown (10YR 5/2 to 5/6, moist); ped surfaces are sometimes coated with olive gray (5Y 5/2, moist); materials contain black shale and igneous and limestone fragments; in many areas in the upper 3 to 6 inches of the till, this material breaks into moderately developed angular blocky structural units 2 to 5 inches across.

VARIATIONS: The color of the subsoil ranges from gray and brownish gray through brownish yellow, yellowish brown, and strong brown. In wooded areas the surface soil, to a depth of 2 or 3 inches, is dark gray to dark grayish brown (10YR 4/1 to 4/2, moist) and has a fairly high content of organic matter. This layer is underlain by light brownish-gray to pale-brown (10YR 6/2 to 6/3, moist) silt loam that may have a few, fine, faint, yellowish-brown mottles.

Runoff is fairly slow. If the soil becomes saturated and puddled during heavy rains, the water runs off the surface and removes large quantities of fine soil particles in suspension. This soil has the capacity to hold

good reserves of water that crops can use. It is cold and warms up slowly in the spring. Crops may be damaged during prolonged wet periods if water stands in shallow depressions or the soil remains saturated. Wheat and legumes are often injured by freezing and thawing in these areas.

In many areas the tilth is poor as a result of continuous cropping. Poor tilth, combined with low natural fertility and frequent overflow, results in low productivity. With good management, however, this soil can be built up to a moderately high level of productivity.

Nappanee silt loam, 2 to 6 percent slopes, slightly eroded (NcB1) (Capability unit IIIw-4).—This soil occupies the gently sloping areas of the glacial lake plain along shallow waterways and draws. The irregular slopes gradually become steeper with the downgrade course of the stream.

With a few minor exceptions, the characteristics of this soil are similar to those of the Nappanee silt loam, 0 to 2 percent slopes. In this soil, the mottling is somewhat less intense immediately below the surface soil, and the light brownish-gray colors are less prominent. Less than half of the surface soil has been lost through erosion. Because of the gently sloping relief, runoff and erosion take place more rapidly than on Nappanee silt loam, 0 to 2 percent slopes. This soil has better natural drainage, and less water is ponded on the surface during wet weather. The two soils respond in much the same way to similar management.

Mapped with this soil are small areas of Nappanee silt loam, 2 to 6 percent slopes, moderately eroded, and small wooded areas of Nappanee silt loam where little or no erosion has taken place. Several small areas of Nappanee loam on slopes of 2 to 6 percent are included with this soil.

Nappanee silt loam, 2 to 6 percent slopes, moderately eroded (NcB2) (Capability unit IIIw-4).—This soil has been damaged by erosion; from half to all of the original surface soil has been lost. This soil occupies gentle slopes along drainageways. Its original profile and that of Nappanee silt loam, 0 to 2 percent slopes, were similar in most respects. This soil, however, has less intense mottling in the upper part of the B horizon, and the color is somewhat lighter brown and grayish brown throughout the B horizon. This soil is generally in the western half of the county.

The present surface soil consists of the upper part of the original subsoil mixed with the remnants of the original surface soil. As a result, the color ranges from grayish brown to yellowish brown and the texture ranges from fine silt loam to fine silty clay loam.

The thinning of the surface soil has brought the reserves of organic matter and plant nutrients to a very low level. Also, there is a greater loss of surface water by runoff, and the available moisture-holding capacity has been reduced to the point that this soil is somewhat droughty in dry weather.

This soil has low productivity, but it can be improved under good management if measures are taken to control erosion. It works into a good seedbed with some difficulty. It produces below-average stands of crops and poor yields. All of this soil is cultivated. In all other respects it is similar to Nappanee silt loam, 0 to 2 per-

cent slopes, and the two soils are managed in the same way.

Included with this soil are several small areas that are severely eroded.

Nappanee loam, 0 to 2 percent slopes (NbA) (Capability unit IIIw-2).—This light-colored soil occupies low ridges and knolls on the glacial lake plain where waves deposited very shallow layers of loamy materials, less than 18 inches thick, on the original clay till. Many of the soil areas are on the outer, very low beach ridges. They occur mostly in the northwestern part of the county.

The surface soil is 9 to 12 inches thick, somewhat thicker than that of Nappanee silt loam, 0 to 2 percent slopes. The upper part of the B horizon is a coarse clay loam or clay loam, and at depths between 12 and 18 inches it grades to the clay B₂ horizon. The upper subsoil is less brown than that of Nappanee silt loam, 0 to 2 percent slopes. The lower profile is similar in the two soils, but carbonates are at slightly greater depths in this soil.

This soil has a fairly porous surface layer, so runoff is slow. Permeability is moderately slow in the upper part of the subsoil and slow in the lower part. This soil responds to tile drains somewhat better than the Nappanee silt loams. It has a low content of organic matter and low fertility, but responds well when fertilized. The surface soil does not puddle so easily as that of the Nappanee silt loams. Problems of management are similar to those on Nappanee silt loam, 0 to 2 percent slopes.

Nappanee fine sandy loam, 0 to 2 percent slopes (NaA) (Capability unit IIIw-2).—This soil developed on a shallow deposit of fine sandy loam over glacial clay till. This feature distinguishes it from other Nappanee soils. The sandy deposits are less than 18 inches thick. This soil occupies nearly level ridges and knolls just above the level of the surrounding soils of the glacial lake plain. Nearly all of it is in Carryall Township.

The surface soil is dark grayish-brown to brown, very friable, loose, fine sandy loam, 10 to 12 inches thick. The structure of this layer is weak granular. It is low in its supply of organic matter and has moderate permeability. Beneath this sandy surface layer is a layer of sandy clay loam to clay loam that is mottled with grayish brown, brown, and yellowish brown. This layer is 3 to 6 inches thick. Under this sandy material the soil layers grade rapidly to the clay B₂ horizon. This B₂ horizon is similar to that of Nappanee silt loam, 0 to 2 percent slopes, except that most of the structural aggregates in the upper part are coated with small quantities of fine sand. Probably this sand was carried down through cracks by percolating water.

Runoff is slow, and permeability is moderate in the upper part of the profile and slow in the lower part. This soil is easy to work; it responds fairly well to tile drains, if they are properly installed. It has a fairly good capacity to hold water that plants can use, although it may be droughty in very dry weather. This soil is low in fertility, and fertilizer should be used in any soil-management program.

Water does not stand on the surface for long periods, but in very wet weather the sandy part of the solum

becomes saturated. This area is known as floating sands.

Nappanee silty clay loam, 0 to 2 percent slopes (NdA) (Capability unit IIIw-2).—This light-colored, moderately fine textured soil occurs on fairly level areas of the glacial lake plain. It occupies the very low ridges and knolls on the broad flats in association with Hoytville clay. Where it is associated with Nappanee silt loams, it may occur in shallow swales or water courses at the heads of draws.

The surface soil of silty clay loam distinguishes this soil from Nappanee silt loam, 0 to 2 percent slopes. The sequence and characteristics of the various layers are much the same in these two soils.

A representative cultivated profile:

Surface soil—

A_p 0 to 7 inches, dark grayish-brown (2.5Y 4/2, moist) to grayish-brown (10YR 5/2, moist) moderately friable silty clay loam; breaks into weakly developed granules less than 0.125 inch across; low in organic matter; slightly acid to medium acid; 6 to 7 inches thick.

Subsoil—

B_{21g} 7 to 15 inches, light brownish-gray (2.5Y 6/2, moist) silty clay or clay highly mottled with strong brown (7.5YR 5/6, moist) to yellowish brown (10YR 5/4, moist); breaks into weakly to moderately developed angular blocky structural units 0.25 to 0.5 inch across; very firm when moist; slightly acid to medium acid, 6 to 10 inches thick.

B_{22g} 15 to 28 inches, clay or silty clay mottled grayish brown (2.5Y 5/2, moist), yellowish brown (10YR 5/4, moist), and strong brown (7.5YR 5/6, moist); breaks into strongly developed angular blocky structural units 0.25 to 0.75 inch across; very firm when moist; medium to slightly acid; 10 to 15 inches thick.

Parent material—

C 28 inches+, calcareous clay glacial till mottled grayish brown (2.5Y 5/2, moist) and yellowish brown (10YR 5/6, moist); very firm when moist; contains black shale, limestone, and igneous pebbles.

VARIATIONS: Differences are great in the prominence and color of the mottlings in the B horizon. The colors grade from pale brown to strong brown.

This soil warms up very slowly in spring. Wheat and legumes are damaged by frost heaving early in spring if this soil is wet. Young growing crops frequently are seriously injured during cool wet spells. Because poor tilth has resulted from continuous cropping, much of this soil puddles severely when wet. If the surface soil becomes saturated and puddled, considerable runoff occurs during heavy rains. Because of the compact impermeable subsoil, tile drains do not function readily, although they help if used with other good management practices. Excess water in shallow depressions commonly damages the crops. A fair amount of water is held for crop growth, but the poor tilth of this soil limits its use.

The surface soil becomes cloddy if worked when too wet or if not enough organic matter is returned to the soil to keep it in good tilth. Under these conditions, it is difficult to prepare a good seedbed. A lack of air in the root zone, poor tilth, low fertility, and meager stands of crops cause many below-average yields.

Nappanee silty clay loam, 2 to 6 percent slopes, slightly eroded (NdB1) (Capability unit IIIw-4).—The light brownish-gray color is less prominent in the upper part of the B horizon of this soil than in Nappanee silty

clay loam, 0 to 2 percent slopes. More runoff occurs, and the crops are damaged less by water standing on the surface. The two soils are similar in fertility, tilth, and water problems.

Nappanee silty clay loam, 2 to 6 percent slopes, moderately eroded (Ndb2) (Capability unit IIIw-4).—The profile of this soil is similar to that of Nappanee silty clay loam, 0 to 2 percent slopes. Between 50 and 100 percent of the original surface soil has been lost, as well as much of the natural fertility and organic matter. As a result, the soil is hard to manage. The surface soil consists of 3 to 5 inches of the clayey B horizon mixed with the remainder of the original surface soil. Its color is grayish brown to yellowish brown, and its texture ranges from a fine silty clay loam to coarse clay.

Much of the rainfall runs off. This soil is hard to work and to make into a good seedbed; consequently, poor stands of crops and low yields result. This soil is managed like Nappanee silty clay loam, 0 to 2 percent slopes.

Ottokee series

These dark-brown, moderately well drained soils developed in deep slightly acid to calcareous sands and loamy sands of the glacial lake plain. They occupy small areas in Brown, Auglaize, and Emerald Townships. They are on crests and undulating upper slopes on the sides of knolls and ridges of sand that occur erratically in a complex pattern. They are classified as Regosols.

The Ottokee soils are the moderately well drained member of the soil catena that includes the well-drained Oakville soils, the imperfectly drained Tedrow soils, the dark-colored, very poorly drained Granby soils, and the very dark colored, very poorly drained Maumee soils. Only the Ottokee, Tedrow, and Granby soils occur in Paulding County.

Ottokee soils developed in sand more than 48 inches in depth. They differ from the shallow Seward soils in this respect. They contain more organic matter than the Berrien soils (not mapped in Paulding County) and have a slightly acid to neutral profile instead of a strongly acid one.

These sandy soils developed in deep, slightly acid to calcareous sands of mixed lithology, over 48 inches in depth. A small but very significant amount of clay, ranging from 2 to slightly more than 5 percent, is present throughout the profile. The total sand content varies from about 80 to more than 90 percent. Mixed through the profile and parent material are occasional lenses of silty clay loam to silty clay material. These lenses occur in an erratic broken pattern and are only 1 to 3 inches thick. The sand is underlain with a calcareous fine silty clay lacustrine material at depths of 4 to 7 feet.

The native forest of deciduous trees included white oak, red oak, tulip-poplar, hickory, and sugar maple. Most of these soils are cultivated. They are used for producing wheat, potatoes, pasture, and some corn and soybeans.

Ottokee loamy sand, 0 to 2 percent slopes (OaA) (Capability unit IIIs-1).—This nearly level soil is of small extent. A representative profile is described:

Surface soil—

A_p 0 to 8 inches, brown to dark-brown (10YR 5/3 to 3/3, moist), loose loamy fine sand, loamy sand, or sand; single-grain structure; moderately high content of organic matter; slightly acid to moderately acid; 7 to 9 inches thick.

A₃ 8 to 23 inches, yellowish-brown (10YR 5/6, moist) loamy fine sand to fine sand; single-grain structure; slightly coherent in place, loose if disturbed; lower boundary is gradual and smooth; slightly acid; 3 to 20 inches thick.

Subsoil—

C₁₁ 23 to 40 inches, yellowish-brown (10YR 5/6, moist), loose fine sand; contains many, coarse, distinct, light yellowish-brown (10YR 6/4, moist) mottles; single-grain structure; bands of slightly coherent and slightly finer textured material colored yellowish red (5YR 4/8, moist) occur at irregular intervals; the occasional iron concretions can be crushed readily; lower boundary is diffuse; slightly acid; 13 to 18 inches thick.

C₁₂ 40 to 70 inches, very pale brown (10YR 7/3, moist) loose loamy sand to sand; single-grain structure; contains bands of light yellowish brown (10YR 6/4, moist) slightly finer textured material in which the structural units are 0.25 to 0.5 inch thick; with increasing depth, mottling becomes strong brown (7.5YR 5/6, moist); material slightly coherent in place, loose if disturbed; slightly acid to neutral; 20 to 35 inches thick.

Substratum—

C₂ 70 inches+, gray to light brownish-gray (10YR 6/1 to 6/2, moist) fine sand; single-grain structure; neutral to calcareous.

VARIATIONS: The texture of the B horizon ranges from fine sand to coarse sandy loam. The finer texture usually occurs in discontinuous bands. In wooded areas the surface layer, 4 to 5 inches thick, is very dark gray to black (10YR 3/1 to 2/1, moist) and is high in organic matter. The depth to mottling ranges from 20 to more than 30 inches.

This soil has a very high infiltration rate; very little rainfall runs off. Water moves rapidly through the solum. The capacity to hold water is low to moderate. During dry periods this is one of the most droughty soils in the county. The addition of large amounts of organic matter, as by plowing under all crop residue and green-manure crops, improves the available moisture-holding capacity.

Ottokee loamy sand, 0 to 2 percent slopes, warms up very quickly in spring. It is an excellent soil for potatoes, strawberries, and other early truck crops. It is easy to work but needs heavy applications of fertilizer to produce good yields. Long-season crops, as corn and soybeans, are not well suited, because this soil has a limited capacity to hold water that plants can use. If enough water is available, this soil responds readily to irrigation if an adequate supply of plant nutrients is also provided. Under irrigation a tile drainage system may be needed to remove excess water. Weeds flourish on this soil and commonly become a nuisance.

Included with this soil are several areas of Ottokee loamy fine sand and sandy loam. These occur in too complex a pattern to be shown separately on a map of the scale used in this report.

Ottokee loamy sand, 2 to 6 percent slopes, slightly eroded (OaB1) (Capability unit IIIs-1).—This soil occupies undulating slopes and has lost by erosion a small amount of fine material from the surface soil. Otherwise, its profile is like that of Ottokee loamy sand, 0 to 2 percent slopes.

Runoff is strong enough to remove a small amount of the fine silt and clays from the surface soil. This soil contains only a very small quantity of these fine soil particles; thus, any reduction in amount of the surface soil lowers the capacity of the soil to hold water and to retain its fertility.

This soil responds to management similar to that used on Ottokee loamy sand, 0 to 2 percent slopes.

Paulding series

The Paulding soils are moderately dark colored, very poorly drained soils developed in very fine-textured lacustrine clays of the glacial lake plain. They are Humic Gley soils that intergrade to the Low-Humic Gley great soil group. These soils are extensive in the northern, northeastern, and eastern parts of Paulding County.

Paulding soils occupy the very broad nearly level to level areas between the major drainageways. They are generally continuous but are associated with isolated bodies of Roselms and other soils. The slopes range from less than 2 feet to about 5 feet per mile. In local areas, the gradient is less than 1 foot per mile.

Other soils on the same kind of parent material are the light-colored, moderately well drained Broughton soils, and the light-colored, imperfectly to poorly drained Roselms soils. These soils formed under wide differences in natural drainage. Small areas of Nappanee soils are associated with Paulding soils in places. The Nappanee soils occur where low knolls of till extend through the lacustrine clay mantle.

The A horizon in Paulding soils is somewhat lighter colored and thinner than that of the Toledo soils. The B horizon contains more clay, has a much weaker structure in the lower part, and is much less permeable than a similar horizon in Toledo soils. The C horizon also has a higher clay content.

The Paulding soils have a thinner A horizon and contain more clay in the B and C horizons than the Latty soils. Their C horizons are less pervious to water than similar horizons of Latty soils.

The amount of clay in Paulding soils ranges from 60 percent to more than 80 percent. The sand content rarely exceeds 10 percent; it usually ranges from 3 to 7 percent, but is less than 2 percent in some areas. The parent material contains from 15 to 25 percent of carbonates. The fine clay content (less than 0.2 micron) of parent material varies from 15 to about 25 percent.

The water-laid materials are 4 to 15 feet thick. They are weakly laminated or varved in the lower parts. Gravels or boulders are almost nonexistent in this material.

The native forest consisted chiefly of pin oak, bur oak, swamp white oak, hickory, and elm. Silver and red maples and white ash occur locally. Much of the present stand is composed of pin oak, which is more prevalent on Paulding soils than on Hoytville or Toledo soils. In many areas the native ground cover consisted of sedges and coarse water-loving grasses.

Most of the Paulding soils have been cleared for crops. Soybeans, wheat, and some corn and meadow hay are produced.

Paulding clay (Pa) (Capability unit IIIw-1.—The fol-

lowing is a description of a typical soil profile from a cultivated area:

Surface soil—

A_p 0 to 6 inches, dark-gray to very dark gray (10YR 4/1 to 3/1, moist) or dark grayish-brown (2.5Y 4/2, moist) clay; breaks into moderately to strongly developed angular blocky structural units 0.5 to 1 inch across; firm when moist, sticky and plastic when wet, very hard when dry; medium organic matter content; lower horizon boundary is abrupt; medium to slightly acid, 4 to 7 inches thick.

Subsoil—

B_{21g} 6 to 12 inches, very fine clay; dark grayish-brown (2.5Y 4/2, moist) to dark-gray or gray (5Y 4/1 to N 5/0); common, fine to medium, distinct, yellowish-brown (10YR 5/4 to 5/8, moist) mottles; weakly developed prismatic structural units 2 to 5 inches across that break into moderately developed angular blocky units 0.5 to 2 inches across; extremely firm when moist, sticky and plastic when wet, very hard when dry; lower horizon boundary is gradual; medium acid to neutral, 4 to 8 inches thick.

B_{22g} 12 to 28 inches, dark-gray to gray (5Y 4/1 to N 5/0, moist) very fine clay; many, medium to large, distinct, yellowish-brown (10YR 5/6 to 5/8, moist) and light olive-brown (2.5Y 5/4, moist) mottles; breaks into weakly to moderately developed angular blocky structural units 0.5 to 2 inches across; extremely firm when moist, sticky and plastic when wet, very hard when dry; lower horizon boundary is gradual to diffuse; slightly acid to neutral, 12 to 24 inches thick.

B_{23g} 28 to 46 inches, gray (N 5/0 to 5Y 6/1, moist) or olive-gray (5Y 5/2, moist) very fine clay; many, fine to medium, prominent, light olive-brown (2.5Y 5/4), yellowish-brown (10YR 5/6, moist), and dark yellowish-brown (10YR 4/4, moist) mottles; massive to very weakly developed angular blocky structural units 1 to 2 inches across; extremely firm when moist, sticky and extremely plastic when wet, extremely hard when dry; lower boundary is clear and wavy; neutral to slightly alkaline; 8 to 20 inches thick.

Parent material—

C 46 inches+, calcareous, very fine water-laid material containing between 60 and 80 percent of grayish-brown (2.5Y 5/2, moist) or gray (N 5/0, 5Y 6/1, moist) clay; mottled yellowish brown (10YR 5/6, moist) and dark brown (10YR 4/3, moist); massive, very firm to extremely firm when moist, sticky and very plastic when wet; extremely compact and impermeable; laminated below 5 feet.

VARIATIONS: Structure, color, and thickness of horizons differ greatly from one place to another. There is very little developed structure below a depth of 2 feet in the center of the Paulding soil area. Where Paulding soils occur near Latty soils, the structure usually is weakly developed down to the calcareous material. In areas that have been tilled under poor management, very little structure remains in the upper part of the solum. The amount of clay in the surface soil varies from 40 to more than 65 percent. The depth to the calcareous material ranges from 36 to about 55 inches.

A few small pebbles occur in the C horizon where Paulding soils approach the Latty soils and also where they are associated with soils of the Nappanee series. Gravel and boulders are rarely present, except locally. In cultivated areas, 2 or 3 inches of the upper part of the B horizon have been mixed with the A horizon.

In wooded areas, the surface soil usually breaks into strong granules 0.125 to 0.25 inch across. This soil has a high content of organic matter. The original A horizon in woodlands is 4 to 6 inches thick, and the structure in the upper part of the B horizon is usually strongly developed.

Paulding clay absorbs water very slowly unless it has become completely dried and cracked. When the surface is dry, the cracks may be 2 inches across and extend

into the solum about 24 inches. Then when it rains, most of the rainfall enters the soil and the cracks swell and close. Once the upper part of the solum becomes saturated, water stands on the surface or runs off slowly through the poorly developed natural drainageways. Water may be ponded for a long time in winter and spring or after heavy storms in the summer (fig. 5).

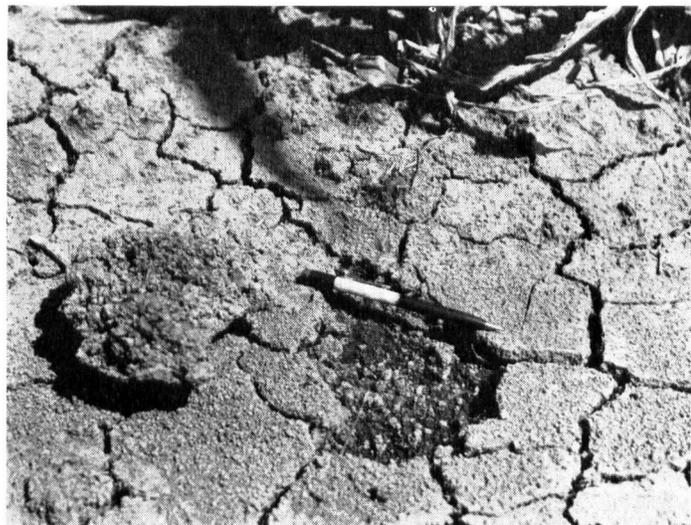


Figure 5.—Paulding clay. *Top:* This soil has a crusted surface when it dries out following prolonged rain; *bottom:* The surface soil is structureless and slick when it is wet.

Paulding clay dries very slowly. By the time the lower part of the plow layer is dry enough to till, the upper 2 or 3 inches are too dry. The surface soil then becomes rough and cloddy when tilled. The timing of tillage should be watched carefully, especially in the spring (fig. 6). The surface also may be made cloddy if it is plowed when too wet.

Hard clods cannot be broken easily, and they interfere with germination of seeds. Then if replanting is necessary, the stands may mature too late for a good harvest. After a crop has been planted, however, gentle rains are needed to sprout the seed in the dry soil. If drenching rains fall, the surface soil puddles severely



Figure 6.—Paulding clay is very hard and cloddy if plowed when too dry or too wet.

and crusts on drying. The rains may seriously damage or destroy the crops, and replanting becomes necessary. A farmer may have to replant his crop several times during a wet season.

Because Paulding clay is nearly impervious, the best tile drainage systems remove excess water very slowly. In many areas surface ditches are used to remove excess water. These ditches are beneficial if they are properly installed.

Paulding clay has a high moisture-holding capacity, but much of the water is held too tightly to be available to plants.

Under the present system of management, weeds are a serious problem. Indian hemp, Canada-thistle, milkweed, and yellow dock are the most common. On many fields Indian hemp has taken over large areas and seriously interferes with the growth of young crops.

Paulding clay is well supplied with plant nutrients, although soybeans sometimes need additional manganese. A complete fertilizer may increase crop yields, but the results are not consistent. It is possible that poor aeration, cloddy structure, and too little or too much moisture may limit crop yields more than a lack of available plant nutrients.

Paulding silty clay loam (Pc) (Capability unit IIIw-1).—This soil occupies areas where very shallow deposits (less than 12 inches thick) of silty or loamy material were laid down on the surface of very fine textured materials. The underlying materials are similar to those

from which Paulding clay developed. This soil usually is several inches higher than the level of the surrounding area.

Paulding silty clay loam has 6 to 8 inches of very dark gray surface soil. It contains more silt and sand and less clay than Paulding clay. This material grades rapidly into fine clay with depth. The characteristics of the subsoil and parent material are similar to those of Paulding clay. The moderately friable surface soil is much easier to work than that of Paulding clay. It also gives better yields because water does not stand on the surface. Movement of water through the solum is very slow, and it is difficult to remove the excess moisture from within the soil with tile drains.

The management problems on Paulding silty clay loam are similar to those on Paulding clay.

Paulding loam (Pb) (Capability unit IIIw-1).—This inextensive soil occurs in small tracts in association with other sandy soils in the Paulding soil area. It developed in places where shallow deposits of sandy to loamy materials, 6 to 12 inches thick, were laid down over the fine-textured clay material.

The surface soil is a very dark gray, friable loam, 7 to 9 inches thick. It has a very high content of organic matter. Beneath the surface layer, the material grades very rapidly from a loam through several inches of clay loam into the very fine textured clay at depths of 12 to 15 inches. A very small amount of sand may be on the surface of the peds in the upper part of the B horizon. This coating probably developed during rains when the loamy surface soil washed down the cracks after extended dry periods.

Paulding loam is easier to work and produces better stands of crops and higher yields than Paulding clay. Water does not stand on the surface so readily and does not cause so much damage to crops as on Paulding clay. Permeability of water through the soil profile is very slow. Because the surface layer is permeable, this soil responds somewhat better to tile drains than Paulding clay. In other respects, the problems and management of the two soils are similar.

Pits, dumps, and made land

This group of land types includes areas where the original soil has been removed or covered with other soil materials, tracts where excavations have been made around tile mills, limestone quarries, highway fills, and other plots not suited to agriculture.

Limestone quarries are designated by an appropriate conventional symbol on the map in the back of this report. They are open excavations from which limestone products have been taken for building and industrial purposes and for road construction.

There are many small areas from which the soil materials have been used for the manufacture of drain tile. The soil has been excavated to the calcareous clays. These areas are shown on the map as *clay pits*. Generally they are suited to pasture, and one large tile-clay pit has been drained and is cultivated. Nevertheless, the feasibility of such an operation has not been determined.

Some of the major problems on these areas are the installation of adequate drainage, the restoration of organic matter and tilth, and the large amount of lime in the cultivated layer. Most of these areas are too

small to warrant the investment of much money for agricultural use.

Several small areas have been excavated to obtain material for construction of highway fills. Normally, these plots do not present serious drainage problems; surface water runs off freely. Permanent vegetation should be established to prevent erosion.

Dumps include city and township dumps where refuse is discarded.

Made land includes those areas where soil has been disturbed, moved, leveled, or piled in such a manner as to destroy the original soil profile. These tracts contain a mixture of surface soil, subsoil, and parent material. No soil development has taken place on them, and they have no significant agricultural value. Nevertheless, they should be covered with grass or trees to prevent the removal of large quantities of silt into adjoining streams.

Rimer series

These light-colored, imperfectly drained soils developed in shallow deposits of sandy materials over calcareous clay. Small bodies, 2 to 10 acres in extent, are mostly in the eastern part of the county. Other areas occur locally in the northern part of the county.

These are Gray-Brown Podzolic soils that intergrade to the Regosol great soil group. They occupy the level to undulating relief of sand ridges and knolls. Slopes range from 1 to about 4 percent. Rimer soils frequently occur in an intricate, complex pattern with other soils on sandy materials, such as Seward, Tedrow, and Wauseon soils.

Associated with the Rimer soils on the same kind of parent material are the light-colored, moderately well drained Seward soils; the dark-colored, very poorly drained Wauseon soils; and the very dark colored, very poorly drained Neapolis soils. Neapolis soils do not occur in Paulding County.

Rimer soils developed in shallow sandy materials, 18 to 48 inches deep, over calcareous clay. Thus they differ from Tedrow soils which developed in sands more than 48 inches in depth. They are more sandy than the Haskins soils which developed in loam to coarse clay loam over calcareous clay.

The underlying substratum consists of two types of clay material: (1) Clay till similar to that underlying the Hoytville soils, and (2) water-laid lacustrine clay similar to that beneath the Paulding and Toledo soils. The Rimer soils at their boundaries grade toward adjoining soils, many of which were formed in different materials.

In some Rimer soils sandy materials are more than 48 inches deep, but a prominent layer of clayey material occurs within the sand. These lenses of clay loam to silty clay are significant if they are more than 4 to 6 inches thick because they restrict the downward movement of water. Such lenses are not generally prevalent in Paulding County.

Rimer soils were originally covered with a deciduous forest of red oak, white oak, elm, sugar maple, beech, hickory, and tuliptree (yellow-poplar). The yellow-poplar has all but disappeared in wooded areas.

Most of the Rimer soils have been cleared for cultivation. The principal crops are corn, wheat, soybeans, and some meadow hay.

Rimer fine sandy loam, 0 to 2 percent slopes (R₀A) (Capability unit IIw-4).—Most areas of this soil are in Brown, Auglaize, Emerald, and Carryall Townships, but small tracts occur in all parts but the southwestern corner of the county. A typical profile in a cultivated area:

Surface soil—

- A_p 0 to 10 inches, dark grayish-brown to pale-brown (10YR 4/2 to 6/3, moist) loose fine sandy loam to loamy fine sand; weak crumb and single-grain structure; slightly to medium acid; low to medium organic content; 8 to 10 inches thick.
- A₂ 10 to 19 inches, pale-brown (10YR 6/3, moist) fine sandy loam to loamy fine sand; common, medium, distinct, yellowish-brown and grayish-brown (10YR 5/4 to 5/2, moist) mottles; separates into weak crumb and single-grain structure; slightly coherent in place, but loose once it is disturbed; slightly acid to medium acid; 4 to 12 inches thick.

Subsoil—

- B₂ 19 to 28 inches, fine sandy loam to sandy clay loam mottled brown (10YR 5/3, moist), yellowish brown (10YR 5/6 to 5/8, moist), and dark yellowish brown (10YR 4/4, moist); breaks into single-grain or weakly developed angular and subangular blocky structural units 0.5 to 1 inch across; friable when moist, slightly sticky and slightly plastic when wet; medium acid; 2 to 15 inches thick.
- B₃ 28 to 40 inches, fine sandy loam, sandy clay loam, loam, or clay loam; mottled yellowish brown (10YR 5/4 to 5/6, moist), grayish brown (10YR 5/2, moist), and gray (5Y 6/1, moist); breaks into very weakly developed angular and subangular blocky structural units 0.5 to 1 inch across; very sticky and plastic when wet; slightly acid to neutral; 0 to 20 inches thick.

Substratum—

- D 40 inches+, mottled gray and yellowish-brown, calcareous, lacustrine silty clay or clay till; very firm when moist.

VARIATIONS: Depth to the clay substratum ranges from 18 to 48 inches and may exceed 48 inches if a prominent lens of clayey material is present. In the shallower areas of Rimer fine sandy loam, the lower part of the solum developed in the upper part of the clay substratum. The sequence and texture of the different materials in the B horizon vary widely from one area to another and within short horizontal distances within a single area. The boundary between the B₃ and D horizons may be abrupt or gradual.

In wooded areas the surface 2 or 3 inches is very dark gray to black (10YR 3/1 to 2/1, moist). It contains a large amount of organic matter.

In the spring this soil has a fairly high water table above the clay substratum. It is slow to warm up unless tile drains are installed and the excess water is removed. Permeability is moderate to moderately rapid in the upper part of the solum and slow in the lower part. Excess water is easily removed with tile drainage. Where the drains are laid in sand, however, precautions should be taken to keep the sand out of the tile lines.

The shallower areas of Rimer fine sandy loam, 0 to 2 percent slopes, that are associated with Paulding clay soils are difficult to drain with tile because the underlying material is very impervious. The surface soil is highly permeable, and runoff is slow. Because of its sand content, this soil is limited in its capacity to hold water that plants can use. In dry weather crops are likely to be damaged by lack of water.

Erosion has removed a small but essential part of the silt, clay, and organic matter. These fine materials are necessary for the retention of water and fertility.

The lack of natural soil fertility requires heavy applications of fertilizer if good yields are to be obtained.

This soil is very friable and easy to work, and good stands of crops are easy to establish. Weeds are a serious nuisance in some areas. This soil is fairly easy to till, but the addition of large quantities of organic matter would improve its capacity to hold water for growing crops.

Included with this soil are some areas of Rimer soils that have loam or loamy fine sand surface soils and a few small areas of Tedrow loamy fine sand. These associated soils occur in a complex pattern and are not shown separately on the map.

Rimer fine sandy loam, 2 to 6 percent slopes, slightly eroded (R₀B1) (Capability unit IIw-4).—This soil occurs on the gently sloping to undulating slopes of the sand ridges and knolls. It is similar to Rimer fine sandy loam, 0 to 2 percent slopes, but the depth to mottling is slightly greater and the light-gray colors in the lower part of the B horizon are less prominent.

The depth to calcareous clay differs widely on areas of the many small sandy knolls. These tracts range in size from less than 1 acre to several acres. On these small knolls the thickness of sand ranges from less than 1 foot to 3 or 4 feet thick within horizontal distances of 50 to 100 feet. The small knolls are scattered over the Paulding and Toledo soil areas; a few are associated with Hoytville soils near the Maumee River.

This soil is managed much the same as Rimer fine sandy loam, 0 to 2 percent slopes. It also responds in the same ways.

Several uneroded wooded areas are included with this soil. They are covered with several inches of dark-gray or very dark gray surface soil that is high in organic matter.

Rimer sandy loam, 0 to 2 percent slopes (R₀B) (Capability unit IIw-4).—The coarser size of the sand particles distinguishes this soil from Rimer fine sandy loam, 0 to 2 percent slopes. It occupies similar slopes and its profile is much the same. It also has a slightly lower available moisture-holding capacity, is somewhat less fertile, and is a little more droughty.

Small areas of Rimer loamy sand and other small areas where the sand is less than 18 inches in depth are included. These more sandy or shallow soils were too small in extent to delineate on the map.

Rimer sandy loam, 2 to 6 percent slopes, slightly eroded (R₀B1) (Capability unit IIw-4).—In general profile characteristics this soil is much like Rimer sandy loam, 0 to 2 percent slopes. The depth to mottling is somewhat greater, although it does not exceed 16 inches. The B horizon also has less light-gray color. This soil varies considerably within short horizontal distances.

Most of this soil occupies small sand knolls throughout areas of Paulding and Toledo soils. A small but significant part of the silt and clay has been lost, and erosion has thus reduced the silt and clay content of the surface soil. These fine materials are needed to maintain an adequate supply of water and plant nutrients for crop growth.

Because this soil is similar to Rimer fine sandy loam, 0 to 2 percent slopes, it has similar management problems and responds to the same treatment.

Included are small uneroded areas of Rimer sandy loam, 2 to 6 percent slopes. They are too small to be delineated separately on the map.

Roselms series

Roselms soils are the light-colored, imperfectly drained to poorly drained soils that developed in very fine textured lacustrine clays of the glacial lake plain. These Low-Humic Gley soils occur in large bodies in all but the southwestern and western parts of the county.

Roselms soils occupy the nearly level to sloping areas near the bottom lands in the Paulding soil area, and also some very low ridges and knolls on the broad flats of that soil. The dominant slopes range from less than 1 to about 2 percent, but along drainageways the slopes may be about 8 or 9 percent where these soils occur in the heads of draws and waterways.

Roselms soils are the imperfectly drained to poorly drained member of the soil catena that includes the light-colored, moderately well drained Broughton soils and the moderately dark colored, very poorly drained Paulding soils. All of these soils developed on similar parent material, but differences in natural drainage have affected their composition.

Roselms soils have more clay in the B and C horizons than Fulton soils, a shallower and more acid surface soil, and weaker structure in the B horizon. Roselms soils also lack the thin lenses of fine sand or silt that may be present occasionally in Fulton soils. They have more clay in the B and C horizons than Nappanee soils, which developed in fine silty clay loam to clay till. Structure of this B horizon is not so strongly developed as in the Nappanee soils, the surface soil is not so deep, and the profile contains a little less sand.

The parent material of the Roselms soils contains from 60 to more than 80 percent of clay and less than 10 percent of sand. In many areas sand makes up from less than 2 to 5 percent of the material. The content of fine clay (less than 0.2 micron) ranges from 15 to 25 percent. These fine lacustrine materials are varved or laminated in the lower part. The thickness of this material in the area of Paulding and Roselms soils ranges from less than 4 to nearly 15 feet. Except locally where the lacustrine mantle is thin and has been mixed with glacial till, this lacustrine clay is free from pebbles or boulders.

The carbonate content of Roselms soils varies from 15 to 25 percent. The depth to calcareous material ranges from 18 to about 36 inches. The greater depth to calcareous material is in the poorly drained areas. On several of these areas in Washington and Brown Townships, light-gray colors dominate in the profile.

A deciduous forest originally covered these soils. The trees were chiefly of white oak, pin oak, swamp white oak, elm, hickory, and an occasional beech. The trees were of poor quality, however, and small in size.

Most of the areas of Roselms soils have been cleared and are cultivated. In some parts of the county many of the abandoned fields are idle or are reverting to brush and scrub timber. Other fields are farmed irregularly and are idle during wet seasons. The principal crops are soybeans and wheat. Small amounts of corn and meadow hay are grown.

Roselms silty clay loam, 0 to 2 percent slopes (RgA) (Capability unit IIIw-3).—This soil is extensive in the eastern and northeastern parts of the county. A profile of a typical forested site follows:

Surface soil—

A₁ 0 to 1 inch, dark-gray to grayish-brown (10YR 4/1 to 5/2, moist) silt loam to silty clay loam; breaks into weakly to moderately developed granules less than 0.125 inch across; friable to firm when moist; moderate amount of organic matter; medium acid; lower horizon boundary clear; 0.5 to 2 inches thick.

A₂ 1 to 5 inches, light brownish-gray to light-gray (10YR 6/2 to 7/2, moist) silty clay loam; common, fine, faint to distinct, olive-yellow (2.5Y 6/6, moist) to dark yellowish-brown (10YR 4/4, moist) mottles; breaks into weakly developed platy units 0.25 to 0.5 inch thick; firm when moist, sticky when wet, hard when dry; very low in organic matter; moderately to strongly acid; lower horizon boundary is gradual to clear and wavy; 3 to 6 inches thick.

Subsoil—

B_{21g} 5 to 9 inches, light-gray (10YR 7/1, moist) to very pale brown (10YR 7/3, moist) very fine clay; a few, medium, distinct, yellowish-brown (10YR 5/6, moist) mottles; breaks into weakly to moderately developed angular blocky structural units 0.25 to 0.5 inch across; extremely firm when moist, sticky and plastic when wet, very hard when dry; roots are common; lower horizon boundary is gradual; very strongly to strongly acid; 3 to 6 inches thick.

B_{22g} 9 to 25 inches, yellowish-brown to brown (10YR 5/4 to 5/3, moist) very fine clay; common, fine, distinct, light brownish-gray, pale-brown, and brownish-yellow (10YR 6/2 to 6/3 to 6/6, moist) mottles; usually massive but occasionally breaks into very weakly developed angular blocky structural units 0.25 to 0.75 inch across; extremely firm when moist, sticky and plastic when wet, very hard when dry; roots are common in the upper part of this horizon, but practically none in the lower part; lower horizon boundary is gradual; very strongly to strongly acid in upper part but becomes slightly acid in lower part; 12 to 18 inches thick.

Parent material—

C 25 inches+, mottled light brownish-gray to grayish-brown (10YR 6/2 to 5/2, moist) and yellowish-brown (10YR 5/4 to 5/8, moist) very fine lacustrine clay; calcareous; massive and extremely firm; contains very little sand and no gravel or boulders.

VARIATIONS: Under cultivation the surface soil is usually composed of all of the A horizon and the upper part of the B horizon. The color of the surface soil in the tilled areas ranges from grayish brown to light brownish gray. It is frequently mottled with yellowish brown as a result of the incorporation of a part of the B horizon into the plow layer.

Disposal of excess water is difficult on this soil. Runoff is slow, and water stands on the surface in the small swales and depressions. Because of extremely slow percolation through the dense solum, internal drainage is very slow. Thus the upper soil layers become saturated very quickly during wet periods. Runoff increases sharply after the upper layers have become saturated or during heavy rains and long wet spells. In spring and during wet weather the perched water table is near the surface of the soil.

It is not practical to install tile drains, because the excess water within this soil moves too slowly to be removed before the crop is damaged. Well-planned and well-constructed surface ditches are the most useful type of drains to use on this soil.

Roselms silty clay loam, 0 to 2 percent slopes, warms up slowly in the spring and remains cold until early summer. Poor tilth is common, and crops frequently drown out during wet periods. If the soil is plowed when too wet, it becomes cloddy and is hard to work

into a good seedbed. Poor stands of crops result, and much replanting is necessary.

Where tilth and aeration are poor, this soil does not hold enough water to support good growth of crops through very dry weather. Much of the water is held tightly by the fine clay and is not available to plants.

Roselms silty clay loam, 0 to 2 percent slopes, is acid and has a low supply of plant nutrients. With good tilth and adequate surface drainage, fertilizer will improve crop yields. This soil is one of the most difficult soils to farm in northwestern Ohio. It has poor drainage, tilth, and fertility. It is probably marginal for general farming and for grain.

Included with this soil are areas of Roselms silt loam, 0 to 2 percent slopes, that are too small to separate on a map of the scale used. Where this soil is located near Latty soils, it is underlain by glacial clay till at about 3 feet. The overlying lacustrine clay is very fine textured, and the entire profile resembles that of the Roselms soils more than that of the Nappanee soils.

Roselms silty clay loam, 2 to 6 percent slopes, slightly eroded (RgB1) (Capability unit IIIw-4).—This soil is similar to Roselms silty clay loam, 0 to 2 percent slopes, but it occupies stronger slopes along water courses and streams. Because it is a little better drained than the Roselms soil for which a profile was described, a pale-yellow color is more prominent than light gray in the upper part of the B horizon.

Erosion has removed 1 to 3 inches of the original A horizon. The present plow layer is made up of the remaining surface soil and a part of the upper B horizon.

Because runoff is somewhat stronger on this soil, the removal of surface water is not such a serious problem as on Roselms silty clay loam, 0 to 2 percent slopes. Internal drainage is very slow because water seeps slowly into the lower part of the subsoil through the very dense subsoil layers. The general characteristics and soil management problems are similar to those of Roselms silty clay loam, 0 to 2 percent slopes, except that surface drainage is naturally better.

Included with this soil are local wooded areas where little or no erosion has taken place.

Roselms silty clay loam, 2 to 6 percent slopes, moderately eroded (RgB2) (Capability unit IIIw-4).—This soil is gently sloping or sloping, and much of its original surface soil has been lost. It differs in these respects from Roselms silty clay loam, 0 to 2 percent slopes. The areas are small and are scattered throughout areas of other Roselms soils. Inasmuch as half or all of the surface soil has been eroded, the present plow layer consists mostly of the upper part of the B horizon. The surface soil is grayish brown to brown, and it ranges in texture from a fine silty clay loam to clay. The characteristics of the lower part of the profile are similar to those of Roselms silty clay loam, 2 to 6 percent slopes, slightly eroded. Originally the profiles of the two soils were very much alike.

