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