Runoff is medium to rapid; internal drainage is very slow. Most of the organic matter and some of the natural fertility have been lost. As a result, the available moisture-holding capacity has been reduced materially. Mixing of subsoil with thin surface soil causes the plow

layer to become cloddy, and thus very poor stands and yields result.

Because of the loss of surface soil, organic matter, tilth, and available moisture-holding capacity, this soil is very difficult to cultivate. Its response to good management is limited, and it is doubtful if grain can be grown profitably.

Several small severely eroded areas have been included with this soil. In these areas practically all of the present surface soil is composed of former subsoil.

Roselms silt loam, 0 to 2 percent slopes (RfA) (Capability unit IIIw-3).—A slightly deeper surface soil that has somewhat less clay distinguishes this soil from Roselms silty clay loam, 0 to 2 percent slopes. This soil is generally on the nearly level or very gently sloping areas near the breaks along drainageways.

The surface soil varies from 6 to 7 inches in depth. Little or no B horizon has been mixed in with the A horizon. A representative profile in a cultivated area is described:

Surface soil—

A_p 0 to 7 inches, grayish-brown to light brownish-gray (10YR 5/2 to 6/2, moist) friable silt loam; breaks into weakly developed granules less than 0.125 inch across; low organic content; slightly to medium acid, 6 to 8 inches thick.

Subsoil—

B_{1a} 7 to 11 inches, light-gray (2.5Y 7/2) silty clay loam highly mottled with yellowish brown (10YR 5/6, moist); mottles are many, medium, and distinct; breaks into moderately developed angular blocky structural units about 0.25 inch across; firm when moist; strongly to very strongly acid; 2 to 4 inches thick.

B_{21a} 11 to 15 inches, yellowish-brown to brown (10YR 5/4 to 5/3, moist) very fine clay; common, medium, distinct, light brownish-gray (2.5Y 6/2, moist) mottles; breaks into weakly to moderately developed angular blocky structural units 0.25 to 0.5 inch across; very firm to extremely firm when moist; strongly to very strongly acid; 4 to 6 inches thick.

B_{22a} 15 to 27 inches, yellowish-brown to brown (10YR 5/4 to 5/3, moist) very fine clay; has pale-brown (10YR 6/3, moist) mottles that are common, fine, and faint; layer is usually massive but occasionally it may break into weakly developed angular blocky structural units 0.25 to 0.5 inch across; extremely firm when moist; moderately acid to strongly acid in upper part, slightly acid in lower part; 10 to 15 inches thick.

Parent material—

C 27 inches+, very fine lacustrine clay mottled light brownish gray (10YR 6/2, moist), grayish brown (10YR 5/2, moist), and yellowish brown (10YR 5/6, moist); massive; calcareous; extremely firm when moist; the depth to calcareous material ranges from 18 to about 30 inches.

Surface drainage is a little better on the Roselms silt loams than on the silty clay loams. Removal of excess surface water remains a major problem, however, because water percolates very slowly through the profile. Internal drainage is very slow, and tile drains are not practicable. Well-planned and well-constructed ditches help to remove the excess surface water. If this water is not drained, the plow layer becomes puddled and waterlogged, and when it dries, very cloddy. This soil is not so difficult to work into a good seedbed as the silty clay loams, and under similar management practices, slightly better stands of crops can be obtained.

This soil warms up very slowly in the spring, and crop growth is delayed seriously. Because of poor tilth and

wet soil, crops frequently drown during wet spells. Replanting then is necessary if satisfactory stands are to be obtained.

Heavy applications of fertilizer and favorable weather will not produce optimum yields unless good tilth is maintained. The moisture-holding capacity of this soil is high, but much of the water is held securely by the fine clay particles. Hence, some of this moisture is not available to plants.

This soil is low in natural fertility and in its supply of organic matter. It also has poor tilth. If crops are to be produced economically, these deficiencies ought to be eliminated.

In other respects, the soil management problems are similar to those on the silty clay loam soils of the Roselms series.

Roselms silt loam, 2 to 6 percent slopes, slightly eroded (RfB1) (Capability unit IIIw-4).—This soil is similar to Roselms silt loam, 0 to 2 percent slopes, except that it is more sloping and has lost from 5 to 50 percent of the original surface soil by erosion. Under cultivation the plow layer includes a small amount of the upper B horizon. The upper part of the B horizon is less gray than in the soil on 0 to 2 percent slopes; otherwise, the profiles of the two soils are similar.

Runoff is more rapid than on the Roselms silt loam, 0 to 2 percent slopes. Internal drainage is very slow. In other respects this soil has the same management problems and responds to treatments similar to those used on Roselms silt loam, 0 to 2 percent slopes.

This soil occurs in small areas on the gentle slopes along the water courses. Several small uneroded wooded areas are mapped with this soil.

Roselms silt loam, 2 to 6 percent slopes, moderately eroded (RfB2) (Capability unit IIIw-4).—Before this soil was cultivated, it had a profile like that of Roselms silt loam, 0 to 2 percent slopes. Since it has been cleared, however, erosion has removed between half and all of the original surface soil. The present plow layer consists of the remainder of the surface soil mixed with the upper part of the B horizon. The color of the surface soil is grayish brown, yellowish brown, or pale brown, and its texture is silty clay loam.

Much of the supply of organic matter and the natural fertility of this soil have been lost through erosion. Owing to the thinning of surface soil, the capacity to hold water that plants can use has also been lowered. More water is lost through runoff than on Roselms silt loam, 0 to 2 percent slopes. Tillage is also more difficult because the upper part of the B horizon has been mixed with the surface soil. The surface soil is likely to be cloddy; then stands and yields are poor. The usual slope is 4 to 6 percent.

Roselms fine sandy loam, 0 to 2 percent slopes (RdA) (Capability unit IIIw-3).—This soil is similar to Rimer fine sandy loam, 0 to 2 percent slopes, but differs from it in having less than 18 inches of fine sandy loam material that was deposited over fine-textured clays. It occurs in close association with the Rimer soils on level to nearly level areas in the eastern and northeastern parts of the county.

The layer of fine sandy loam distinguishes this soil from Roselms silt loams and silty clay loams. The A

horizon developed in the sandy materials. The depth of the solum is also a little greater than that of the other Roselms soils. A typical profile in a cultivated area is described:

Surface soil—

A_p 0 to 8 inches, grayish-brown (10YR 5/2, moist) very friable fine sandy loam that separates into very weak, medium, granular structure; medium organic content; slightly acid to medium acid; 7 to 9 inches thick.

A₂ 8 to 12 inches, light brownish-gray to very pale brown (10YR 6/2 to 7/3, moist) very friable fine sandy loam; many, coarse, prominent, yellowish-brown (10YR 5/4 to 5/6, moist) mottles; separates into very weak, medium, granular structure; medium to strongly acid; 2 to 8 inches thick.

Subsoil—

B_{21g} 12 to 23 inches, pale-brown to light-gray (10YR 6/3 to 7/2, moist) clay loam to sandy clay; many, coarse, prominent, yellowish-brown (10YR 5/6 to 5/8, moist) mottles; breaks into weakly developed angular and subangular blocky structural units 0.25 to 1 inch across; firm when moist, slightly plastic when wet; strongly to very strongly acid; 4 to 12 inches thick.

B_{22g} 23 to 40 inches, mottled light-gray (10YR 7/2, moist), pale-brown (10YR 6/3, moist), and yellowish-brown (10YR 5/8, moist) fine clay; breaks into very weakly developed angular blocky structural units more than 2 inches across; thin coatings of sand on the surfaces of peds were probably washed down the cracks from the upper layers; firm when moist; strongly acid in upper part to slightly acid in lower part; 10 to 20 inches thick.

Parent material—

C 40 inches+, mottled gray and yellowish-brown (10YR 6/1 to 5/8, moist), calcareous, very fine lacustrine clay; extremely firm when moist, plastic when wet.

VARIATIONS: This soil varies considerably from place to place in thickness of horizons, texture of the layer beneath the sandy loam, and color of the different horizons. Thickness of the sandy material varies from 6 or 7 inches to 18 inches. The sands overlie clay in some places, but in others they grade through sandy clay loam and sandy clay to fine clays.

Runoff is slow until the soil becomes saturated. Permeability is moderately slow in the upper part of the solum and very slow in the lower part.

Where this soil occurs in small areas along with one or more of the Roselms silt loams or silty clay loams, it is not likely that tile will remove excess water. This soil has a fair capacity to store available moisture but may be somewhat droughty in very dry weather. It works easily into a seedbed, and good stands of crops are easy to obtain. Natural fertility is very low. With good soil management, this soil responds readily to fertilizer and lime.

Locally, this soil is referred to as "floating sands" if it becomes saturated with water.

Included with this soil are small areas of Rimer fine sandy loam, 0 to 2 percent slopes, and Roselms sandy loam, 0 to 2 percent slopes, that are too small to delineate on the map.

Roselms loam, 0 to 2 percent slopes (ReA) (Capability unit IIIw-3).—The upper layers of this soil developed in loamy material that lies over very fine textured lacustrine clay. It usually occurs with Rimer soils, but it differs from them in having less than 18 inches of loamy material over clay. Roselms loam, 0 to 2 percent slopes, occupies slightly raised areas on the glacial lake plain.

The grayish-brown friable surface soil, 7 to 8 inches deep, is rather low in organic matter. Beneath this

layer is a 2- to 8-inch layer of mottled gray and yellowish-brown fine loam or clay loam. This material overlies fine-textured clays similar to those underlying the Roselms silt loams and fine sandy loams.

In the upper part of the B horizon, many of the surfaces of the structural aggregates are covered with a thin coating of fine sand that has been carried down by percolating water. The depth to carbonates ranges from 24 to 32 inches.

Because of better tilth, aeration, and available moisture-holding capacity, this soil is somewhat more productive than other soils in the Roselms series. Natural fertility and organic content are low, however, and crops benefit from applications of fertilizer.

Runoff is slow, but water does not stand on the surface so long as it does on Roselms silty clay loam, 0 to 2 percent slopes. As a result, crops are damaged somewhat less. Internal drainage is slow in the upper part of the profile and very slow in the lower part. Thus tile drains may not be effective in removing excess water. This soil is slow to warm in the spring. If it becomes saturated, it is referred to locally as "floating sands."

This soil includes small areas of Roselms silt loam, 0 to 2 percent slopes, Roselms fine sandy loam, 0 to 2 percent slopes, and Rimer fine sandy loam, 0 to 2 percent slopes, that are too small to delineate separately on the map.

Roselms loam, 2 to 6 percent slopes, slightly eroded (ReB1) (Capability unit IIIw-4).—This soil has profile features much like those of Roselms loam, 0 to 2 percent slopes. It occurs to a very limited extent on gentle slopes along drainageways. Runoff is slightly greater than on the more gently sloping soil, less water is ponded on the surface, and crops are not damaged so much.

Part of the surface soil has been lost through erosion. Inclusions in the mapping unit are several areas of Roselms fine sandy loam not large enough to be shown separately on the map.

Roselms clay, 0 to 2 percent slopes (RcA) (Capability unit IIIw-3).—This soil is associated with Paulding clay on the broad flats of the glacial lake plain. It occupies nearly level or level areas that rise 2 to 6 inches above the surrounding Paulding soil. It differs from Paulding clay in having a strongly to very strongly acid reaction throughout the upper part of the profile, a lower content of organic matter in the surface soil, and very little structural development in the profile. The profile is much like that of the Roselms silty clay loams except that there is more clay in the surface soil and the plow layer is extremely difficult to work. The following profile is representative in a cultivated area:

Surface soil—

A_p 0 to 5 inches, dark-gray to grayish-brown (10YR 4/1 to 5/2, moist) fine clay; massive; very firm; low in organic matter; strongly to very strongly acid; 4 to 6 inches thick.

Subsoil—

B_{21g} .5 to 9 inches, gray to grayish-brown (10YR 5/1 to 5/2, moist) very fine clay mottled with yellowish brown (10YR 5/6, moist); usually massive but occasionally breaks into very weakly developed angular blocky structural units 0.25 to 0.5 inch across; extremely firm when moist; strongly to very strongly acid; 3 to 6 inches thick.

B_{22g} 9 to 36 inches, very fine clay mottled gray and yellowish brown (10YR 5/1 to 5/6, moist); massive:

extremely firm; strongly acid to very strongly acid in the upper part of the solum to slightly acid in the lower part; 15 to 30 inches thick.

Parent material—

C 36 inches+, very fine calcareous clay mottled gray, grayish brown, and yellowish brown; extremely firm.

VARIATIONS: The amount of clay in the subsoil and parent material ranges from 60 to nearly 80 percent. The parent material is laminated in places.

Because of the extremely slow permeability of this soil, runoff is medium during heavy storms or if the soil becomes saturated. Internal drainage is very slow. Tile is of little use in removing excess water. During wet spells, water stands on the surface for days. Well-planned and well-constructed surface ditches make up the only drainage system that is beneficial. Although large quantities of water are held by this soil, much of it is retained by the clay and is not available to plants. Dry weather, therefore, may damage crops.

Roselms clay, 0 to 2 percent slopes, has very poor tilth and becomes very cloddy if cultivated. It is the most difficult soil in the county to work into a seedbed. Poor tilth, lack of aeration, and very cloddy seedbeds cause many of the scanty stands of crops. These factors, combined with low natural fertility, result in very low yields. This soil is not well suited to agriculture.

Several areas of poorly drained Roselms clay are included in this mapping unit. In the mottled B horizon of this soil, the color of the matrix is light gray. There are also included some areas where the slope is 2 to 6 percent. In these sloping areas the natural drainage is a little better than that described for typical Roselms clay.

Ross series

These dark-colored, well-drained, very fertile Alluvial soils occupy small areas of the bottom land along the Maumee River. They consist of recent alluvium from highly calcareous Wisconsin glacial drift and soils developed in such material. Ross soils do not have a definite sequence of A, B, and C horizons. They are small in extent and occur only in Crane Township.

The Ross soils occupy level to nearly level positions on high bottom lands and are seldom flooded. They are associated with the soils of the Genesee catena. They differ from Genesee soils in having a darker colored surface soil and greater supply of organic matter in the upper subsoil.

The texture of the alluvium ranges from loam or silt loam to silty clay loam or clay loam. This material is well supplied with plant nutrients. It is usually stratified and in some places is underlain with sandy materials at 4 or 5 feet.

The Ross soils were originally covered with a deciduous forest of black walnut, butternut, sugar maple, hackberry, sycamore, buckeye, and oak. They have been cleared and are used for corn, soybeans, wheat, and meadow.

Ross silt loam (Rh) (Capability unit I-2).—A profile of a typical soil:

Surface soil—

A_p 0 to 8 inches, very dark grayish-brown (10YR 3/2, moist) friable silt loam; breaks into strongly developed granules up to 0.125 inch in diameter; high in organic matter; neutral to slightly alkaline; 7 to 10 inches thick.

Substratum—

- 8 to 20 inches, very dark grayish-brown (10YR 3/2, moist) friable silt loam to coarse silty clay loam; breaks into strongly developed granules about 0.125 inch across; high in organic matter; neutral to slightly alkaline; 8 to 16 inches thick.
- 20 to 36 inches, brown (10YR 4/3 to 5/3, moist) silt loam to silty clay loam; somewhat stratified; neutral to alkaline.
- 36 inches+, pale-brown and yellowish-brown silty clay loam alluvium streaked with loam and silt loam alluvial materials.

VARIATIONS: In local areas, a few faint mottles occur at about 30 inches.

Runoff is very slow and internal drainage is medium. Excess water moves easily from the solum. Under good soil management, this soil is very well suited to irrigation.

Ross silt loam is one of the most productive soils in the county. It has no water problems except that it is flooded occasionally late in winter and early in spring. It holds very good supplies of water for crop growth. Good tilth, a large amount of organic matter, and a rich natural supply of plant nutrients make this soil very responsive to good soil management. Several areas of loam, too small to delineate on the map, have been included with Ross silt loam.

Seward series

These light-colored, moderately well drained sandy soils developed in shallow sand over calcareous clay. The Seward soils are of small extent and occupy some of the nearly level to sloping sandy areas throughout the eastern and northern parts of the county. They are classified as Gray-Brown Podzolic soils intergrading to the Regosol group.

The Seward soils are the moderately well drained member of the soil catena that includes the light-colored, imperfectly drained Rimer soils; the dark-colored, very poorly drained Wauseon soils; and the very dark colored, very poorly drained Neapolis soils. Neapolis soils are not present in Paulding County.

Seward soils differ from Ottokee soils in having developed in sandy materials, 18 to 48 inches thick over calcareous clay, instead of in deep neutral to calcareous sands.

The sandy material ranges from light fine sandy loam to sand. The underlying clay is calcareous at or just below the sand and may consist of either lacustrine material or till.

These soils were covered originally with a deciduous forest of white oak, red oak, beech, maple, yellow-poplar, and hickory. Generally, they have been cleared and are used for corn, wheat, soybeans, and hay. Some areas are wooded or in pasture.

Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded (SoB1) (Capability unit IIIs-1).—This soil occupies the gentle slopes of the sandy ridges and knolls. A profile of a typical cultivated soil is described:

Surface soil—

- A_p 0 to 8 inches, dark grayish-brown to brown (10YR 4/2 to 5/3, moist) very friable fine sandy loam; very weak, medium, granular structure; slightly acid to medium acid; 7 to 9 inches thick.
- A₂ 8 to 12 inches, dark grayish-brown to brown (10YR 4/2 to 5/3, moist) very friable fine sandy loam; very weak, medium, granular structure; slightly acid to medium acid; 3 to 6 inches thick.

Subsoil—

- B₂₁ 12 to 24 inches, brown to yellowish-brown (10YR 5/3 to 5/6, moist) loose loamy fine sand to sand; single-grain structure; slightly acid to medium acid; 8 to 15 inches thick.
- B₂₂ 24 to 40 inches, brown to pale-brown (10YR 5/3 to 6/3, moist) loose loamy fine sand to sand; many coarse, distinct, strong-brown (7.5YR 5/6, moist) mottles; single-grain structure; noneohere; medium to slightly acid; 8 to 20 inches thick.
- B₂₃ 40 to 48 inches, sandy loam, loam, or clay loam; grayish-brown (10YR 5/2, moist), yellowish-brown (10YR 5/4 to 5/6, moist), pale-brown (10YR 6/3, moist), and light-gray (10YR 7/1, moist) mottles; overlies or changes abruptly to clay that is calcareous within a few inches from the boundary; neutral; 0 to 8 inches thick.

Substratum—

- D 48 inches+, grayish-brown (10YR 5/2, moist), mottled with light-gray and yellowish-brown (10YR 7/2 to 5/4, moist), calcareous lacustrine clay or fine clay loam to clay till; the depths to this material range from 18 to 48 inches.

VARIATIONS: In some areas the depth of the sandy material exceeds 4 feet, but at least one significant lens of fairly impermeable clay loam to silty clay is present above the 4-foot depth. The color of these clay lenses is usually light gray to nearly white (10YR 7/1 to 8/2, moist) with many, prominent, yellowish-brown to brownish-yellow (10YR 5/6 to 6/8, moist) mottles; the material is massive or it breaks into weakly developed angular blocky structural units 0.125 to 0.5 inch across; firm when moist; medium acid; 4 to 8 inches thick. These clayey lenses restrict the downward movement of water, as does the underlying clay substratum. If the clay layer is more than 4 inches thick, the soil is classified with the Seward soils. In places where the clay layer does not significantly affect penetration of water, the soil is classified with the Ottokee soils. Depth to mottling ranges from about 16 to 24 inches. The sandy material is well sorted as to grain size.

In wooded areas the top 2- to 4-inch layer is very dark grayish brown to black (10YR 3/2 to 2/1, moist) and has a high content of organic matter. This layer is underlain by a yellowish-brown (10YR 5/4, moist), very friable sandy loam A₂ horizon.

Water moves readily through the sandy part of the solum, and the soil has only a fair to low capacity to hold water that plants can use. This soil may need additional moisture during droughts. Because of the permeable surface soil, very little runoff occurs. The water table fluctuates considerably from wet to dry periods, and the mottled layer is saturated during wet weather. Little erosion takes place, but the small amount of runoff that occurs during wet spells removes some of the organic matter as well as some silt and clay from the soil. These fine materials are needed to maintain the available moisture-holding capacity of the soil and to retain its fertility.

This soil warms up quickly in spring. It is easy to work and is well suited to early truck crops. It is also suited to irrigation if adequate subsoil drainage is provided. It responds very well to fertilizer if enough water is also available. Weeds commonly become a problem because the excellent seedbed also provides a good place for germination of weed seeds.

Small areas of Ottokee soils are included with this soil. They form such a complex pattern that they are not shown separately on the map.

Seward fine sandy loam, 0 to 2 percent slopes (SoA) (Capability unit IIIs-1).—This soil occupies nearly level to very gently undulating tops of the sand ridges. Its profile is generally similar to that of Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded, except that no significant erosion has taken place. The surface soil

contains a little more organic matter; in some places it is very dark grayish brown (10YR 3/2, moist).

Runoff is very slow, and very few fine materials are removed by erosion. The incorporation of organic matter slightly increases the available moisture-holding capacity, but this soil remains droughty during dry weather. In other respects this soil can be managed in the same way as Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded, and the responses to good management practices are somewhat similar.

Seward fine sandy loam, 6 to 15 percent slopes, slightly eroded (ScC1) (Capability unit IIIs-1).—This soil is similar to Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded, but it occurs on stronger slopes. It has a low capacity to hold water that plants can use and is droughty.

Successful soil management should include practices to control erosion. Otherwise this soil is managed the same as Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded.

Seward sandy loam, 2 to 6 percent slopes, slightly eroded (SbB1) (Capability unit IIIs-1).—This soil is similar to Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded, except that the surface soil contains more medium and coarse sand. The water-holding capacity is low.

Shoals series

These light-colored, imperfectly drained Alluvial soils consist of medium to moderately fine textured recent alluvium. The alluvium came from highly calcareous glacial drift of the Wisconsin age and from soils derived from such materials. These soils are fairly extensive on the bottom lands. The areas may be as much as 10 acres in size and are associated in a complex pattern with other soils of the bottom lands.

Shoals soils occupy level or nearly level areas of the bottom land where the water table is near the surface during wet periods and several feet below it during dry spells. Other soils in similar alluvium are the light-colored, well-drained Genesee soils; the light-colored, moderately well drained Eel soils; and the dark-colored, very poorly drained Sloan soils. The Shoals soils are the dominant light-colored soils along the tributary streams of the Maumee and Auglaize Rivers.

The Shoals soils are not so fine textured as the Defiance soils. Their parent material ranges from loam to silty clay loam or clay loam in texture. In some areas thin lenses of silty clay occur in the profile, but they are not thick enough to dominate in the profile. In many areas the substratum is underlain by stratified fine sandy loam to fine sands at depths of 3 to 5 feet. Like most alluvium, this material differs greatly from one area to another and the texture is variable in short horizontal distances.

A deciduous forest of oak, maple, sycamore, hackberry, hickory, elm, and cottonwood originally covered the Shoals soils. Much of the forest has been cleared, and the soil is used principally for soybeans and corn. Along Flatrock Creek, Blue Creek, the Little Auglaize River and its tributaries, Sixmile Creek, and other streams, many areas have been retired from cultivation in past years because of the danger of overflow. Floods may

occur at any time along these streams. These areas are used for pasture or are idle. They are growing up in thornapple (hawthorn) and other brushy plants that have little value. A small part of the soil remains in trees.

Shoals silt loam (Sc) (Capability unit IIw-1).—This soil occupies many of the bottom lands of the county. A representative profile of a cultivated soil:

Surface soil—

A_p 0 to 7 inches, dark-gray to grayish-brown (10YR 4/1 to 5/2, moist) friable silt loam; breaks into weakly developed granules up to 0.125 inch across; moderately high in organic matter; slightly acid to neutral; 7 to 8 inches thick.

Substratum—

7 to 10 inches, dark grayish-brown (10YR 4/2, moist) silt loam to silty clay loam; breaks into moderately developed angular blocky structural units 0.25 to 0.5 inch across; friable to firm when moist; slightly acid to slightly alkaline; 2 to 8 inches thick.

10 to 19 inches, grayish-brown (10YR 5/2, moist) stratified silt loam or silty clay loam; common, fine to medium, distinct, yellowish-brown (10YR 5/4 to 5/6, moist), brown (7.5YR 4/4, moist), and light brownish-gray (10YR 6/2, moist) mottles; breaks into moderately developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist; slightly acid to slightly alkaline; 6 to 12 inches thick.

19 to 34 inches, silty clay loam mottled grayish brown (10YR 5/2, moist) and yellowish brown (10YR 5/4 to 5/6, moist); contains silt loam, clay loam, and a few, thin, silty clay lenses; peds have thin, grayish-brown (10YR 5/2, moist) coatings of clay; breaks into weakly to moderately developed angular and subangular blocky structural units 0.25 to 0.75 inch across; firm when moist; slightly acid to slightly alkaline; 12 to 20 inches thick.

34 inches+, stratified silty clay loam, clay loam, silt loam, and loam; mottled light brownish gray (10YR 6/2, moist), pale brown (10YR 6/3, moist), and yellowish brown (10YR 5/6, moist); frequently overlies stratified sandy alluvium; massive; neutral to calcareous.

VARIATIONS: The thickness and sequence of the different horizons differ greatly from one area to another. Thin silty clay lenses may occur in any of the underlying horizons.

Drainage is a major problem on this soil because most of the surface water soaks in and permeability is moderately slow to slow. Shoals silt loam responds fairly well to tile drainage if suitable outlets are available. Because the water table is high throughout much of the spring, this soil is slow to warm up and to provide a favorable medium for plant growth. Crops are sometimes damaged by the high water table and wet soil. If adequate drainage is provided, however, the reserves of water are ample for crop growth.

Shoals silt loam is moderately easy to handle where it is not flooded. This soil has moderate natural fertility, and under good management it responds well to fertilizer. In many cultivated areas the control of weeds is difficult.

Several small areas of Shoals loam and of Defiance silty clay loam are included with Shoals silt loam. They are too small to be shown separately on the map.

Sloan series

The Sloan soils are the very fertile, dark-colored, very poorly drained soils that consist of recent alluvium from highly calcareous Wisconsin glacial till or from soils developed in such materials. They belong to the great soil group of Humic Gley soils intergrading to Alluvial soils. These soils are very extensive on all the flood

plains in the county; they occupy about 30 percent of the bottom lands.

Sloan soils are on low-lying bottoms where the water table was originally at or near the surface during much of the year. These level to slightly depressional areas are the first to flood and the last to dry. In places additional water comes from higher areas.

Other members of this same catena are the light-colored, well-drained Genesee soils; the light-colored, moderately well drained Eel soils; and the light-colored, imperfectly drained Shoals soils. The Sloan soils are dark colored like the Wabash soils but are not so fine textured.

The Sloan soils were covered originally with a deciduous forest of swamp white oak, bur oak, elm, silver maple, cottonwood, willow, and hickory. Most of these soils have been cleared and are used principally for soybeans and corn. Wheat and hay are grown to a small extent. Along some of the tributary streams of the Maumee and Auglaize Rivers, where the danger of flooding is serious, areas have been abandoned or are used for pasture. On the idle areas thornapple and other brush have become the principal cover. The brush has little value for agriculture.

Sloan silty clay loam (Se) (Capability unit IIw-1).—This fertile soil occurs in all parts of the county but is most extensive in Benton, Washington, Crane, and Carryall Townships. A representative profile of a cultivated soil:

Surface soil—

A_p 0 to 8 inches, very dark grayish-brown to dark-gray (10YR 3/2 to 4/1, moist) silty clay loam; breaks into moderately to strongly developed granules up to 0.125 inch across, or into angular blocky structural units 0.125 to 0.25 inch across; firm when moist; high in organic matter; neutral to slightly alkaline; 7 to 10 inches thick.

Substratum—

8 to 20 inches, very dark gray to dark-gray (10YR 3/1 to 4/1, moist) silty clay loam; common, fine, distinct, yellowish-brown mottles; breaks into moderately to strongly developed angular blocky structural units that are 0.25 to 0.5 inch across; firm when moist; high in organic matter; neutral to slightly alkaline; 6 to 15 inches thick.

20 to 40 inches, dark-gray to gray (10YR 4/1 to 5/1, moist) silty clay loam; many, medium, distinct, yellowish-brown mottles; thin lenses of silty clay occur locally; breaks into moderately developed angular blocky structural units that are 0.25 to 0.75 inch across; structure is not so well developed in lower part; firm when moist; neutral to alkaline.

40 inches+, mottled gray and yellowish-brown loam, silt loam, or silty clay loam; commonly overlies sandy materials with depth; neutral to alkaline.

VARIATIONS: This soil differs from place to place in texture, thickness, and sequence of the horizons of the substratum. Lenses of silty clay frequently occur in the substratum, but they are not dominant.

Along some of the smaller streams Sloan silty clay loam consists of shallow alluvium, 24 to 48 inches in depth, over calcareous glacial clay till. The difference in underlying material causes the soils of these areas to vary somewhat from the typical soil derived wholly from deep alluvium.

Runoff is very slow; some places are ponded. In many areas excess water from higher levels drains onto the surface. Internal drainage is fairly slow in the lower part of the solum, but excess water can be removed readily through tile drains if good outlets are available. If suitable tile outlets are not available, open ditches make

satisfactory drains. Many soil areas are broken up by old stream channels and scoured areas; these uneven surfaces complicate the establishment of good drainage. This soil holds excellent reserves of water for plant growth.

If the excess water is removed, Sloan silty clay loam warms up fairly early in spring and is fairly easy to work. This soil is very productive, and weeds abound in many fields. Sloan silty clay loam responds well to good soil management. It is well suited to irrigation if adequate tile drains are provided.

Many areas along the streams have been abandoned and are reverting to pasture or brush. Heavy rainfall on the headwaters of the streams, such as Flatrock Creek, Blue Creek, and the Little Auglaize River, can cause them to rise quickly and overflow their banks at any time. When the bottom lands are flooded, the crops may be lost.

Small areas of Shoals silty clay loam (not mapped separately in Paulding County) and Wabash silty clay are included with Sloan silty clay loam.

Sloan silt loam (Sd) (Capability IIw-1).—Most of this soil occurs in shallow swales along the Maumee River. The soil profile is much like that of Sloan silty clay loam except that it is composed mostly of loam and silt loam instead of silty clay loam. The surface soil is a very friable silt loam that has a very high supply of organic matter. It is easy to work. Responses to management are similar to those on Sloan silty clay loam.

St. Clair series

These light-colored, moderately well drained soils developed in calcareous fine silty clay loam to clay glacial till of Wisconsin age. They occupy small, long, narrow sloping to steep areas, in association with Hoytville and Latty soils. They are common throughout the southern, central, and western parts of the county. They are classified as Gray-Brown Podzolic soils.

The dominant position of these soils is on the short slopes near the bottom land. These slopes range from gently sloping to steep. They adjoin nearly every water-course and extend well up toward the point of its origin. The slopes usually are more gentle along the upper reaches of the stream. The degree of slope is variable within short distances. The length of slope ranges from less than 60 feet to about 150 feet.

The St. Clair soils are the light-colored, moderately well drained member of the soil catena that includes the light-colored, imperfectly drained Nappanee soils; the moderately dark colored, poorly drained Wetzel soils; and the dark-colored, very poorly drained Hoytville soils. St. Clair soils also occur on sloping to steep areas in association with the Nappanee soils that occur near Latty soils.

St. Clair soils differ from Broughton soils in having thicker A horizons, less clay in the B and C horizons, and in having developed on calcareous glacial till instead of calcareous, very fine, lacustrine clay. They have thinner A horizons than the Morley soils (not mapped in the county), which developed in somewhat coarser till and are recognized in other counties of western Ohio. They resemble the Lucas soils in some respects but have developed in till rather than water-laid clay.

The parent material contains 38 to nearly 50 percent of clay. Its sand content varies from 12 to about 18 per-

cent, and carbonates make up 15 to 25 percent. The till is compact and firm. It probably was reworked to some extent by waves in the glacial lake. Small amounts of coarse materials are present. They consist of pebbles and fragments of black shale (Ohio shale), limestone, and igneous rocks, and an occasional glacial boulder. The upper 4- to 8-inch layer of till commonly breaks into weakly to moderately developed angular blocky structural units 1 to 3 inches across. Structural development decreases rapidly with depth.

The original deciduous forest consisted of white oak, red oak, hickory, beech, sugar maple, and white ash. Much of the area has been cleared. Some of the less steep areas are used for soybeans, corn, wheat, and hay. The stronger slopes are mostly in pasture or wooded. Some areas are idle.

The St. Clair soils are likely to be eroded if row crops are planted. The danger of erosion is increased by the medium to high runoff if these soils are placed under intensive grain farming. Most of the cultivated St. Clair soils have lost more than half of their original A horizon.

St. Clair silt loam, 12 to 18 percent slopes, moderately eroded (SgD2) (Capability unit VIe-1).—Much of this soil was once cultivated, but large areas are now idle or used for pasture. Following is a profile of a formerly cultivated area that was in pasture at the time it was examined:

Surface soil—

A_p 0 to 5 inches, dark grayish-brown to brown (10YR 4/2 to 5/3, moist) friable silt loam; breaks into weakly developed granules up to 0.125 inch in diameter; has a moderate amount of organic matter; slightly acid to neutral; 4 to 6 inches thick.

Subsoil—

B₁ 5 to 7 inches, grayish-brown to brown (10YR 5/2 to 5/3, moist) silty clay loam; common, fine, faint, yellowish-brown (10YR 5/4 to 5/6, moist) mottles; breaks into weakly developed subangular blocky structural units 0.25 to 0.5 inch across; firm when moist; lower horizon boundary is clear; slightly to medium acid; 1 to 2 inches thick.

B₂₁ 7 to 10 inches, pale-brown to brown (10YR 6/3 to 5/3, moist) silty clay or clay; many, medium, faint, yellowish-brown (10YR 5/6, moist) mottles; breaks into moderately to strongly developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist; lower horizon boundary is gradual; slightly acid to medium acid; 3 to 5 inches thick.

B₂₂ 10 to 17 inches, brown (10YR 5/3, moist) clay or silty clay; many, medium, faint, yellowish-brown (10YR 5/6, moist) mottles; structural units thinly coated with grayish-brown (10YR 5/2, moist) clay; breaks into moderately developed angular blocky structural units 0.25 to 0.75 inch across; very firm when moist, slightly plastic and sticky when wet; lower horizon boundary is clear; slightly acid to slightly alkaline; 5 to 10 inches thick.

Parent material—

C 17 inches+, mottled yellowish-brown and grayish-brown (10YR 5/6 to 5/2, moist) silty clay or clay; the upper 4 to 6 inches break into moderately developed angular blocky structural units 0.5 to 2 inches across; development of structure decreases rapidly with depth; surface of pedes have thin coatings of grayish-brown (10YR 5/2, moist) clay; very firm when moist; calcareous glacial till contains many pebbles of black shale, granite, and limestone.

VARIATIONS: In some areas mottling is not present in the upper part of the B horizon. The depth to the calcareous materials varies from about 15 to 25 inches. Where this soil is now

cultivated, the color of the surface soil ranges from grayish brown to pale brown. The color is modified by the severity of erosion.

In cultivated areas the texture of the surface soil varies from a fine silt loam to silty clay loam in the small, severely eroded tracts included with this soil.

The surface soil in the wooded, uneroded areas is a friable, dark grayish-brown (10YR 4/2, moist) silt loam that is 2 or 3 inches thick. It contains a fairly large amount of organic matter. It breaks into weakly developed granules less than 0.125 inch across; the A₂ horizon is a friable, pale-brown (10YR 6/3, moist) silt loam that is 4 to 6 inches thick. Below this point the original profile is like that of St. Clair silt loam, 12 to 18 percent slopes, moderately eroded.

Runoff is rapid on this soil because it occupies sloping areas and the subsoil is slowly permeable. Internal drainage is slow. Tile drains are not needed, because the water table does not stand near the surface for extended periods. The uneroded soil has a good capacity to hold water that plants can use. As erosion removes increasing amounts of the permeable and friable surface soil, the capacity to hold water decreases rapidly. As a result, areas that have lost most of the surface soil are somewhat droughty during very dry periods.

This soil is too steep for row crops. If it is cultivated, it erodes very easily. It is low in natural fertility and supply of organic matter, but it responds well to good soil management. In some eroded areas the soil is moderately hard to work into a good seedbed, and poor stands of crops are produced. If this soil is cultivated, below-average yields generally result, because of the loss of friable surface soil, lack of available water, low fertility, and poor crop stands. The soil is best suited to hay or pasture.

Included with this moderately eroded soil are many small areas of uneroded or slightly eroded St. Clair soils on slopes of 12 to 18 percent that are too small to be delineated on the map.

St. Clair clay, 12 to 18 percent slopes, severely eroded (SfD3) (Capability unit VIIe-1).—This soil occurs only in Blue Creek and Benton Townships. It developed on the same kind of parent material as St. Clair silt loam, 12 to 18 percent slopes, moderately eroded, and, originally, the two soils had the same general features. This soil has lost all of its original surface layer, and in many areas the upper part of the subsoil has been thinned by erosion. The present plow layer, if the soil is cultivated, consists of former subsoil. It has a brown to yellowish-brown color; its texture is fine silty clay loam to coarse clay.

Because of the loss of practically all of the A horizon, the capacity of this soil to hold water for growing crops is low. Most of the organic matter and plant nutrients were removed with the surface soil. It is hard to work the surface layer into a friable seedbed, and poor stands of crops result. With good soil management, this soil can be built up to produce good yields of meadow and pasture crops.

St. Clair silt loam, 6 to 12 percent slopes, moderately eroded (SgC2) (Capability unit IVe-1).—This soil is similar to St. Clair silt loam, 12 to 18 percent slopes, moderately eroded, but is less steep. In general, profiles of the two soils are much alike. On the average this soil is slightly deeper to calcareous till. Runoff is affected by the use to which the land is put; it ranges from very slow in wooded areas to rapid in cultivated areas.

If this soil is cultivated, it is likely to be eroded. In tilled areas, where half or more of the original A horizon and much of the organic matter and plant nutrients have been lost, the present plow layer consists of the remaining surface soil mixed with the upper part of the B horizon. It is moderately difficult to cultivate.

The color of the plow layer ranges from grayish brown to pale brown. In areas where little or no erosion has taken place, the texture is silt loam, but, where erosion has been active, the texture is usually silty clay loam or clay loam. If this soil is cultivated, only moderate yields can be expected because of the loss of surface soil, loss of fertility, and reduced water-holding capacity.

Included with this soil are numerous, small, slightly eroded areas of St. Clair silt loam. The slightly eroded and moderately eroded soils occur in such a complex pattern along the breaks near streams that they cannot be delineated separately on the map.

Most of the small slightly eroded areas are used for trees or pasture. Many of the areas now in pasture were once cultivated. This soil also includes many small areas having slopes of 2 to 6 percent and others with slopes of 12 to 18 percent. All these inclusions are too small to be mapped separately.

St. Clair silt loam, 2 to 6 percent slopes, slightly eroded (SgB1) (Capability unit IIIe-1).—This soil occupies gentle slopes along the bottom lands. It is small in extent and occurs only on those areas where little or no seepage water comes from higher areas.

This soil has a profile similar, except for the surface layer, to that of St. Clair silt loam, 12 to 18 percent slopes, moderately eroded. The A horizon consists of 7 to 9 inches of friable, grayish-brown silt loam that has a fine, granular structure. This layer is underlain with a pale-brown to brown silty clay loam B₁ horizon that is 3 to 4 inches thick. In some areas the B₁ horizon is mottled faintly with grayish brown and yellowish brown. Beneath this layer is 14 to 18 inches of brown to yellowish-brown slightly plastic and sticky clay. This horizon is often faintly mottled in the lower part. The parent material, similar to that under other St. Clair soils, is below this layer.

From 1 to 3 inches of surface soil have been removed by erosion. Because this soil is only slightly eroded and occupies gentle slopes, less rainfall is lost through runoff than from the other St. Clair soils. Permeability is moderately slow to slow, and water movement is somewhat restricted in the lower part of the profile.

Although this soil is somewhat low in natural fertility, it is moderately productive and responds well to good soil management.

St. Clair clay, 6 to 12 percent slopes, severely eroded (SfC3) (Capability unit VIe-1).—This soil is distinguished from St. Clair silt loam, 6 to 12 percent slopes, moderately eroded, by having lost all of its original surface soil. In many areas several inches of the upper subsoil have also been removed by erosion. The present plow layer consists of plastic, dense, yellowish-brown to brown clay. The subsoil and layers of parent material are similar to those in the lower part of the profile of St. Clair silt loam, 12 to 18 percent slopes, moderately eroded.

The depth to calcareous till is 12 to 20 inches, the

variability being somewhat proportional to the degree of erosion. Nearly all of the plant nutrients and organic matter, along with the surface soil, have been removed.

Runoff is rapid on this soil, and it causes greater erosion if tillage is continued. Because of its low available moisture-holding capacity, this soil is droughty during dry weather. It is difficult to work, and the surface is usually cloddy and likely to produce poor stands of crops. For these reasons yields are low.

Several small areas of St. Clair silt loam on 6 to 12 percent slopes and on moderately eroded 12 to 18 percent slopes, have been included with this soil. Several severely eroded areas on 12 to 18 percent slopes have also been included. These included soils are too small and in a pattern too complex to be mapped separately.

St. Clair silt loam, 2 to 6 percent slopes, moderately eroded (SgB2) (Capability unit IIIe-1).—This soil is similar to St. Clair silt loam, 2 to 6 percent slopes, slightly eroded, but erosion has removed between 50 and 100 percent (4 to 8 inches) of the A horizon. The remaining surface soil, plus some of the upper part of the B horizon, comprise the present plow layer. To a large extent, the organic matter and plant nutrients were removed with the surface soil. The present surface soil is grayish brown, pale brown, or brown, and its texture is a fine silt loam to silty clay loam. Erosion has been irregular; consequently, the present surface soil has a spotted appearance.

The capacity of this soil to hold water that plants can use decreased as the A horizon was eroded. The amount of runoff is medium. The surface soil contains enough clay to make preparation of a good seedbed difficult. These unfavorable features result in poorer stands of crops and decreased yields. This soil responds well to good soil management, which ought to include practices to control erosion.

St. Clair silt loam, 18 to 25 percent slopes, moderately eroded (SgE2) (Capability unit VIIe-1).—This soil occupies moderately steep slopes along the Maumee River. It also occurs in small areas along Flatrock Creek and tributaries of the Maumee River. The profile is similar to that of St. Clair silt loam, 12 to 18 percent slopes, moderately eroded, except that the solum is thinner.

The A horizon, when uneroded, is dark grayish-brown to pale-brown silt loam, 3 to 5 inches thick. It is underlain by 6 to 12 inches of yellowish-brown to brown clay subsoil. The calcareous glacial till is beneath this horizon. Thickness of the different horizons varies widely. All of this soil is idle or is used for woodlots and pasture.

Because of the thin surface soil and strong slopes, runoff is rapid. This soil is low in fertility and productivity, but it can be improved, and good pasture or timber can be produced.

Included with this soil are some severely eroded areas of St. Clair silt loam. These have lost all the surface soil and are low in productivity. They are suitable only for pasture and forest. Also included are several small areas that are either uneroded or slightly eroded.

St. Clair clay, 25 to 35 percent slopes, severely eroded (SfF3) (Capability unit VIIe-1).—This soil occupies steep areas along the Maumee River and the lower parts of

its tributaries. It is a shallow soil that developed on calcareous glacial till. Originally the sequence of horizons was similar to that of St. Clair silt loam, 12 to 18 percent slopes, moderately eroded, but they were much thinner.

This soil is used for pasture and woodlots. Some areas are idle. Trees should be planted where the cover is not thick enough to prevent further erosion.

Included with this soil are very small uneroded, moderately eroded, and slightly eroded areas of St. Clair silt loam. All of these inclusions are too small to be shown separately on the map.

Tedrow series

These sandy, imperfectly drained soils are level to nearly level; they developed in deep sands and loamy sands. Most of the areas are 2 to 10 acres in size and form a complex pattern with Ottokee, Seward, and Rimer soils. The Tedrow soils are Regosols.

Other members of the same catena are the well-drained Oakville soils; the moderately well drained Ottokee soils; the dark-colored, very poorly drained Granby soils; and the very dark colored, very poorly drained Maumee soils. (There are no Oakville and Maumee soils in Paulding County).

The Tedrow soils differ from the Rimer soils in having developed on sands more than 48 inches deep over calcareous clay. They differ from Morocco soils (not present in Paulding County) in having developed on slightly acid to calcareous sands instead of strongly acid sands.

The sands in which these soils developed are of mixed lithology. They were deposited by wind or water and occur in an erratic pattern in the northeastern and eastern parts of the county. A small but very significant amount of clay (2 to about 5 percent) occurs throughout the profile. Lenses that range in texture from clay loam to silty clay occur within the solum in many profiles. These lenses are from 1 to 3 inches thick; as a rule, there is only one in the profile at any point. The sand is underlain with calcareous fine clay at depths of 4 to slightly more than 7 feet.

The Tedrow soils developed under a hardwood forest of oak, sugar maple, yellow-poplar, beech, hickory, and elm. All of these soils are cleared. They are used for wheat and potatoes. Some truck crops, corn, soybeans, and hay are grown.

Tedrow loamy fine sand (Tc) (Capability unit IIw-4).—A representative profile of Tedrow loamy fine sand in a cultivated area:

Surface soil—

A_p 0 to 9 inches, dark-brown to dark grayish-brown (10YR 3/3 to 4/2, moist) loamy fine sand; separates into single grains or very weakly developed granules less than 0.125 inch in diameter; nearly loose, but slightly coherent in place; slightly acid to medium acid; 7 to 10 inches thick.

A₃ 9 to 20 inches, yellowish-brown (10YR 5/6, moist) to strong-brown (7.5YR 5/6, moist) loamy sand mottled with yellowish red (5YR 5/8, moist); mottles are few, medium, and distinct; separates into single grains or very weakly developed granules; slightly coherent in place, but loose once it is disturbed; lower horizon boundary is clear and wavy; slightly acid to medium acid; 7 to 20 inches thick.

Subsoil—

C₁₁ 20 to 36 inches, pale-brown to light yellowish-brown (10YR 6/3 to 6/4, moist) loamy sand to sand; many, coarse, prominent, light-gray (10YR 6/1 to 7/2,

moist) and yellowish-red (5YR 5/8, moist) mottles; separates into single-grain structure; slightly coherent in place, but loose once it is disturbed; lower horizon boundary is gradual and wavy; slightly acid to medium acid; 12 to 20 inches thick.

C₁₂ 36 to 60 inches, light brownish-gray, light yellowish-brown (10YR 6/2 to 6/4, moist), or white (10YR 7/1 to 8/1, moist) loamy sand to sand; a few, fine, distinct, brown (10YR 5/3, moist) mottles; separates into single-grain structure; slightly coherent in place, but loose once it is disturbed; lower horizon boundary is gradual and wavy; neutral to slightly acid; 20 to 30 inches thick.

Parent material—

C₂ 60 inches+, light brownish-gray (10YR 6/2, moist) calcareous sand; loose; single-grain structure.

VARIATIONS: In some places loamy to sandy clay loam lenses 1 to 3 inches thick are in the subsoil. Some lenses have weakly developed, subangular blocky structure. These lenses are not continuous; they occur at varying depths and form an erratic pattern. Iron concretions, 1 to 2 inches across, that can be crushed in the hand are common between depths of 12 and 24 inches.

This soil is highly permeable. It loses very little water by runoff. Water moves rapidly through the solum until the soil above the clay becomes saturated. Impermeable clay at 4 to 6 or 7 feet restricts the downward movement of water during wet periods. A water table above the clay is thus produced, and its depth below the surface fluctuates from season to season.

Excess water can be removed easily from within the soil by installing tile drains, but measures should be taken to keep the fine sand from sifting into the drains and filling the lines. Because this soil is sandy, it holds only small quantities of water that plants can use and becomes droughty during dry weather. Drought is likely to cause serious damage to corn, soybeans, or other crops that require a long growing season.

Tedrow loamy fine sand is well suited to crops such as wheat, potatoes, strawberries, and other early season crops. It requires heavy fertilization to obtain good yields. It is easy to work and warms up early in the spring if properly drained. If adequate water is available, this soil responds well to irrigation under good soil management. Weeds grow readily and are likely to become a problem.

Included with this soil are small areas of Tedrow fine sandy loam or sandy loam soils.

Toledo series

The Toledo soils are dark-colored, very poorly drained, fertile soils that developed in calcareous lacustrine clays of the glacial lake plain. These Humic Gley soils occupy extensive areas in Auglaize and Brown Townships. Small tracts are scattered throughout the county. The large areas may cover more than 500 acres.

These level soils occur on the broad flats between the major drainageways. They are associated in a complex pattern with smaller areas of sandy soils.

Included in the soil catena with Toledo soils are the light-colored, moderately well drained Lucas soils; the imperfectly drained, light-colored Fulton soils, and the very dark colored, very poorly drained Bono soils. (Bono soils do not occur in Paulding County.)

Toledo soils differ from Paulding soils in having thicker and darker A horizons, better structural development in the lower part of the B horizon, and greater permeability throughout the solum. Toledo soils de-

veloped on lacustrine clay containing less than 60 percent of clay, whereas the clay content of Paulding soils exceeds 60 percent.

The water-laid clay in which Toledo soils developed contains less than 10 percent of sand, is smooth, and is free from gravel and boulders. Very thin lenses of fine sand are present in some places. The clay, as a rule, is laminated or varved in the lower part of the profile. Where Toledo soil occurs near areas of sandy soils, more sand is mixed with the clay throughout the profile.

Swamp white oak, bur oak, red maple, elm, hickory, sycamore, and basswood made up the deciduous swamp forest. Beneath the canopy of trees the ground cover consisted of coarse water-loving grasses and sedges.

Nearly all of this fertile soil has been cleared and tilled. The principal crops are corn, soybeans, small grain, and hay. A few potatoes and truck crops are grown locally.

Toledo silty clay loam (Te) (Capability unit IIw-3).—A representative profile of a cultivated soil:

Surface soil—

- A_p 0 to 7 inches, very dark gray (10YR 3/1, moist) silty clay loam; breaks into moderately developed granules about 0.125 inch in diameter; moderately friable to firm when moist; slightly acid to neutral; 7 to 9 inches thick.
- A₁₂ 7 to 9 inches, very dark gray (10YR 3/1, moist) silty clay loam; moderately developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist; slightly acid to neutral; 1 to 3 inches thick.

Subsoil—

- B_{21g} 9 to 12 inches, dark-gray (10YR 4/1, moist) silty clay; common, fine, distinct, yellowish-brown (10YR 5/6 to 5/8, moist) and grayish-brown (10YR 5/2, moist) mottles; breaks into moderately to strongly developed angular blocky structural units about 0.25 inch across; very firm when moist, plastic when wet; slightly acid to neutral; 3 to 6 inches thick.
- B_{22g} 12 to 30 inches, dark-gray (5Y 4/1, moist) silty clay; common, fine, and distinct mottles of grayish brown (10YR 5/2, moist), yellowish brown (10YR 5/6, moist), and light gray (5Y 6/1, moist); breaks into strongly developed angular blocky structural units about 0.25 inch across; very firm when moist, plastic when wet, very hard when dry; neutral to mildly alkaline; 15 to 25 inches thick.
- B_{23g} 30 to 54 inches, gray (10YR 5/1, moist) silty clay; numerous yellowish-brown (10YR 5/6, moist) mottles; breaks into moderately developed angular blocky structural units 0.25 to 0.75 inch across; very firm when moist, plastic when wet, very hard when dry; neutral to alkaline; 15 to 25 inches thick.

Parent material—

- C 54 inches+, mottled gray and yellowish-brown (10YR 6/1 to 5/6, moist) calcareous lacustrine silty clay; very firm when moist; massive and weakly laminated.

VARIATIONS: Lenses of somewhat coarser textured materials are present in the B horizon of some profiles. These lenses are 2 to 6 inches thick; they are likely to be present where this soil is close to areas of sandy soils. The texture of the lenses ranges from silty clay loam to coarse clay loam. The depth to calcareous clay ranges from less than 4 feet to about 5 feet.

In forested areas the surface soil is covered with 1 to 2 inches of partly decomposed organic materials formed from leaves, twigs, coarse grasses, and other debris. The top 3- to 4-inch layer is very dark gray to black silty clay loam. It has a very high content of organic matter and breaks into strongly developed granules. This layer is underlain by a very dark gray silty clay loam horizon that also contains a large amount of organic matter. Below this layer the subsoil is similar to that of the cultivated soil.

Toledo silty clay loam is nearly level. Because the surface soil is permeable, very little runoff occurs. Perme-

ability is moderately slow in the upper part of the solum and slow in the lower part. Excess water is fairly easy to remove with tile drains if the soil is kept in good tilth. During heavy rainstorms, water occasionally stands on the surface for brief periods, but serious damage to growing crops is not common. Large quantities of organic matter have accumulated in the upper soil layers; the dark-colored surface soil is rich in humus and nitrogen. The large supply of organic matter aids this soil in holding excellent reserves of water for plant growth.

If Toledo silty clay loam is well drained with tile, it warms up fairly early in the spring, is moderately easy to work, and is very productive. Although good supplies of plant nutrients are available within the soil, crops respond well to fertilizer if other good management practices are used.

This soil is well suited to irrigation where water is available.

Toledo silt loam (Tc) (Capability unit IIw-3).—This soil is closely associated with other sandy soils and contains more silt and fine sand in the surface soil than Toledo silty clay loam. The surface soil is a very dark gray friable silt loam that is 10 to 12 inches deep. It contains a high supply of organic matter.

Beneath the surface soil is a silty clay loam B₁ horizon, 2 to 4 inches thick, that is very dark gray and has a fairly high content of organic matter. Below this layer the B₂ horizon is much like that of Toledo silty clay loam except lenses of coarser textured materials are more numerous. The lenses are composed of silty clay loam to clay loam.

Natural surface drainage is very poor. Water readily penetrates the surface soil, and very little runoff occurs. Permeability is moderately slow to slow, but tile is very satisfactory for removing excess water from within the soil. Although Toledo silt loam holds large supplies of water for crop growth, it warms up rapidly in the spring if tile drains are used to remove the excess water. During heavy rainstorms crops are seldom damaged from the ponding of water. This soil is easy to work and is high in natural fertility. It is one of the most productive soils in the county.

Toledo silt loam is well suited to irrigation if good soil management and adequate drainage are provided. In other respects it is managed like Toledo silty clay loam.

Toledo loam (Tb) (Capability unit IIw-3).—This is one of the most productive soils in Paulding County. It is closely associated with Wauseon soils and other sandy soils in Auglaize and Brown Townships. Toledo loam developed in shallow deposits of loamy materials, less than 18 inches thick, over lacustrine clays.

The surface soil is friable very dark gray loam, 10 to 14 inches thick. It has a very high supply of organic matter. This material overlies a very dark gray, friable to firm, fine loam to clay loam layer that has a fairly high content of organic matter. This layer is 4 to 6 inches thick. Beneath this horizon is a dark gray, firm, silty clay or clay layer mottled with yellowish brown. In many areas the subsoil contains stratified layers or lenses of clay loam, sandy clay, or loam mixed with the silty clay material. The parent material consists of calcareous lacustrine silty clay.

In places this soil occupies a transitional position between the sandy soils and the finer textured Toledo soils. In these areas Toledo loam differs widely in texture and in depth of the various horizons. Some areas of Toledo loam have a fine clay loam texture down to the lower B horizon.

Most of the rainfall is absorbed, and runoff is very slow. Originally the water table was on or near the surface throughout wet periods. Water moves through this soil without serious restrictions, and the excess is removed easily with tile drains.

Toledo loam has high natural fertility, but crops respond readily to the addition of plant nutrients. If adequate drainage is installed this soil warms up early and is easy to work. It is well suited to irrigation. Small areas of Wauseon and Mermill loams are so intricately mixed with this soil in a pattern so complex that they cannot be shown separately on the map.

Toledo silty clay (Td) (Capability unit IIw-3).—This dark-colored, fine-textured soil occurs principally in Brown and Auglaize Townships. It differs from Toledo silty clay loam in having developed in somewhat finer textured materials. A profile in a cultivated area is described:

Surface soil—

A_p 0 to 8 inches, very dark gray (10YR 3/1, moist) silty clay; breaks into strongly developed angular blocky structural units 0.25 to 0.5 inch across; firm to very firm when moist; neutral to mildly alkaline; 7 to 9 inches thick.

Subsoil—

B_{21k} 8 to 13 inches, dark-gray (5Y 4/1, moist) to gray (N 5/0, moist) silty clay; many, medium, distinct, yellowish-brown (10YR 5/6, moist) and strong-brown (7.5YR 5/6, moist) mottles; breaks into strongly developed angular blocky structural units 0.25 to 0.5 inch across; very firm when moist, moderately plastic and slightly sticky when wet, very hard when dry; neutral to mildly alkaline; 4 to 7 inches thick.

B_{22k} 13 to 22 inches, gray (N 5/0 to 5Y 5/1, moist) silty clay; common, coarse, distinct, yellowish-brown (10YR 5/6 to 5/8, moist) mottles; breaks into strongly developed angular blocky structural units 0.25 to 0.75 inch across; very firm when moist, moderately plastic and slightly sticky when wet, very hard when dry; mildly alkaline; 5 to 8 inches thick.

B_{23k} 22 to 32 inches, gray (N 5/0 to 5Y 6/1, moist) silty clay; many, coarse, prominent, yellowish-brown (10YR 5/6, moist) mottles; breaks into weakly developed prismatic structural units 1 to 2 inches across; these units break into moderately developed angular blocky structural units 0.25 to 0.5 inch across; very firm when moist, slightly sticky and slightly plastic when wet; mildly alkaline; 8 to 12 inches thick.

B_{24k} 32 to 52 inches, mottled gray (5Y 6/1, moist) and yellowish-brown (10YR 5/6, moist) silty clay; breaks into weakly to moderately developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist, slightly plastic when wet; mildly alkaline; 12 to 24 inches thick.

Parent material—

C 52 inches+, mottled dark-brown (10YR 4/3, moist), yellowish-brown (10YR 5/6 to 5/8, moist), and gray (5Y 6/1, moist) silty clay; weakly laminated, calcareous, and very firm.

Because of the finer textured surface soil of Toledo silty clay, rainfall does not penetrate the surface so readily as on Toledo silty clay loam. However, runoff is very slow because this soil is level. Although water moves slowly through the solum, tile drains are successful in removing excess water from within the soil if good

tilth is maintained (fig. 7). The drains function somewhat more slowly on this soil than on other Toledo soils. Because the structure of the subsoil is better, Toledo silty clay responds more readily to tile drains than does Paulding clay. Locally, this soil is subject to ponding after heavy rain. As a rule, crops are not seriously damaged, however, because the water is absorbed except during long wet spells.

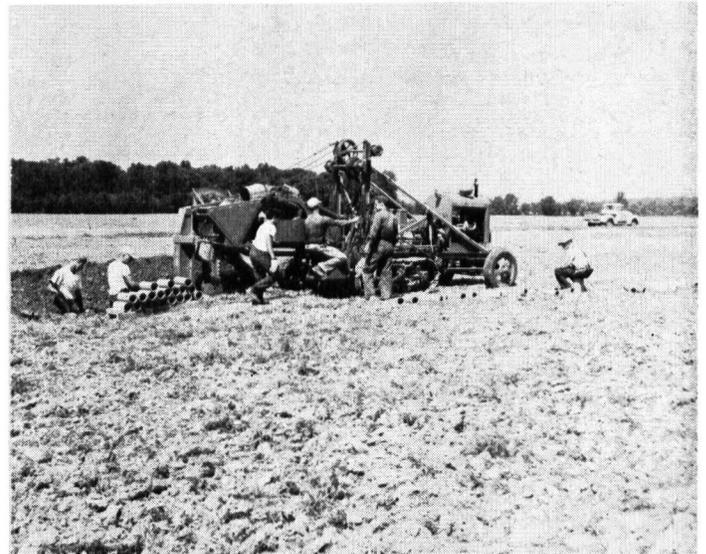


Figure 7.—Installing tile drains. This system normally will provide good drainage in Toledo silty clay.

Toledo silty clay is somewhat difficult to work into a good seedbed unless good tilth is maintained. It is fertile and warms up fairly early in the spring if adequate drainage is installed. It responds very well to applications of fertilizer and to other good management practices.

Toledo silty clay is fairly uniform over Brown and Auglaize Townships; small local areas of Toledo silty clay loam are included with it.

Wabash series

These fine-textured, dark-colored, and very poorly drained soils are developing in alluvial material. They generally occur along the tributary streams of the Auglaize and Maumee Rivers. They occupy very low swampy bottoms, sloughs, and backwater channels where water stands on the surface for long periods. They belong to the Humic Gley great soil group intergrading to Alluvial soils.

The Wabash soils are the dark-colored, very poorly drained member of the soil catena that includes the light-colored, imperfectly drained Defiance soils. They are finer textured than the Sloan soils and commonly are near areas of the Sloan or Shoals soils.

Wabash soils are developing in fine-textured sediments from calcareous glacial clay drift and lacustrine clay and from soils developed in such materials. In many old backwater channels and swampy areas the sediments are very smooth and look like slack-water clays. The amount of clay in the dominant layer exceeds 40 percent, and in many areas it exceeds 50 percent. The alluvium

is usually stratified, especially in the lower substratum. It contains numerous lenses of silty clay loam, but silty clay is the dominant texture in the profile. Stratified sands commonly underlie the fine alluvium at depths of 5 to 6 feet.

These soils were covered with a swamp forest of deciduous trees consisting mostly of swamp white oak, pin oak, silver maple, and elm. Many of these soils have been cleared for cultivation, but other areas are in pasture. Because of the danger of frequent floods, many fields are in pasture or are idle. Where these soils are cultivated, corn and soybeans are the chief crops.

Wabash silty clay (Wc) (Capability unit IIw-1).—The following profile is representative of a cultivated area:

Surface soil—

A_p 0 to 9 inches, very dark gray (10YR 3/1, moist) silty clay; breaks into moderately developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist, hard when dry; high content of organic matter; neutral to mildly alkaline; 7 to 9 inches thick.

Substratum—

9 to 26 inches, dark-gray (10YR 4/1, moist) silty clay; many, distinct, fine to medium, brown (7.5YR 5/4, moist) and yellowish-brown (10YR 5/6, moist) mottles; breaks into strongly developed angular blocky structural units 0.125 to 0.25 inch across; very firm when moist, plastic but nonsticky when wet; moderately high supply of organic matter; neutral to mildly alkaline.

26 to 60 inches, gray (10YR 5/1, moist) silty clay or stratified silty clay loam and silty clay; many, medium, distinct, yellowish-brown (10YR 5/6, moist) mottles; breaks into moderately to strongly developed angular blocky structural units 0.125 to 0.25 inch across; units become somewhat coarser with depth; very firm when moist, plastic but nonsticky when wet; neutral to mildly alkaline.

60 inches+, mottled gray (10YR 5/1, moist) and yellowish-brown (10YR 5/6, moist), stratified silty clay loam, sandy clay loam, silt loam, and loam; structureless and friable to firm when moist; neutral to calcareous.

VARIATIONS: The thickness, texture, and sequence of the various layers vary widely from one area to another. The dominant texture of the upper three layers is silty clay, but lenses of silty clay loam or silt loam materials can occur at any depth. In places the profile is underlain with stratified coarser textured materials. In many old backwater channels and sloughs, a silty clay makes up the entire profile. Along many of the smaller streams, the alluvium is only 2 to 4 feet deep, and is underlain by clay till.

This soil is the first to flood and the last to drain during any period of overflow. Runoff is almost non-existent; furthermore, considerable water from higher areas flows onto these low areas. Water moves slowly through the solum. This soil is frequently ponded for long periods during winter and spring or in other wet periods. If the soil is not ponded, the water table lies near the surface in the lower areas. Many areas are so low that adequate outlets cannot be installed for tile drains. Excess water can be removed from some of these areas by surface ditches.

If adequate drainage can be established, this soil is productive. If it is worked when wet, the surface soil is likely to become cloddy. It is then difficult to prepare a good seedbed. Weeds are a major problem in corn and soybeans in the many areas that are subject to overflow.

Wauseon series

The Wauseon soils are the fertile, dark-colored soils that developed in 18 to 48 inches of sandy materials over calcareous clay. The clay substratum may be either glacial clay till or lacustrine clay. These Humic Gley soils occur most commonly in small areas in Brown and Auglaize Townships and in small tracts in the northern half of the county.

Wauseon soils occupy nearly level to slightly depressed areas on the glacial lake plain. They are closely associated with other soils that developed in sandy materials, and with Toledo soils.

Wauseon soils are the dark-colored, very poorly drained member of the catena that includes the moderately well drained Seward soils; the light-colored, imperfectly drained Rimer soils; and the very dark colored, very poorly drained Neapolis soils. (Neapolis soils are not present in Paulding County.)

Wauseon soils are underlain by clay and thus differ from Granby soils, which have developed in deep sands. They are coarser textured than the Mermill soils.

The Wauseon soils were covered with a deciduous swamp forest that included swamp white oak, silver maple, red elm, American basswood, and sycamore.

Nearly all of these soils have been cleared. Corn, soybeans, wheat, and some hay are grown.

Wauseon fine sandy loam (Wb) (Capability unit IIw-5).—The following is a representative profile of a cultivated area:

Surface soil—

A_p 0 to 8 inches, very dark gray to very dark grayish brown (10YR 3/1 to 3/2, moist) fine sandy loam; separates into very weak, fine, granular structure; very high content of organic matter; neutral to slightly acid; 7 to 9 inches thick.

A₁ 8 to 10 inches, very dark gray (10YR 3/1, moist) fine sandy loam; separates into very weak, fine, granular structure; high content of organic matter; neutral to slightly acid; 2 to 5 inches thick.

Subsoil—

B_{21g} 10 to 14 inches, dark-gray (10YR 4/1, moist) to grayish-brown (2.5Y 5/2, moist), loose loamy fine sand; separates into single-grain structure; neutral to mildly alkaline; 3 to 6 inches thick.

B_{22g} 14 to 36 inches, dark-gray to grayish-brown (10YR 4/1 to 5/2, moist) loamy fine sand; distinct mottles of pale brown (10YR 6/3, moist) and yellowish brown (10YR 5/6, moist); slightly coherent in place, but loose once it is disturbed; separates into single-grain structure; neutral to slightly alkaline; 6 to 36 inches thick.

Substratum—

D 36 inches+, distinctly mottled, gray (10YR 6/1, moist) and yellowish-brown (10YR 5/6, moist), calcareous clay till or lacustrine clay; firm when moist; massive.

VARIATIONS: Wauseon fine sandy loam differs greatly from one area to another. Where the sandy materials are fairly shallow, the lower part of the solum developed in the underlying clay substratum. In local areas the B_{21g} horizon is cemented slightly with dark-brown (7.5YR 4/4, moist) iron accumulations.

Practically no rainfall is lost through runoff. Water moves easily through the upper part of the solum, but the clay substratum restricts movement of water in the lower part. Tile drains are used to remove the excess water from within the soil. The Wauseon soils rarely become droughty and are well suited to irrigation if a good underdrainage can be installed.

This soil is very easy to work and, with its high natural fertility, is excellent for growing truck crops. If good drainage is provided, Wauseon fine sandy loam warms up early in spring. It responds very well to heavy applications of fertilizer.

Included with this soil are small areas of Wauseon loam and Toledo loam, and soils of the Rimer series that have sandy loam textures. These inclusions occur in a complex pattern too intricate to allow showing the soils separately on the map.

Wauseon loam (Wc) (Capability unit IIw-5).—This soil is similar to Wauseon fine sandy loam. The surface soil, 9 to 12 inches thick, is a very dark gray to very dark grayish brown friable loam. It has a fairly high supply of organic matter. In general, the subsoil is similar to that of Wauseon fine sandy loam, but the material is ordinarily a fine sandy loam instead of a loamy fine sand.

Very little, if any, runoff occurs. Water readily moves through the solum above the clay substratum, but it percolates slowly through the substratum.

Excess water is easily removed from the soil with tile drains. Wauseon loam is easily worked into a very good seedbed. It is well suited to truck crops. It has high natural fertility and responds very well to fertilizer. It is well suited to irrigation, if adequately drained with tile. In other respects this soil is managed much the same as Wauseon fine sandy loam.

This soil occurs in a complex pattern and includes small areas of Toledo loam and some areas of Rimer fine sandy loams. These areas are too small to separate on the map.

Wetzel series

The Wetzel soils are moderately dark colored, poorly drained soils that are closely associated with the Hoytville soils on the glacial lake plain. They are in the Humic Gley great soil group but intergrade toward the Low-Humic Gley group.

Wetzel soils occupy very low knolls and ridges just above the surrounding Hoytville soils. Some are in narrow shallow swales that cross large bodies of Nappanee soils. Areas are mostly less than 20 acres in size and occur throughout the western and southern parts of the county.

Other soils developed on the same kind of parent material and associated with Wetzel soils are the light-colored, moderately well drained St. Clair soils; the light-colored, imperfectly drained Nappanee soils; and the dark-colored, very poorly drained Hoytville soils.

The A horizon of the Wetzel soils is not so dark as that of the Hoytville soils, and the B horizon is highly mottled immediately below the A horizon. Wetzel soils differ from Nappanee soils in having a darker colored surface soil that lacks an A₂ horizon and in having a profile that is nearly neutral in reaction.

Wetzel soils developed in fine clay loam, fine silty clay loam, silty clay, or clay calcareous till. The till contains 38 to nearly 50 percent of clay and 12 to 18 percent of sand. The coarse fraction of the glacial till consists of pebbles of black shale (Ohio shale), limestone, and igneous materials, and an occasional igneous boulder.

The carbonate content of the till ranges from about 15 to 25 percent.

These soils were covered with a deciduous forest of bur oak, red maple, swamp white oak, red oak, elm, hickory, American basswood, and an occasional sugar maple and beech.

Nearly all of these soils have been cleared. They are used for corn, soybeans, small grain, and some meadow hay.

Wetzel silty clay loam (We) (Capability unit IIw-3).—A representative profile of a cultivated soil:

Surface soil—

A_p 0 to 7 inches, dark-gray (10YR 4/1, moist) silty clay loam; breaks into weakly to moderately developed granules about 0.125 inch in diameter; firm when moist; slightly acid to neutral; 6 to 8 inches thick.

A₁ 7 to 9 inches, dark-gray (10YR 4/1, moist) silty clay loam; a few, fine, and distinct mottles are yellowish brown (10YR 5/4, moist); breaks into moderately developed angular blocky structural units 0.25 to 0.5 inch across; firm when moist; slightly acid to neutral; 1 to 3 inches thick.

Subsoil—

B_{21g} 9 to 12 inches, mottled grayish-brown (10YR 5/2, moist) and yellowish-brown (10YR 5/6, moist) silty clay or clay; breaks into strongly developed angular blocky structural units 0.125 to 0.5 inch across; very firm when moist, slightly plastic and slightly sticky when wet; slightly acid to neutral; 4 to 8 inches thick.

B_{22g} 12 to 28 inches, distinctly mottled grayish-brown (10YR 5/2, moist) and yellowish-brown (10YR 5/4 to 5/6, moist) silty clay or clay that has thin coating of grayish brown (10YR 5/2, moist) on ped surfaces; breaks into strongly developed angular blocky structural units 0.25 to 0.75 inch across; firm to very firm when moist, slightly sticky and slightly plastic when wet; neutral to mildly alkaline; 10 to 14 inches thick.

Parent material—

C 28 inches+, distinctly mottled grayish-brown (2.5Y 5/2, moist), yellowish-brown (10YR 5/4, moist), and light-gray (10YR 6/1, moist) calcareous clay or silty clay till; massive to weakly developed angular blocky structural units 1 to 2 inches across; very firm when moist, slightly plastic when wet; till contains pebbles of black shale, limestone, and granite.

VARIATIONS: This soil varies from one area to another in the depth to calcareous till, in supply of organic matter, in thickness of horizons, and in color of the A horizon. The calcareous till occurs at depths of 24 to 40 inches.

This soil is closely associated with Hoytville clay and has many problems in common with that soil. Its natural fertility is slightly lower, however, and it does not respond so well to tile drainage.

Although runoff is fairly slow on Wetzel silty clay loam, water does not stand on the surface for long periods. The moderately slow to slow percolation of water through the subsoil results in fairly slow drainage. Excess water can be removed successfully with tile drainage systems. If this soil is adequately drained, a good reserve of water is held for plant growth.

Wetzel silty clay loam is managed much like Hoytville silty clay loam, but it is not so easy to till. The natural level of fertility is moderate to high, and under good management this soil responds to practices that improve fertility. This soil is fairly easy to work; it produces well if good tilth is maintained.

Wetzel clay (Wd) (Capability unit IIw-3).—This soil has a surface soil that ranges from dark gray to dark grayish brown. It has more clay in the surface soil than Wetzel silty clay loam. Otherwise, the profile

characteristics of the two soils are much alike. The large amount of clay in the plow layer makes Wetzel clay somewhat difficult to work. If it is worked when too wet, it becomes hard and cloddy, and poor stands of crops result.

Water enters the surface soil rather slowly, and runoff is slow. Occasionally, local areas become ponded for short periods. Water moves slowly within the soil, but tile drains can be used successfully to remove the excess water. In other respects this soil is managed much the same as Wetzel silty clay loam.

Use and Management of Soils⁴

This section has six parts. The first explains how soils are grouped according to their capability and lists the capability units (groups of soils) in Paulding County. The second part makes general suggestions for the management of each capability unit.

The third part contains general management suggestions if the soils are used for row crops, pasture and hay, or woodland. The fourth part gives estimates of yields that can be expected on each soil under average management and under a high level of management.

The fifth part indicates how the soils can be used for special purposes, (1) if they are irrigated, (2) if special crops are grown for commercial use, and (3) if they are managed to increase the number and variety of birds and game.

The sixth part gives the engineering properties of the soils if they are used for highways and if they are used for residential development.

Capability Groups of Soils

Capability grouping is a system of classification used to show the relative suitability of soils for crops, grazing, forestry, or wildlife. It is a practical grouping based on the needs and limitations of the soils, the risks of damage to them, and also their response to management. In this report, soils have been grouped on three levels above the soil mapping unit. They are the capability unit, the subclass, and the class.

The *capability unit*, which can also be called a management group of soils, is the lowest level of capability grouping. A capability unit is made up of soils similar in kind of management needed, in risk of damage, and in general suitability for use. It is identified by Arabic numerals in the capability classification system.

The next broader grouping, the *subclass*, is used to indicate the dominant kind of limitation. The subclass is shown by a letter. The letter symbol "e" means that the main limiting factor is risk of erosion if the plant cover is not maintained. The symbol "w" means that excess water retards plant growth or interferes with cultivation. The symbol "s" means that the soils are shallow, droughty, or low in fertility.

The broadest grouping, the *class*, is identified by Roman

numerals. All the soils in one class have limitations and management problems of about the same degree, but of different kinds as shown by the subclass. All the classes except class I may have one or more subclasses.

In classes I, II, and III are soils that are suitable for annual or periodic cultivation of annual or short-lived crops.

Class I soils are those that have the widest range of use and the least risk of damage. They are level or nearly level, productive, well drained, and easy to work. They can be cultivated with almost no risk of erosion and will remain productive if managed with normal care.

Class II soils can be cultivated regularly, but they do not have quite so wide a range of suitability as class I soils. Some class II soils are gently sloping and consequently need moderate care to prevent erosion. Other soils in class II may be slightly droughty, wet, or somewhat limited in depth.

Class III soils can be cropped regularly, but they have a narrow range of use. They need even more careful management than soils in class I or II.

In class IV are soils that should be cultivated only occasionally or only under very careful management.

In classes V, VI, and VII are soils that normally should not be cultivated for annual or short-lived crops but can be used for pasture, for forests, or for wildlife.

Class V soils (none in Paulding County) are nearly level and gently sloping, but they are droughty, wet, low in fertility, or otherwise unsuitable for cultivation.

Class VI soils are not suitable for crops because they are steep or droughty or otherwise limited, but they give fair yields of forage and fair to high yields of forest products. Some soils in class VI can, without damage, be cultivated enough so that fruit trees or forest trees can be set out or pasture crops seeded.

Class VII soils provide only poor to fair yields of forage. Yields of forest products may be fair to high. The soils have characteristics that severely limit their use for pasture and, in some places, for trees.

In class VIII are soils that have practically no agricultural use. Some areas have value for watershed protection, wildlife shelter, or scenery. No class VIII soils have been mapped in Paulding County.

The soils of Paulding County are grouped into the following classes, subclasses, and units.

Class I.—Deep, level or nearly level, productive soils that have few or no permanent limitations; suitable for tilled crops and other uses.

Unit I-1.—Level or nearly level, well-drained loamy soil.

Unit I-2.—Level or nearly level, well-drained or moderately well drained soils on the bottom lands.

Class II.—Soils that have moderate limitations if cultivated; suitable for crops, pasture, and trees.

Subclass IIe.—Level to gently sloping soils, subject to erosion if not protected.

Unit IIe-1.—Level to nearly level, moderately well drained, light-colored soils of the terraces.

Unit IIe-2.—Gently sloping, well-drained or moderately well drained soils on the beach ridges.

⁴The authors acknowledge the assistance by GLEN R. BERNATH, management agronomist; JEPHIA D. FITZGERALD, soil conservationist; and LLOYD A. WAKEMAN, hydraulic engineer, U.S. Soil Conservation Service; in preparing this part of the report.

Subclass IIw.—Level to nearly level or gently sloping soils that are limited by poor drainage or excess water.

Unit IIw-1.—Level to nearly level soils of the bottom lands that are subject to flooding.

Unit IIw-2.—Level to nearly level soils that are imperfectly drained.

Unit IIw-3.—Dark-colored very poorly drained soils that require drainage to remove excess water.

Unit IIw-4.—Grayish, imperfectly drained sandy soils that are level to gently sloping and require drainage to remove excess water.

Unit IIw-5.—Dark, sandy, level to gently sloping soils that have a high water table.

Class III.—Soils that have severe limitations that reduce the choice of plants or require special conservation practices, or both; suitable for crops, pasture, and trees.

Subclass IIIe.—Sloping soils that are highly susceptible to erosion if cultivated.

Unit IIIe-1.—Sloping, moderately well drained soils over a fairly heavy subsoil.

Unit IIIe-2.—Shallow, sloping, moderately well drained soils over calcareous sands and gravel.

Subclass IIIw.—Soils limited by excess water.

Unit IIIw-1.—Dark, nearly level soils in which drainage is limited by a high content of clay.

Unit IIIw-2.—Light-colored, nearly level to gently sloping soils with clay subsoils.

Unit IIIw-3.—Light-colored, nearly level, imperfectly to poorly drained soils in highly sorted, lake-laid clays.

Unit IIIw-4.—Grayish, gently sloping sandy loam soils in which fine texture of the subsoil restricts the downward movement of water.

Subclass IIIs.—Soils severely limited by their texture and content of organic matter and plant nutrients.

Unit IIIs-1.—Sandy soils that hold a low supply of organic matter and plant nutrients and need amendments for their best use.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both; suitable for limited or occasional cultivation but well suited to pasture.

Subclass IVe.—Soils subject to severe erosion if not protected.

Unit IVe-1.—Moderately eroded soils limited by rapid runoff and heavy subsoil.

Class VI.—Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife food and cover.

Subclass VIe.—Soils moderately limited for pasture or trees and subject to erosion if a cover is not maintained.

Unit VIe-1.—Hilly and eroded soils.

Class VII.—Soils that have very severe limitations that make them unsuited for cultivation and restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.—Soils subject to severe erosion if cover is not maintained.

Unit VIIe-1.—Steep, moderately to severely eroded soils.

Management of Capability Units

In the following pages each capability unit is described briefly, the soils in each are listed, and some suggestions for the use and management of those soils are given.

Capability unit I-1

This capability unit consists of one level to nearly level loamy soil on which there is little or no danger of erosion. The soil is deep and friable and water moves through the solum moderately well. The soil has good capability to hold water that crops can use. It is generally productive. The soil mapping unit is Haney silt loam and loam, 0 to 2 percent slopes (HaA).

This soil is generally used for crops. The rotation should include one meadow crop in 4 years or a cover crop every other year.

If yields become higher as a result of good management, more crop residues should be incorporated into the soil. Green-manure crops can then be used part of the time as a substitute for meadow.

Tile drains are usually not necessary. They should be used in low spots, particularly if special crops are grown.

Good pasture can be grown. Nitrogen fertilizers are desirable if early pasture is to be produced. If proper amounts of lime and fertilizer are applied, alfalfa, red clover, alsike clover, sweetclover, ladino clover, timothy, and bluegrass are suitable grasses and legumes.

Trees are seldom planted on these soils. Native hardwoods, such as yellow-poplar, red oak, black walnut, black maple, and white oak could be planted in open areas already in woodland. Because the underlying soil material is generally neutral or limy, plantings of spruce and cedar may be feasible.

Capability unit I-2

Capability unit I-2 consists of level or nearly level soils of the bottom lands. These soils are generally friable and provide a good root zone. They are well drained, except the Eel soils, which are moderately well drained. All of the soils may be flooded occasionally. The soils in this unit are:

Eel loam (Ea).
Eel silt loam (Eb).
Eel silty clay loam (Ec).
Genesee fine sandy loam (Ga).
Genesee loam (Gb).
Genesee silt loam (Gc).
Ross silt loam (Rh).

Row crops can be grown more frequently on these soils than on many soils in the county. A cropping program should include cover crops and green-manure crops whenever feasible. The incorporation of a large amount of crop residue will help obtain high yields. Cover crops should be utilized to the fullest extent if the soils are flooded often in winter, and row crops are planted nearly every year. If the soils are not flooded frequently, small grain and green-manure crops can be grown more often.

Tile drains are usually not needed. They may be necessary in low spots, however, particularly if special crops are grown. Furrows or shallow ditches may make appropriate surface drainage for pastureland.

Excellent stands of pasture can be obtained, and yields are good during dry weather. Pastures should be mowed frequently so that the clover will not be smothered by grasses.

Fertilizer may be needed. Ladino clover, bluegrass, alfalfa, birdsfoot trefoil, red clover, and timothy are suitable hay and pasture plants.

New tree plantings usually are not made. Open areas in the woodlands can be filled in with black walnut, yellow-poplar, white ash, and green ash.

Capability unit IIe-1

This unit consists of one level to nearly level soil that has a fairly heavy subsoil. Generally, this soil is moderately well drained, and water moves slowly through the profile. Because water enters the soil slowly, the excess may stand on the surface in spots for short periods of time after heavy rainfall. The soil is Lucas silt loam, sandy substratum, 0 to 2 percent slopes (LdA).

A rotation without a cover crop should include at least 2 years of meadow crops in each 5 years. If a cover crop is grown, 1 year of meadow crop in 4 years is adequate.

As the yields improve, a greater amount of crop residue should be incorporated into the soil. Green-manure crops can then substitute for meadow.

Although tile drains are not usually necessary, they may be desirable in low spots. If special crops are grown, the tile may be particularly beneficial in depressions.

Although this soil is usually in row crops, good pasture can be produced. The land is well suited to early pasture if nitrogen is applied. Where the pasture is properly limed and fertilized, suitable grasses and legumes are ladino clover, birdsfoot trefoil, bluegrass, and orchardgrass.

Trees usually are not set out on these soils. Nevertheless, many of the open areas in existing forests can be filled in with native hardwoods to improve the stand. Desirable plantings would include hard maple, yellow-poplar, red oak, and white oak.

Capability unit IIe-2

In this unit are the gently sloping soils that are usually friable and are well drained to moderately well drained. Water moves easily through the subsoil of Belmore loam. These soils are subject to erosion, especially if row crops are grown. They are productive under good soil management. Only two soils are in this capability unit:

- Belmore loam, 2 to 6 percent slopes, slightly eroded (BaB1).
- Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded (HaB1).

If other soil-management practices are good, erosion can be kept to a minimum by including at least 1 year of meadow in 4 years, or 2 years of hay or pasture in each 5 years. A thick cover crop is desirable after a row crop is grown.

As yields improve, more crop residue should be incorporated into the soil. A green-manure crop can then be substituted for a full season of meadow.

If diversion ditches are constructed, the outlets should be established first to remove the water before the soil is washed away. If terraces are built on uniform slopes,

the rows should have a slight drop toward the waterways to provide surface drainage.

These soils are generally used for crops, but good pasture can be grown. They are well suited to early pasture if nitrogen fertilizer is applied. Grasses and legumes will grow if they are properly limed and fertilized. Ladino clover, alfalfa, red clover, birdsfoot trefoil, bluegrass, and orchardgrass are particularly suited to pasture crops.

New plantings of trees usually are not made on these soils. The native hardwoods, such as yellow-poplar, black walnut, green ash, white ash, red oak, and sugar maple, should be encouraged or planted in open areas in the woodlands.

Spruce pine and cedar can be planted because these soils are generally neutral to limy. Scotch pines are usually not suitable, but pines for Christmas trees may do fairly well.

Capability unit IIw-1

This unit consists of level to nearly level soils of the bottom lands. Internal drainage is generally slow. Water may stand on the surface, and flooding may become serious. Wabash silty clay is particularly subject to overflow. These soils are generally improved if tile drains or surface ditches are installed. Because they are usually neutral and fertile, a limited response to heavy fertilization can be expected. The soils in this capability unit are:

- Defiance silty clay loam (Da).
- Shoals silt loam (Sc).
- Sloan silt loam (Sd).
- Sloan silty clay loam (Se).
- Wabash silty clay (Wa).

Cover crops and green-manure crops should be included in a cropping program whenever possible on these soils.

Where the soils are subject to considerable overflow, row crops should predominate and cover crops should be grown as often as possible. If floods are not frequent, small grain and green-manure crops can be planted more often.

Diversion ditches may be feasible to control excess water that flows from nearby slopes. Tile drainage systems properly installed will normally drain these soils (fig. 8). Most of them will be benefited by a complete tile drainage system if outlets are available. For row crops, the tiles should be spaced 50 to 70 feet apart at depths of 36 to 42 inches. Surface ditches are suggested for removing excess water from the cropland, and furrows or shallow ditches for draining pasture or meadow.

The soils in this capability unit are excellent for pasture. They produce well in dry weather. The fields should be mowed frequently so that bluegrass will not smother the clover.

Fertilizer may be needed. The grasses and legumes suited to these soils include ladino clover, orchardgrass, bluegrass, and reed canarygrass.

Trees usually are not planted on these soils. Many of the native hardwoods, such as green ash, white ash, sycamore, eastern cottonwood, and red maple, can be planted in open areas of the woodlands to improve the stands.



Figure 8.—A corrugated metal pipe outlet for tile drains. The rate of flow is affected by the kind of soil and the practices used to improve tilth.

Capability unit IIw-2

Nearly level to level soils that are imperfectly drained make up this unit. The surface soil is grayish and has a low supply of organic matter. These soils respond to tile drainage. They need lime and fertilizer. Sufficient meadow crops and crop residues should be turned under to maintain tilth and to build up the content of organic matter. The soils in this capability unit are:

- Digby loam, 0 to 2 percent slopes (DcA).
- Digby loam, 2 to 6 percent slopes, slightly or moderately eroded (DcB1).
- Digby silt loam, 0 to 2 percent slopes (DdA).
- Digby silt loam, 2 to 6 percent slopes, slightly or moderately eroded (DdB1).
- Haskins loam (Hb).
- Haskins silt loam (Hc).

Under good soil management and if good yields are obtained, a crop sequence should include at least 1 year of meadow (hay or pasture) in every 3 or 4 years. If stands are poor and the yields are low, the rotation should include a longer period in meadow. Green-manure crops may serve part of the time as a substitute for meadow grasses.

Establish sod waterways, if feasible, wherever water flows across the fields. Make the channels smooth and wide enough to carry the runoff from the heaviest storms. Fertilize and mow the waterways to obtain a dense sod, and use enough lime and seed.

Tile that are properly installed will normally drain these soils. For general farm crops, tile lines should be spaced 50 to 75 feet apart at depths of 30 to 42 inches. Proper blinding of tile with porous material is desirable. Surface drains will help to remove excess water. Furrows or shallow ditches may be suitable for pasture.

These soils will puddle easily if they are pastured and trampled when too wet. If properly limed and fertilized, suitable grasses and legumes are ladino clover, bluegrass, orchardgrass, tall fescue, and reed canarygrass.

New plantings of trees generally are not made on these soils. Sugar maple, swamp white oak, white ash, green ash, and red maple can be encouraged by removing deadwood and thinning branches. Seedlings can be planted in open areas of the woodlands.

Capability unit IIw-3

This unit consists of dark-colored soils that are very poorly drained. Tile and surface drains are necessary if row crops are grown. These soils are very productive if meadow grasses, cover crops, or crop residues are plowed under to maintain soil tilth and to build up the content of organic matter. The soils in this unit are:

- Hoytville clay (Hd).
- Hoytville silt loam (He).
- Hoytville silty clay loam (Hf).
- Mermill silt loam (Mb).
- Mermill silty clay loam (Mc).
- Millgrove silt loam (Me).
- Millgrove silty clay loam (Mf).
- Toledo loam (Tb).
- Toledo silt loam (Tc).
- Toledo silty clay (Td).
- Toledo silty clay loam (Te).
- Wetzel clay (Wd).
- Wetzel silty clay loam (We).

If crop yields are to be maintained, a rotation that includes at least 1 year of meadow in 4 years should be included in the management program. A 3-year crop sequence that includes cover crops and green-manure crops is also satisfactory.

Good tilth and high fertilization will help produce high yields, and then large amounts of residues are produced. If the residues are turned under, the soil can be cropped intensively. Cover crops and green-manure crops are needed to obtain the best yields.

Properly installed tile lines will normally give good drainage of these soils. For row crops, drains should be 50 to 75 feet apart at depths of 36 to 42 inches. Proper blinding of tile with porous material is desirable.

Surface drains will also aid in removing excess water. Ditches that can be crossed with heavy machinery should not be more than 1 foot deep with side slopes of 8 to 1. At least one such ditch in every 660 feet is effective. On pastureland, either furrows or shallow ditches may be suitable.

These soils will puddle easily if they are pastured and trampled when too wet. Grasses and legumes should be fertilized to establish a thick cover of sod. Suitable legumes and grasses are ladino clover, bromegrass, tall fescue, bluegrass, and alfalfa.

Trees are not usually planted on these soils. White ash, sycamore, eastern cottonwood, swamp white oak, and American basswood should be encouraged on open spaces of existing woodlands. Some replanting of these species might be worthwhile.

Capability unit IIw-4

Capability unit IIw-4 consists of light-colored, grayish sandy soils. They are level to gently sloping and are imperfectly drained. They have a low supply of organic matter and plant nutrients. Good response to tile drains can be expected. Six soils are in this unit:

Digby fine sandy loam, 0 to 2 percent slopes (DbA).
 Rimer fine sandy loam, 0 to 2 percent slopes (RaA).
 Rimer fine sandy loam, 2 to 6 percent slopes, slightly eroded (RaB1).
 Rimer sandy loam, 0 to 2 percent slopes (RbA).
 Rimer sandy loam, 2 to 6 percent slopes, slightly eroded (RbB1).
 Tedrow loamy fine sand (Ta).

With good soil management a crop sequence should have 1 year of meadow in each 4 years. A 3-year system on sites that are not subject to water erosion could include corn, a cover crop, soybeans, and winter wheat followed by a green-manure crop.

Tile drains usually will drain these soils. The clay layer in the soils will influence depth of the tile. For general farm crops, a spacing of 50 to 70 feet at depths of 36 to 42 inches is suggested. Precautions should be taken to prevent sand from washing into the tile lines.

Pastures do not withstand dry weather on these soils; therefore, deep-rooted legumes should be seeded for late-season grazing. Ladino clover, bromegrass, tall fescue, and alfalfa make suitable plantings if the fields receive lime and fertilizer.

As a rule, new plantings of trees are not made on these soils. In open areas of existing woodlands, yellow-poplar, red oak, white oak, and sugar maple should be encouraged. Some replanting of these species would supplement natural reforestation.

Capability unit IIw-5

This unit consists of dark-colored sandy soils that are level, nearly level, or gently sloping. They have a high water table. Good response from tile drains can be expected. These soils are generally very productive. A list of the soils follows:

Granby fine sandy loam (Gd).
 Mermill loam (Ma).
 Millgrove loam (Md).
 Wauseon fine sandy loam (Wb).
 Wauseon loam (Wc).

Since these soils are loamy and permeable, meadows to maintain good tilth are not needed so urgently as they are on the heavier soils. If forage crops are not needed on the farm, cover crops, green-manure crops, and other good management will keep the soil in good condition.

Properly installed tile lines will drain these soils. Lines should be spaced 60 to 75 feet apart and 36 to 48 inches deep. Special precautions should be taken to prevent large amounts of sand from washing into the tile.

Animals will trample and compact the soils if the areas are pastured when too wet. Grasses and legumes generally hold up well during dry weather. If the pasture is properly fertilized, birdsfoot trefoil, ladino clover, bromegrass, reed canarygrass, tall fescue, and bluegrass will do well.

Trees are not usually planted. Many of the native hardwoods, however, can be encouraged in open areas of existing woodlands. Desirable trees are swamp white

oak, sycamore, eastern cottonwood, white ash, green ash, American basswood, and red maple.

Capability unit IIIe-1

The gently sloping soils in this capability unit have a very heavy subsoil that retards downward movement of water. These soils are moderately well drained, however, and runoff is fairly rapid. They will erode, especially if planted to row crops. Even with good management, they are usually below average in productivity. The soils are:

Broughton silty clay loam, 2 to 6 percent slopes, slightly eroded (BcB1).
 Broughton silty clay loam, 2 to 6 percent slopes, moderately eroded (BcB2).
 Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded (LcB1).
 Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded (LdB1).
 Lucas silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded (LdB2).
 St. Clair silt loam, 2 to 6 percent slopes, slightly eroded (SgB1).
 St. Clair silt loam, 2 to 6 percent slopes, moderately eroded (SgB2).

If these soils are generally well managed, erosion losses can be kept to a minimum if at least 3 years of meadow crops are grown each 6 years. Cover crops should follow row crops.

If cultivated crops are to be planted on the contour, the rows should drop slightly to provide surface drainage. With contour farming, one meadow crop in 4 years or two meadow crops in each 5 years, would be desirable. In this system also, cover crops should follow the row crops.

If it is feasible to build diversion ditches, the outlets should be established first. Wherever water flows across the fields, sod waterways are desirable. A smooth channel should be built that is wide enough to carry the runoff from the heaviest storms. The outlets and waterways should receive amounts of lime, seed, and fertilizer that will obtain a dense sod. They should be mowed to control weeds.

These soils will puddle easily and become compact if pastured when too wet. Water will stand in the hoof-prints and injure the grass. Usually these soils do not produce the earliest pasture, but they can be pastured earlier than some of the other soils. If early grazing is desired, a fertilizer containing nitrogen should be applied. If the soils are properly limed and fertilized, suitable grasses and legumes are ladino clover, alsike clover, timothy, red clover, and bluegrass.

New plantings of trees usually are not made on these soils. Red oak and white pine may be planted in open areas in existing woodlands.

Capability unit IIIe-2

This unit consists of two undifferentiated soils that are shown by one symbol on the map. They are sloping and need to be protected from erosion if they are used for row crops. They are moderately well drained and hold moisture fairly well. With good management, they are moderately productive. The mapping unit is Haney silt loam and loam, 6 to 15 percent slopes, moderately eroded (HaC2).

Losses from erosion can be kept to a minimum if the rotation includes at least 3 years of meadow crop in each

5 years. Where the soil can be cultivated on the contour, the rotation should include 2 years of meadow hay or pasture in each 4 years.

If diversion terraces are feasible, the outlets should be built before the terraces. In fields that are not terraced, establish sod waterways wherever water flows. The channel should be smooth and wide enough to carry runoff from the heaviest storms. Lime, seed, and fertilizer adequately; mow the outlets and waterways to establish and to keep a dense sod.

These soils are well suited to pasture, but nitrogen is needed for early grazing. Appropriate grasses and legumes are ladino clover, alfalfa, red clover, birdsfoot trefoil, bluegrass, and orchardgrass.

Trees are usually not set out on these soils. Because most areas are in crops or pasture, any plantings to improve the stands should be on open or exposed plots in the woodlands. Some trees suitable for planting are tulip-poplar, red oak, white ash, black walnut, and also pines for Christmas trees.

Capability unit IIIw-1

This extensive capability unit consists of moderately dark colored soils that are very poorly drained. They are nearly level, and each soil contains a large amount of clay. Thus it is difficult to drain excess water from the surface (fig. 9) and to remove water from the subsoil.



Figure 9.—Ponded areas on Paulding clay can cause considerable damage to wheatfields.

The soil is hard and cloddy when it is dry and becomes sticky and puddles when it is wet. If these soils are managed well and the weather is fairly good, they are productive. The soils in this capability unit are:

- Latty clay (La).
- Latty silty clay loam (Lb).
- Paulding clay (Pa).
- Paulding loam (Pb).
- Paulding silty clay loam (Pc).

Under good management and if yields are high, these soils should be in meadow crops about a third of the time in order to maintain tilth. If large amounts of crop residues and manure are turned under and cover

crops are grown, the proportion of meadow crops can be reduced to 1 year in 4.

Tile drains function rather slowly, even if good tilth is maintained. For general farm crops, tile lines should be 45 to 60 feet apart and 30 to 36 inches deep. Proper blinding of tile with porous material is desirable.

Surface drainage can be improved by shallow ditches. Ditches about 1 foot deep with side slopes of 8 to 1 feet can be crossed with farm machinery. Such ditches at intervals of 350 to 600 feet are effective. Furrows or shallow ditches are adequate for pastureland.

Pastures will puddle and become hard if they are grazed and trampled when too wet. If the soils are properly limed and fertilized, suitable grasses and legumes include ladino clover, bromegrass, tall fescue, alfalfa, bluegrass, and reed canarygrass.

Trees are seldom planted on these soils. Nevertheless, tree growth can be encouraged in open areas of existing woodlands by thinning and woodland improvement. Occasional plantings of swamp white oak, white ash, and green ash will improve the stand.

Capability unit IIIw-2

Light-colored (grayish) soils that have poor internal drainage make up this capability unit. They are nearly level or very gently sloping. Tight subsoils prevent downward movement of water. Soil management offers problems because of the difficulty of removing excess water from the surface and of draining water from the subsoil. The content of organic matter and the supply of plant nutrients normally are low. The soils become cloddy and hard when dry. During wet weather they are sticky and plastic, and water is likely to stand in ponds. With good soil management and average weather conditions, these soils are moderately productive. The soils are:

- Fulton fine sandy loam, 0 to 2 percent slopes (FaA).
- Fulton loam, 0 to 2 percent slopes (FbB).
- Fulton silt loam, 0 to 2 percent slopes (FcA).
- Fulton silt loam, sandy substratum, 0 to 2 percent slopes (FdA).
- Fulton silty clay loam, 0 to 2 percent slopes (FeA).
- Fulton silty clay loam, sandy substratum, 0 to 2 percent slopes (FfA).
- Nappanee fine sandy loam, 0 to 2 percent slopes (NaA).
- Nappanee loam, 0 to 2 percent slopes (NbA).
- Nappanee silt loam, 0 to 2 percent slopes (NcA).
- Nappanee silty clay loam, 0 to 2 percent slopes (NdA).

If the soils are managed well and yields are high, meadow crops should be in the rotation a fourth or a third of the time. If poor stands and yields are obtained, the soils should be left in meadow for longer periods.

As high yields are attained through the application of large quantities of barnyard manure or other nitrogenous materials, cover crops and green-manure crops may be substituted part of the time in the rotation in place of meadow hay.

Tile will function moderately well if good tilth is maintained. For most crops, drains spaced 45 to 60 feet apart, 30 to 36 inches deep, are suggested. Proper blinding of tile with porous material is desirable.

Surface drainage can be improved by shallow ditches. These ditches should be properly constructed and maintained for maximum efficiency. Ditches about 1 foot deep can be crossed by farm implements if the side slopes are not steeper than 8 to 1 feet. At least one such ditch is needed every 350 to 600 feet. Surface drainage with

furrows or shallow ditches may be suitable on the meadows and pasture.

The soils will puddle easily if they are grazed and trampled when too wet. Even if nitrogen fertilizer is used to produce early pasture, these soils cannot be grazed so early as some of the others. If enough lime and fertilizer are used, suitable grasses and legumes include ladino clover, orchardgrass, tall fescue, alfalfa, and reed canarygrass.

Swamp white oak, white ash, green ash, red oak, white oak, and red maple should be encouraged in open areas in existing woodlands. New plantings are seldom made in the areas that have been cleared.

Capability unit IIIw-3

This capability unit consists of nearly level, light-colored (grayish) soils that are imperfectly drained to poorly drained. The surface soil and subsoil generally contain a large amount of clay. Water moves through these soils very slowly, which makes tile drains of questionable value. These soils are usually low in supply of plant nutrients and are not very productive. The soils are:

- Roselms clay, 0 to 2 percent slopes (RcA).
- Roselms fine sandy loam, 0 to 2 percent slopes (RdA).
- Roselms loam, 0 to 2 percent slopes (ReA).
- Roselms silt loam, 0 to 2 percent slopes (RfA).
- Roselms silty clay loam, 0 to 2 percent slopes (RgA).

Because these soils are usually compact and poorly drained, deep-rooted crops do not yield well. If tilling and drainage permit, a rotation that includes soybeans, wheat, and meadow crops is best. Corn is usually not a profitable crop on these soils. All crop residues should be plowed into the soil.

Tile drains function very poorly in these soils. Surface drainage ditches should be used. They should be properly constructed and maintained for maximum efficiency. Crossable ditches about 1 foot deep with side slopes of 8 feet to 1 foot are suggested. Ditches should be 300 to 400 feet apart in wet areas. Furrows or shallow ditches may be suitable for draining pastureland.

Pastures will become cloddy if they are grazed when too wet. The soils are not well suited to early spring grazing. If lime and fertilizer are applied, suitable legumes and grasses are ladino clover, orchardgrass, tall fescue, and reed canarygrass.

Trees usually are not planted on these soils: Swamp white oak and red and silver maples can be encouraged in open areas in existing woodlands.

Capability unit IIIw-4

In this capability unit are grayish, gently sloping soils having a fine-textured subsoil that restricts the downward movement of water. These soils erode easily, particularly if they are in row crops. Usually the content of plant nutrients and organic matter is low. The soils are:

- Fulton silt loam, 2 to 6 percent slopes, slightly eroded (FcB1).
- Fulton silt loam, 2 to 6 percent slopes, moderately eroded (FcB2).
- Fulton silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded (FdB1).
- Fulton silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded (FdB2).
- Nappanee silt loam, 2 to 6 percent slopes, slightly eroded (NcB1).

- Nappanee silt loam, 2 to 6 percent slopes, moderately eroded (NcB2).
- Nappanee silty clay loam, 2 to 6 percent slopes, slightly eroded (NdB1).
- Nappanee silty clay loam, 2 to 6 percent slopes, moderately eroded (NdB2).
- Roselms loam, 2 to 6 percent slopes, slightly eroded (ReB1).
- Roselms silt loam, 2 to 6 percent slopes, slightly eroded (RfB1).
- Roselms silt loam, 2 to 6 percent slopes, moderately eroded (RfB2).
- Roselms silty clay loam, 2 to 6 percent slopes, slightly eroded (RgB1).
- Roselms silty clay loam, 2 to 6 percent slopes, moderately eroded (RgB2).

Good soil management will generally require a cropping system that includes 3 years of meadow crops in each 5 years.

Tile drains may be used in the Fulton and Nappanee soils to carry water from the subsoil. If tile is installed, the lines should be spaced 45 to 60 feet apart and 30 to 36 inches deep. Proper blinding of the tile with porous material is desirable. Tile drains will not function well in the Roselms soils of this capability unit.

Surface ditches, diversion terraces, or drainage terraces can be installed on some of these soils to remove surplus water and reduce soil erosion. Outlets should be provided before any terraces or other water-diverting structures are built. Build sod waterways for outlets and in other places where water flows across fields. Make the channel wide and smooth enough to carry runoff from the heaviest storms. Apply lime and adequate seed to the waterways to establish a dense sod. Fertilize and mow the outlets to keep them in good condition. Furrows or shallow ditches will generally provide the drainage needed for pastures.

If animals are turned on pasture when it is too wet, they will trample the soil and make it cloddy. Because these soils dry out slowly, pastures on them are not well suited to early spring grazing. Good pasture cover can be established if the soils are properly limed and fertilized and appropriate grasses and legumes are planted. Alfalfa, ladino clover, orchardgrass, tall fescue, and reed canarygrass do well on these soils.

Trees are seldom planted on these soils. Many of the native hardwoods, such as swamp white oak, white ash, green ash, red oak, white oak, hard maple, and red maple should be encouraged in open areas in existing woodlands.

Capability unit IIIs-1

This capability unit consists of nearly level to sloping sandy soils that are moderately well drained. These soils generally hold moisture fairly well. They have a low supply of organic matter and plant nutrients. Soils in this capability unit are:

- Ottokee loamy sand, 0 to 2 percent slopes (OaA).
- Ottokee loamy sand, 2 to 6 percent slopes, slightly eroded (OaB1).
- Seward fine sandy loam, 0 to 2 percent slopes (SaA).
- Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded (SaB1).
- Seward fine sandy loam, 6 to 15 percent slopes, slightly eroded (SaC1).
- Seward sandy loam, 2 to 6 percent slopes, slightly eroded (SbB1).

These sandy soils require additions of organic matter to maintain fertility and to give them more water-holding capacity.

Sand blows in the spring in some areas, particularly

during brief dry periods or if the winds are strong. Crop residues on the surface and cover crops will help reduce this hazard.

Crops that mature early before dry weather or deep-rooted legumes that resist drought are best suited to these soils. Spring grains are not well suited because of the hazard of wind erosion while the seedbed is prepared and the chance of insufficient moisture during the early growing period.

These soils can be farmed intensively if they are treated and managed properly and if enough cover crops and green-manure crops are grown. Unless they are managed intensively, the rotation should include meadow.

Contour farming of the gently sloping and sloping soils will help control erosion. If these soils are tile drained, care should be taken to prevent washing of sand into the tile lines.

Usually these soils are used for crops, but they will produce good pasture. Nitrogen fertilizer will help produce early forage for grazing. Because the pasture does not hold up well during dry spells, deep-rooted legumes should be seeded. If the fields are properly limed and fertilized, alfalfa, red clover, timothy, ladino clover, and orchardgrass are suitable pasture plants.

Trees are seldom planted on these soils. Many of the native hardwoods such as yellow-poplar, red oak, black walnut, white oak, and black maple should be encouraged or planted in open areas in existing woodlands. These species could be planted in thinly wooded spaces to improve the stand.

Spruce and white pine are adapted to these soils for forest planting. Scotch pine can be planted for Christmas trees with moderate chances of success.

Capability unit IVe-1

This capability unit is composed of sloping soils that have a fairly heavy subsoil. Water moves slowly through the subsoil, and runoff is rapid, which makes soils subject to considerable erosion. The soils are the following:

- Broughton silty clay loam, 6 to 12 percent slopes, moderately eroded (BcC2).
- Lucas silt loam, 6 to 12 percent slopes, moderately eroded (LcC2).
- Lucas silt loam, sandy substratum, 6 to 12 percent slopes, moderately eroded (LcC2).
- St. Clair silt loam, 6 to 12 percent slopes, moderately eroded (SgC2).

If row crops are grown, these soils should be cultivated on the contour and other good management practices should be followed. A rotation that includes 3 years of meadow crops out of 5 is necessary.

If diversion terraces are feasible, the outlets should be built first to take care of the runoff.

Construct sod waterways, if feasible, wherever water flows across the fields. The channel should be smooth and wide enough to carry runoff from the heaviest storms. Seed and mow the waterways and apply fertilizer and lime to encourage a dense sod.

These soils are well suited to pasture. Nitrogen fertilizer is needed to produce early grazing. Ladino clover, alfalfa, red clover, birdsfoot trefoil, bluegrass, and orchardgrass are suitable grasses and legumes if the fields have received proper amounts of lime and fertilizer.

New tree plantings are seldom made. Most of these

soils are in crops or pasture; therefore, any plantings should be in exposed areas. White pine, spruce, and red oak are adapted to these soils. If feasible, the seedlings should be set in furrows on the contour.

Capability unit VIe-1

This capability unit consists of hilly soils that have been moderately or severely eroded and are not well suited to crops. Because of these limitations, they should be used for pasture or trees. The following soils are in this capability unit:

- Broughton clay, 6 to 12 percent slopes, severely eroded (BbC3).
- Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded (BcD2).
- Lucas silt loam, sandy substratum, 12 to 25 percent slopes, moderately or severely eroded (LdD2).
- St. Clair silt loam, 12 to 18 percent slopes, moderately eroded (SgD2).
- St. Clair clay, 6 to 12 percent slopes, severely eroded (SfC3).

If nitrogen is applied, these soils can be used for early pasture. The native pasture is not dependable during droughts and can be damaged easily by overgrazing. Deep-rooted legumes should be seeded to improve the quantity of forage and to provide cover during dry weather.

If the soils are properly limed and fertilized, the following grasses and legumes are suitable: Ladino clover, alfalfa, red clover, bluegrass, orchardgrass, and timothy.

New tree plantings or natural regeneration is suggested for these soils. Most of the soils are now used for pasture. The severely eroded areas should be planted to white pine, pitch pine, or Austrian pine. The moderately eroded areas may grow these trees and also some Norway spruce and red oak. If feasible, new plantings should be in furrows on the contour.

Capability unit VIIe-1

The soils in this capability unit are hilly or very steep, eroded, and droughty. Because of these limitations, they are best suited to trees or pasture. The following soils are in this capability unit:

- Broughton clay, 12 to 18 percent slopes, severely eroded (BbD3).
- Broughton silty clay loam, 18 to 35 percent slopes, moderately or severely eroded (BcE2).
- Lucas silt loam, 12 to 25 percent slopes, moderately eroded (LcD2).
- St. Clair clay, 12 to 18 percent slopes, severely eroded (SfD3).
- St. Clair silt loam, 18 to 25 percent slopes, moderately eroded (SgE2).
- St. Clair clay, 25 to 35 percent slopes, severely eroded (SfF3).

Early pasture can be produced on these soils if nitrogen fertilizer is added. The native pasture may not be dependable during dry spells, and the fields can be damaged easily by overgrazing.

Deep-rooted legumes should be seeded to improve the quality of forage and to supply plant nutrients during the dry season.

Ladino clover, alfalfa, red clover, bluegrass, orchardgrass, and timothy are suited to these soils if they are properly limed and fertilized.

New tree plantings or natural reforestation is suggested for these soils, particularly in open and exposed areas in the pasture. The severely eroded areas should be planted to white pine, pitch pine, or Austrian pine. The moderately eroded areas may grow these trees and also

some Norway spruce and red oak. If feasible, new plantings should be in furrows on the contour.

General Management Suggestions

Some management practices for crop fields and pastures are applicable to nearly all the soils in Paulding County, although the soils differ in their suitability for different crops and in some of the kinds of management required. Each soil needs an adequate supply of fertilizer and suitable amounts of water and air in the root zone. Some need drainage, some need control of erosion, and some need both if they are to produce crops efficiently.

Crops will respond to fertilizer on most of the soils. Tests should be made, and the history of the field should be studied, to find out what plant nutrients are needed. The proper amount depends on the kind of crop to be grown, the supply of water in the soil, the soil's capacity to hold enough water and air, and the amount of air in the root zone. In deciding on the kind and amount of fertilizer to apply, the farmer should consider how much it will increase the crop yields, and the cost and extra labor required.

Regular additions of organic matter are needed for all the soils that are used for crops. As fresh organic matter decays, the structure and aeration of the soil are improved and nitrogen is made available to plants.

All of the soils in Paulding County should be limed every few years. Lime will maintain a favorable soil reaction and is a source of calcium and magnesium. The amount of lime needed depends on the kind of soil, its reaction (which can be measured by a soil test), and the needs of the crop.

Most soils in the county need drainage (fig. 10). Run-off on other soils should be controlled to save water and to check erosion. Some of the sloping, imperfectly drained soils need both drainage and erosion control practices.

Specific suggestions are not given in this report for all the alternative cropping systems or the amounts of lime, fertilizer, and other amendments for each kind of soil. It is expected that further progress will be made in research on these items, and one should consult the county agent, the local representative of the Soil Conservation Service, or the Ohio Agricultural Experiment Station (2) for the latest information on fertilizers, cropping systems, crop rotations, crop varieties, and conservation practices.

Row crops

Row crops are generally the most profitable part of the rotation on soils that are suitable for cultivation. Sod crops, cover crops, and green-manure crops add organic matter and help to control runoff and erosion; thus, they are important in every cropping system.

A good rotation provides sod crops or green-manure crops often enough to maintain the supply of organic matter. The most intensive cropping systems suggested for Paulding County are those that can be used on nearly level soils of the bottom lands of capability units I-2



Figure 10.—Drainage ditches in Paulding County. *Top*: Township and county ditches are needed to provide outlets for tile and collection ditches; *bottom*: Properly constructed surface ditches will remove much of the excess water from level, poorly drained soils.

and IIw-5. On those soils cover crops and green-manure crops need to be turned under often enough to keep the plow layer in good tilth. Soils in the other capability units need green-manure or sod crops more often.

Some farmers in Paulding County are maintaining the organic-matter content of their soils by using at least 2 years of an excellent legume-grass meadow in each 5 years, or an equivalent amount of green-manure crops. On some of the heavier soils, as Paulding clay, even more organic matter is needed to keep the soil highly productive. To be most effective a good legume-grass meadow should contain grass and a deep-rooted legume such as alfalfa or sweetclover. Cornstalks, straw, and other crop residues should be returned to the soil. Animal manure is an excellent source of organic matter; in rotations, it should be applied for those crops that will make the greatest response to it.

Lime and fertilizer should be applied according to the needs of the crop, the supply in the soil as revealed by tests, and the history of the field. Drainage or control of runoff, or both, may be necessary. Sod crops and mulches help to control runoff. Other supporting practices, such as contour cultivation, contour stripcropping, diversion terraces, and field terraces are needed to control runoff and erosion on sloping soils. The combination to be used depends on the kind of soil and the cropping system. Some of the suitable choices are given in the discussions of the different capability units.

The following suggestions apply to all the soils that are used for row crops:

- (1) Return all crop residues, corn stover, and straw, except where a new seeding of hay or pasture is to be made. Because straw and other residues can injure young seedlings of grass or legumes, ask your soil conservationist or county agent how to seed if a mulch is used.
- (2) Apply all available manure, and use more on eroded areas than on uneroded soil.
- (3) Arrange for timely plowing, planting, cultivating, and harvesting.
- (4) Avoid excessive tilling in preparing the seedbed. Do not operate tractors and other heavy machinery in soil that is too wet.
- (5) Plant varieties of crops that are suitable for your soils and at the recommended rate. Ask for the latest bulletin of the Ohio Agricultural Extension Service on recommended crop varieties and corn hybrids (9).
- (6) Inoculate legume seeds.

Pasture and hay

The best soils in Paulding County are generally used for row crops, but they are also well suited to hay and pasture. Some of the less desirable soils can be used to better advantage in hay or pasture than in crops, since cattle, hogs, and dairy products are important farm products. Dairy and beef cattle need large amounts of forage. Use of pastures for hogs is increasing as a means of lowering the cost of production and improving sanitation.

Many of the fertile soils have a high water table or are subject to overflow from streams. Tile drains or ditches are needed to drain the wet soils.

For early grazing on the sandy soils, large amounts

of nitrogen are needed. Most of the clay soils are not suitable for early grazing. An even distribution of forage through summer and fall is necessary to meet the requirements for livestock feeding. For late-season crops, deep-rooted legumes that will withstand dry weather are desirable.

Many pastures need to be limed and fertilized and then seeded with carefully selected mixtures. Methods and rates of seeding and other aspects of pasture management are covered in bulletins of the Ohio Agricultural Extension Service. Information can also be obtained from the county agent, the Ohio Agricultural Experiment Station, and the U. S. Soil Conservation Service.

Some pastures are grazed from 1 to 4 years in a rotation with harvested crops. Others, especially those on soils not so well suited to cultivation, are used as semi-permanent pasture. They are grazed for 4 to 6 years. The hilly soils in capability class VI, if needed for pasture, should be kept permanently in sod and should be renovated and reseeded when necessary.

On the soils that are in capability classes I through IV, pastures can be seeded in a trash mulch or with a nurse crop of small grain. The trash-mulch method is used mostly on sloping soils of class IV or class VI that may remain in pasture for several years. Pastures that are part of a regular rotation are usually seeded with small grain.

Collect soil samples and have them tested before the seed is planted. Apply enough lime to bring the pH value to about 6.5, and add fertilizer according to the recommendations made on the basis of the tests. For a pasture that is to last no more than 4 years and is to be of high quality, fertilizer should be applied every year.

On many of the soils, brome grass and alfalfa make a good seeding mixture for hay or pasture that is planned to last no more than 4 years. Wilt-resistant varieties of alfalfa should be used. Most pastures should contain some ladino clover. In small areas, some orchardgrass can be seeded with the alfalfa and ladino clover for early intensive grazing or for early cutting as silage. Orchardgrass grows rapidly, however, and will soon become coarse and unpalatable if it is not pastured heavily or clipped while it is still succulent.

Control of grazing, particularly by rotating the animals to different plots, is needed to maintain the stand of grasses and legumes. About 4 inches of growth should be left at all times. The pastures should be mowed frequently; the surplus forage not used by the animals can be cut for hay or silage.

For semipermanent hay or pasture that is to last 5 or 6 years, test the soil and fertilize and prepare the seedbed as though preparing for a short-term pasture. Select a mixture of grasses and legumes suitable for the soil. The most productive mixtures, as a rule, contain brome grass, alfalfa, and ladino clover. If the forage is to be cut for hay, ladino clover should not be planted. Some orchardgrass can be planted if the meadow is to be grazed early in spring, but it should then be clipped frequently while it is still succulent.

Each year, apply the amount of fertilizer that is recommended by the Agricultural Extension Service (county agent) for your kind of soil and pasture. Regulate grazing, preferably by rotating the cattle to different areas, so that at least 4 inches of grass remains at all times.

For establishing and managing long-term pastures, follow the suggestions given under capability unit VIe-1.

Woodlands

There are about 19,000 acres of woodlands in Paulding County (5). These are fairly well distributed, although more are in the northern and eastern townships than elsewhere. Practically all of the woodlands are in small tracts, mostly farm woodlands.

Swamp forest originally covered most of the county. During the period from 1880 to 1900, many of the major drainage ditches were built in this part of the State. After the land was drained, large areas were cleared and used for crops. For many years, the best timber was cut from the remaining forests and the small and inferior trees were allowed to grow. The present stands are usually small, but many contain trees that would yield some immediate returns (fig. 11). Over a period



Figure 11.—A second-growth stand of white oak, red maple, and elm. Natural reforestation occurs on the poorly drained soils, particularly on Paulding clay.

of several decades, these stands could be developed into woodlands that would increase in value if they were well managed.

Suggestions for using certain soils for farm woodlands or for raising Christmas trees are given in the discussions of the various capability units. Most of the soils

in class VII will produce more income from trees than from any other use. For more information about managing woodland for profit, consult your county agent, the extension forester, or the soil conservationist.

The following general suggestions are made for all the woodlands:

- (1) Protect the woods from fire and grazing to give the young trees a chance to grow and to let seedlings develop in open areas.
- (2) If seed trees are absent, plant desirable species in the open areas to hasten reforestation.
- (3) Cut or girdle undesirable trees if they interfere with the growth of young or desirable species. Cut grapevines and heavy underbrush if they are interfering with growth of good trees.
- (4) Harvest the trees as they mature. Cut and remove them with the least possible damage to surrounding trees.
- (5) Leave a few hollow trees and some with hollow limbs as dens for some kinds of wildlife.

Estimated Yields⁵

Table 7 shows, for each soil in the county, estimates of the yields per acre of the principal crops that can be expected over a period of years, under average management and improved management. The crop yields in columns A (average yields) result from practices most generally followed by farmers of the county; the yields in columns B (high yields) are those to be expected if the best farming practices are followed. The management practices are given, in a general way, in the various capability units.

The estimates of yields for crops are based on information obtained from farmers in the county, the county agricultural agent, and other agricultural leaders, and from observations made for 3 to 5 years before the soil survey was completed in 1954.

The estimated yields in columns A are those that can be expected over a period of years under broad levels of management and may not apply to specific tracts of land for any particular year. Management practices vary from farm to farm; climatic conditions also markedly affect the success or failure of a crop. In years with favorable weather, the yields may be above the average on some soils and for some crops. On the other hand, yields may be generally low for some or all crops in other years because of unfavorable weather, poor management, insects and diseases, or a combination of these.

The yields indicated in the B columns reflect the potential productivity of each soil if the best management practices are used consistently on it. Under improved management, all feasible practices are applied, including liming, fertilizing, control of erosion, drainage where needed, maintenance of organic matter, and good tillage. Irrigation has not been considered in these estimates. The cost of production and the profits to be derived from any level of yields will vary with prevailing economic conditions (2).

⁵ The authors acknowledge assistance by G. KENNETH DOTSON, Division of Lands and Soils, Ohio Department of Natural Resources, in the preparation of this part of the report.

TABLE 7.—*Expected average acre yields of principal crops under two levels of management*

[Estimates in columns A are the yields expected under present management; those in columns B are based on improved management. If no yields are indicated the crop is not grown under the management specified or the soil is not suited to its production]

Soil	Corn		Oats		Wheat		Soybeans		Mixed clover		Mixed alfalfa	
	A	B	A	B	A	B	A	B	A	B	A	B
Belmore loam, 2 to 6 percent slopes, slightly eroded.....	Bu. 56	Bu. 78	Bu. 49	Bu. 60	Bu. 32	Bu. 38	Bu. 20	Bu. 30	Tons 2.3	Tons 3.0	Tons 2.6	Tons 4.0
Broughton silty clay loam, 2 to 6 percent slopes, slightly eroded.....	54	60	45	55	25	32	18	24	2.2	2.4	2.6	3.2
Broughton silty clay loam, 2 to 6 percent slopes, moderately eroded.....	44	50	43	45	22	26	16	20	2.0	2.2	2.5	2.9
Broughton silty clay loam, 6 to 12 percent slopes, moderately eroded.....	40	47	34	43	21	24	16	20	2.0	2.1	2.5	2.8
Broughton clay, 6 to 12 percent slopes, severely eroded.....												
Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded.....												
Broughton clay, 12 to 18 percent slopes, severely eroded.....												
Broughton silty clay loam, 18 to 35 percent slopes, moderately or severely eroded.....												
Defiance silty clay loam.....	60	75	45	57	18	27	23	28	2.3	2.4	2.4	3.3
Digby fine sandy loam, 0 to 2 percent slopes.....	55	80	38	60	23	32	19	30	2.2	2.8	2.8	3.8
Digby loam, 0 to 2 percent slopes.....	56	85	40	68	23	35	21	33	2.3	2.8	2.6	3.7
Digby loam, 2 to 6 percent slopes, slightly or moderately eroded.....	55	82	39	65	22	34	20	30	2.3	2.8	2.6	3.7
Digby silt loam, 0 to 2 percent slopes.....	56	85	40	68	23	35	21	30	2.3	2.9	2.6	3.7
Digby silt loam, 2 to 6 percent slopes, slightly or moderately eroded.....	55	82	39	65	22	34	20	30	2.3	2.9	2.6	3.7
Eel loam.....	68	95	49	62	21	32	26	32	2.7	2.9	3.2	3.9
Eel silt loam.....	68	95	49	62	21	32	26	32	2.7	2.9	3.2	3.9
Eel silty clay loam.....	66	92	48	60	21	30	26	30	2.7	2.9	3.2	3.9
Fulton fine sandy loam, 0 to 2 percent slopes.....	50	85	37	62	27	35	24	30	2.5	2.7	2.7	3.6
Fulton loam, 0 to 2 percent slopes.....	50	85	37	65	27	35	24	32	2.5	2.7	2.7	3.6
Fulton silt loam, 0 to 2 percent slopes.....	48	83	35	64	25	34	22	32	2.3	2.5	2.5	3.4
Fulton silt loam, 2 to 6 percent slopes, slightly eroded.....	41	80	31	64	25	34	22	31	1.8	2.5	1.8	3.5
Fulton silt loam, 2 to 6 percent slopes, moderately eroded.....	40	70	30	55	24	28	22	26	1.8	2.2	1.8	2.9
Fulton silt loam, sandy substratum, 0 to 2 percent slopes.....	48	82	35	64	25	34	22	32	2.3	2.5	2.5	3.4
Fulton silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.....	41	80	31	64	25	34	22	31	1.8	2.5	1.8	3.5
Fulton silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.....	40	70	30	55	24	28	22	26	1.8	2.2	1.8	2.9
Fulton silty clay loam, 0 to 2 percent slopes.....	48	75	35	62	25	32	22	31	2.3	2.4	2.5	3.2
Fulton silty clay loam, sandy substratum, 0 to 2 percent slopes.....	48	75	35	62	25	32	22	31	2.3	2.4	2.5	3.2
Genesee fine sandy loam.....	70	85	50	60	22	38	26	30	2.7	3.0	3.2	3.9
Genesee loam.....	70	100	50	70	22	40	26	35	2.7	3.2	3.2	4.2
Genesee silt loam.....	70	100	50	70	22	40	26	35	2.7	3.2	3.2	4.2
Granby fine sandy loam.....	92	110	55	68	32	35	26	35	2.7	3.5	3.6	4.5
Haney silt loam and loam, 0 to 2 percent slopes.....	63	90	50	67	30	36	22	32	2.5	2.8	2.8	3.8
Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded.....	57	80	49	65	28	33	21	30	2.4	2.6	2.7	3.5
Haney silt loam and loam, 6 to 15 percent slopes, moderately eroded.....	51	76	45	60	26	30	20	26	2.2	2.4	2.7	3.2
Haskins loam.....	56	85	40	65	23	35	21	32	2.3	2.5	2.6	3.4
Haskins silt loam.....	56	85	40	65	23	34	21	32	2.3	2.5	2.6	3.4
Hoytville clay.....	72	113	50	73	29	38	28	38	2.8	3.5	4.0	4.5
Hoytville silt loam.....	74	115	51	75	30	40	28	42	2.9	3.5	4.0	4.6
Hoytville silty clay loam.....	72	113	50	75	29	40	28	40	2.8	3.5	4.0	4.6
Latty clay.....	51	95	37	65	26	35	22	36	2.6	3.1	3.1	3.9
Latty silty clay loam.....	52	100	38	67	27	37	22	37	2.6	3.1	3.1	3.9
Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded.....	56	70	45	61	25	30	18	28	2.2	2.5	2.6	3.3
Lucas silt loam, 6 to 12 percent slopes, moderately eroded.....	48	67	35	55	22	28	16	24	2.0	2.3	2.5	3.0
Lucas silt loam, 12 to 25 percent slopes, moderately eroded.....												
Lucas silt loam, sandy substratum, 0 to 2 percent slopes.....	59	85	48	66	30	36	21	32	2.2	2.7	2.7	3.6
Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.....	57	80	46	66	32	36	19	31	2.3	2.6	2.7	3.5

TABLE 7.—*Expected average acre yields of principal crops under two levels of management—Continued*

[Estimates in columns A are the yields expected under present management; those in columns B are based on improved management. If no yields are indicated the crop is not grown under the management specified or the soil is not suited to its production]

Soil	Corn		Oats		Wheat		Soybeans		Mixed clover		Mixed alfalfa	
	A	B	A	B	A	B	A	B	A	B	A	B
Lucas silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.....	Bu. 55	Bu. 70	Bu. 44	Bu. 58	Bu. 25	Bu. 30	Bu. 17	Bu. 26	Tons 2.1	Tons 2.4	Tons 2.5	Tons 3.2
Lucas silt loam, sandy substratum, 6 to 12 percent slopes, moderately eroded.....	48	57	35	55	22	28	16	24	2.0	2.3	2.5	3.0
Lucas silt loam, sandy substratum, 12 to 25 percent slopes, moderately or severely eroded.....									.9	1.2	2.0	2.5
Mermill loam.....	90	115	51	75	30	40	28	40	2.7	3.5	3.5	4.7
Mermill silt loam.....	74	115	51	75	30	40	28	40	2.9	3.5	4.0	4.6
Mermill silty clay loam.....	73	114	50	75	30	40	28	40	2.9	3.5	4.0	4.6
Millgrove loam.....	90	115	51	75	30	40	26	40	2.7	3.5	3.5	4.7
Millgrove silt loam.....	74	115	51	75	30	40	28	40	2.9	3.5	4.0	4.6
Millgrove silty clay loam.....	72	113	50	75	29	40	28	40	2.8	3.5	4.0	4.5
Nappanee fine sandy loam, 0 to 2 percent slopes.....	50	80	37	57	27	33	24	28	2.5	2.5	2.7	3.4
Nappanee loam, 0 to 2 percent slopes.....	50	80	37	60	27	32	24	30	2.5	2.5	2.7	3.4
Nappanee silt loam, 0 to 2 percent slopes.....	48	78	35	60	25	32	22	30	2.0	2.3	2.5	3.2
Nappanee silt loam, 2 to 6 percent slopes, slightly eroded.....	41	75	31	60	25	32	22	29	1.8	2.5	1.8	3.4
Nappanee silt loam, 2 to 6 percent slopes, moderately eroded.....	40	65	30	53	24	26	22	25	1.8	2.0	1.8	2.7
Nappanee silty clay loam, 0 to 2 percent slopes.....	48	75	35	60	25	30	22	30	2.0	2.3	2.5	3.0
Nappanee silty clay loam, 2 to 6 percent slopes, slightly eroded.....	41	75	31	60	25	30	22	29	1.8	2.4	1.8	3.2
Nappanee silty clay loam, 2 to 6 percent slopes, moderately eroded.....	40	65	30	53	24	25	22	29	1.8	2.0	1.8	2.7
Ottokee loamy sand, 0 to 2 percent slopes.....	59	72	40	50	25	28	19	22	2.0	2.2	2.8	3.2
Ottokee loamy sand, 2 to 6 percent slopes, slightly eroded.....	58	70	39	52	24	28	18	22	2.0	2.2	2.8	3.2
Paulding clay.....	50	80	35	53	25	33	20	33	2.3	2.5	3.0	3.5
Paulding loam.....	52	85	38	57	27	35	22	35	2.5	2.7	3.1	3.6
Paulding silty clay loam.....	51	85	37	56	26	35	22	36	2.5	2.7	3.1	3.6
Rimer fine sandy loam, 0 to 2 percent slopes.....	55	77	35	55	23	30	19	30	2.2	2.4	2.8	3.4
Rimer fine sandy loam, 2 to 6 percent slopes, slightly eroded.....	54	75	34	54	22	30	18	29	2.2	2.4	2.8	3.4
Rimer sandy loam, 0 to 2 percent slopes.....	55	75	35	54	23	30	19	29	2.2	2.4	2.8	3.4
Rimer sandy loam, 2 to 6 percent slopes, slightly eroded.....	54	73	34	53	22	30	18	28	2.2	2.4	2.8	3.4
Roselms clay, 0 to 2 percent slopes.....	34	40	20	35	17	22	15	20	1.3	1.5	1.5	2.0
Roselms fine sandy loam, 0 to 2 percent slopes.....	35	53	21	40	24	29	16	24	1.6	1.8	1.6	2.4
Roselms loam, 0 to 2 percent slopes.....	35	55	21	44	23	28	16	26	1.6	1.8	1.6	2.4
Roselms loam, 2 to 6 percent slopes, slightly eroded.....	41	55	31	47	24	29	22	25	1.8	2.0	1.8	2.7
Roselms silt loam, 0 to 2 percent slopes.....	35	47	21	40	21	26	16	24	1.5	1.7	1.6	2.3
Roselms silt loam, 2 to 6 percent slopes, slightly eroded.....	39	49	29	44	22	27	18	23	1.8	2.0	1.8	2.6
Roselms silt loam, 2 to 6 percent slopes, moderately eroded.....	35	40	28	35	18	23	13	18	1.3	1.5	1.8	2.0
Roselms silty clay loam, 0 to 2 percent slopes.....	34	45	20	40	20	25	15	22	1.4	1.6	1.5	2.2
Roselms silty clay loam, 2 to 6 percent slopes, slightly eroded.....	39	49	29	44	21	26	16	21	1.6	1.8	1.8	2.4
Roselms silty clay loam, 2 to 6 percent slopes, moderately eroded.....	38	48	28	35	18	22	13	18	1.3	1.5	1.8	2.0
Ross silt loam.....	72	115	52	75	24	40	27	36	2.8	3.5	3.3	4.5
Seward fine sandy loam, 0 to 2 percent slopes.....	60	75	41	56	23	28	19	24	2.2	2.3	2.9	3.4
Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded.....	59	75	40	56	23	28	19	24	2.1	2.3	2.8	3.4
Seward fine sandy loam, 6 to 15 percent slopes, slightly eroded.....	57	70	37	50	22	27	18	22	2.0	2.2	2.8	3.3
Seward sandy loam, 2 to 6 percent slopes, slightly eroded.....	58	74	39	55	22	27	18	22	2.0	2.2	2.8	3.3
Shoals silt loam.....	60	85	45	60	18	32	23	32	2.3	2.5	2.4	3.4
Sloan silt loam.....	70	113	50	70	18	38	28	40	3.0	3.2	3.5	4.2
Sloan silty clay loam.....	70	113	50	70	18	38	28	40	3.0	3.2	3.5	4.2
St. Clair clay, 6 to 12 percent slopes, severely eroded.....									1.0	1.5	2.1	2.4
St. Clair clay, 12 to 18 percent slopes, severely eroded.....												
St. Clair clay, 25 to 35 percent slopes, severely eroded.....												

TABLE 7.—*Expected average acre yields of principal crops under two levels of management—Continued*

[Estimates in columns A are the yields expected under present management; those in columns B are based on improved management. If no yields are indicated the crop is not grown under the management specified or the soil is not suited to its production]

Soil	Corn		Oats		Wheat		Soybeans		Mixed clover		Mixed alfalfa	
	A	B	A	B	A	B	A	B	A	B	A	B
St. Clair silt loam, 2 to 6 percent slopes, slightly eroded.....	Bu. 57	Bu. 80	Bu. 46	Bu. 63	Bu. 29	Bu. 34	Bu. 19	Bu. 32	Tons 2.3	Tons 2.6	Tons 2.7	Tons 3.5
St. Clair silt loam, 2 to 6 percent slopes, moderately eroded.....	55	70	44	56	22	27	17	26	2.1	2.3	2.5	3.0
St. Clair silt loam, 6 to 12 percent slopes, moderately eroded.....	48	67	35	53	20	25	16	22	2.0	2.3	2.5	3.0
St. Clair silt loam, 12 to 18 percent slopes, moderately eroded.....												
St. Clair silt loam, 18 to 25 percent slopes, moderately eroded.....												
Tedrow loamy fine sand.....	57	70	38	55	25	30	20	27	2.3	2.5	2.9	3.6
Toledo loam.....	75	116	52	75	31	40	28	40	2.9	3.5	4.1	4.7
Toledo silt loam.....	74	115	51	75	30	40	28	40	2.9	3.5	4.0	4.6
Toledo silty clay.....	72	113	50	73	29	40	28	40	2.8	3.5	4.0	4.5
Toledo silty clay loam.....	72	115	50	75	29	38	28	38	2.8	3.5	4.0	4.6
Wabash silty clay ¹	60	90					24	32	2.6	2.8	3.1	3.7
Wauseon fine sandy loam.....	90	115	50	73	30	40	26	40	2.7	3.5	3.5	4.7
Wauseon loam.....	90	115	50	75	30	40	26	40	2.7	3.5	3.5	4.7
Wetzel clay.....	69	95	47	67	28	35	27	35	2.6	2.8	4.0	3.8
Wetzel silty clay loam.....	71	100	50	70	29	38	28	38	2.8	3.0	4.0	4.0

¹ Subject to severe floods.

Groups of Soils for Special Purposes

In Paulding County, many of the soils can be used for special purposes. In places where the floodwaters can be stored or where ponds and streams furnish a dependable source of water, it may pay to irrigate crops that have a high commercial value. Other areas are particularly suited to the growing of commercial crops if intensive management practices are used. Some of the soils are too wet or shallow for tilled crops or pasture and are best left as a refuge for wildlife.

Irrigation

A farmer who wants to irrigate his crops or pasture should find out about the source of the water supply and his right to use it. Before he takes water from a flowing stream for irrigation, he should consult the Ohio Department of Natural Resources. A landowner can drill a well on his land and use whatever quantity of ground water he wishes. He can also use water from a pond, provided he does not cut off or diminish the normal flow to a user living downstream.

Only productive soils are worth irrigating. The texture and structure of the surface soil should be such that water will penetrate it readily. The soil should have a high capacity to hold water that plants can use, but it should also drain quickly.

Soils particularly suited to irrigation are those having a very permeable subsoil and substratum. Some soils, less permeable than others, can be irrigated if other management practices are used that will improve the soil or benefit the crops.

Irrigation will increase yields if water is the principal factor that limits production. As production increases, however, the need for plant nutrients and organic mat-

ter becomes greater. Thus, under irrigation, more intensive management is required to increase fertility, maintain tilth, and conserve moisture.

The frequency of irrigation will depend upon the rainfall, the moisture needs of the crop, and the available moisture-holding capacity of the soil. After a rain that thoroughly saturates the soil, some water will drain away and the rest will be held in the soil against the pull of gravity. The amount of moisture held in the soil after such a rain is called *field capacity*. The root zone should contain at least half of its field capacity throughout the growing season.

The most efficient rate of irrigation depends on the amount of moisture the soil will absorb and the rate at which it will enter the surface soil at the time of irrigation. The rate of intake is affected by the cover. The soils in Paulding County listed as irrigable will absorb and hold $\frac{1}{2}$ inch of water per hour on bare ground and 1 inch per hour in areas covered with vegetation.

Many of the soils in Paulding County are suitable for irrigation if water is available and if a crop of high value is to be grown. A list follows of five groups of soils, arranged according to their suitability for irrigation:

Irrigation group 1: Soils well suited to irrigation

- Belmore loam, 2 to 6 percent slopes, slightly eroded.
- Genesee fine sandy loam.
- Genesee loam.
- Genesee silt loam.
- Ottokee loamy sand, 0 to 2 percent slopes.
- Ottokee loamy sand, 2 to 6 percent slopes, slightly eroded.
- Ross silt loam.

Three of these soils have a slight risk from flooding—Genesee fine sandy loam, Genesee loam, and Genesee silt loam.

Irrigation group 2: Soils moderately well suited to irrigation

Eel loam.
 Eel silt loam.
 Eel silty clay loam.
 Haney silt loam and loam, 0 to 2 percent slopes.
 Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded.
 Seward fine sandy loam, 0 to 2 percent slopes.
 Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded.
 Seward sandy loam, 2 to 6 percent slopes, slightly eroded.

Eel loam, Eel silt loam, and Eel silty clay loam have a slight risk of damage from overflow.

Irrigation group 3: Soils moderately to well suited to irrigation if drained

Digby fine sandy loam, 0 to 2 percent slopes.
 Digby loam, 0 to 2 percent slopes.
 Digby loam, 2 to 6 percent slopes, slightly or moderately eroded.
 Digby silt loam, 0 to 2 percent slopes.
 Digby silt loam, 2 to 6 percent slopes, slightly or moderately eroded.
 Granby fine sandy loam.
 Haskins loam.
 Haskins silt loam.
 Hoytville clay.
 Hoytville silt loam.
 Hoytville silty clay loam.
 Mermill loam.
 Mermill silt loam.
 Mermill silty clay loam.
 Millgrove loam.
 Millgrove silt loam.
 Millgrove silty clay loam.
 Rimer fine sandy loam, 0 to 2 percent slopes.
 Rimer fine sandy loam, 2 to 6 percent slopes, slightly eroded.
 Rimer sandy loam, 0 to 2 percent slopes.
 Rimer sandy loam, 2 to 6 percent slopes, slightly eroded.
 Shoals silt loam.
 Sloan silt loam.
 Sloan silty clay loam.
 Tedrow loamy fine sand.
 Toledo loam.
 Toledo silt loam.
 Toledo silty clay.
 Toledo silty clay loam.
 Wauseon fine sandy loam (with tile drains, this soil may be placed in irrigation group 1).
 Wauseon loam.
 Wetzel silty clay loam.

Three of these soils have slight risk of flooding—Shoals silt loam, Sloan silt loam, and Sloan silty clay loam.

Irrigation group 4: Soils poorly suited to irrigation

Broughton silty clay loam, 2 to 6 percent slopes, slightly eroded.
 Broughton silty clay loam, 2 to 6 percent slopes, moderately eroded.
 Defiance silty clay loam.
 Fulton fine sandy loam, 0 to 2 percent slopes.
 Fulton loam, 0 to 2 percent slopes.
 Fulton silt loam, 0 to 2 percent slopes.
 Fulton silt loam, 2 to 6 percent slopes, slightly eroded.
 Fulton silt loam, 2 to 6 percent slopes, moderately eroded.
 Fulton silt loam, sandy substratum, 0 to 2 percent slopes.
 Fulton silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.
 Fulton silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.
 Fulton silty clay loam, 0 to 2 percent slopes.
 Fulton silty clay loam, sandy substratum, 0 to 2 percent slopes.
 Haney silt loam and loam, 6 to 15 percent slopes, moderately eroded.
 Latty clay.
 Latty silty clay loam.
 Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded.
 Lucas silt loam, sandy substratum, 0 to 2 percent slopes.

Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.
 Lucas silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.
 Nappanee fine sandy loam, 0 to 2 percent slopes.
 Nappanee loam, 0 to 2 percent slopes.
 Nappanee silt loam, 0 to 2 percent slopes.
 Nappanee silt loam, 2 to 6 percent slopes, slightly eroded.
 Nappanee silt loam, 2 to 6 percent slopes, moderately eroded.
 Nappanee silty clay loam, 0 to 2 percent slopes.
 Nappanee silty clay loam, 2 to 6 percent slopes, slightly eroded.
 Nappanee silty clay loam, 2 to 6 percent slopes, moderately eroded.
 Paulding clay.
 Paulding loam.
 Paulding silty clay loam.
 Seward fine sandy loam, 6 to 15 percent slopes, slightly eroded.
 St. Clair silt loam, 2 to 6 percent slopes, slightly eroded.
 St. Clair silt loam, 2 to 6 percent slopes, moderately eroded.
 Wabash silty clay.
 Wetzel clay.

Defiance silty clay loam and Wabash silty clay have moderate risk of flooding.

Irrigation group 5: Soils very poorly suited to irrigation

Broughton clay, 6 to 12 percent slopes, severely eroded.
 Broughton clay, 12 to 18 percent slopes, severely eroded.
 Broughton silty clay loam, 6 to 12 percent slopes, moderately eroded.
 Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded.
 Broughton silty clay loam, 18 to 35 percent slopes, moderately or severely eroded.
 Lucas silt loam, 6 to 12 percent slopes, moderately eroded.
 Lucas silt loam, 12 to 25 percent slopes, moderately eroded.
 Lucas silt loam, sandy substratum, 6 to 12 percent slopes, moderately eroded.
 Lucas silt loam, sandy substratum, 12 to 25 percent slopes, moderately or severely eroded.
 Roselms clay, 0 to 2 percent slopes.
 Roselms fine sandy loam, 0 to 2 percent slopes.
 Roselms loam, 0 to 2 percent slopes.
 Roselms loam, 2 to 6 percent slopes, slightly eroded.
 Roselms silt loam, 0 to 2 percent slopes.
 Roselms silt loam, 2 to 6 percent slopes, slightly eroded.
 Roselms silt loam, 2 to 6 percent slopes, moderately eroded.
 Roselms silty clay loam, 0 to 2 percent slopes.
 Roselms silty clay loam, 2 to 6 percent slopes, slightly eroded.
 Roselms silty clay loam, 2 to 6 percent slopes, moderately eroded.
 St. Clair clay, 6 to 12 percent slopes, severely eroded.
 St. Clair clay, 12 to 18 percent slopes, severely eroded.
 St. Clair clay, 25 to 35 percent slopes, severely eroded.
 St. Clair silt loam, 6 to 12 percent slopes, moderately eroded.
 St. Clair silt loam, 12 to 18 percent slopes, moderately eroded.
 St. Clair silt loam, 18 to 25 percent slopes, moderately eroded.

Special crops

The soils of Paulding County have a wide range in their adaptability to special crops. The fine-textured soils are not well suited to vegetables and small fruits, but sugar beets and tomatoes (for canning) have been produced successfully. Even so, poor drainage and standing water are a problem on most of the fine-textured soils. Some difficulty is experienced in getting good stands of these crops if the soil is too wet or too dry.

A small acreage (about 150 acres) of vegetables and small fruit is grown on the sandy soils, particularly in the northeastern part of the county where most of the sandy soils occur. Orchards and vineyards are confined to small plantings for home use, and the acreage has decreased rapidly in recent years.

Although the acreage in special crops is small (1,500 to 2,000 acres), some improvements can be made in their

culture. The tile drains should be spaced more closely than for field crops, and usually fertilizer applications should be heavier. Some protection from wind erosion should be provided on the very sandy soils and from water erosion on the sloping areas.

On the fine-textured soils, good tilth should be maintained and a good seedbed established. Germination and early growth are poor in the large, hard clods that develop if the fine-textured soils are plowed when too wet or too dry. Freezing or wetting the soil will usually break these clods. Sprinkler irrigation may be profitable for improving the seedbed and the stand of crops, but water for this purpose is limited.

A good, thick sod will help to keep the fine-textured soils well granulated. Cover crops are well suited to this purpose on the sandy soils.

Wildlife

Game and fur-bearing animals, songbirds, predatory birds, and insect-eating birds bring pleasure and benefit to those who live on the farm. As for crops and livestock, the maximum production of wildlife should be planned and managed with care.

Wildlife needs food, water, and shelter within close range. Wildlife areas should be well distributed over the farm. Where the population of insect-eating songbirds and other kinds of wildlife is heavy, a permanent cover should be near feeding areas on every 20 acres of land (12).

Most of the soils in Paulding County are used intensively for growing corn and other grains, soybeans, and meadow hay. The waste grain helps supply ample food for wildlife. Much food is also supplied by seeds from the waste grain from the hay and pasture plants, seeds from foxtail, ragweed, and other weeds, and by grasshoppers and other insects. The heavily cultivated areas do not provide adequate nesting areas, places for wildlife to live, breed, and hide, or good enough winter cover. The fertile soils are too valuable to be used solely as a wildlife shelter, but on most farms some areas can be developed that will afford natural protection.

Long, narrow strips of cover planted along the hedgerows or on the banks of drainage ditches and streams will provide shelter near feeding areas. In addition, the grasses and legumes take root on the banks and berms of drainage ditches and keep the silt and sediment out of the ditch. If the seedlings are not mowed until after the grain is harvested, they will supply nesting cover for pheasants, rabbits, and some songbirds.

A hedgerow of multiflora rose or other shrubs occupies a small space and furnishes a nesting place for insect-eating birds and small mammals near growing crops. The hedges are also useful as living fences or windbreaks and for dividing fields. A shrubby border planted along the woodlands or a windbreak will also provide a narrow strip of shelter near the croplands. The birds will reduce the insect population. The borders also furnish shelter for insects, such as the praying mantis, that feed on harmful insects.

Sweetclover is a forage crop and it also makes good cover for nesting wildlife. It requires a soil that is nearly neutral, one having a reaction above pH 6.3. Pheasants, for some reason, thrive better in this county

on glacial and lake-laid soils than on those developed from other parent materials.

Practices that destroy the food and shelter for wildlife should be avoided. Among such practices are the burning of crop residues, pastures, and woodlands; overgrazing and trampling the fields; and the indiscriminate use of herbicides and pesticides.

The principal plants that supply food and cover for wildlife are given for groups of soils, as follows:

1. Generally dark-colored, very poorly drained soils:

Granby	Paulding
Hoytville	Toledo
Latty	Wauseon
Mermill	Wetzel
Millgrove	
- Corn, small grain, native grasses and legumes, multiflora rose, reed canarygrass, sweetclover, sweet crabapple, highbush cranberry, dogwood, autumn olive.
2. Generally dark-colored, very poorly drained soils on the flood plains:

Sloan	Wabash
-------	--------
- Corn, cottonwood, black walnut, purple-osier willow; on marshy areas the vegetation is sedges, burreed, cattail, arrowhead, and bulrush.
3. Generally grayish-colored, poorly drained soils:

Digby	Rimer
Fulton	Roselms
Haskins	Tedrow
Nappanee	
- Corn, small grain, native grasses and legumes, multiflora rose, reed canarygrass, sweet crabapple, highbush cranberry, dogwood, autumn olive.
4. Generally grayish-colored, poorly drained soils of the flood plains:

Defiance	Shoals
----------	--------
- Corn, cottonwood, black walnut, purple-osier willow; on marshy areas the vegetation is sedges, burreed, cattail, arrowhead, and bulrush.
5. Generally well drained and moderately well drained soils, and soils on slopes:

Belmore	Ottokee
Broughton	Seward
Haney	St. Clair
Lucas	
- Corn, small grain, native grasses and legumes, sericea lespedeza, multiflora rose, Scotch pine, cedar, spruce, bush-honeysuckle, wild plum, sweetclover, sweet crabapple, highbush cranberry, dogwood, American filbert or hazelnut, autumn olive, black locust.
6. Generally well drained and moderately well drained soils on the flood plains:

Eel	Ross
Genesee	
- Corn, cottonwood, black walnut, purple-osier willow.

Use of Soils for Roads and Buildings⁶

Engineers, planners, and builders can use information from the soil survey. Table 8 shows some interpretations for engineering uses of the most extensive soils. Major soil series are listed by name in the table.

Each soil series name is chosen from names of places where that kind of soil was first mapped or where a typical area of it occurs. The name is applied to that kind of soil wherever it is mapped. The Latty soils, for

⁶JAMES O. EVANS, soil scientist, Division of Lands and Soil, Ohio Department of Natural Resources, assisted in preparing this section of the report.

example, are named for a place not far from Paulding, but they occupy several hundred square miles in parts of several counties of northwestern Ohio.

Most of the soil series contain more than one mapping unit. A mapping unit is a kind of soil shown by a symbol on the soil map. Mapping units in the Latty series, for example, are Latty clay, shown by symbol lc; and Latty silty clay loam, by lb. These two soils have a surface soil of different texture to a depth of 6 to 12 inches, but below the surface layer they are very much alike.

Table 8 contains a brief description of major soil series and lists the characteristics most likely to affect uses for roads and buildings. Depth to bedrock has been omitted, since no soil in the county has bedrock within 6 feet of the surface. Texture of the surface soil is generally clay unless described otherwise. Texture of surface soil forms part of the name of each soil, but this texture is only that of the surface layer, not that of the subsoil or the deeper layers.

More complete descriptions of each soil series and each soil mapping unit are given in the section, Descriptions of the Soils.

Engineering tests on samples of the important layers of seven soil series are given in table 9. Samples of the two profiles of Paulding soils were analyzed by the Bureau of Public Roads in the soil physics laboratory of Ohio State University. Analyses reported are those of the soil material that passed a No. 4 sieve. Grain-size analyses were made by sieve and hydrometer methods, and data were calculated to give percentages of the fractions as noted. Percentages of clay obtained by the hydrometer method should not be used in naming textural classes of soils. Atterberg limits and moisture-density relationships were determined by standard methods that have been published by the American Association of State Highway Officials, Designation T 88-54 (1).

Engineering classifications are given for the soil samples that were tested. In the system approved by the American Association of State Highway Officials (1), soil materials are classified in seven principal groups. The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A-7, consisting of soils that have low strength when wet. For samples tested by the Bureau of Public Roads, relative engineering value of the soil material is indicated by a group index number in parentheses. This index is computed from the percentage of coarse material, the liquid limit, and the plasticity index. The group indexes range from 0 for the best materials to 20 for the poorest. Classification by a modification of the AASHTO system is also shown. In this modification certain soils high in silt are A-4b and some silty clays are A-6b, as determined by the Ohio State Testing Laboratory.

There is also shown a group index number used by the Ohio State Highway Testing Laboratory. These group indexes also range from 0 for the best materials to 20 for the poorest. Assuming good drainage and thorough compaction, the lower this group index, the higher the supporting value of the soil as a subgrade material (information dated February 1, 1955, from the Ohio State Highway Testing Laboratory, Columbus 10, Ohio).

Some engineers prefer to use the Unified Soil Classi-

fication System (18). In this system, soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic.

Soils and residential developments.—In planning a development, whether it is to be one homesite or a proposed community, the characteristics of the soil should be studied. The site should have enough slope to provide good surface drainage. In areas where the water table is seasonably or permanently high, subsurface drainage will be required to remove excess water. In areas that receive runoff from higher ground or overflow from neighboring streams, the water should be diverted or otherwise disposed of through ditches or other channels. The possibility of floods should be considered in choosing a location.

Other important factors are the source and availability of the water supply; whether an area is influenced by runoff, overflow, or ponded water; the depth of the soil and soil material over bedrock; and the nature of the subsoil and substratum as they affect construction of a basement or placement of a septic tank. Suitable drainage should be provided for the outlets of septic tanks and other sewage disposal units. Each building lot should be large enough to provide a discharge filter bed that will dispose of the outflow.

In areas not serviced by town or city water systems, an adequate supply of uncontaminated water is necessary. The Ohio Department of Natural Resources, Division of Water, will tell you about the supply of ground water. The county or State Department of Health should be contacted regarding purity of the proposed water supply.

Before construction is started, the surface soil should be scraped and pushed aside from the foundation site or from other areas that will be covered with fill. After the building is completed, the original surface soil can be returned. It provides a better material than fill for grass, flowers, shrubs, or landscaping.

The advantages and disadvantages for homesites pointed out in the following paragraphs do not mean that a particular site should be either chosen or rejected. The statements are intended to show the types of problems that can be anticipated, if the soils are used for residential purposes.

Some of the soils are particularly suited to homesites. They are the permeable, well-drained soils. They have a low water table, are easy to drain, and they provide good filter beds for the outflow from septic tanks. Such soils are those of the Belmore, Haney, Ottokee, and Seward series.

The Eel, Genesee, and Ross soils also have good internal characteristics. They make good homesites if they can be protected from flooding.

The Broughton and Lucas soils have a low water table, but permeability of the subsoil is somewhat limited. Provision should be made for adequate drainage fields for septic tanks before any construction is begun.

Several soils in Paulding County periodically have a high water table; they need drainage systems to remove the excess water at such times. Permeability is generally slow in these soils, and provision should be made for drainage fields for the septic tanks. Soils that require such special engineering attention to make sure the drainage field is adequate are the Digby, Granby,

TABLE 8.—Engineering interpretations

Soil series and map symbols	Description	Horizon ¹	Usual depth
Broughton (BbC3, BbD3, BcB1, BcB2, BcC2, BcD2, BcE2).	Light-colored, moderately well drained soils from calcareous lacustrine clays. Water table not a problem. No bedrock or boulders.	A B C	<i>Inches</i> 0 to 6..... 6 to 16..... 16+.....
Defiance (Da).....	Light-colored, imperfectly drained soil on bottom lands. Water table may be at or near the surface during winter and spring. Normally, no major physical limitations such as bedrock or boulders. ³	A H	0 to 9..... 9 to 45+.....
Digby (DbA, DcA, DcB1, DdA, DdB1).....	Light-colored, imperfectly drained, loamy soils over sandy and gravelly material; calcareous clay till at depths of 42 inches or more. Water table likely to be at or near surface during winter and spring. Normally, no obstacles for grading, but a few large boulders and some cobbles are present.	A B C D	0 to 11..... 11 to 31..... 31 to 54..... 54+.....
Eel (Ea, Eb, Ec).....	Moderately well drained soil on bottom land. Water table normally not a problem; no bedrock or boulders. ³	A H	0 to 9..... 9 to 35+.....
Fulton (FaA, FbB, FcA, FcB1, FcB2, FdA, FdB1, FdB2, FeA, FfA).	Light-colored, imperfectly drained soils in calcareous lacustrine clay. Water table at or near surface during winter and spring. Normally, no bedrock or boulders. Sandy substratum phases underlain by loamy soil or gravel at 3 to 5 feet.	A B C D	0 to 8..... 8 to 30..... 30+.....
Genesee (Ga, Gb, Gc).....	Well-drained, medium-textured soils on bottom land. Water table normally not a problem. No bedrock or boulders. ³	A H	0 to 8..... 8 to 48+.....
Haskins (Hb, Hc).....	Light-colored, imperfectly drained, medium-textured soils up to 42 inches deep over calcareous clay. Water table at or near surface during winter and spring. Normally, no bedrock or boulders.	A B D	0 to 7..... 7 to 24..... 24+.....
Hoytville (Hd, He, Hf).....	Dark-colored, very poorly drained soils in calcareous fine silty clay loam to clay till. Water table at or near surface during winter and spring. A few boulders; normally, no bedrock.	A B C	0 to 8..... 8 to 38..... 38+.....
Latty (La, Lb).....	Dark-colored, very poorly drained soils developed from mixed calcareous lacustrine clay and calcareous clay till. Water table at or near surface during winter and spring. No bedrock or boulders.	A B C	0 to 6..... 6 to 42..... 42+.....
Lucas (LcB1, LcC2, LcD2, LdA, LdB1, LdB2, LdC2, LdD2).	Light-colored, moderately well drained soils in calcareous lacustrine clay. Water table normally not a problem. No bedrock or boulders. Sandy substratum phases underlain by coarse-textured materials at about 2 to 4 feet.	A B C D	0 to 8..... 8 to 22..... 22+.....
Mermill (Ma, Mb, Mc).....	Dark-colored, very poorly drained, medium-textured soils up to 42 inches deep over calcareous clay. Water table at or near surface during winter and spring. Normally, no bedrock or boulders.	A B D	0 to 9..... 9 to 40..... 40+.....
Nappanee (NaA, NbA, NcA, NcB1, NcB2, NdA, NdB1, NdB2).	Light-colored, imperfectly drained soils in calcareous fine silty clay loam to clay till. Water table at or near surface during winter and spring.	A B C	0 to 7..... 7 to 27..... 27+.....
Paulding (Pa, Pb, Pc).....	Moderately dark colored, very poorly drained soils in calcareous lacustrine clays. Water table at or near surface during winter and spring. No boulders. ⁵	A B C	0 to 4..... 4 to 45..... 45+.....
Rimer (RaA, RaB1, RbA, RbB1).....	Light-colored, imperfectly drained sandy soils on calcareous clay at depths of 18 to 48 inches. Water table near the surface during winter and spring. No boulders.	A B C	0 to 5..... 5 to 25..... 25+.....
Roselms (RcA, RdA, ReA, ReB1, RfA, RfB1, RfB2, RgA, RgB1, RgB2).	Light-colored, imperfectly drained soils developed on calcareous lacustrine clay; water table may be at or near the surface during winter or spring months; normally no major physical limitations such as bedrock or boulders.	A B D	0 to 10..... 10 to 31..... 31+.....
Shoals (Sc).....	Light-colored, imperfectly drained, medium-textured soils on bottom lands. Water table at or near the surface during winter and spring. No boulders. ³	A H	0 to 7..... 7 to 34+.....
Sloan (Sd, Se).....	Dark-colored, very poorly drained, moderately fine textured soils on bottom lands. Water table at or near surface during winter and spring. No boulders. ³	A H	0 to 8..... 8 to 40+.....

See footnotes at end of table.

of major soil series

Estimated general rating as subgrade	Estimated suitability for—				
	Winter grading	Disposal of effluent	Ponds	Borrow materials	Source of topsoil ²
Poor..... Poor..... Poor.....	} Moderate.....	Very poor.....	Good.....	Poor.....	Fair.
Poor..... Poor.....					
Fair..... Fair to poor..... Good..... Poor.....	} Moderate.....	Poor.....	Fair.....	Good above approximately 54 inches; poor below.	Good.
Poor..... Poor to fair.....					
Poor..... Poor..... Poor..... Fair.....	} Moderate to poor.....	Good.....	Good.....	Poor.....	Good.
Poor..... Poor..... Poor.....					
Poor..... Poor to fair.....	} Moderate to poor.....	Very poor.....	Fair to poor.....	Fair to good.....	Poor.
Poor..... Poor.....					
Fair..... Fair..... Poor.....	} Moderate to poor.....	Good.....	Fair to good.....	Fair.....	Good.
Poor..... Poor.....					
Poor..... Poor..... Poor.....	} Moderate to poor.....	Poor.....	Fair to good.....	Fair.....	Good. Good. Good.
Poor..... Poor.....					
Poor..... Poor..... Poor.....	} Poor.....	Very poor.....	Good.....	Poor.....	Good.
Poor..... Poor.....					
Poor..... Poor..... Poor.....	} Poor.....	Very poor.....	Good.....	Poor.....	Good.
Poor..... Poor.....					
Poor..... Poor..... Fair.....	} Moderate.....	Very poor.....	Good.....	Poor.....	Fair.
Poor..... Fair.....					
Fair..... Good..... Fair.....	} Moderate.....	Fair to poor.....	Fair to good.....	Fair to good.....	Poor.
Fair..... Fair.....					
Fair..... Good..... Fair.....	} Moderate to poor.....	Poor.....	Fair to good.....	Fair to good.....	Good. Good. Good.
Fair..... Fair.....					
Fair..... Poor..... Poor.....	} Poor.....	Very poor.....	Good.....	Poor.....	Poor.
Poor..... Poor.....					
Poor..... Poor..... Poor.....	} Poor.....	Very poor.....	Good.....	Poor.....	Fair to poor.
Poor..... Poor.....					
Good..... Good..... Poor.....	} Moderate.....	Poor.....	Fair.....	{ Good..... Good..... Poor.....	} Good.
Poor..... Poor.....					
Poor..... Poor..... Poor.....	} Poor.....	Very poor.....	Good.....	{ Poor..... Poor..... Poor.....	} Poor.
Poor..... Poor.....					
Poor..... Poor to fair.....	} Poor.....	Poor.....	Poor.....	Poor.....	Fair.
Poor..... Poor.....					
Poor..... Poor to fair.....	} Poor.....	Poor.....	Poor.....	Poor.....	Good.
Poor..... Poor.....					

TABLE 8.—Engineering interpretations

Soil series and map symbols	Description	Horizon ¹	Usual depth
St. Clair (SfC3, SfD3, SfF3, SgB1, SgB2, SgC2, SgD2, SgE2).	Light-colored, moderately well drained soils from calcareous fine silty clay loam to clay till. Water table normally not a problem. A few boulders.	A B C	<i>Inches</i> 0 to 5----- 5 to 17----- 17+-----
Toledo (Tb, Tc, Td, Te)-----	Dark-colored, very poorly drained soils in calcareous lacustrine clay. Water table at or near the surface during winter and spring. No boulders.	A B C	0 to 9----- 9 to 54----- 54+-----
Wabash (Wa)-----	Dark-colored, very poorly drained, fine-textured soils on bottom lands. Water table at or near the surface during winter and spring. No boulders. ^{3 5}	A H	0 to 9----- 9 to 60+-----
Wauseon (Wb, Wc)-----	Dark-colored, very poorly drained sandy soils on calcareous clay at depths of 18 to 48 inches. Water table at or near the surface during winter and spring. No boulders.	A B D	0 to 9----- 9 to 38----- 38+-----
Wetzel (Wd, We)-----	Moderately dark colored, very poorly drained soils developed in calcareous fine silty clay loam to clay till. Water table at or near surface during winter and spring. A few boulders.	A B C	0 to 9----- 9 to 28----- 28+-----

¹A horizon, or surface soil, usually contains 2 to 6 percent of organic matter; B horizon, or subsoil, usually has the greatest content of clay; C horizon, or parent material, is related to the geological formation; D horizon or underlying material, normally has greatly different physical composition from overlying soil material;

its composition is related to the underlying geological formation; H horizon is similar to overlying A horizon but shows little or no modification since it was deposited.

²Data for A horizon unless otherwise noted.

TABLE 9.—Engineering test data and classifications

Soil	Horizon	Depth	Fine gravel and sand (fraction retained on sieve)			Passing No. 200 sieve	Silt			
			No. 10 (4.7–2.0 mm.)	No. 40 (2.0–0.42 mm.)	No. 200 (0.42–0.074 mm.)		Total (0.074–0.005 mm.)	Coarse (0.074–0.05 mm.)	Medium (0.05–0.02 mm.)	Fine (0.02–0.005 mm.)
		<i>Inches</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Haskins-----	A	0 to 7-----	11	13	34	42	17			
	B	7 to 24-----	30	8	11	51	15			
	C	24+-----	10	5	11	74	25			
Hoytville-----	A	0 to 8-----	1	2	17	80	32			
	B	8 to 38-----	1	3	16	80	25			
	C	38+-----	8	4	14	74	26			
Mermill-----	A	0 to 9-----	6	5	41	48	17			
	B	9 to 40-----	16	4	48	32	12			
	D	40+-----	5	5	18	72	21			
Nappance-----	A	0 to 7-----	3	7	32	58	22			
	B	7 to 27-----	2	4	19	75	17			
	C	27+-----	10	4	11	75	23			
Paulding-----	A	0 to 4-----	0	1	5	94	19	0	6	13
	B	4 to 45-----	0	0	3	97	16	0	5	11
	C	45+-----	0	1	3	96	19	1	8	10
Paulding-----	A	0 to 6-----	0	0	3	97	16	1	4	11
	B	6 to 22-----	0	0	3	97	13	0	5	8
	B	22 to 48-----	0	0	1	99	15	1	6	8
	C	48 to 63-----	0	1	2	97	14	0	2	12
Rimer-----	A	0 to 10-----	(¹)	2	80	18	9			
	B	10 to 31-----	(¹)	2	86	12	5			
	D	31+-----	9	3	15	73	25			
Wauseon-----	A	0 to 9-----	(¹)	3	68	29	9			
	B	9 to 38-----	(¹)	4	68	28	8			
	C	38+-----	6	4	13	77	37			

¹ Trace.

of major soil series—Continued

Estimated general rating as subgrade	Estimated suitability for—									
	Winter grading	Disposal of effluent	Ponds	Borrow materials	Source of topsoil ²					
Poor..... Poor..... Poor.....	} Moderate to poor.....	} Very poor.....	} Good.....	} Poor.....	} Fair.					
Poor..... Poor..... Poor.....						} Poor.....	} Very poor.....	} Good.....	} Poor.....	} Good.
Poor..... Poor.....										
Poor..... Poor.....	} Poor.....	} Very poor.....	} Good.....	} Poor.....	} Fair.					

³ Subject to flooding.

⁴ Ratings for D layer in phases having a sandy substratum.

⁵ Considerable swelling of the soil during wet periods and shrinkage during droughts.

of soil samples from eight soil profiles

Clay				Atterberg limits		Plasticity index	Moisture density (compaction)		Classification			
Less than 0.005 mm.	(0.005-0.002 mm.)	(0.002-0.001 mm.)	Less than 0.001 mm.	Liquid limit	Plastic limit		Maximum dry density	Optimum moisture	Unified	AASHO	Ohio Department of Highways	
Percent	Percent	Percent	Percent	Percent of water	Percent of water	Lb./cu. ft.	Percent			Group designation	Group index	
25				21	17	4				A-4	A-4a	1
36				28	19	9				A-4	A-4a	3
49				31	19	12				A-6	A-6a	9
48				37	26	11				A-6	A-6a	8
55				32	19	13				A-6	A-6a	9
48				36	20	16				A-6	A-6b	10
31				33	23	10				A-4	A-4a	3
20				24	14	10				A-2-4	A-2-4	0
51				35	19	16				A-6	A-6b	10
36				28	19	9				A-4	A-4a	5
58				36	20	16				A-6	A-6b	10
52				34	19	5				A-6	A-6a	10
75	13	11	51	76	40	36	80	33	MH or OH	A-7-5	A-7-5	20
81	12	10	59	75	31	44	96	23	CH	A-7-5	A-7-5	20
77	13	10	54	69	27	42	100	24	CH	A-7-6	A-7-6	20
81	15	9	57	68	35	33	88	25	MH or OH	A-7-5	A-7-5	20
84	13	8	63	77	32	45	94	25	CH	A-7-5	A-7-5	20
84	13	9	62	78	30	48	96	25	CH	A-7-5	A-7-5	20
83	17	11	55	63	28	35	101	23	CH	A-7-6	A-7-6	20
9				² NP	² NP	² NP				A-2-4	A-3a	0
7				² NP	² NP	² NP				A-2-4	A-3a	0
48				33	17	16				A-6	A-6b	10
20				² NP	² NP	² NP				A-2-4	A-3a	0
20				² NP	² NP	² NP				A-2-4	A-3a	0
40				28	17	11				A-6	A-6a	8

² NP=Nonplastic.

Haskins, Mermill, Millgrove, Rimer, Tedrow, and Wauseon.

The Shoals and Sloan soils are not suitable for construction unless they are drained. Permeability is moderately slow to slow, and the water table is high at times. The soils are also subject to overflow.

St. Clair soils have slowly or very slowly permeable subsoil, and a check should be made before a septic tank is installed to drain into any of them. If homes are built on sloping St. Clair soils, surface water should be diverted into protected channels to prevent further erosion.

Soils in the Fulton, Hoytville, Latty, Nappanee, Toledo, and Wetzel series are generally level and very poorly drained. They have clay subsoil, and permeability is generally slow to very slow. In addition, water may be ponded during spring and fall. In planning a homesite on any of these soils, suitable drainage should be provided and outlets for the septic tanks should be investigated with great care.

Defiance soils may be severely flooded at any time, and water often stands on the surface in spring and fall. Water percolates slowly through them. Drainage and protection from floods are needed if they are used for buildings.

Paulding and Roselms soils are level to nearly level; Paulding soils are very poorly drained. The water table is periodically high so that drains are necessary if Paulding or Roselms soils are to be used as homesites. They are very slowly to slowly permeable and difficult to drain. In addition, the Paulding and Roselms soils swell when they are wet and shrink when they are dry. This process tends to crack basement walls.

Wabash soils have the same drainage problems as Paulding and Roselms soils. The builder must also protect the site from overflow by constructing diversion ditches.

Genesis, Morphology, and Classification of Soils⁷

Soil is formed by the forces of weathering and soil development acting upon materials that have been deposited or accumulated by geological activity. The characteristics of the soil at any given point depend upon (1) the physical and mineralogical composition of the parent material, (2) the climate under which the material has accumulated and existed since accumulation, (3) the plant and animal life in and on the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active factors in soil genesis. Little is known of the micro-organisms, earthworms, and other populations living in the soil, but they probably equal the influence of vegetation in changing the composition and organic matter of the soil. Plants and animal life act upon the parent material which has been deposited or accumulated; they slowly change it into a natural body with genetically related horizons.

The effects of climate and vegetation are modified by

⁷ This section prepared by G. M. SCHAFER and ROY W. SIMONSON, Soil Conservation Service, and NICHOLAS HOLOWAYCHUK, Ohio Agricultural Experiment Station.

the nature of the parent material and by relief which, in turn, influences drainage. In places parent material and relief dominate among the soil-forming factors. This influence is particularly noticeable in Paulding County where large areas of clay-textured parent materials occur on nearly level relief.

Finally, time is required before the parent material can be changed into soil. It takes long periods for weathering, leaching, translocation of soil particles, formation of soil structure, and other soil-forming processes to differentiate horizons in soil parent materials.

Soil Formation in Paulding County

The differences among soils in Paulding County result chiefly from the influence of parent material and relief. The forces of climate and vegetation also have strongly affected the development of the soils, but these factors are so nearly uniform throughout the county that none of the differences among the soils can be attributed to them.

Parent materials

Glacial till and lacustrine deposits are the chief parent materials for soils in Paulding County. The area was covered by several glaciers that left a mantle of fine-textured till. The mantle ranged in thickness from less than 20 feet to nearly 50 feet. As the last glacier (the Late Wisconsin) receded, the melt waters were ponded by the ice front (the Defiance moraine) for extended periods until the present outlet was reestablished to Lake Erie. At least two glacial lake stages, Lake Maumee and Lake Whittlesey, covered or partially covered the county. Lake Maumee with several stages, highest elevation 800 feet, covered the entire county. Lake Whittlesey, elevation 738 feet, covered a good part of the county. Lacustrine material, deposited at the time of the glacial lakes, covers the till over much of the eastern, central, and northern parts of the county. The mantle of till and lacustrine sediments is clayey and calcareous.

The soils in the western and northwestern parts of the county were derived mainly from glacial till of moderately fine texture. Amounts of clay in 17 samples of till collected in the county ranged from 37.5 to 49.8 percent, with a median value of 43.6 percent. The lime carbonate content in seven samples of till taken below the partially leached C₁ horizon, expressed as calcium carbonate equivalent, ranged from 18.7 to 24.7 percent. The average of these values is 22.5 percent. This moderately fine textured till was modified and reworked to some extent by wave action on the floor of the glacial lakes. The relief is nearly level to gently undulating, except along the major drainageways. The land slopes from 5 to 10 feet per mile in most of this area. Here, the Hoytville soils are predominant.

The soils in the eastern and northern parts of the county were derived mainly from lacustrine clays. The parent materials of the major area are composed of firm, plastic, impervious clay. Soils of the Paulding series predominate in this area. The clay content generally ranges from 60 to 75 percent. The median clay content in the 27 samples collected for analyses was 69.9 percent, whereas the range was 52.8 to 84.7 percent. The calcium carbonate equivalent of these samples ranges

from 14.7 to 24.4 percent, with an average of 19 percent. Some samples obtained in the C₁ horizon or upper part of the parent materials may be partially leached. They give low values for the calcium carbonate equivalent. The thickness of this material over the till varies from about 4 to about 14 feet. This area is nearly level, with slopes of less than 5 feet per mile. In places the gradient is less than 1 foot per mile.

An area of till mixed with lacustrine material occupies a belt 2 to 5 miles wide between the areas of till and lacustrine clay. Here the lacustrine material is fairly thin, and the action of the waves tended to blend it with the glacial till. The content of clay ranges from 50 to 60 percent. This area is nearly level, and the gradients are less than 5 feet per mile. Latty soils are predominant in this belt.

In the northeastern part of the county, in eastern Auglaize and northeastern Brown Townships, is an area of lacustrine materials laid down after those from which the Paulding soils developed. These lake-laid materials are principally of silty clay texture; they contain between 40 and 60 percent of clay. Thin lenses of silty clay loam to fine sand are common in this material. The profile is frequently laminated or varved in the lower part. In this area the underlying materials have textures similar to those of the Paulding soils below 5 feet. Soils of the Toledo series are the principal soils in this part of the county.

Physiography and relief

Paulding County is part of the glacial lake plain section of northwestern Ohio. Generally level or nearly so, the land surface has been affected by glaciation in two ways. It was planed by the ice sheets of the several glaciers that crossed the country. Level topography was then enhanced by sedimentation in Lake Maumee and Lake Whittlesey, both glacial lakes (3). The effect of glaciation, through the action of the ice sheets and through sedimentation in the lakes, has been to make the land surface a nearly level plain. Furthermore, there has been very little dissection subsequent to glaciation. Broad flat areas between streams are 4 to 6 miles wide in places. The land surface generally has a fall of less than 5 feet per mile. Exceptions are the occasional strips bordering major streams where the land surface becomes steep to rolling in places.

The generally low relief contributes to poor drainage in much of the county. Combined with fine-textured and rather impervious materials, this has made many of the soils wet under natural conditions. Intensive use of the soils for agriculture was not possible until many miles of open ditches and tile drains had been installed. In fact, adequate drainage is still a problem on many farms. Restricted drainage is strongly reflected in the morphology of the soils as well as in their agricultural behavior.

Native vegetation

The original vegetation of the lake plain of Ohio was primarily deciduous swamp forest (10). It covered the extensive, poorly drained, nearly level to flat areas that are characteristic of this part of the State. It was conducive to the development of certain tree species and the comparative absence of others. Scattered through-

out the swamp forest were grassy clearings, or openings, and occasionally a wet, boggy tract where water-loving grasses and sedges were dominant.⁸ Drier sites also suited for forest vegetation occurred on sloping areas bordering the streams and on some of the low sandy knolls and old beach ridges.

The trees common to the poorly drained land in Paulding County were black and white ash, American elm, shagbark and big shellbark hickory, basswood, swamp white oak, pin oak, and, to a lesser extent, bur oak, sycamore, silver maple, and cottonwood.⁹ After the forests were cleared and cut, the secondary growth was composed mainly of bur oak, shellbark hickory, pin oak, and swamp white oak.

Where the drainage was especially poor, black ash, sycamore, and cottonwood tended to dominate in the original cover. Pin oak and swamp white oak were more common in the secondary forests in the very poorly drained sites.

The better drained, somewhat sloping soils, such as those bordering the streams, supported other trees. In such areas beech, basswood, white oak, red oak, and sugar maple dominated in the original stand.

One of the more extensive boggy areas was covered with water-loving grasses and sedges. This area is in the southwestern part of the county; it was an extension of Big Bear Swamp that covered a part of northwestern Van Wert County.

In the central and eastern parts of the county, the present cover is dominated by scrubby stands of pin oak, swamp white oak, and hawthorn (thornapple). This vegetation frequently occurs on idle land. It is associated with the tight, clayey soils of the Paulding and Roselms series, which are extensive in this part of Paulding County.

Climate

The climate—precipitation, temperature, humidity, and wind—significantly affects soil development. It influences the rate of plant growth as well as the amount of water available to plants or the removal of materials by leaching and the degree of soil temperature.

Paulding County has a temperate, humid, continental climate. The average annual precipitation is about 35 inches. The average annual precipitation is equivalent to the estimated potential evapo-transpiration for this area. Appreciable freezing may occur, so that soil temperatures are low for considerable periods. According to estimates (17), frost may penetrate to about 20 inches in this area.

Time

All soils require time for the development of distinct horizons. The influence of time is greatly modified by other soil-forming factors, however, particularly by the effects of relief and parent material.

In Paulding County all of the parent materials are of Late Wisconsin age, or younger. The land surfaces were exposed as the Late Wisconsin glacier receded from

⁸ SHANKS, ROYAL EASTMAN. THE ORIGINAL VEGETATION OF THE LAKE PLAIN OF NORTHWESTERN OHIO: WOOD AND HENRY COUNTIES. [Unpublished Ph. D. thesis. Ohio State Univ.] 1938.

⁹ GOOD, ERNEST E. A HISTORY OF THE NATURAL RESOURCES OF VAN WERT COUNTY, OHIO. [Unpublished master's thesis. Ohio State Univ.] 1938.

the area. There are minor differences in the age of the parent materials, however. The fine, clay-textured lacustrine materials, from which the Paulding soils developed, overlie the clay-textured glacial till. In turn, the lacustrine deposits of silty clay and silty clay loam, from which the Toledo soils developed, are above the Paulding parent materials. Radiocarbon dates indicate the age of the lake plain to be about 13,000 years or less.

Soil Classification in Paulding County

Soils can be classified in a number of ways, depending upon the purpose to be served. Soils are placed in narrow classes for the organization and application of knowledge about soil behavior within farms and fields. They are placed in broad classes for their study and comparison over continents.

Soils are placed in six different categories, one below the other, in the classification system now used in the United States (16). Beginning at the top, the six categories are: Order, suborder, great soil group, family, series, and type.

Each category consists of a number of classes at the same level. The classes are few and broad in the highest category, whereas they are many and narrow in the lowest category. In the highest category of the classification system, the soils of the United States are placed in three orders, whereas thousands of soil types are recognized in the lowest category. The number of classes in categories between the top and the bottom fall between these limits, gradually increasing down the ladder.

Among the six categories, those of the order, great soil group, series, and type have been most used. The suborder and family categories have never been fully developed and thus have been used little. Attention has been given largely to the classification of soils by soil types and soil series within counties and to the subsequent grouping of series into great soil groups and orders for States or for the country as a whole.

Classes in the highest category of the classification scheme are the zonal, intrazonal, and azonal orders (16). Each of these is represented in Paulding County by one or more great soil groups, each of which, in turn, includes one or more soil series.

The zonal order comprises soils with evident, genetically related horizons that reflect the dominant influence of climate and living organisms in their formation. Such soils formed in materials that have been in place a long time, are intermediate in their physical and chemical composition, and are not subject to extremes in drainage or topography. The zonal order is represented in Paulding County by the Gray-Brown Podzolic great soil group.

The intrazonal order comprises soils with evident, genetically related horizons that reflect the dominant influence of local factors of topography, parent materials, or time over the effects of climate and living organisms. Like the zonal soils, these also formed from materials that have been in place a long time. The materials, however, may be extreme in nature, as for example very fine textured or highly calcareous. Alternately, the soils may develop where parent materials are not extreme but conditions of drainage are restricted by flat topography. In Paulding County there are many nearly level, fine-textured areas where both external and internal drainage are restricted and where geological erosion is very slow.

Soils of these areas are members of the Humic Gley and Low-Humic Gley great soil groups of the intrazonal order.

The azonal order comprises soils that lack evident, genetically related horizons because of youth, resistant parent materials, or steep topography. Soils of this order may be formed from recently transported sediments, such as those in the flood plain of a stream. Sediments on a flood plain may have been in place too short a time to allow the differentiation of horizons. Other soils of the azonal order lack genetically related horizons because parent materials are so resistant to change, as is true of quartz sand. Still other azonal soils occupy steep slopes where removal of materials by geological erosion keeps pace with horizon differentiation. In Paulding County, the azonal order is represented by the Regosol and Alluvial great soil groups.

A great soil group is a broad class of soils having major profile characteristics in common; that is, all members of the class have the same number and kind of definitive horizons. Such horizons need not be expressed to the same degree in every soil but must always be present. Thus, a given definitive horizon may be faint in some and prominent in other members of the same great soil group. Every soil series in the Gray-Brown Podzolic group must have certain horizons in its profile, expressed to some degree. The nature of each of the five great soil groups occurring in Paulding County will be indicated in subsequent discussions of those groups. The 30 soil series of the county are placed in these great soil groups, and the reasons for such placement are given in those discussions. The definitions of great soil groups follow those given by Thorp and Smith (15).

Gray-Brown Podzolic soils

Gray-Brown Podzolic soils developed under deciduous forest in the humid, temperate region. They have thin, dark-colored A_1 horizons under virgin conditions and eluviated A_2 horizons. The A_2 horizons are light colored, generally gray, grayish brown, or pale brown.

The B horizon contains more clay than the A_2 horizon because of eluviation from the A_2 horizon. It is also a horizon of greater chroma; brown, yellowish-brown, or strong-brown colors are the most common.

The Gray-Brown Podzolic soils also have characteristic reaction and base saturation patterns in the profile. They are more acid in the lower A and upper B horizons than in the lower B horizon. The reaction is usually strongly acid to slightly acid in the upper horizons and medium acid to neutral in the lower B horizon. There is a similar pattern in base saturation. Saturation values as low as 30 percent may occur in the lower A and upper B horizons, whereas the base saturation in the lower B horizon is seldom below 50 percent. A typical example of the Gray-Brown Podzolic soils is Belmore loam, site number PD-53 (see table 10).

Gray-Brown Podzolic soils of Paulding County may be divided into two groups: (1) those that are moderately well drained to well drained, and (2) those that are mottled and have imperfect drainage. Gray-Brown Podzolic soils are not extensive in Paulding County, but representative profiles of both groups are present.

The better drained soils are those of the Belmore, Broughton, Haney, Lucas, and St. Clair series. The Seward series is also listed as a Gray-Brown Podzolic soil, but it intergrades to the Regosol great soil group in that it has a faint B horizon. Of these soils, only the Belmore, which occurs on sloping beach ridges and is underlain by sandy or gravelly material, is well drained. Soils of the other series are mottled in the lower part of the profile, which indicates development under somewhat restricted drainage.

The imperfectly drained Gray-Brown Podzolic soils are the Digby, Fulton, Haskins, and Nappanee series. The Rimer soils, which is also grouped with the imperfectly drained Gray-Brown Podzolic soils, have a faint B horizon. They, like the Seward soils, intergrade to the Regosol group.

The profiles of several Gray-Brown Podzolic soils have been sampled in Paulding County. The descriptions of the profiles and the laboratory data by horizons are given later in the section, Laboratory Data and Profile Descriptions.

The profile of Belmore loam, PD-53, is typical for well-drained Gray-Brown Podzolic soils developed from medium-textured materials. This profile was sampled on a 3-percent slope on the glacial beach ridge of Lake Maumee. The occurrence of the underlying sandy loam material is apparent in the mechanical analysis of the C horizon. The B horizon has an accumulation of clay sufficient to give it a clay loam texture. The minimum pH value also occurs in the B horizon.

The Broughton series developed from the same lacustrine parent materials as the Paulding series. This relationship is indicated by the large amount of clay in the C horizon of the Broughton silty clay loam profile, PD-41. Broughton soils occur on the moderately steep to steep slopes along drainageways; thus, they have greater runoff and better drainage than do the neighboring Paulding and Roselms soils. Leaching is shallow in these fine-textured materials. Carbonates occur at a depth of 14 inches on the Broughton profile that was sampled.

The Broughton series is a member of the Gray-Brown Podzolic group but has faint horizonation. The low degree of development is shown by the clay content of the B horizon, which is no higher than that of the C horizon. Transfer of clay within the profile is limited by the texture of the parent materials.

A profile of Haney silt loam, PD-52, was sampled to represent the undifferentiated soil group, Haney silt loam and loam. The profile was taken from the beach ridge of glacial Lake Maumee, near the location of the sample of Belmore loam, PD-53, mentioned above. This Gray-Brown Podzolic soil has a textural B horizon, underlain by stratified, calcareous sandy loam material. The calcareous clay till below 56 inches was not sampled.

Members of the St. Clair series are moderately well drained Gray-Brown Podzolic soils developed from clay-textured calcareous till. The profile of St. Clair silt loam, PD-54, shows a depth of leaching of 17 inches in a calcareous till containing 43 percent of clay. The moderately developed B horizon has slightly more clay than does the parent material. The minimum pH value in the profile is in the upper part of the B horizon.

Profiles of the Lucas and Seward series, members of

the Gray-Brown Podzolic great soil group, were not sampled for laboratory analysis.

Digby loam, PD-59, is an imperfectly drained Gray-Brown Podzolic soil. It developed from medium-textured materials that overlie poorly sorted sandy or gravelly material. The profile sampled has a sufficient accumulation of clay in the B horizon to give it a sandy clay loam texture, whereas the C horizon has a sandy loam texture. Underlying the profile is calcareous clay till at 54 inches. The pH is nearly neutral throughout the profile.

Two profiles of the imperfectly drained Fulton soils were sampled. The one profile of Fulton loam, PD-58, was sampled in the northeastern part of the county in an area of lacustrine silty clay and silty clay loam which overlies clay-textured lacustrine material. A profile of Fulton silt loam, sandy substratum phase, PD-5, was sampled on a high terrace along the Auglaize River.

The profile of Fulton loam has formed where a thin, loam-textured mantle overlies stratified lacustrine silty clay. This mantle has provided the loamy surface horizon and has also increased the amount of sand throughout the upper profile. The sandy mantle has probably improved drainage, as compared to that of adjacent Toledo soils.

The Fulton silt loam, sandy substratum phase, has loam and sandy loam textures below 54 inches. Mottling, which indicates imperfect drainage, is evident below 10 inches in the profile. The B horizon of this profile is strongly developed, as indicated by both texture and structure. The B₂ horizon is a clay, whereas the B₃ is a silty clay loam. The pH minimum also occurs in the B₂ horizon.

The Haskins are imperfectly drained Gray-Brown Podzolic soils that developed from medium-textured materials overlying clay at depths of 18 to 42 inches. These characteristics are shown in the description and laboratory data given for Haskins loam, PD-50.

No profiles of the Nappanee or Rimer series, imperfectly drained Gray-Brown Podzolic soils, were sampled in Paulding County.

Humic Gley soils

Humic Gley soils are poorly or very poorly drained. They occupy nearly level or depressional areas that have periodically high water tables. The natural vegetation on these soils in Paulding County was swamp forest.

These soils have thick, dark surface layers over drab and mottled subsoils which show gleying. The drab colors and mottled patterns are the result of poor drainage. Amounts of organic matter in the surface horizons of Humic Gley soils are moderately high to high. These surface horizons are normally thicker than those of the associated Gray-Brown Podzolic soils. Several soil series in Paulding County which do not fully meet the requirement of thick, dark surface layers are included in the Humic Gley group. These series, Paulding, Latty, and Wetzel, are discussed more fully in the latter part of this section.

Leaching of bases has been restricted in the Humic Gley soils because of the poor drainage. However, the depth to carbonates is usually greater than in associated better drained soils. This condition is reflected in the slightly acid to mildly alkaline reaction of the soils. For

the most part, the surface horizons are slightly acid to neutral and the deeper horizons are neutral to mildly alkaline. Along with these reactions, the percentage base saturation is high. Base saturation increases with depth in the profile in all of these soils. Most profiles of Humic Gley soils have a base saturation above 70 percent in the surface layer, and few are below 50 percent (11).

Two groups of Humic Gley soils can be distinguished in the county on the basis of translocation of clay within the profile. One group has an evident accumulation of clay in the B horizon and the other does not. These two groups are described separately. The second group includes several series which have a few characteristics normally found more clearly expressed in the Low-Humic Gley and Grumusol groups.

In Paulding County the Humic Gley soils with accumulations of clay in the B horizon are the Hoytville, Mermill, Millgrove, and Toledo series.

Soils of the Hoytville series are the most extensive Humic Gley soils in Paulding County. Three sampled Hoytville profiles are described more fully with laboratory data in a later section of this report. The Hoytville soils have developed from clay-textured calcareous till. The amount of clay in the parent materials is between 40 and 50 percent. The depth to the carbonates ranges from 36 to 46 inches. The surface soils are very dark gray or very dark grayish brown. The B horizons in these Hoytville profiles have weak textural development in terms of clay accumulations, whereas the angular blocky structure is strongly developed.

The Mermill series is not extensive in Paulding County. It was not sampled for laboratory analysis.

One profile of Millgrove loam, PD-61, was sampled on a terrace along the Maumee River. This profile has a dark-colored surface horizon. The amount of clay increases in the B horizon, which gives this layer a sandy clay loam texture. The pH increases from medium acid at the surface to neutral in the lower part of the horizon. The texture of the underlying material is a sandy loam.

The Toledo series has been sampled at four locations in the northeastern part of the county. These samples are described more fully in the section, Laboratory Data and Profile Descriptions. These are typical Humic Gley profiles; they have dark-colored surface horizons to depths of 8 to 14 inches and gleyed gray or grayish, mottled subsoils. The surface soils of the samples analyzed are silty clay or fine silty clay loam; the subsoils are silty clay. At two locations, impervious lacustrine clay, similar to that of the Paulding parent material (clay content of more than 60 percent), was reached at depths of below 60 inches. The reaction is nearly neutral or neutral at the surface and remains the same throughout the profile, or increases slightly with depth.

In Paulding County the Humic Gley soils without accumulation of clay in the B horizon are the Granby, Latty, Paulding, Sloan, Wabash, Wauseon, and Wetzel.

The Granby and Wauseon soils have formed in coarse-textured materials that contain little clay. The Wauseon soils have a clay substratum below depths of 18 to 48 inches. Neither of these series is extensive in the county and no samples were taken for laboratory analyses.

In the past the Sloan and Wabash soils have been

considered Alluvial soils with dark-colored surface horizons and gleyed deeper profiles. Both have the dark A horizons high in organic matter characteristic of Humic Gley soils. The deeper profiles also bear the marks of strong gleying. Consequently, the two series are included in the Humic Gley group at the present time. Both soils may be considered intergrades to the Alluvial group. One profile of Wabash silty clay loam, PD-56, was sampled for laboratory study, and the description and data are given in the section, Laboratory Data and Profile Descriptions. The variation in the texture of this Wabash profile appears to be caused by stratification rather than by soil development. No samples of the Sloan soils were collected for laboratory study.

The Latty, Paulding, and Wetzel soils are included in the Humic Gley group, but with some reservations as to their placement. These soils have been considered members of that group in the past because they all have moderately dark, fairly thick A₁ horizons and were developed under conditions of poor drainage. The thickness and color of the A₁ horizon is marginal, however, for Humic Gley soils. Soils of these three series are therefore considered Humic Gley soils intergrading to the Low-Humic Gley group. It may be that they will be placed in the Low-Humic Gley group when the limits between the two are finally established. Limits between the Humic Gley and Low-Humic Gley groups are not fully worked out as yet.

A further question on the classification of the Latty and Paulding soils results from their high clay content. Both series are derived from lacustrine sediments very high in clay. Horizon differentiation proceeds slowly in fine-textured materials of low permeability. Furthermore, the soils are high enough in clay throughout their profiles to permit marked changes in volume with changes in moisture content. The soils could shrink and crack extensively on drying and swell markedly as they again become wetted.

The high proportions of clay, accompanied by marked shrinking and swelling, are characteristic of the great soil group known as Grumusols. Marked shrinking and swelling results in churning or mixing of materials within the soil. The shrinking and swelling with attendant churning is not possible, however, if the soil remains either wet or dry. Changes in moisture content from wet to dry, and vice versa, are necessary for the operation of the process. Large changes in moisture content seem unlikely so long as the Paulding and Latty soils were under their natural conditions of poor drainage. The soils would have dried out at rare intervals, if at all. With the introduction of artificial drainage they will become dry more often, and the process of churning can be expected in the future if it has not already started. Marks of the process are obscure as yet but, even so, the process may have operated to a limited extent and blurred horizons in the profiles. Thus, the Latty and Paulding soils do have some kinship to Grumusols.

The Latty, Paulding, and Wetzel soils lack evident accumulations of clay in the B horizon. Less than half of the profiles sampled have more clay in the B horizon than in the calcareous parent material. For the profiles that have a clay maximum above the calcareous parent material the difference in clay content is small.

Variations in the nature of the original sediments could easily account for the small differences that do exist.

The Latty, Paulding, and Wetzel soils are of major importance in the county. Paulding clay occupies a larger total area in the county than any other soil type or series. Consequently, more than a dozen profiles were described and sampled for laboratory study. The descriptions and data for five of those profiles were selected as representative and are given later. The Latty and Wetzel soils are less extensive than Paulding soils, and, therefore, fewer profiles were described and sampled. Three profiles of Latty clay are covered in the section, Laboratory Data and Profile Descriptions.

The profiles of the Paulding, Latty, and Wetzel soils have a number of features in common. All three have moderately dark A₁ horizons, mainly dark gray in color, though a few are dark grayish brown or very dark gray. The deeper horizons show the effects of gleying in gray or olive-gray colors and in mottled patterns. These deeper horizons commonly have weak to moderate grades of structure. Depth to carbonates in the profiles sampled ranges from 32 to 54 inches.

Most profiles are medium acid to neutral at the surface (two profiles of the Paulding series sampled have pH values as low as 5.3 in the surface horizon but the data are not reported). These soils are most acid at the surface or just below the surface, and the pH values increase with depth. The lower horizons of all these soils are neutral. Exchangeable cations and base saturation are reported for two Paulding clay profiles, PD-49 and PD-S32. In these profiles the base saturation is more than 70 percent in the surface soil and increases to 88 percent just above the calcareous parent material.

The content of organic matter in the plow layers for eight Paulding and Latty profiles is between 4.4 and 7 percent. For a Wetzel profile, the amount of organic matter in the surface horizon is 3.2 percent. These values are within the range reported for Humic Gley soils (11). The content of organic matter in four uncultivated profiles ranges from 6.6 to 9.4 percent in the surface 4 to 5 inches, but the amount decreases sharply immediately below the surface. This range in organic matter content appears to be slightly less than reported for other Humic Gley soils under forest vegetation (11).

As already indicated, Paulding soils developed from lacustrine materials high in clay. The amount of clay in the calcareous parent material is more than 60 percent and often is greater than 70 percent. This range is drawn from data for 14 Paulding profiles, five of which are described in the section, Laboratory Data and Profile Descriptions. The profiles are high in clay throughout, all with more than 60 percent of clay in the B horizon. Some of the profiles have slightly less and others have slightly more clay in the B horizon than in the parent material.

The Latty soils have profiles similar to those of the Paulding series, except that they are lower in clay. The Latty soils occur at the border of the lacustrine area, where the lacustrine material has been mixed to some extent with the underlying clay-textured till. The clay content of the B horizon and of the calcareous parent material generally is between 50 and 60 percent.

The Wetzel soils developed from calcareous clay till. They occur in association with the darker Hoytville series. The clay content in the B horizon and in the calcareous parent material generally ranges between 38 and 50 percent. Laboratory data are not reported for a Wetzel profile.

Low-Humic Gley soils

This great soil group was proposed (15) for poorly drained soils with thin A₁ horizons, in contrast to the thick ones of Humic Gley soils. Deeper horizons of Low-Humic Gley soils are strongly gleyed, as is indicated by dominant gray or neutral colors, with or without mottling. The limits between the Low-Humic Gley and Humic Gley groups have not been fully worked out, as was brought out in the earlier discussion of the Latty, Paulding, and Wetzel series. It may be that one or more of these three series should be placed in the Low-Humic Gley group, although all three are clearly near the limit between the two great soil groups, however classified. At present, only the Roselms series in Paulding County is placed in the Low-Humic Gley group.

The Roselms soils developed from the same kind of lacustrine sediments as the Paulding. Poor drainage of the soils is indicated by gray or light-gray A₂ horizons and the occurrence of mottling a few inches below the surface. The depth to carbonates is greater than in the associated Broughton soils and ranges from 18 to 32 inches. The B horizons are high in clay, as is the parent material, and have weak grades of structure. Three profiles of Roselms silty clay loam (PD-7, PD-9, and PD-42) have 64 to 69 percent of clay in the C horizon and very little more in the B horizon. The three Roselms profiles sampled have a slight sandy mantle on the soil surface, shown by a higher sand content (to a depth of 3 to 8 inches) than in the lower horizons. Descriptions and laboratory data for the three profiles are given later.

Alluvial soils

The Alluvial soils are developed from recently deposited alluvium. Most of these soils receive additional deposits when the streams overflow. Little or no change in the soil material has taken place through the processes of soil formation. The soils generally lack discernible horizons, although some have weakly developed A₁ or A_p horizons caused by slight accumulation of organic matter. Alluvial soils are of limited extent in Paulding County. They occur mainly along the Maumee and Auglaize Rivers.

The well-drained and moderately well drained Alluvial soils are in the Genesee, Ross, and Eel series. No profiles of these were collected for laboratory analyses. The Ross and Genesee series lack horizon differentiation, but the Ross soils have a darker profile and contain slightly more organic matter than the Genesee soils. The Eel soils show mottling below a depth of 18 to 20 inches.

The Shoals and Defiance soils are imperfectly drained Alluvial soils. The differences in texture within the profile reflect stratification of the alluvial materials. Mottling begins just below the surface horizon. The Defiance soils are finer textured throughout the profile than the Shoals. The Shoals soils were not sampled in Paulding County. Mechanical analysis of the profile of

Defiance silty clay loam, PD-55, indicates stratification within the vertical section. Texture becomes finer with increasing depth and reaches a silty clay in the lower part of the profile. The content of organic matter is moderately high.

Regosols

Soils of this group have few and faint genetic horizons. They may have a faint A horizon grading downward into a C horizon. Regosols differ from Alluvial soils

in that they are not subject to recurring deposition resulting from overflow of streams. They differ from Lithosols in being developed from unconsolidated parent material and in their associated freedom from stoniness. The lack of distinct genetic horizons sets these azonal soils apart from those of the zonal and intrazonal orders.

The Ottokee and Tedrow soils in Paulding County are classified as Regosols. Both are derived from coarse-textured sands and loamy sands of the glacial lake plain. Both occupy positions where they are no longer subject

TABLE 10.—Data on particle size distribution, bulk density,

Soil, site number, and location	Horizon	Depth	Particle size distribution				
			Very coarse sand (2-1)	Coarse sand (1-0.5)	Medium sand (0.5-0.25)	Fine sand (0.25-0.1)	Very fine sand (0.1-0.05)
		Inches	Percent	Percent	Percent	Percent	Percent
Belmore loam, PD-53 Location: SE¼SE¼ sec. 31, T. 1 N., R. 1 E., Benton Township.	A _p	0-8	-----	-----	-----	-----	-----
	A ₂	8-12	-----	-----	-----	-----	-----
	B ₂	12-34	-----	-----	-----	-----	-----
	C ₁	34-45	-----	-----	-----	-----	-----
	C ₂	45+	-----	-----	-----	-----	-----
Broughton silty clay loam, PD-41 Location: SW¼SE¼ sec. 33, T. 3 N., R. 3 E., Emerald Township.	A ₁	0-2	-----	-----	-----	-----	-----
	A ₂	2-4	-----	-----	-----	-----	-----
	B ₁	4-6	-----	-----	-----	-----	-----
	B ₂	6-14	-----	-----	-----	-----	-----
	C ₁	14-21	-----	-----	-----	-----	-----
	C ₂	21+	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----
Defiance silty clay loam, PD-55 Location: NE¼NW¼ sec. 34, T. 2 N., R. 3 E., Jackson Township.	-----	0-5	-----	-----	-----	-----	-----
	-----	5-9	-----	-----	-----	-----	-----
	-----	9-15	-----	-----	-----	-----	-----
	-----	15-24	-----	-----	-----	-----	-----
	-----	24-45	-----	-----	-----	-----	-----
Digby loam, PD-59 Location: SE¼NW¼ sec. 27, T. 2 N., R. 1 E., Harrison Township.	A _p	0-8	-----	-----	-----	-----	-----
	A ₂	8-11	-----	-----	-----	-----	-----
	B ₂₁	11-16	-----	-----	-----	-----	-----
	B ₂₂	16-31	-----	-----	-----	-----	-----
	C	31-54	-----	-----	-----	-----	-----
	D	54+	-----	-----	-----	-----	-----
Fulton loam, PD-58 Location: SW¼SW¼ sec. 10, T. 2 N., R. 4 E., Brown Township.	A _p	0-6	-----	-----	-----	-----	-----
	B ₁	6-10	-----	-----	-----	-----	-----
	B ₂₁	10-16	-----	-----	-----	-----	-----
	B ₂₂	16-21	-----	-----	-----	-----	-----
	B ₂₃	21-30	-----	-----	-----	-----	-----
	C	30+	-----	-----	-----	-----	-----
Fulton silt loam, sandy substratum, PD-5 Location: NW¼NE¼ sec. 17, T. 2 N., R. 4 E., Brown Township.	A _p	0-7	-----	3.6	4.2	3.0	6.4
	A ₂₁	7-10	-----	4.5	3.9	2.7	6.3
	A ₂₂	10-13	-----	3.0	3.2	2.3	6.6
	B ₂₁	13-22	-----	.2	.7	.6	1.7
	B ₂₂	22-40	-----	.3	.8	.7	1.3
	B ₃	40-54	-----	.6	1.4	2.2	9.4
	D ₁	1 54	-----	.3	3.7	19.4	23.4
	D ₂	1 96	-----	17.9	13.6	16.1	15.6
	-----	-----	-----	-----	-----	-----	-----
	-----	-----	-----	-----	-----	-----	-----
Haney silt loam, PD-52 ² Location: SE¼SE¼ sec. 31, T. 1 N., R. 1 E., Benton Township.	A _p	0-7	-----	-----	-----	-----	-----
	A ₃	7-10	-----	-----	-----	-----	-----
	B ₂₁	10-18	-----	-----	-----	-----	-----
	B ₂₂	18-35	-----	-----	-----	-----	-----
	B ₃	35-42	-----	-----	-----	-----	-----
	C	42-56	-----	-----	-----	-----	-----
Haskins loam, PD-50 ³ Location: SW¼SW¼ sec. 29, T. 3 N., R. 4 E., Auglaize Township.	A _p	0-7	1.0	5.6	24.6	29.3	3.4
	B ₁	7-28	.6	9.6	23.5	28.3	2.6
	B ₂	28-36	.3	4.8	9.6	13.8	1.5
	-----	-----	-----	-----	-----	-----	-----
	D	36+	1.2	0	2.3	3.6	.6

See footnotes at end of table.

to deposition. Both are uniform in clay content within the profile. Soils of these two series have brown to dark grayish-brown A₁ horizons, 8 to 10 inches thick, that grade to yellowish-brown to strong-brown C horizons. Colors in the deeper parts of the profile are redder, higher in chroma, or both, than in the Alluvial soils of the county. No samples of the Ottokee soils were collected for laboratory analyses. One profile of Tedrow loamy fine sand was described and sampled, and the data for that profile are given in the following section.

Laboratory Data and Profile Descriptions

Data on particle size distribution, bulk density, pH, organic matter, and carbonates for 30 profiles representing 16 soil series are given in table 10. Data on exchangeable cations in two Paulding profiles are given in table 11.

Some of the profiles that were analyzed are described in the section, Descriptions of the Soils. Descriptions of the other profiles are given in this section.

pH, organic matter, and carbonates of several soil profiles

in millimeters				Textural class	Bulk density	Carbonates (CaCO ₃ equivalent)	pH	Organic matter
Total sand (2.0-0.05)	Silt (0.05-0.002)	Clay < (0.002)	Fine clay < (0.0002)					
<i>Percent</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>			<i>Percent</i>		<i>Percent</i>
40.3	42.9	16.8		Loam			6.5	2.3
39.0	39.8	21.2		Loam			6.0	1.8
33.0	34.9	32.1		Clay loam			5.3	
67.9	17.8	14.3		Sandy loam			7.3	
70.0	23.3	6.7		Sandy loam		32.6	7.5	
10.2	53.2	36.6		Silty clay loam			6.9	
11.3	49.2	39.5		Silty clay loam			6.8	
6.9	37.3	55.8		Clay			6.5	
1.5	18.9	79.6		Clay			6.3	
.8	19.3	79.9		Clay		18.6	7.9	
.5	14.8	84.7		Clay		20.2	8.0	
14.9	54.9	30.2		Silty clay loam			7.2	5.2
20.9	54.0	25.1		Silt loam			7.0	3.6
22.4	49.7	27.9		Clay loam			6.7	
13.3	49.3	37.4		Silty clay loam			5.0	
10.7	41.1	43.2		Silty clay			6.1	
46.1	36.4	17.5		Loam			7.2	4.4
45.7	36.8	17.5		Loam			7.2	.6
42.9	34.9	22.2		Loam			7.2	
49.5	18.6	31.9		Sandy clay loam			7.1	
70.8	19.5	9.7		Sandy loam			7.3	
18.2	30.7	51.1		Clay		17.8	7.6	
45.1	38.2	16.7		Loam			7.0	2.2
35.0	34.1	30.9		Clay loam			5.5	.4
25.2	27.0	47.8		Clay			4.8	
12.5	33.6	53.9		Clay			5.0	
7.1	35.8	57.1		Clay			6.1	
2.2	40.6	57.2		Silty clay		10.0	7.6	
17.2	58.0	24.8	6.3	Silt loam			7.8	3.3
17.4	57.7	24.9	6.5	Silt loam			7.4	3.0
15.1	54.0	30.9	7.4	Silty clay loam			6.3	.7
3.2	40.8	56.0	25.6	Silty clay			5.1	
3.1	38.2	58.7	25.0	Clay			5.1	
13.6	48.6	37.8	16.6	Silty clay loam			5.9	
46.8	28.7	24.5	11.1	Loam		1.3	6.6	
63.2	24.2	12.6	4.5	Sandy loam		9.3	7.9	
31.5	51.4	17.1		Silt loam			5.6	2.1
28.0	51.2	20.8		Silt loam			5.9	1.1
27.2	46.2	26.6		Loam			5.9	
43.0	29.8	27.2		Clay loam			5.9	
24.2	38.2	37.6		Clay loam			6.9	
52.3	29.9	17.8		Sandy loam		11.4	7.4	
63.9	14.7	21.4	6.8	Sandy clay loam			7.1	2.3
64.6	6.2	29.2	17.8	Sandy clay loam			5.5	.5
30.0	11.6	58.4	23.7	Clay			7.0	
7.7	15.5	76.8	23.3	Clay		20.5	7.9	

TABLE 10.--Data on particle size distribution, bulk density,

Soil, site number, and location	Horizon	Depth	Particle size distribution				
			Very coarse sand (2-1)	Coarse sand (1-0.5)	Medium sand (0.5-0.25)	Fine sand (0.25-0.1)	Very fine sand (0.1-0.05)
		Inches	Percent	Percent	Percent	Percent	Percent
Hoytville clay, No. 5 Location: NW¼SE¼, sec. 20, T. 1 N., R. 1 E., Benton Township.	A _p	0-8					
	B _{21g}	8-16					
	B _{22g}	16-36					
	C ₁	36+					
Hoytville clay, No. 6 Location: SE¼SW¼ sec. 12, T. 1 N., R. 1 E., Benton Township.	A _p	0-9					
	B _{21g}	9-18					
	B _{22g}	18-42					
	C ₁	42+					
Hoytville clay, PD-47 Location: NE¼NW¼ sec. 20, T. 2 N., R. 1 E., Harrison Township.	A _p	0-8		0.9	4.4	3.1	5.2
	B _{21g}	8-15		.9	4.2	3.0	4.9
	B _{22g}	15-30		.9	3.8	2.8	4.6
	B _{23g}	30-36		1.1	4.3	2.9	4.9
	C ₁	36+		.8	4.2	2.9	5.0
Latty clay, No. 10 Location: SW¼SW¼ sec. 19, T. 2 N., R. 3 E., Jackson Township.	A _p	0-7					
	B _{21g}	7-18					
	B _{22g}	18-32					
	C ₁	32+					
Latty clay, PD-36 Location: SW¼SW¼ sec. 33, T. 1 N., R. 3 E., Latty Township.	A _{p1}	0-2		1.3	5.0	3.1	4.8
	A _{p2}	2-6		1.2	4.3	2.9	4.9
	B _{21g}	6-8		1.6	4.1	3.2	5.8
	B _{22g}	8-18		1.2	4.0	3.0	5.7
	B _{23g}	18-40		1.3	3.6	2.7	5.8
	C ₁	40+		1.7	3.8	3.0	5.9
Latty clay, PD-38 Location: NE¼NE¼ sec. 7, T. 2 N., R. 2 E., Paulding Township.	A _p	0-8					
	B _{21g}	8-18					
	B _{22g}	18-40					
	C ₁	40+					
Millgrove loam, PD-61 Location: NW¼NE¼ sec. 12, T. 3 N., R. 2 E., Crane Township.	A _{1p}	0-8					
	A ₁₂	8-14					
	B ₂₁	14-24					
	B ₂₂	24-35					
	D	35+					
Paulding clay, PD-10 Location: SE¼SE¼ sec. 21, T. 3 N., R. 3 E., Emerald Township.	A ₁	0-4		.6	1.8	.7	.1
	B ₂₁	4-8		.3	1.8	1.2	.4
	B _{22g}	8-16		.6	1.9	1.0	1.0
	B _{23g}	16-23		.6	1.9	.9	.9
	B _{24g}	23-28		.4	1.8	.8	.9
	C ₁	1 38		1.0	2.2	.9	.9
	C ₂	1 84		.1	.3	.2	.3
Paulding clay, PD-39 Location: NW¼SE¼ sec. 7, T. 2 N., R. 2 E., Paulding Township.	A _p	0-7					
	B _{21g}	7-12					
	B _{22g}	12-22					
	B _{22g}	22-31					
	B _{23g}	31-38					
	C ₁	1 38					
Paulding clay, PD-49 Location: Center of sec. 11, R. 4 E., T. 1 N., Washington Township.	A _p	0-6		1.0	1.3	1.0	1.5
	B ₂₁	6-11		.2	1.0	.7	1.1
	B ₂₂	11-44		.1	.9	.8	1.1
	C ₁	44		.9	1.5	.9	1.0

See footnotes at end of table.

pH, organic matter, and carbonates of several soil profiles—Continued

in millimeters				Textural class	Bulk density	Carbonates (CaCO ₃ equivalent)	pH	Organic matter
Total sand (2.0-0.05)	Silt (0.05-0.002)	Clay <(0.002)	Fine clay <(0.0002)					
Percent	Percent	Percent	Percent			Percent		Percent
15.2	40.5	44.3		Silty clay			7.2	5.1
13.5	38.2	48.3		Clay			7.2	
13.2	35.9	50.9		Clay			7.3	
13.5	37.8	48.7		Clay		4.3	7.6	
16.6	42.3	41.1		Silty clay			6.5	5.5
15.5	39.0	45.5		Clay			7.0	
15.6	38.7	45.7		Clay			7.2	
16.3	36.6	47.1		Clay		4.0	7.6	
13.6	40.4	46.0	19.8	Silty clay			6.8	6.2
13.0	35.6	51.4	21.7	Clay			7.1	2.3
12.1	36.1	51.8	22.3	Clay			7.2	2.3
13.2	37.0	49.8	21.2	Clay			7.5	2.2
12.9	37.3	49.8	20.5	Clay		5.0	7.7	
12.7	38.6	48.7		Clay			6.6	5.2
10.9	31.3	57.8		Clay			7.1	1.9
10.8	30.4	58.8		Clay			7.4	
11.2	28.0	60.8		Clay		2.1	7.6	
14.2	37.8	48.0	16.3	Clay			7.2	6.1
13.3	37.1	49.6	14.7	Clay			7.2	6.2
14.7	33.8	51.5	19.1	Clay			7.1	3.5
13.9	33.1	53.0	21.1	Clay			7.1	2.3
13.4	34.0	52.6	21.1	Clay			7.4	
14.4	35.2	50.4	18.1	Clay		4.4	7.7	
13.5	37.4	49.1		Clay			6.4	5.6
14.4	32.3	53.3		Clay			6.9	2.3
14.5	33.8	51.7		Clay			7.4	
16.9	42.0	41.1		Silty clay		10.8	7.8	
53.2	33.2	13.6		Sandy loam ⁴			5.8	3.9
52.7	32.7	14.6		Sandy loam ⁴			6.3	2.9
50.6	27.2	22.2		Sandy clay loam			6.8	
57.9	21.5	20.6		Sandy clay loam			7.0	
74.0	15.4	10.6		Sandy loam		3.0	7.2	
3.2	40.3	56.5	23.2	Silty clay			6.9	7.0
3.7	31.5	64.8	27.4	Clay			6.2	3.5
4.5	27.4	68.1	25.8	Clay			6.2	3.0
4.3	26.8	68.9	28.2	Clay			6.8	1.7
3.9	27.0	69.1	28.3	Clay			7.0	
5.0	30.1	64.9	25.1	Clay		6.1	7.8	
.9	27.1	72.0	21.6	Clay		20.6	7.9	
11.6	29.5	58.9		Clay			6.5	5.2
11.3	25.0	63.7		Clay			6.7	3.2
9.6	23.0	67.4		Clay			7.3	1.7
10.8	24.5	64.7		Clay			7.4	
11.5	25.1	63.4		Clay		1.8	7.6	
11.6	26.6	61.8		Clay		6.6	7.8	
4.7	23.7	71.6		Clay		17.1		
4.8	28.0	67.2	21.3	Clay			5.8	7.0
3.0	22.7	74.3	29.6	Clay			6.5	3.5
2.9	22.8	74.3	33.9	Clay			7.2	2.6
4.3	23.5	72.2	30.6	Clay		4.7	7.8	2.1

TABLE 10.—Data on particle size distribution, bulk density,

Soil, site number, and location	Horizon	Depth	Particle size distribution				
			Very coarse sand (2-1)	Coarse sand (1-0.5)	Medium sand (0.5-0.25)	Fine sand (0.25-0.1)	Very fine sand (0.1-0.05)
		Inches	Percent	Percent	Percent	Percent	Percent
Paulding clay, PD-S8 Location: 1 mi. west and ½ mi. north of Junction, 75 ft. east of road; SW¼NW¼ sec. 24, T. 3 N., R. 3 E., Auglaize Township.	A _p	0-6					
	B _{1g}	6-9					
	B _{21g}	9-16					
	B _{22g}	16-22					
	B _{23g}	22-30					
	B _{3g}	30-39					
	B _{3g}	39-48					
	C ₁	48-63					
	C ₂	63-80					
	C ₂	80-90					
C ₂	90-98						
Paulding clay, PD-S32 Location: 3 mi. north and ⅛ mile east of Grover Hill, 80 ft. north of road in woods. SW¼SW¼ sec. 1, T. 1 N., R. 3 E., Latty Township.	A ₁	0-4	0.7	1.0	0.7	3.3	2.3
	B _{1g}	4-9	1.5	.4	.4	1.2	2.1
	B _{2g}	9-15	.6	.3	.4	1.8	1.1
	B _{2g}	15-23	.1	.3	.4	1.9	1.3
	B _{3g}	23-33	.2	.3	.4	1.8	1.1
	B _{3g}	33-45	.2	.3	.4	1.7	.8
	C ₁	45-66	1.2	1.4	.7	2.3	1.1
	C ₂	66-76	.3	.3	.3	1.0	.6
	D	76-84	1.7	1.7	.9	4.2	3.6
	Roselms silty clay loam, PD-7 Location: NE¼NE¼ sec. 29, T. 2 N., R. 4 E., Brown Township in a wooded area.	A ₁	0-2		4.7	5.4	1.6
A ₂₁		2-5		6.8	4.9	1.5	2.1
A ₂₂		5-8		8.2	4.3	1.3	2.0
B ₁		8-11		1.4	1.9	.9	1.6
B ₂		11-18		.3	.9	.5	1.0
B ₃		18-32		.5	1.5	.7	1.2
C ₁		32+		.3	.7	.4	.8
C ₂		60+		.7	1.5	.4	.4
Roselms silty clay loam, PD-9 Location: NW¼SW¼ sec. 35, T. 3 N., R. 3 E., Emerald Township.		A ₁	0-2		4.8	9.6	3.6
	A ₂	2-3		7.9	11.4	2.7	1.7
	B ₁	3-4		.9	3.6	1.4	4.6
	B ₂₁	4-11		.7	2.5	1.3	1.0
	B ₂₂	11-18		.5	2.7	1.1	1.2
	C ₂	18+		.6	3.0	2.0	1.3
	Roselms silty clay loam, PD-42 Location: SE¼SW¼ sec. 1, T. 2 N., R. 3 E., Jackson Township.	A ₁	0-1		8.5	7.5	1.9
A ₂		1-5		7.4	8.0	1.6	1.8
B ₁		5-9		1.2	1.7	.5	.5
B ₂₁		9-18		.4	.6	.2	.3
B ₂₂		18-25		1.4	4.5	1.6	1.1
C ₂		25+		.5	1.5	.5	.6
St. Clair silt loam, PD-54 Location: SE¼ sec. 3, T. 1 N., R. 1 E., Benton Township.	A _p	0-5					
	B ₁	5-6½					
	B ₂₁	6½-10					
	B ₂₂	10-17					
	C ₁	17+					
Tedrow loamy fine sand, PD-44 Location: SE¼NW¼ sec. 1, T. 2 N., R. 4 E., Brown Township.	A _p	0-10					
	A ₃	10-20					
	C ₁	20-34					
	C ₁	34+					
Toledo silty clay, PD-1 Location: NW¼NW¼ sec. 6, T. 2 N., R. 5 E., in Putnam County across the road from sec. 1 of Brown Township, Paulding County.	A _{1p}	0-4		.3	1.0	.4	1.3
	A _{1p}	4-8		.1	1.5	.4	1.3
	B ₂₁	8-14		0	1.9	.9	2.2
	B _{22g}	14-20		0	1.4	.6	1.5
	B _{23g}	20-32		.3	1.4	.6	1.8
	C ₁	32		.5	2.1	.9	2.9
	D	166		0	.3	.2	.4

See footnotes at end of table.

pH, organic matter, and carbonates of several soil profiles—Continued

in millimeters				Textural class	Bulk density	Carbonates (CaCO ₃ equivalent)	pH	Organic matter
Total sand (2.0-0.05)	Silt (0.05-0.002)	Clay < (0.002)	Fine clay < (0.0002)					
Percent	Percent	Percent	Percent			Percent		Percent
4.5	31.4	64.1	18.9	Clay	1.16		6.7	5.5
3.0	27.8	69.2	29.2	Clay	1.26		6.4	3.7
2.6	25.5	71.9	30.4	Clay	1.32		6.5	
4.0	25.0	71.0	28.6	Clay	1.33		6.6	
3.2	23.2	73.6	32.1	Clay			6.9	
2.9	23.7	73.4	32.5	Clay	1.37		7.2	
2.2	22.5	75.3	32.0	Clay	1.41	1.2	7.5	
3.7	30.7	65.6	25.0	Clay	1.51	18.9	8.1	
.6	19.7	79.7	27.4	Clay		17.5	8.1	
.4	18.4	81.2	25.6	Clay		18.2	7.9	
.4	18.6	81.0	23.0	Clay		19.9	8.0	
8.0	36.7	55.3		Clay	.93		6.4	9.4
5.6	33.7	60.7	22.5	Clay			6.5	5.8
4.2	30.8	65.0	28.0	Clay	1.25		6.8	2.9
4.0	28.0	68.0	26.7	Clay	1.30		7.1	
3.8	28.0	68.2	31.1	Clay	1.38	.9	7.6	
3.4	26.9	69.7	31.8	Clay	1.45	1.9	7.6	
6.7	33.7	59.6	23.4	Clay		13.8	7.7	
2.5	24.0	73.5	24.2	Clay		15.2	7.8	
12.1	39.0	48.9	13.9	Clay		22.2	7.8	
13.7	50.9	35.4	10.2	Silty clay loam			6.3	5.1
15.3	50.4	34.3	10.1	Silty clay loam			6.1	2.5
15.8	48.6	35.6	9.5	Silty clay loam			5.3	1.4
5.8	43.1	51.1	21.2	Silty clay			5.1	
2.7	27.1	70.2	37.8	Clay			5.1	
3.9	36.9	59.2	23.5	Clay			7.0	
2.2	41.2	56.6	17.4	Silty clay		15.0	7.8	
3.0	27.6	69.4	16.2	Clay		20.0	7.6	
20.6	46.4	33.0	8.9	Clay loam			7.1	8.6
23.7	37.5	38.8	9.5	Clay loam			7.0	3.7
10.5	26.7	62.8	28.2	Clay			6.9	2.5
5.5	24.9	69.6	34.0	Clay			6.8	1.7
5.5	20.8	73.7	35.9	Clay			6.6	
6.9	28.9	64.2	20.2	Clay		20.9	7.7	
20.7	54.3	25.0	3.5	Silt loam			5.7	6.9
18.8	49.7	31.5	5.6	Silty clay loam			5.0	1.7
3.9	35.7	60.4	25.8	Clay			4.7	.8
1.5	25.4	73.1	45.2	Clay			4.7	.9
8.6	27.4	64.0	32.9	Clay			6.4	.83
3.1	31.5	65.4	23.8	Clay		17.3	7.8	
27.5	48.2	24.3		Loam			7.0	4.1
19.2	43.5	37.3		Silty clay loam			6.9	1.8
15.7	37.9	46.4		Clay			6.5	
14.6	37.8	47.6		Clay			7.3	
18.1	38.9	43.0		Clay		14.2	7.5	
80.6	13.6	5.8		Loamy fine sand				3.0
78.1	16.6	5.3		Loamy sand				.8
88.5	7.7	3.8		Sand				
93.1	5.5	1.4		Sand				
3.0	42.9	54.1	18.7	Silty clay			7.3	4.0
3.3	45.3	51.4	19.5	Silty clay			7.3	4.1
5.0	44.2	50.8	16.4	Silty clay			7.4	3.5
3.5	41.9	54.6	22.4	Silty clay			7.5	1.4
4.1	43.5	52.4	22.1	Silty clay			7.5	
6.4	48.6	45.0	18.1	Silty clay		8.5	7.5	
.9	30.9	68.2	17.3	Clay		21.3	7.6	

TABLE 10.—Data on particle size distribution, bulk density,

Soil, site number, and location	Horizon	Depth	Particle size distribution				
			Very coarse sand (2-1)	Coarse sand (1-0.5)	Medium sand (0.5-0.25)	Fine sand (0.25-0.1)	Very fine sand (0.1-0.05)
Toledo silty clay, PD-2 Location: NW¼NE¼ sec. 13, T. 2 N., R. 4 E., Brown Township.	A ₁₁	Inches 0-3	Percent	Percent	Percent	Percent	Percent
	A ₁₂	3-6	-----	0.3	0.5	0.5	1.7
	B ₂₁	6-10	-----	0	.6	.6	1.6
	B _{22g}	10-28	-----	0	.7	.6	1.7
	B _{23g}	28-36	-----	.2	.7	.6	1.8
	B _{24g}	36-54	-----	.1	.8	.8	1.9
	C ₁	54	-----	.1	1.1	.9	2.1
	D	84	-----	.6	1.9	1.1	1.9
Toledo silty clay loam, PD-51 Location: SW¼NW¼ sec. 2, T. 2 N., R. 4 E., Brown Township.	A _{1p}	0-7	-----	.1	.3	.5	.5
	B ₁	7-10	-----	-----	-----	-----	-----
	B _{21g}	10-40	-----	-----	-----	-----	-----
	B _{22g}	40-68	-----	-----	-----	-----	-----
Toledo silty clay loam, PD-S22 Location: 2 mi. south and 1 mi. east of Arthur, NW¼NW¼ sec. 6, T. 2 N., R. 5 E., in Putnam County across the road from sec. 1 of Brown Township in Paulding County.	D	68+	-----	-----	-----	-----	-----
	A _{1p}	0-8	0.1	.5	2.3	4.3	4.0
	B _{21g}	7-13	.1	.4	2.1	4.6	5.0
	B _{22g}	13-22	.1	.4	2.3	5.2	6.3
	B _{23g}	22-33	.1	.5	2.3	5.1	6.6
	B _{31g}	33-52	(⁵)	.3	1.2	2.5	3.6
	B _{32g}	52-66	(⁵)	.2	.6	1.2	1.8
Wabash silty clay loam, PD-56 ⁶ Location: NW¼NW¼ sec. 34, T. 2 N., R. 3 E., Jackson Township.	C ₁	66-70	(⁵)	.1	.3	.6	.7
	A _p	0-9	-----	-----	-----	-----	-----
	G ₁	9-26	-----	-----	-----	-----	-----
	G ₂	26-60	-----	-----	-----	-----	-----

¹ Sampled only at the depth indicated.² Profile of Haney silt loam, PD-52, taken from an undifferentiated soil group of Haney silt loam and loam.³ The texture of the A_p horizon of Haskins loam, PD-50, analyzed sandy clay loam.

TABLE 11.—Exchangeable cations in two Paulding soils

Soil, site number, and location	Horizon	pH	Exchangeable cations				Summary exchangeable cations	Total bases	Base saturation
			H	Ca	Mg	K			
Paulding clay, PD-49 Location: Center of sec. 11, T. 1 N., R. 4 E., Washington Township.	A _p	5.8	meq./100 gm. 10.1	meq./100 gm. 19.9	meq./100 gm. 4.9	meq./100 gm. 0.59	meq./100 gm. 35.5	meq./100 gm. 25.4	Percent 72
	B ₂₁	6.5	5.5	22.3	6.5	.49	34.8	29.3	84
	B ₂₂	7.2	3.9	22.0	6.8	.49	33.2	29.3	88
	C	7.8	-----	-----	-----	-----	-----	-----	-----
Paulding clay, PD-S32 Location: 3 mi. north and ½ mi. east of Grover Hill, 80 ft. north of road in woods, SW¼SW¼ sec. 1, T. 1 N., R. 3 E., Latty Township.	A ₁	6.4	11.4	27.3	7.5	.92	47.1	35.7	76
	B _{1g}	6.5	8.7	24.7	6.7	.80	40.9	32.2	79
	B _{2g}	6.8	6.1	24.4	6.8	.62	37.9	31.8	84
	B _{2g}	7.1	4.0	22.2	7.2	.59	34.0	30.0	88
	B _{3g}	7.6	-----	-----	-----	-----	-----	-----	-----
	C ₁	7.6	-----	-----	-----	-----	-----	-----	-----
	D	7.8	-----	-----	-----	-----	-----	-----	-----

Belmore series.—A profile of Belmore loam, site PD-53, was sampled on April 28, 1955, in Benton Township (SE¼SE¼ sec. 31, T. 1 N., R. 1 E.). The site was on a 3-percent slope on the beach ridge of glacial Lake Maumee.

For a description of this profile, see the section, Descriptions of the Soils.

Broughton series.—A profile of Broughton silty clay loam, site PD-41, was sampled April 21, 1954, in Emerald Township (SW¼SE¼ sec. 33, T. 3 N., R. 3 E.). The

pH, organic matter, and carbonates of several soil profiles—Continued

in millimeters				Textural class	Bulk density	Carbonates (CaCO ₃ equivalent)	pH	Organic matter
Total sand (2.0-0.05)	Silt (0.05-0.002)	Clay <(0.002)	Fine clay <(0.0002)					
Percent	Percent	Percent	Percent			Percent		Percent
3.0	59.3	37.7	14.5	Silty clay loam			6.7	9.9
2.8	55.7	41.5	17.1	Silty clay			7.1	7.0
3.0	52.2	44.8	19.4	Silty clay			7.2	4.1
3.3	46.4	50.3	21.3	Silty clay			7.1	2.6
3.6	46.1	50.3	22.3	Silty clay			7.2	
4.2	47.0	48.8	21.4	Silty clay			7.3	
5.5	51.5	43.0	17.3	Silty clay		5.4	7.7	
1.4	41.4	57.2	18.9	Silty clay		15.9	7.5	
17.5	45.5	37.0	10.7	Silty clay loam			6.7	5.2
18.7	41.6	39.7	15.8	Silty clay loam			6.5	
21.3	43.0	35.7	15.6	Clay loam			7.1	
7.0	45.4	47.6	17.2	Silty clay		4.5	7.7	
2.6	26.5	70.9	20.1	Clay		20.0	7.7	
11.2	50.8	38.0	11.7	Silty clay loam	1.29		7.3	4.4
12.2	49.0	38.8	16.3	Silty clay loam	1.41		7.3	1.7
14.3	46.4	39.3	18.5	Silty clay loam	1.49		7.1	
14.6	46.9	38.5	17.8	Silty clay loam	1.61		7.4	
7.6	54.2	38.2	16.1	Silty clay loam		.9	7.5	
3.8	47.8	48.4	16.8	Silty clay		4.8	7.7	
1.7	49.2	49.1	16.5	Silty clay		7.2	7.8	
9.2	51.6	39.2		Silty clay loam			7.4	2.6
6.2	42.8	51.0		Silty clay			7.3	
18.5	50.6	30.9		Silty clay loam		2.7	7.5	

⁴ The texture of the A_{1p} and A₁₂ horizons is sandy loam but is very near the sandy loam-loam boundary.

⁶ Trace.

⁶ A profile of Wabash silty clay loam, PD-56, was taken from an area of Wabash silty clay; texture is near the silty clay boundary.

site was located in open woods having a cover of bur oak, white oak, red oak, and white elm.

Profile description:

- A₀ Very thin layer of leaf duff, dead grass, and weeds.
- A₁ 0 to 2 inches, dark-gray (10YR 4/1, moist) silty clay loam; moderate, fine and medium, granular structure; friable; clear and irregular lower boundary; pH 6.9.
- A₂ 2 to 4 inches, pale-brown (10YR 6/3, moist) silty clay loam; very weak, coarse, subangular blocky structure; friable when moist, slightly sticky when wet; gradual lower boundary; pH 6.8; many roots are present and tongues of darker colors extend downward from A₁ horizon.
- B₁ 4 to 6 inches, pale-brown (10YR 6/3, moist) and yellowish-brown (10YR 5/4, moist) clay; weak, medium and coarse, angular blocky structure; very firm when moist, sticky and plastic when wet; diffuse lower boundary; pH 6.5; darker stains extend through this horizon in old root channels.
- B₂ 6 to 14 inches, yellowish-brown (10YR 5/4, moist) clay; strong, fine, angular blocky structure; extremely firm when moist, sticky and plastic when wet; clear lower boundary; pH 6.3; roots are common; occasional coatings of pale-brown (10YR 6/3) silty clay material from upper horizons have been deposited in cracks.
- C₁ 14 to 21 inches, pale-brown (10YR 6/3, moist) and yellowish-brown (10YR 5/4, moist) clay; moderate, fine and medium, angular blocky structure; peds coated with grayish brown (10YR 5/2, moist); very firm when moist, sticky and plastic when wet; diffuse lower

boundary; roots are few; calcareous lacustrine material.

C₂ 21 inches+, gray (10YR 5/1, moist) to brown (10YR 5/3, moist) clay; massive; very firm when moist, sticky and plastic when wet; calcareous lacustrine material is varved in places.

Defiance series.—A profile of Defiance silty clay loam, PD-55, was sampled on April 29, 1955, in Jackson Township (NE¹/₄NW¹/₄ sec. 34, T. 2 N., R. 3 E.). The site is in pasture and open woods on nearly level bottom land. A detailed description of this profile may be seen in the section, Descriptions of the Soils.

Digby series.—A profile of Digby loam, PD-59, was sampled in Harrison Township (SE¹/₄NW¹/₄ sec. 27, T. 2 N., R. 1 E.). The site was in a cultivated field on a 1-percent slope. A detailed description of this sample is given in the section, Descriptions of the Soils.

Fulton series.—Two profiles were sampled to represent the Fulton series, one of Fulton loam and the other of the sandy substratum phase of Fulton silt loam.

Following is a description of the profile of Fulton loam, PD-58, sampled April 27, 1955, in Brown Township (SW¹/₄SW¹/₄ sec. 10, T. 2 N., R. 4 E.). The site is a nearly level, cultivated area on the lake plain; it was in meadow at the time of sampling. A thin mantle of loamy material overlies the lacustrine clay.

Profile description:

- A_p 0 to 6 inches, grayish-brown (10YR 5/2, moist) loam; weak, fine, granular structure; friable; pH 7.0; roots are abundant.
- A₂ 6 to 7 inches, pale-brown (10YR 6/3, moist) loam with common, fine, faint mottlings of yellowish brown (10YR 5/4, moist); weak, thin, platy structure; friable; clear lower boundary; pH 6.2; horizon not sampled.
- B₁ 7 to 10 inches, pale-brown (10YR 6/3, moist) clay loam with many, medium and coarse, distinct mottles of yellowish brown (10YR 5/4 to 5/6, moist) and light gray (10YR 7/2, moist); moderate, medium, angular and subangular blocky structure; firm when moist, slightly plastic when wet; clear lower boundary; pH 5.5; roots are common.
- B₂₁ 10 to 16 inches, mottled yellowish-brown (10YR 5/6, moist) and light brownish-gray (10YR 6/2, moist) clay; ped surfaces are coated with pale brown 10YR 6/3, moist); strong, fine, angular blocky structure; firm when moist, plastic when wet; gradual lower boundary; pH 4.8; roots are common.
- B₂₂ 16 to 21 inches, mottled yellowish-brown and brown (10YR 5/4 to 5/3, moist) clay with occasional light brownish-gray (10YR 6/2, moist) coatings; strong, fine and medium, angular blocky structure; firm when moist, plastic when wet; gradual lower boundary; pH 5.0; roots are common.
- B₂₃ 21 to 30 inches, clay; peds are coated with grayish brown and brown (10YR 5/2 to 5/3, moist), ped interiors are yellowish brown (10YR 5/4, moist); moderate, fine and medium, angular blocky structure; firm when moist, plastic when wet; clear and wavy lower boundary; pH 6.1; few roots.
- C 30 inches+, mottled grayish-brown (10YR 5/2, moist) and yellowish-brown (10YR 5/4, moist) calcareous, lacustrine silty clay; weak, fine, angular blocky structure in upper 3 to 4 inches, and then massive; very firm.

A profile of Fulton silt loam, sandy substratum, PD-5, was sampled in 1953 in Brown Township (NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 17, T. 2 N., R. 4 E.).

Profile description:

- A_p 0 to 7 inches, dark grayish-brown (10YR 4/2, moist) silt loam; weak, fine, crumb structure; very friable; pH 7.8.
- A₂₁ 7 to 10 inches, brown (10YR 5/3, moist) silt loam; weak, fine, crumb structure; very friable; pH 7.4; occasional concretions.
- A₂₂ 10 to 13 inches, pale-brown (10YR 6/3, moist) silty clay loam mottled with yellowish brown (10YR 5/4, moist); moderate, thick, platy structure; friable; pH 6.3.
- B₂₁ 13 to 22 inches, brown (7.5YR 5/4, moist) silty clay with few, fine, faint, strong-brown (7.5YR 5/6, moist) and grayish-brown (10YR 5/2, moist) mottles; strong, medium and coarse, subangular and angular blocky structure; firm; pH 5.1.
- B₂₂ 22 to 40 inches, brown (7.5YR 5/4, moist) clay with pale-brown (10YR 6/3, moist) mottles; moderate, medium, prismatic structure which breaks to weak, medium, subangular blocky structure; firm; pH 5.1.
- B₃ 40 to 54 inches, light brownish-gray (10YR 6/2, moist) silty clay loam with strong-brown (7.5YR 5/6, moist) mottles; weak, fine, angular blocky structure; firm; pH 5.9.
- D₁ At 54 inches, grayish-brown and brown (10YR 5/2 to 5/3, moist) loam; massive; firm; calcareous.
- D₂ At 96 inches, sandy loam substratum; calcareous.

Haney series.—To represent the undifferentiated group of Haney silt loam and loam, a profile of Haney silt loam, PD-52, was sampled on April 28, 1955, in Benton Township (SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 31, T. 1 N., R. 1 E.). The cultivated site was on a 1- to 2-percent slope on the beach ridge of glacial Lake Maumee.

Profile description:

- A_p 0 to 7 inches, dark-brown (10YR 3/3, moist) silt loam; moderate, fine, granular structure; very friable; pH 5.6; 3 to 5 percent of horizon, by volume, is gravel.
- A₃ 7 to 10 inches, brown to dark-brown (10YR 4/3, moist) silt loam; moderate, medium and coarse, granular structure; very friable; pH 5.9.
- B₂₁ 10 to 18 inches, brown to dark-brown (10YR 4/3, moist) loam; moderate, very fine, subangular blocky structure; slightly firm; pH 5.9; about 5 percent of material, by volume, is pebbles up to $\frac{1}{4}$ inch in diameter.
- B₂₂ 18 to 35 inches, dark grayish-brown (10YR 4/2, moist) clay loam with common, medium, faint mottles of dark brown (7.5YR 3/2 to 10YR 4/3, moist); weak, fine, angular blocky structure; slightly firm when moist, slightly sticky and plastic when wet; pH 5.9; 5 to 10 percent of material, by volume, is pebbles.
- B₃ 35 to 42 inches, dark-gray (10YR 4/1, moist) gravelly clay loam with few, fine, distinct mottles of yellowish brown (10YR 5/6, moist); weak, subangular blocky structure to massive; slightly firm when moist, sticky and slightly plastic when wet; pH 6.9; 10 to 15 percent of material, by volume, is pebbles.
- C 42 to 56 inches, dark-gray (10YR 4/1, moist) sandy loam (stratified sand with silt lenses); loose; calcareous.
- D 56 inches+, gray (10YR 5/1, moist) and yellowish-brown (10YR 5/6, moist) clay glacial till; calcareous; not sampled.

Haskins series.—A profile of Haskins loam, PD-50, was sampled on May 14, 1954, in Auglaize Township (SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 29, T. 3 N., R. 4 E.). The site was in a nearly level, cultivated field. The parent material is a moderately deep, medium-textured overlay on fine-textured lacustrine clay.

Profile description:

- A_p 0 to 7 inches, very dark grayish-brown (10YR 3/2, moist) sandy clay loam; weak, fine and medium, granular structure; friable; abrupt and smooth lower boundary; field pH 6.8.
- B₁ 7 to 28 inches, strong-brown (7.5YR 5/6, moist) sandy clay loam with many, distinct, dark-gray (10YR 4/1, moist) mottles; weak, fine and medium, angular blocky structure; firm; gradual and wavy lower boundary; field pH 5.8.
- B₂ 28 to 36 inches, dark-gray (10YR 4/1, moist) clay with many yellowish-brown (10YR 5/6, moist) mottles; strong, fine and medium, angular blocky structure; ped surfaces coated with grains of sand that may have been washed from the upper horizons; very firm; diffuse and wavy lower boundary; field pH 6.8.
- D 36 inches+, yellowish-brown (10YR 5/6, moist) fine clay mottled with dark gray (10YR 4/1, moist); massive; extremely firm; calcareous.

Hoytville series.—Several profiles of the Hoytville series were sampled for laboratory analysis. Descriptions of three Hoytville clay profiles follow; all of these samples were taken in cultivated areas on a slope of less than 1 percent.

Profile of Hoytville clay, No. 5, sampled in 1952 in Benton Township (NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 20, T. 1 N., R. 1 E.):

- A_p 0 to 8 inches, very dark gray (10YR 3/1, moist) silty clay; strong, fine, angular blocky structure; firm; pH 7.2.
- B_{21x} 8 to 16 inches, dark-gray (5Y 4/1, moist) clay with many, medium to coarse, prominent, yellowish-brown (10YR 5/6, moist) mottles; strong, coarse, angular blocky structure; very firm; pH 7.2.
- B_{22x} 16 to 36 inches, olive-gray (5Y 5/2, moist) clay with many, coarse, prominent, yellowish-brown (10YR 5/6, moist) mottles; moderate, coarse, angular blocky structure; very firm; pH 7.3.
- C₁ 36 inches+, mottled light olive-gray (5Y 6/2, moist) and yellowish-brown (10YR 5/6, moist) clay till; weak, coarse, angular blocky structure; very firm; calcareous.

Profile description of Hoytville clay, No. 6, sampled in 1952 in Benton Township (SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 12, T. 1 N., R. 1 E.):

- A_D 0 to 9 inches, very dark gray (10YR 3/1, moist) silty clay; strong, medium, angular blocky structure; firm; pH 6.5.
- B_{21g} 9 to 18 inches, dark-gray (5Y 4/1, moist) clay with many, medium to coarse, yellowish-brown (10YR 5/6, moist) mottles; strong, fine and medium, angular blocky structure; very firm; pH 7.0.
- B_{22g} 18 to 42 inches, gray (5Y 5/1, moist) clay with many, coarse, prominent, yellowish-brown (10YR 5/6, moist) mottles; moderate, fine and medium, subangular blocky structure; very firm; pH 7.2; granitic and black shale pebbles and fragments are common.
- C₁ 42 inches+, mottled gray (5Y 5/1, moist) and brown (7.5YR 5/4, moist) clay glacial till; massive; firm; calcareous, with lime concretions.

Profile description of Hoytville clay, PD-47, sampled in a cornfield on June 10, 1954, in Harrison Township (NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 20, T. 2 N., R. 1 E.):

- A_D 0 to 8 inches, very dark grayish-brown (10YR 3/2, moist) silty clay; fine to medium, granular structure; firm when moist, slightly sticky when wet; abrupt lower boundary; pH 6.8; roots are abundant.
- B_{21g} 8 to 15 inches, dark-gray (10YR 4/1, moist) clay with many, fine, prominent, strong-brown (7.5YR 5/6, moist) mottles; strong, fine, subangular blocky structure; very firm when moist, slightly sticky when wet; gradual lower boundary; pH 7.1; roots are common.
- B_{22g} 15 to 30 inches, dark-gray (10YR 4/1, moist) clay with many, fine, distinct, dark yellowish-brown and brown (10YR 4/4 to 4/3, moist) mottles; strong, medium, subangular blocky structure; very firm when moist, slightly sticky when wet; gradual lower boundary; pH 7.2; roots are common.
- B_{23g} 30 to 36 inches, gray (5Y 5/1, moist) clay with many, coarse, prominent, dark yellowish-brown (10YR 4/4, moist) mottles; moderate, medium, subangular blocky structure; very firm when moist, slightly sticky when wet; pH 7.5; roots are common.
- C₁ 36 inches+, grayish-brown (2.5Y 5/2, moist) and dark yellowish brown (10YR 4/4, moist) clay of glacial till origin; weak, coarse, prismatic structure in upper few inches and then massive; firm; calcareous.

Latty series.—Several samples of Latty clay were taken in Paulding County, three of which are described below.

Profile description of Latty clay, No. 10, sampled in Jackson Township (SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 19, T. 2 N., R. 3 E.) in 1952, in a meadow on a slope of less than 1 percent:

- A_D 0 to 7 inches, dark-gray (10YR 4/1, moist) clay; massive; very firm; pH 6.6.
- B_{21g} 7 to 18 inches, gray (2.5Y 6/1, moist) clay with many, medium to coarse, prominent, yellowish-brown (10YR 5/6, moist) mottles; moderate, coarse, angular blocky structure; very firm; pH 7.1.
- B_{22g} 18 to 32 inches, grayish-brown (2.5Y 5/2, moist) clay with many, medium and coarse, distinct, yellowish-brown (10YR 5/6, moist) mottles; weak, coarse, prismatic structure that breaks readily into strong, coarse, angular blocky structure; very firm when moist, plastic and sticky when wet; pH 7.4.
- C₁ 32 inches+, light olive gray (5Y 6/2, moist) clay with common, medium, distinct, yellowish-brown (10YR 5/4, moist) mottles; massive; firm when moist, plastic and sticky when wet; pH 7.6; calcareous.

Profile description of Latty clay, PD-36, sampled in Latty Township (SW $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 33, T. 1 N., R. 3 E.) on August 20, 1953; the site was in a very poor meadow on a slope of less than 1 percent:

- A_{D1} 0 to 2 inches, dark-gray (10YR 4/1, moist) clay; strong, coarse, granular structure; firm; clear lower boundary; pH 7.2.

- A_{D2} 2 to 6 inches, dark-gray (10YR 4/1, moist) clay; strong, medium to coarse, angular blocky structure; very firm; clear lower boundary; pH 7.2.
- B_{21g} 6 to 8 inches, gray (10YR 5/1, moist) clay with yellowish-brown (10YR 5/6, moist) and olive-brown (2.5Y 4/4, moist) mottles; strong, coarse, angular blocky structure; extremely firm; gradual lower boundary; pH 7.1; roots are common.
- B_{22g} 8 to 18 inches, gray (5Y 5/1, moist) clay with yellowish-brown (10YR 5/6, moist) and dark yellowish-brown (10YR 4/4, moist) mottles; strong, fine and medium, angular blocky structure; extremely firm; diffuse lower boundary; pH 7.1; roots are common.
- B_{23g} 18 to 40 inches, grayish-brown (10YR 5/2, moist) clay with yellowish-brown (10YR 5/6, moist) mottles; weak, coarse, prismatic structure that breaks readily into moderate, coarse, angular blocky structure; extremely firm; pH 7.4; few roots.
- C₁ 40 inches+, grayish-brown (10YR 5/2, moist) clay glacial till with yellowish-brown and dark-brown (10YR 5/6 to 4/3) mottles; firm; calcareous; contains shale and granite fragments.

Profile description of Latty clay, PD-38, sampled April 14, 1954, in Paulding Township (NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 7, T. 2 N., R. 2 E.) in a fall-plowed field:

- A_D 0 to 8 inches, dark-gray (10YR 4/1, moist) clay; moderate, fine and very fine, subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; pH 6.4.
- B_{21g} 8 to 18 inches, gray (5Y 6/1, moist) and olive-gray (5Y 5/2, moist) clay with many, medium, prominent, yellowish-brown (10YR 5/6, moist) mottles; strong, fine, angular blocky structure; very firm when moist, plastic and slightly sticky when wet; diffuse lower boundary; pH 6.9.
- B_{22g} 18 to 40 inches, gray (5Y 6/1, moist) and yellowish-brown (10YR 5/6, moist) clay; moderate, fine and medium, angular blocky structure; very firm when moist, plastic and sticky when wet; pH 7.4.
- C 40 inches+, gray (5Y 6/1, moist) and yellowish-brown (10YR 5/6, moist) clay; massive; very firm when moist, slightly sticky and plastic when wet; calcareous.

Millgrove series.—A profile of Millgrove loam, PD-61, was sampled on April 27, 1955, in Crane Township (NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 12, T. 3 N., R. 2 E.). The profile was in a cultivated field on a terrace along the Maumee River.

Profile description:

- A_{1D} 0 to 8 inches, very dark gray (10YR 3/1, moist) loam; weak, fine, granular structure; very friable; pH 5.8.
- A₁₂ 8 to 14 inches, very dark gray (10YR 3/1, moist) loam; weak, medium, angular and subangular blocky structure; very friable; pH 6.3.
- B₂₁ 14 to 24 inches, dark-gray (10YR 4/1, moist) sandy clay loam with common, fine, faint, grayish-brown (10YR 5/2, moist) mottles; moderate, coarse prismatic and coarse angular blocky structure; friable; pH 6.8.
- B₂₂ 24 to 35 inches, mottled dark grayish-brown (10YR 4/2, moist) and light olive-brown (2.5Y 5/4, moist) sandy clay loam; weak, medium and coarse, angular and subangular blocky structure; moderately firm; slightly sticky and plastic; pH 7.0.
- D 35 inches+, grayish-brown (10YR 5/2, moist) sandy loam; loose consistence; single-grain structure; very friable; weakly calcareous.

Paulding series.—Fourteen profiles of the Paulding series were sampled in the county, five of which are described in detail below. All of the samples described were developed from lacustrine clay parent material in level or nearly level areas on the lake plain.

Profile description of Paulding clay, PD-10, sampled on July 29, 1953, in Emerald Township (SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 21, T.

3 N., R. 3 E.) in an open forest made up largely of pin oak, bur oak, swamp white oak, hickory, and elm:

- A₁ 0 to 4 inches, very dark gray (10YR 3/1, moist) silty clay; strong, coarse, granular structure; very firm; gradual lower boundary; pH 6.9; roots are abundant.
- B₂₁ 4 to 8 inches, dark-gray (10YR 4/1, moist) clay with many, fine, distinct, dark yellowish-brown (10YR 4/4, moist) mottles; weak, prismatic structure in place, which breaks into strong, fine to coarse, angular blocky structure; clear lower boundary; pH 6.2; roots are abundant.
- B_{22k} 8 to 16 inches, dark-gray (2.5Y 4/1, moist) clay with many, fine, distinct, yellowish-brown and dark yellowish-brown (10YR 5/6 to 4/4, moist) mottles; very strong, angular blocky structure; extremely firm; gradual lower boundary; pH 6.2; roots are abundant.
- B_{23k} 16 to 23 inches, gray (5Y 5/1, moist) clay with many, fine to coarse, distinct, yellowish-brown (10YR 5/4 to 5/8, moist) mottles; moderate, coarse, angular blocky structure; extremely firm; gradual lower boundary; pH 6.9; roots are common; vertical cracks extend from the horizon above to the bottom of this horizon.
- B_{24k} 23 to 38 inches, gray (5Y 5/1, moist) clay with many, fine, faint to distinct, olive-brown (2.5Y 4/4, moist) mottles; very weak, fine, angular blocky structure; occasional strong, coarse, subangular blocky units; very firm; pH 7.0; roots are few.
- C₁ At 38 inches, gray, grayish-brown, and yellowish-brown (2.5Y 5/1 to 5/2, 10YR 5/6, moist) lacustrine clay; massive; very firm; pH 7.8; calcareous; practically no roots.
- C₂ At 84 inches, gray and yellowish-brown lacustrine clay; calcareous.

Profile of Paulding clay, PD-39, sampled on April 15, 1954, in a meadow in Paulding Township (NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 7, T. 2 N., R. 2 E.).

Profile description:

- A_p 0 to 7 inches, dark grayish-brown (2.5Y 4/2, moist) clay; moderate, medium and coarse, angular blocky structure; firm when moist, sticky and plastic when wet; pH 6.5.
- B_{21k} 7 to 12 inches, dark-gray (5Y 4/1, moist) clay with common, fine, distinct, dark-brown (7.5YR 4/4, moist) mottles; strong, fine and medium, angular blocky structure; very firm when moist, sticky and plastic when wet; pH 6.7.
- B_{22k} 12 to 31 inches, gray (5Y 6/1, moist) clay with many, fine and medium, distinct, yellowish-brown (10YR 5/6, moist) and light olive-brown (2.5Y 5/4, moist) mottles; moderate, fine, angular blocky structure; very firm when moist, sticky and plastic when wet; pH 7.3. Sampled at depths of 12 to 22 inches and 22 to 31 inches.
- B_{23k} 31 to 38 inches, gray (5Y 6/1, moist) and yellowish-brown (10YR 5/6, moist) clay; weak, fine, angular blocky structure; very firm when moist, sticky and plastic when wet; pH 7.6.
- C₁ At 38 inches, gray (5Y 6/1, moist) and yellowish-brown (10YR 5/6, moist) lacustrine clay; massive; firm when moist, sticky and plastic when wet; pH 7.8; calcareous.
- C₂ At 58 inches, similar to horizon above.

Profile of Paulding clay, PD-49, sampled on June 13, 1954, in a very poorly drained meadow at an elevation near 720 feet in Washington Township (center of sec. 11, R. 4 E., T. 1 N.).

Profile description:

- A_p 0 to 6 inches, dark-gray (10YR 4/1, moist) clay with fine to medium, subangular blocky structure; dry color (2.5Y 6/2 to 5/2).
- B₂₁ 6 to 11 inches, very dark-gray (10YR 3/1, moist) clay, commonly mottled with fine, distinct, dark yellowish-

brown (10YR 4/4, moist) spots; prismatic structure in place, with moderate, coarse, blocky peds; dry color (2.5Y 6/2).

- B₂₂ 11 to 44 inches, yellowish-brown (10YR 5/4, moist) clay with many, fine, distinct, light yellowish-brown to dark yellowish-brown (10YR 6/4 to 4/4, moist) mottles; weak structure, with fine to medium blocky peds; dry color (2.5Y 6/2).
- C 44 inches+, light brownish-gray, calcareous clay (2.5Y 6/2, moist; 5Y 6/3, dry).

A profile of Paulding clay, PD-S8, was sampled on May 25, 1955, a mile west and one-half mile north of Junction, 75 feet east of the road in Auglaize Township (SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 24, T. 3 N., R. 3 E.). The site was at an elevation of 717 feet. It was cultivated and had been in soybeans the previous year. Drainage was very poor, and the soil was moist throughout.

Profile description:

- A_p 0 to 6 inches, dark grayish-brown (2.5Y 4/2, moist) clay; massive to weakly developed, coarse, granular structure, becomes more massive in lower 4 inches; sticky and moderately plastic when wet, extremely hard when dry; clear lower boundary; slightly acid; dry color: gray (N 6/0 to 5/0).
- B_{1k} 6 to 9 inches, gray (N 5/0 to 4/0, moist) clay with many, distinct, fine, yellowish-brown (10YR 5/8 to 6/8, moist) mottles; massive to very weak, fine, angular blocky structure; firm when moist, plastic and sticky when wet, extremely hard when dry; gradual lower boundary; slightly acid; few roots; dry color: gray (N 5/0) and yellowish brown (10YR 5/6).
- B_{21k} 9 to 22 inches, gray (N 5/0 to 4/0, moist) clay with common, large, distinct, yellowish-brown (10YR 5/8 to 6/8, moist) mottles; strong, medium, angular blocky structure; firm when moist, sticky and plastic when wet, extremely hard when dry; gradual lower boundary; slightly acid; samples taken at 9 to 16 inches and 16 to 22 inches; dry color: gray (N 6/0 to 5/0) and yellowish brown (10YR 5/6).
- B_{22k} 22 to 30 inches, gray (N 5/0, moist) clay with many, fine, distinct, yellowish-brown (10YR 5/6, moist) mottles; weak, medium, angular blocky structure; moderately firm when moist, sticky and plastic when wet, extremely hard when dry; diffuse lower boundary; neutral; contains thin bands (about one-eighth inch in diameter) of black carbonaceous material that appear to be carbonized roots; dry color: gray (N 6/0) and yellowish brown (10YR 5/6).
- B_{3k} 30 to 48 inches, gray (5Y 5/1 to 6/1, moist) clay with many, fine, distinct, yellowish-brown (10YR 5/6, moist) mottles; massive; firm when moist, plastic and moderately sticky when wet, extremely hard when dry; clear and wavy lower boundary; mildly alkaline; dry color: gray (N 6/0 to 5/0) and yellowish brown (10YR 5/6); samples taken at 30 to 39 inches and 39 to 48 inches.
- C₁ 48 to 63 inches, dark yellowish-brown (10YR 4/4, moist) clay distinctly mottled with gray (5Y 5/1) and with large (1 inch in diameter) light-gray (10YR 7/2, moist) splotches of calcareous material; massive; firm when moist, extremely hard when dry; calcareous; dry color: gray (N 6/0 to 7/0), olive yellow (2.5Y 6/6), and white (2.5Y 8/2).
- C₂ 63 to 80 inches, yellowish-brown (10YR 5/6, moist) clay distinctly mottled with gray (N 5/0) on vertical faces and along surfaces of laminations; no splotches of calcareous material evident; weakly laminated; firm when moist, very hard when dry; calcareous; dry color: light gray (N 6/0 to 7/0) and olive yellow (2.5Y 6/6).
- C₂ 80 to 90 inches, olive-brown (2.5Y 4/4, moist) clay with gray coatings (N 5/0) along vertical faces and horizontally along surfaces of laminations; laminated structure; calcareous; very hard when dry; dry color: light olive brown (2.5Y 5/6 to 6/6) and gray (N 6/0 to 7/0).

- C₂ 90 to 98 inches, dark yellowish-brown (10YR 4/4, moist) clay faintly mottled with gray (N 5/0) along laminations; fine laminated structure; very firm when moist, very hard when dry; calcareous; dry color: light brownish gray (2.5Y 6/2).

A profile of Paulding clay, PD-S32, was sampled on May 26, 1955, 3 miles north and 1/8 mile east of Grover Hill, 80 feet north of the road in the woods in Latty Township (SW 1/4 SW 1/4 sec. 1, T. 1 N., R. 3 E.). The site was at an elevation of 724 feet. Drainage was very poor, and the soil was moist throughout the profile. The sample was taken from a clearing about 25 feet wide that had a good cover of sedge. The vegetation was second-growth forest of elm, pin oak, swamp white oak, bur oak, ash, and hickory, and the trees were up to 8 inches in diameter.

Profile description:

- A₁ 0 to 4 inches, very dark gray (10YR 3/1, moist) clay; granular; firm when moist, slightly sticky and moderately plastic when wet, hard when dry; clear lower boundary; slightly acid; roots are abundant; dry color: gray (N 5/0 to 10YR 5/1).
- B_{1g} 4 to 9 inches, dark-gray (5Y 4/1, moist) clay with many, distinct, fine, yellowish-brown (10YR 5/6, moist) and light olive-brown (2.5Y 5/6, moist) mottles; moderate, fine, angular blocky structure; firm when moist, plastic and moderately sticky when wet, very hard when dry; gradual lower boundary; slightly acid; roots are common; dry color: gray (N 6/0), light yellowish brown (10YR 6/4), and yellowish brown (10YR 5/8).
- B_{2g} 9 to 23 inches, gray (5Y 5/1 or 2.5Y 5/1, moist) with many, large, distinct, yellowish-brown (10YR 5/6, moist) and brownish-yellow (10YR 6/6, moist) mottles; moderate to strong, medium, angular blocky structure; very firm when moist, sticky and plastic when wet, very hard when dry; neutral; roots are common; dry color: light gray (2.5Y 7/1 or 5Y 7/1) and yellowish brown (10YR 5/6); bulk density samples taken at 9 to 12 and 16 to 19 inches.
- B_{3g} 23 to 45 inches, gray (2.5Y 5/1 or N 5/0, moist) clay with common, large, distinct, yellowish-brown (10YR 5/6, moist) mottles; massive but breaks into weak, fine and medium, angular blocky units; very firm when moist, sticky and plastic when wet, very hard when dry; clear and wavy lower boundary; mildly alkaline; some roots present; dry color: light gray (N 7/0), light yellowish brown (2.5Y 6/4), and yellowish brown (10YR 5/6); bulk density samples taken at 27 to 30 inches and 36 to 39 inches.
- C₁ 45 to 66 inches, gray (N 5/0) clay with distinct, yellowish-brown (10YR 5/4, moist) and light yellowish brown (10YR 6/4, moist) ped interiors, and white (10YR 8/2, moist) calcareous splotches; the gray is most common along the faces of vertical cracks; very weak, fine to coarse, angular and subangular blocky structure; very firm when moist, sticky and plastic when wet, extremely hard when dry; calcareous; few roots are evident; dry color: light gray (5Y 7/1), yellowish brown (10YR 5/4), and white (N 8/0).
- C₂ 66 to 76 inches, yellowish-brown (10YR 5/6 to 5/4, moist) clay faintly mottled with gray (10YR 5/1, moist); weakly laminated structure; sticky and plastic when wet, very hard when dry; calcareous; dry color: pale brown (10YR 6/3), light gray (5Y 7/1), and white (N 8/0).
- D 76 to 84 inches, dark-brown (10YR 4/3, moist) clay till faintly mottled with gray (N 5/0); sticky and slightly plastic when wet, hard when dry; calcareous; dry color: pale brown (10YR 6/3 to 5/3) and light gray (N 7/0).

Structure becomes weak to very weak below 23 inches; mottling is distinct to 66 inches, and then decreases.

Below 66 inches the gray mottling occurs mainly as coatings or stains on the vertical faces of cracks or partings.

Roselms series.—Three profiles to represent the Roselms series were sampled in Paulding County. All of the samples analyzed were Roselms silty clay loam.

One profile, PD-7, was sampled on July 1, 1953, in a wooded area in Brown Township (NE 1/4 NE 1/4 sec. 29, T. 2 N., R. 4 E.).

Profile description:

- A₀ 1/4 to 0 inch, thin layer of duff.
- A₁ 0 to 2 inches, grayish-brown (2.5Y 5/2, moist) silty clay loam; moderate, coarse, granular structure; friable; gradual and wavy lower boundary; pH 6.3; roots are abundant; streaks of organic stain extend from the A₁ into the A₂ horizon.
- A₂₁ 2 to 5 inches, light brownish-gray (2.5Y 6/2, moist) silty clay loam with common, fine, distinct, dark-brown (7.5YR 4/4, moist) mottles; weak, thick, platy structure; firm; gradual lower boundary; pH 6.1; roots are common.
- A₂₂ 5 to 8 inches, pale-yellow (5Y 7/3, moist) silty clay loam with many, coarse, prominent, yellowish-brown (10YR 5/4, moist) mottles; weak, thick, platy structure; gradual lower boundary; pH 5.3; roots are common.¹⁰
- B₁ 8 to 11 inches, pale-yellow (5Y 7/3, moist) silty clay with many, medium, prominent, yellowish-brown (10YR 5/6, moist) mottles; strong, fine, angular blocky structure; very firm; clear lower boundary; pH 5.1; roots are common.
- B₂ 11 to 18 inches, clay mottled with light brownish gray (2.5Y 6/2, moist), brownish yellow, and yellowish brown (10YR 6/6 to 5/6, moist); weak, medium and coarse, prismatic structure that breaks to weak, fine, angular blocky structure; very firm when moist, plastic when wet; gradual lower boundary; pH 5.1; roots are common.
- B₃ 18 to 32 inches, clay mottled with pale brown (10YR 6/3, moist) and yellowish brown (10YR 5/6, moist); massive; extremely firm; plastic; gradual lower boundary; pH 7.0.
- C₁ 32 inches+, dark-brown (10YR 4/3, moist) clay with grayish-brown (10YR 5/2, moist) coatings; moderate, fine to coarse, angular blocky structure; very firm; pH 7.8; calcareous; no roots are present.
- C₂ 60 inches, calcareous lacustrine clay; pH 7.6.

Another profile, PD-9, was sampled in 1953 in a sodded road cut in Emerald Township (NW 1/4 SW 1/4 sec. 35, T. 3 N., R. 3 E.).

Profile description:

- A₁ 0 to 2 inches, dark-gray (10YR 4/1, moist) clay loam; strong, medium and coarse, granular structure; friable; clear lower boundary; pH 7.1; roots are abundant.
- A₂ 2 to 3 inches, gray (5Y 5/1, moist) and light olive-gray (5Y 6/2, moist) clay loam with common, fine, prominent yellowish-brown (10YR 5/6, moist) mottles; weak, coarse, granular structure; friable; clear lower boundary, pH 7.0.
- B₁ 3 to 4 inches, light brownish-gray (2.5Y 6/2, moist) and pale-brown (10YR 6/3, moist) clay with many, distinct, brown (10YR 5/3, moist) and yellowish-brown (10YR 5/6, moist) mottles; weak, coarse, subangular blocky structure, almost massive; very firm; gradual lower boundary; pH 6.9.
- B₂₁ 4 to 11 inches, brown (10YR 5/3, moist) clay with many, fine, distinct, yellowish-brown (10YR 5/6, moist) mottles; massive except for vertical cracks that extend to about 20 inches in depth; extremely firm; gradual lower boundary; pH 6.8.

¹⁰ On the opposite side of a 3-foot pit only half an inch of A₂ and an inch of B₁ horizons were present. Remnants of the B₁ and B₂ horizons remained within 4 inches of the surface.

- B₂₂ 11 to 18 inches, dark grayish-brown (10YR 4/2, moist) clay with few, fine, faint, dark yellowish-brown (10YR 4/4, moist) mottles; massive; extremely firm; pH 6.6.
- C₂ 18 inches+, grayish-brown (10YR 5/2, moist) lacustrine clay with few, fine, faint, dark yellowish-brown (10YR 4/4, moist) mottles; massive; extremely firm; calcareous; pH 7.7.

A third profile, PD-42, was sampled on April 21, 1954, in Jackson Township (SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 1, T. 2 N., R. 3 E.). This site had a slope of less than 1 percent and was in a wooded area that had a native cover of white oak, pin oak, and hickory.

Profile description:

- A₁ 0 to 1 inch, grayish-brown (10YR 5/2, moist) silt loam; weak, fine, granular structure; friable; clear lower boundary; pH 5.7.
- A₂ 1 to 5 inches, light-gray (10YR 7/2, moist) silty clay loam with a few, fine, faint, olive-yellow (2.5Y 6/6, moist) mottles; very weak, thick, platy structure; moderately friable when moist; sticky when wet; clear and wavy lower boundary; pH 5.0.
- B₁ 5 to 9 inches, light-gray (10YR 7/1, moist) and yellowish-brown (10YR 5/6, moist) clay; weak, fine, angular blocky structure; sticky and very plastic when wet; gradual lower boundary; pH 4.7.
- B₂₁ 9 to 18 inches, yellowish-brown (10YR 5/4, moist) and pale-brown (10YR 6/3, moist) clay; weak, fine, angular blocky structure; sticky and very plastic when wet; gradual lower boundary; pH 4.7; few roots.
- B₂₂ 18 to 25 inches, brown (10YR 5/3, moist) clay with few, fine, faint, brownish-yellow (10YR 6/6, moist) mottles; massive; sticky and very plastic; pH 6.4; practically no roots.
- C₂ 25 inches+, light brownish-gray (10YR 6/2, moist) clay; massive; calcareous lacustrine material; no roots.

St. Clair series.—One profile was selected to represent the St. Clair series. That was a silt loam in Benton Township (SE $\frac{1}{4}$ of sec. 3, T. 1 N., R. 1 E.). The profile was sampled in a pasture that had formerly been plowed.

Profile description:

- A_p 0 to 5 inches, dark grayish-brown (10YR 4/2, moist) silt loam; weak, medium and coarse, granular structure; friable; pH 7.0.
- B₁ 5 to 6 $\frac{1}{2}$ inches, grayish-brown (10YR 5/2, moist) silty clay loam with common, fine, distinct, yellowish-brown (10YR 5/4 to 5/6, moist) mottles; weak, fine and medium, subangular blocky structure; firm; clear lower boundary; pH 6.9; roots are common.
- B₂₁ 6 $\frac{1}{2}$ to 10 inches, pale-brown (10YR 6/3, moist) clay with many, medium, distinct, yellowish-brown (10YR 5/6) mottles; peds are thinly coated with discontinuous, pale-brown (10YR 6/3, moist) clay skins; strong, very fine to medium, angular blocky structure; very firm; gradual lower boundary; pH 6.5.
- B₂₂ 10 to 17 inches, brown (10YR 5/3, moist) clay with thin, grayish-brown (10YR 5/2, moist) clay skins on ped surfaces and many, medium, distinct, yellowish-brown (10YR 5/6, moist) mottles in interiors; moderate, fine and medium, angular blocky structure; very firm; clear lower boundary; pH 7.3.
- C 17 inches+, grayish-brown (10YR 5/2, moist) and yellowish-brown (10YR 5/6, moist) clay; ped surfaces coated with grayish brown (10YR 5/2, moist); moderate, medium and coarse, angular blocky structure in upper 4 to 6 inches; structural development decreases rapidly with depth; very firm; calcareous till contains many fragments and pebbles of black shale, granite, and limestone.

Tedrow series.—A profile of Tedrow loamy fine sand, PD-44, was sampled for laboratory analyses on May 5, 1954, in Brown Township (SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 1, T. 2 N., R. 4 E.). The horizons were described and samples were taken to a depth somewhat below 34 inches, where

a water table was encountered. The site had a slope between 1 and 2 percent.

Profile description:

- A_p 0 to 10 inches, dark-brown (10YR 3/3, moist) loamy fine sand; single-grain structure; loose consistence.
- A₃ 10 to 20 inches, yellowish-brown (10YR 5/6, moist) loamy sand with few, large, distinct, strong-brown (7.5YR 5/6, moist) mottles; single-grain structure; loose consistence; abrupt upper boundary.
- C₁ 20 to 34 inches, light yellowish-brown (10YR 6/4, moist) sand with many, large, distinct, light-gray (10YR 7/1, moist) mottles; single-grain structure; loose consistence; clear and wavy upper boundary.
- C₁ 34 inches+, white (10YR 8/1, moist) sand with few, fine, distinct pale-brown (10YR 6/3, moist) mottles; single-grain structure; loose consistence; gradual and wavy upper boundary.

A more complete profile description of Tedrow loamy fine sand was obtained near the site of profile PD-44 on July 9, 1954. By that time, the water table had lowered and the soil could be examined to a greater depth. This second description was obtained near but not exactly at the site of the profile sampled for laboratory analysis. The second description is included here, however, because it provides information on the soil to greater depth.

Profile description:

- A_p 0 to 9 inches, very dark grayish-brown (10YR 3/2, moist) loamy fine sand; single-grain structure; loose consistence; abrupt and wavy lower boundary; field pH 5.4.
- A₃₁ 9 to 17 inches, light olive-brown (2.5Y 5/4, moist) and yellowish-brown (10YR 5/6, moist) loamy sand with few, fine and medium, distinct, yellowish-red (5YR 5/8, moist) mottles; single-grain structure; loose; slightly coherent in place; clear and wavy lower boundary; occasional soft iron concretions; field pH 5.6.
- A₃₂ 17 to 20 inches, light-gray (10YR 7/1, moist) sandy clay loam with common, fine and medium, strong brown (7.5YR 5/6, moist) and reddish-yellow (7.5YR 6/8 moist) mottles; weak, medium subangular blocky structure; firm when moist, slightly sticky when wet; clayey lenses occur very erratically and are not continuous; clear and wavy lower boundary; field pH 5.6.
- C₁ 20 to 38 inches, light-gray (10YR 7/1 to 7/2, moist) sand with many, coarse, prominent, yellowish-red (5YR 5/8, moist) and light yellowish-brown (10YR 6/4, moist) mottles; single-grain structure; loose; slightly coherent in place; gradual and wavy lower boundary; field pH 5.4.
- C₁ 38 to 62 inches, pale-brown (10YR 6/3, moist) sand with few, fine, faint, brown (10YR 5/3, moist) mottles; single-grain structure; somewhat compact in place, but loose once disturbed; field pH 7.4.
- C₂ 62 inches+, light brownish-gray (10YR 6/2, moist) sand; single-grain structure; loose; calcareous; consists largely of quartz sand; the sand extends to about 6 or 7 feet, where it is underlain by calcareous clay.

Toledo series.—Four profiles of the Toledo series were sampled, two of Toledo silty clay, and two of Toledo silty clay loam.

The first profile was sampled in Putnam County (NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 6, T. 2 N., R. 5 E.) on June 5, 1953, at a site across the road from sec. 1 of Brown Township in Paulding County.

Profile description of Toledo silty clay, PD-1:

- A_{1p} 0 to 4 inches, very dark gray (2.5Y 3/1, moist) silty clay; very strong, fine, angular blocky structure; very firm; pH 7.3.

- A_{1p} 4 to 8 inches, very dark gray (2.5Y 3/1, moist) silty clay; strong, medium and coarse, angular blocky structure; very firm; pH 7.3.
- B₂₁ 8 to 14 inches, dark-gray (5Y 4/1, moist) silty clay with many, fine and medium, prominent, yellowish-brown (10YR 5/6, moist) mottles; very strong, fine and medium, angular blocky structure; very firm; pH 7.4.
- B_{22g} 14 to 20 inches, gray (5Y 5/1, moist) silty clay with many, coarse, prominent, yellowish-brown (10YR 5/6 and 5/8, moist) mottles; strong, fine and medium, angular blocky structure; very firm; pH 7.5.
- B_{23g} 20 to 32 inches, gray (5Y 5/1, moist) silty clay with many, coarse, prominent, yellowish-brown (10YR 5/6, moist) mottles; strong, fine, angular blocky structure; firm; pH 7.5.
- C₁ At 32 inches, lacustrine silty clay, colored gray (5Y 5/1, moist) and yellowish brown (10YR 5/6, moist); moderate, fine and medium, subangular blocky structure; firm; contains lime concretions between 36 and 60 inches.
- D At 66 inches, clay of lacustrine origin; calcareous.

A profile of Toledo silty clay, PD-2, was sampled in 1953 in Brown Township (NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 2 N. R. 4 E.). The site was in an open forest on a slope of less than 1 percent.

Profile description:

- A₁₁ 0 to 3 inches, very dark gray (10YR 3/1, moist) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; pH 6.7.
- A₁₂ 3 to 6 inches, very dark gray (10YR 3/1, moist) silty clay with few, fine, faint, olive (5Y 5/3, moist) mottles; strong, medium, subangular blocky structure; firm; pH 7.1.
- B₂₁ 6 to 10 inches, dark-gray and gray (5Y 4/1 and 5/1, moist) silty clay with common, fine, faint, yellowish-brown (10YR 5/4, moist) mottles; strong, fine, angular blocky structure; firm; pH 7.2.
- B_{22g} 10 to 28 inches, gray (N 5/0, moist) silty clay with many, medium, prominent, yellowish-brown and brownish-yellow (10YR 5/4 to 6/8, moist) mottles; very strong, medium and coarse, angular blocky structure; very firm; pH 7.1.
- B_{23g} 28 to 36 inches, gray (5Y 6/1, moist) silty clay with common, large, distinct, yellowish-brown (10YR 5/6, moist) mottles; moderate, medium, prismatic structure that breaks to strong, coarse, angular blocky structure; very firm; pH 7.2.
- B_{24g} 36 to 54 inches, gray (5Y 6/1, moist) and yellowish-brown (10YR 5/6, moist) silty clay; weak, medium, angular blocky structure; firm; pH 7.3.
- C₁ At 54 inches, gray and yellowish-brown silty clay; massive; firm; calcareous lacustrine material.
- D At 84 inches there is calcareous lacustrine silty clay that is somewhat finer than the material above, but similar in other respects.

A profile of Toledo silty clay loam, PD-51, was sampled on May 12, 1954, in Brown Township (SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 2, T. 2 N., R. 4 E.). The nearly level site was in a cultivated field on the lake plain.

Profile description:

- A_{1p} 0 to 7 inches, very dark gray (10YR 3/1, moist) silty clay loam; moderate, medium, granular structure; moderately friable; field pH 6.8.
- A₁₂ 7 to 8 inches, very dark gray (10YR 3/1, moist) silty clay loam; moderate, fine and medium, angular blocky structure; firm; field pH 6.8; (not sampled).
- B₁ 8 to 10 inches, dark-gray (10YR 4/1, moist) and grayish-brown (10YR 5/2, moist) silty clay loam with common, fine, distinct, yellowish-brown (10YR 5/6 to 6/8, moist) mottles; moderate, fine, angular blocky structure; very firm; field pH 6.6.
- B_{21g} 10 to 40 inches, dark-gray (5Y 4/1, moist) clay loam with common, fine, distinct, light-gray (5Y 6/1, moist) and yellowish-brown (10YR 5/6, moist) mottles; strong, fine, angular blocky structure; very firm; field pH 7.2.

- B_{22g} 40 to 68 inches, mottled gray (10YR 5/1, moist), olive-gray (5Y 4/2, moist), and yellowish-brown (10YR 5/6, moist) silty clay with occasional thin lenses of silty clay loam; moderate, fine and medium, angular blocky structure; very firm; pH 7.4.
- D 68 inches+, mottled gray (10YR 5/1, moist) and yellowish-brown (10YR 5/6, moist) calcareous clay; massive material of lacustrine origin; very firm.

A profile of Toledo silty clay loam, PD-S22, was sampled on June 26, 1955, 2 miles south and 1 mile east of Arthur in Putnam County (NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 6, T. 2 N., R. 5 E.) across the road from sec. 1 of Brown Township in Paulding County. The site was nearly level and at an elevation of 720 feet on the lake plain where the drainage was very poor. It was in freshly broken sod planted to alfalfa.

This Humic Gley soil was distinctly mottled with yellowish brown to a depth of 66 inches; dark yellowish-brown mottling became more prominent below 52 inches and was dominant below 66 inches. This mottling is more noticeable than in Paulding clay.

Profile description:

- A_p 0 to 8 inches, very dark grayish-brown (2.5Y 3/2, moist) silty clay loam; moderate, medium, granular structure in upper 5 inches; weak, coarse, granular to massive in lower 3 inches; moderately firm, hard when dry; clear lower boundary; dark grayish brown (2.5Y 4/2 to 5/2) when dry.
- B_{21g} 8 to 13 inches, gray (N 5/0 to 4/0, moist) silty clay loam distinctly mottled with many, medium, yellowish-brown (10YR 5/6, moist), and strong-brown (7.5YR 5/6, moist) mottles; moderate, fine, angular blocky structure; very firm in place; moderately plastic and slightly sticky when wet, very hard when dry; roots are common; gray (N 5/0) and yellowish brown (10YR 5/6) when dry.
- B_{22g} 13 to 22 inches, gray (N 5/0 or 10YR 5/1, moist) silty clay loam distinctly mottled with common, medium to large, yellowish-brown (10YR 5/8, moist) mottles; moderate, fine to medium, angular blocky structure; firm when moist, moderately plastic and slightly sticky when wet, very hard when dry; diffuse lower boundary; light gray (N 7/0 to 6/0) and yellowish brown (10YR 5/6) when dry.
- B_{23g} 22 to 33 inches, silty clay loam distinctly mottled with an intermingling of gray and yellowish brown (N 5/0 to 10YR 6/1, and 10YR 5/6, moist); very weak, medium, prismatic structure breaks into weak, fine, angular blocky units; gray is extensive on the prism faces; moderately firm when moist, slightly sticky and slightly plastic when wet, very hard when dry; crawfish holes up to 2 inches in diameter are filled with dark grayish-brown (2.5Y 4/2, moist) silty clay loam material in this horizon; diffuse lower boundary; light gray (5Y 7/1) and yellowish brown (10YR 5/6 to 6/6) when dry.
- B_{31g} 33 to 52 inches, yellowish-brown (10YR 5/6, moist) silty clay loam, distinctly mottled with gray (5Y 6/1); firm when moist, very hard when dry; crawfish holes noted when sampled by boring; light gray (N 7/0), yellowish brown (10YR 5/8 to 5/6), and brownish yellow (10YR 6/6) when dry.
- B_{32g} 52 to 66 inches, dark yellowish-brown and yellowish-brown (10YR 4/4 and 10YR 5/8, moist) silty clay distinctly mottled with a few gray coatings (N 5/0); weakly laminated; very firm when wet, very hard when dry; yellowish brown (10YR 5/8 to 6/8) and light gray (10YR 7/0) when dry.
- C 66 to 70 inches, dark yellowish-brown (10YR 4/4 to 4/2, moist) silty clay faintly mottled with dark gray (N 5/0 to 4/0); very firm when moist, very hard when dry; smooth; laminated; calcareous; light gray (2.5Y 7/0 to 6/0), brownish yellow (10YR 6/6), and yellowish brown (10YR 5/8) when dry.

Wabash series.—A profile of Wabash silty clay loam, PD-56, was sampled on April 29, 1955, in Jackson Township (NW¼NW¼ sec. 34, T. 2 N., R. 3 E.). The site was in a plowed field which was in meadow the previous year.

Profile description:

- A_p 0 to 9 inches, very dark gray (10YR 3/1, moist) fine silty clay loam; moderate, fine, angular blocky structure; firm; abrupt lower boundary; pH 7.4.
- G₁ 9 to 26 inches, dark-gray (10YR 4/1, moist) silty clay with common, fine and medium, distinct, brown (7.5YR 5/4, moist) mottles; strong, fine and very fine, angular blocky structure; very firm when moist, plastic when wet; clear lower boundary; pH 7.3; roots are common.
- G₂ 26 to 60 inches, gray (10YR 5/1, moist) silty clay loam with many, medium, distinct, yellowish-brown (10YR 5/6, moist) mottles; strong, fine and very fine, angular blocky structure; very firm when moist, plastic when wet; pH 7.5.
- C_z 60 inches+, gray (10YR 6/1, moist) and yellowish-brown (10YR 5/6, moist) stratified silty clay loam, sandy clay loam, silt loam, and loam (this layer not sampled).

Glossary

Acid soil. Generally, a soil that is acid throughout most, or all, of the parts that plant roots occupy. Practically, a soil more acid than pH 6.6; precisely, a soil having a pH value less than 7.0; more technically, a soil having a preponderance of hydrogen ions over hydroxyl ions in the soil solution.

Aeration, soil. The exchange of air in the soil with air from the atmosphere. The composition of air in a well-aerated soil is similar to that in the atmosphere; in a poorly aerated soil, the air in the soil is considerably higher in carbon dioxide and lower in oxygen than the atmosphere above the soil.

Alluvial soils. Soils developing from transported and fairly recently deposited material (alluvium); little or no modification of the original materials by soil-forming processes.

Alluvium. Fine material, as sand, silt, mud, or other sediments, deposited on land by streams.

Association, soil. Two or more soils that are geographically associated in a fairly distinct pattern. An association may contain contrasting soils and members of one or more catenas.

Azonal soils. A soil order in which the soils are without distinct genetic horizons.

Calcareous soil. Soil material that contains enough lime or calcium carbonate (often with magnesium carbonate) to effervesce (fizz) when treated with dilute hydrochloric acid. It is alkaline in reaction because calcium carbonate is present.

Catena, soil. A group of soils, within one zonal region, that developed from similar parent material but are unlike in characteristics because of differences in relief or drainage.

Cation-exchange capacity. A measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in milliequivalents per 100 grams of soil at neutrality (pH 7) or at some other stated value. (Formerly called base-exchange capacity.)

Clay particle. As a soil separate, a mineral soil particle less than 0.002 millimeter in diameter. The clay particles constitute the chemically active part of the soil.

Consistence. The combination of properties of soil material that determine its resistance to crushing and its ability to be molded or changed in shape. Consistence depends mainly on the forces of attraction between soil particles. Consistence is described by such words as loose, friable, firm, plastic, and sticky.

Loose. Noncoherent.

Friable. Soil material crushes easily under gentle to moderate pressure between thumb and forefinger and coheres when pressed together.

Firm. Aggregates are stable and cannot be crumbled easily between the fingers.

Soft. Soil mass is very weakly coherent and fragile; breaks to powder or individual grains under very slight pressure.

Plastic. Soil mass is capable of being molded without rupture.

Sticky. Soil material is cohesive and does not separate readily.

Deciduous trees. Trees that shed their leaves in autumn.

Eluviation. The movement of material from one place to another within the soil, either in true solution or in colloidal suspension. Horizons that have *lost* material through eluviation are referred to as *eluvial* and those that have *received* material as *illuvial*. With an excess of rainfall over evaporation, eluviation may take place downward or sidewise, according to the direction of water movement.

Erosion. The wearing away of the land surface by detachment and transport of the soil and rock materials by running water, wind, or other geological agents.

Normal. Normal, or natural, erosion takes place in the undisturbed land surface, as under the protective cover of native vegetation. This type of erosion is sometimes referred to as geological erosion. It is an important process in soil development, but it is not mapped in soil survey work.

Accelerated. Erosion of the soil or rock materials over and above normal erosion brought about by changes in the natural cover or exposure of the soil to runoff, including changes due to human activity. This type of erosion is identified and mapped in soil survey work. It may consist of sheet, rill, or gully erosion.

Flood plain. Nearly flat lands along stream courses that are subject to overflow.

Glacial till. A deposit of earth, sand, gravel, and boulders transported by glaciers. It is not stratified.

Granule. A single mass, or cluster, of soil consisting of many soil particles held together.

Gray-Brown Podzolic soils. A zonal group of soils having thin organic coverings and organic-mineral layers over grayish-brown leached layers that rest upon an illuvial brown horizon. These soils developed under deciduous forest in a temperate moist climate.

Horizon, soil. A layer of soil approximately parallel to the soil surface having distinct characteristics produced by soil-forming processes. The relative position of the several soil horizons in a typical soil profile and their nomenclature are shown below:

- A₀ Organic debris, partly decomposed or matted.
- A₁ A dark-colored horizon having a fairly high content of organic matter mixed with mineral matter.
- A₂ A light-colored horizon, often representing the zone of maximum leaching where podzolized; absent in wet, dark-colored soils.
- A₃ Transitional to B horizon but more like A than B; sometimes absent.
- B₁ Transitional to B horizon but more like B than A; sometimes absent.
- B₂ Usually, a deeper colored horizon, which often represents the zone of maximum illuviation where podzolized.
- B₃ Transitional to C horizon.
- C Slightly weathered parent material; absent in some soils.
- D Underlying substratum.

The A horizons make up a zone of eluviation, which is a leached zone. The B horizons make up a zone of illuviation, in which clay or other materials have accumulated. The A and B horizons, taken together, are called the solum, or true soil.

Humic Gley soils. A group of poorly to very poorly drained intrazonal soils with dark-colored, organic mineral horizons of moderate thickness. They are underlain by mineral gley horizons that are mottled gray, grayish brown, yellow, or yellowish brown. These soils developed under grasses, sedges, or timber, or both, in a humid climate.

Illuviation. (See **Eluviation**.)

Infiltration. The process of water entering or penetrating the soil surface through the soil pores or interstices. The rate of infiltration is measured in inches per hour.

Intrazonal soils. Any one of the great soil groups having more or less well developed soil characteristics that reflect the dominating influence of some local factor of relief, parent material, or age over the normal effect of climate and vegetation. Each group of intrazonal soils may be associated with two or more of the zonal soils.

Lacustrine deposits. Materials deposited from lake waters; in places the fine materials were carried into the lake in suspension and settled out as the water became quiet. Many nearly level soils have developed from such deposits, which were dropped in old lakes that have since disappeared.

Leaching. The removal of materials, such as lime and other plant nutrients, in solution by passage of water through the soils.

Loess. Geological deposit of fairly uniform fine material, mostly silt, presumably transported by the wind.

Low-Humic Gley. A group of imperfectly to poorly drained intrazonal soils with very thin surface horizons. They are moderately high in organic matter and occur over mottled gray and brown gleyed mineral horizons having a low degree of texture differentiation (15).

Mottled. Irregularly marked with spots of different colors; mottling normally is associated with poor drainage.

Neutral soil. A soil that is not significantly acid or alkaline. Strictly, a soil having a pH of 7.0; practically, one having a pH between 6.6 and 7.3. (See pH.)

Nutrient, plant. Any element taken in by a plant and essential to its growth and used by it in the development of its food and tissue. Essential nutrients include nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, boron, and possibly other elements from the soil, and carbon, hydrogen, and oxygen, largely from the air and water.

Outwash, glacial. A deposit of gravelly, sandy, or fine materials swept out, sorted, and left beyond the glacial ice front by streams of melt waters. Frequently, this outwash occurs as broad, flat plains and overlies till that has been deposited previously.

Parent material. The unconsolidated mass of rock material (or peat) from which the soil profile develops.

Percolation. The downward movement of water through the soil.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. It can be measured quantitatively in terms of rate of flow of water through a unit cross section in unit time under specified temperature and hydraulic conditions. Values for saturated soils usually are called hydraulic conductivity. The permeability of a soil may be limited by the presence of one nearly impermeable horizon, even though the others are permeable.

pH. A numerical designation of relatively weak acidity and alkalinity as in soils and other biological systems. (See Reaction in section, How A Soil Survey Is Made.)

Phase, soil. The subdivision of a soil type or other classificational soil unit having variations in characteristics not significant to the classification of the soil in its natural landscape but significant to the use and management of the soil. The variations recognized by phases of soil types include differences in slope, stoniness, and thickness because of accelerated erosion.

Porosity, soil. The degree to which the soil mass is permeated with pores or cavities. It is expressed as the percentage of the whole volume of a soil horizon that is unoccupied by soil particles.

Profile, soil. A vertical section of the soil, extending from the surface into the parent material.

Reaction, soil. The degree of acidity or alkalinity of the soil mass expressed in pH values. (See Acidity in section, How A Soil Survey Is Made.)

Regosol. An azonal group of soils. Soils without definite horizons that are developing from deep, unconsolidated or soft, rocky deposits. Largely confined to recent sand dunes and to loess and glacial drift on steep sloping land.

Relief. The elevations or inequalities of a land surface, the slope gradient, and the pattern of these considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 2.0 to 0.05 millimeter.

Series, soil. A group of soils having similar characteristics in all respects except texture of the surface soil.

Silt. Individual mineral particles of soil ranging in diameter from the upper size of clay, 0.002 millimeter, and the lower size of very fine sand, 0.05 millimeter.

Solum. The upper part of the soil profile, above the parent material in which the processes of soil formation are active. In mature soils, the solum includes the A and B horizons. The characteristics of the material in these horizons generally are unlike those of the parent material.

Stratified. Composed of or arranged in strata, or layers, such as stratified alluvium. The term is confined to geological materials. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The morphological aggregates in which the individual soil particles are arranged. It may refer to their natural arrangement in the soil when in place and undisturbed or to the soil at any degree of disturbance. Soil structure is classified according to grade, class, and type.

Grade. Degree of distinctness of aggregation. Grade expresses the differential between cohesion within aggregates and adhesion between aggregates. Terms: Structureless (single grain or massive), weak, moderate, and strong.

Class. Size of soil aggregates. Terms: Very fine or very thin, fine or thin, medium, coarse or thick, and very coarse or very thick.

Type. Shape of soil aggregates. Terms: Platy, prismatic, columnar, blocky, subangular blocky, granular, and crumb.

Subsoil. Technically, the B horizon in soils with distinct profiles; roughly, that part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil. Term is applied to both parent materials and to other layers unlike the parent material, below the B horizon, or subsoil.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness.

Terrace (geological). A nearly level or undulating plain, commonly rather narrow and usually with a steep front, bordering a river, lake, or the sea. Many streams are bordered by a series of terraces that occur at different levels. These variations would indicate that the flood plains were laid down at successive periods.

Texture, soil. The relative proportions of the various size groups of individual soil grains in a mass of soil.

Soil separate. One of the individual-size groups of mineral soil particles—sand, silt, or clay.

Soil textural classes. Classes of soil texture based on the relative proportion of soil separates. The basic classes, in increasing proportions of the fine separates, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay.

Till, glacial. (See Glacial till.)

Tilth. The ease with which a soil can be tilled, its response to farm machinery, and its fitness for root penetration.

Type, soil. A subgroup or category under the soil series based on the texture of the surface soil. A soil type is a group of soils having horizons similar in differentiating characteristics and arrangement in the soil profile and developed from a particular type of parent material. The name of a soil type consists of the name of the soil series plus the textural class name of the upper part of the soil equivalent to the surface soil.

Water table. The upper limit of that part of the soil or underlying material that is wholly saturated with water. In places, an upper, or perched, water table may be separated from an underlying body of ground water by an unsaturated zone.

Zonal soil. A soil having well-defined soil characteristics that reflect the influence of the active factors of soil formation, especially climate and vegetation.

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GUIDE TO MAPPING UNITS AND CAPABILITY UNITS

Map symbol	Soil	Described on page—	Capabil- ity unit	Described on page—	Map symbol	Soil	Described on page—	Capabil- ity unit	Described on page—
BaB1	Belmore loam, 2 to 6 percent slopes, slightly eroded.	9	IIe-2	53	Ga	Genesee fine sandy loam.....	19	I-2	52
BbC3	Broughton clay, 6 to 12 percent slopes, severely eroded.	11	VIe-1	58	Gb	Genesee loam.....	19	I-2	52
BbD3	Broughton clay, 12 to 18 percent slopes, severely eroded.	10	VIIe-1	58	Gc	Genesee silt loam.....	19	I-2	52
BcB1	Broughton silty clay loam, 2 to 6 percent slopes, slightly eroded.	11	IIIe-1	55	Gd	Granby fine sandy loam.....	20	IIw-5	55
BcB2	Broughton silty clay loam, 2 to 6 percent slopes, moderately eroded.	11	IIIe-1	55	HaA	Haney silt loam and loam, 0 to 2 percent slopes.	21	I-1	52
BcC2	Broughton silty clay loam, 6 to 12 percent slopes, moderately eroded.	10	IVe-1	58	HaB1	Haney silt loam and loam, 2 to 6 percent slopes, slightly or moderately eroded.	20	IIe-2	53
BcD2	Broughton silty clay loam, 12 to 18 percent slopes, moderately eroded.	10	VIe-1	58	HaC2	Haney silt loam and loam, 6 to 15 percent slopes, moderately eroded.	21	IIIe-2	55
BcE2	Broughton silty clay loam, 18 to 35 percent slopes, moderately or severely eroded.	11	VIIe-1	58	Hb	Haskins loam.....	21	IIw-2	54
Da	Defiance silty clay loam.....	12	IIw-1	53	Hc	Haskins silt loam.....	21	IIw-2	54
DbA	Digby fine sandy loam, 0 to 2 percent slopes.	14	IIw-4	55	Hd	Hoytville clay.....	22	IIw-3	54
DcA	Digby loam, 0 to 2 percent slopes..	13	IIw-2	54	He	Hoytville silt loam.....	23	IIw-3	54
DcB1	Digby loam, 2 to 6 percent slopes, slightly or moderately eroded.	13	IIw-2	54	Hf	Hoytville silty clay loam.....	23	IIw-3	54
DdA	Digby silt loam, 0 to 2 percent slopes.	13	IIw-2	54	La	Latty clay.....	24	IIIw-1	56
DdB1	Digby silt loam, 2 to 6 percent slopes, slightly or moderately eroded.	13	IIw-2	54	Lb	Latty silty clay loam.....	24	IIIw-1	56
Ea	Eel loam.....	15	I-2	52	LcB1	Lucas silt loam, 2 to 6 percent slopes, slightly or moderately eroded.	25	IIIe-1	55
Eb	Eel silt loam.....	14	I-2	52	LcC2	Lucas silt loam, 6 to 12 percent slopes, moderately eroded.	26	IVe-1	58
Ec	Eel silty clay loam.....	15	I-2	52	LcD2	Lucas silt loam, 12 to 25 percent slopes, moderately eroded.	26	VIIe-1	58
FaA	Fulton fine sandy loam, 0 to 2 percent slopes.	17	IIIw-2	56	LdA	Lucas silt loam, sandy substratum, 0 to 2 percent slopes.	26	IIe-1	53
FbB	Fulton loam, 0 to 2 percent slopes..	17	IIIw-2	56	LdB1	Lucas silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.	26	IIIe-1	55
FcA	Fulton silt loam, 0 to 2 percent slopes.	16	IIIw-2	56	LdB2	Lucas silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.	27	IIIe-1	55
FcB1	Fulton silt loam, 2 to 6 percent slopes, slightly eroded.	16	IIIw-4	57	LdC2	Lucas silt loam, sandy substratum, 6 to 12 percent slopes, moderately eroded.	27	IVe-1	58
FcB2	Fulton silt loam, 2 to 6 percent slopes, moderately eroded.	16	IIIw-4	57	LdD2	Lucas silt loam, sandy substratum, 12 to 25 percent slopes, moderately or severely eroded.	27	VIe-1	58
FdA	Fulton silt loam, sandy substratum, 0 to 2 percent slopes.	17	IIIw-2	56	Ma	Mermill loam.....	28	IIw-5	55
FdB1	Fulton silt loam, sandy substratum, 2 to 6 percent slopes, slightly eroded.	18	IIIw-4	57	Mb	Mermill silt loam.....	27	IIw-3	54
FdB2	Fulton silt loam, sandy substratum, 2 to 6 percent slopes, moderately eroded.	18	IIIw-4	57	Mc	Mermill silty clay loam.....	28	IIw-3	54
FeA	Fulton silty clay loam, 0 to 2 percent slopes.	17	IIIw-2	56	Md	Millgrove loam.....	28	IIw-5	55
FfA	Fulton silty clay loam, sandy substratum, 0 to 2 percent slopes.	18	IIw-2	56	Me	Millgrove silt loam.....	29	IIw-3	54
					Mf	Millgrove silty clay loam.....	29	IIw-3	54
					NaA	Nappanee fine sandy loam, 0 to 2 percent slopes.	31	IIIw-2	56
					NbA	Nappanee loam, 0 to 2 percent slopes.	31	IIIw-2	56
					NcA	Nappanee silt loam, 0 to 2 percent slopes.	30	IIIw-2	56
					NcB1	Nappanee silt loam, 2 to 6 percent slopes, slightly eroded.	30	IIIw-4	57

GUIDE TO MAPPING UNITS AND CAPABILITY UNITS—Continued

Map symbol	Soil	Described on page—	Capabil-ity unit	Described on page—	Map symbol	Soil	Described on page—	Capabil-ity unit	Described on page—
NcB2	Nappanee silt loam, 2 to 6 percent slopes, moderately eroded.	30	IIIw-4	57	RgB2	Roselms silty clay loam, 2 to 6 percent slopes, moderately eroded.	38	IIIw-4	57
NdA	Nappanee silty clay loam, 0 to 2 percent slopes.	31	IIIw-2	56	Rh	Ross silt loam.....	40	I-2	52
NdB1	Nappanee silty clay loam, 2 to 6 percent slopes, slightly eroded.	31	IIIw-4	57	SaA	Seward fine sandy loam, 0 to 2 percent slopes.	41	IIIs-1	57
NdB2	Nappanee silty clay loam, 2 to 6 percent slopes, moderately eroded.	32	IIIw-4	57	SaB1	Seward fine sandy loam, 2 to 6 percent slopes, slightly eroded.	41	IIIs-1	57
OaA	Ottokee loamy sand, 0 to 2 percent slopes.	32	IIIs-1	57	SaC1	Seward fine sandy loam, 6 to 15 percent slopes, slightly eroded.	42	IIIs-1	57
OaB1	Ottokee loamy sand, 2 to 6 percent slopes, slightly eroded.	32	IIIs-1	57	SbB1	Seward sandy loam, 2 to 6 percent slopes, slightly eroded.	42	IIIs-1	57
Pa	Paulding clay.....	33	IIIw-1	56	Sc	Shoals silt loam.....	42	IIw-1	53
Pb	Paulding loam.....	35	IIIw-1	56	Sd	Sloan silt loam.....	43	IIw-1	53
Pc	Paulding silty clay loam.....	34	IIIw-1	56	Se	Sloan silty clay loam.....	43	IIw-1	53
RaA	Rimer fine sandy loam, 0 to 2 percent slopes.	36	IIw-4	55	SfC3	St. Clair clay, 6 to 12 percent slopes, severely eroded.	45	VIe-1	58
RaB1	Rimer fine sandy loam, 2 to 6 percent slopes, slightly eroded.	36	IIw-4	55	SfD3	St. Clair clay, 12 to 18 percent slopes, severely eroded.	44	VIIe-1	58
RbA	Rimer sandy loam, 0 to 2 percent slopes.	36	IIw-4	55	SfF3	St. Clair clay, 25 to 35 percent slopes, severely eroded.	45	VIIe-1	58
RbB1	Rimer sandy loam, 2 to 6 percent slopes, slightly eroded.	36	IIw-4	55	SgB1	St. Clair silt loam, 2 to 6 percent slopes, slightly eroded.	45	IIIe-1	55
RcA	Roselms clay, 0 to 2 percent slopes.	40	IIIw-3	57	SgB2	St. Clair silt loam, 2 to 6 percent slopes, moderately eroded.	45	IIIe-1	55
RdA	Roselms fine sandy loam, 0 to 2 percent slopes.	39	IIIw-3	57	SgC2	St. Clair silt loam, 6 to 12 percent slopes, moderately eroded.	44	IVe-1	58
ReA	Roselms loam, 0 to 2 percent slopes.	39	IIIw-3	57	SgD2	St. Clair silt loam, 12 to 18 percent slopes, moderately eroded.	44	VIe-1	58
ReB1	Roselms loam, 2 to 6 percent slopes, slightly eroded.	40	IIIw-4	57	SgE2	St. Clair silt loam, 18 to 25 percent slopes, moderately eroded.	45	VIIe-1	58
RfA	Roselms silt loam, 0 to 2 percent slopes.	38	IIIw-3	57	Ta	Tedrow loamy fine sand.....	46	IIw-4	55
RfB1	Roselms silt loam, 2 to 6 percent slopes, slightly eroded.	39	IIIw-4	57	Tb	Toledo loam.....	47	IIw-3	54
RfB2	Roselms silt loam, 2 to 6 percent slopes, moderately eroded.	39	IIIw-4	57	Tc	Toledo silt loam.....	47	IIw-3	54
RgA	Roselms silty clay loam, 0 to 2 percent slopes.	37	IIIw-3	57	Td	Toledo silty clay.....	48	IIw-3	54
RgB1	Roselms silty clay loam, 2 to 6 percent slopes, slightly eroded.	38	IIIw-4	57	Te	Toledo silty clay loam.....	47	IIw-3	54
					Wa	Wabash silty clay.....	49	IIw-1	53
					Wb	Wauseon fine sandy loam.....	49	IIw-5	55
					Wc	Wauseon loam.....	50	IIw-5	55
					Wd	Wetzel clay.....	50	IIw-3	54
					We	Wetzel silty clay loam.....	50	IIw-3	54



Areas surveyed in Ohio shown by shading. Reconnaissance surveys shown by northwest-southeast hatching; crosshatching indicates areas covered by both detailed and reconnaissance surveys.

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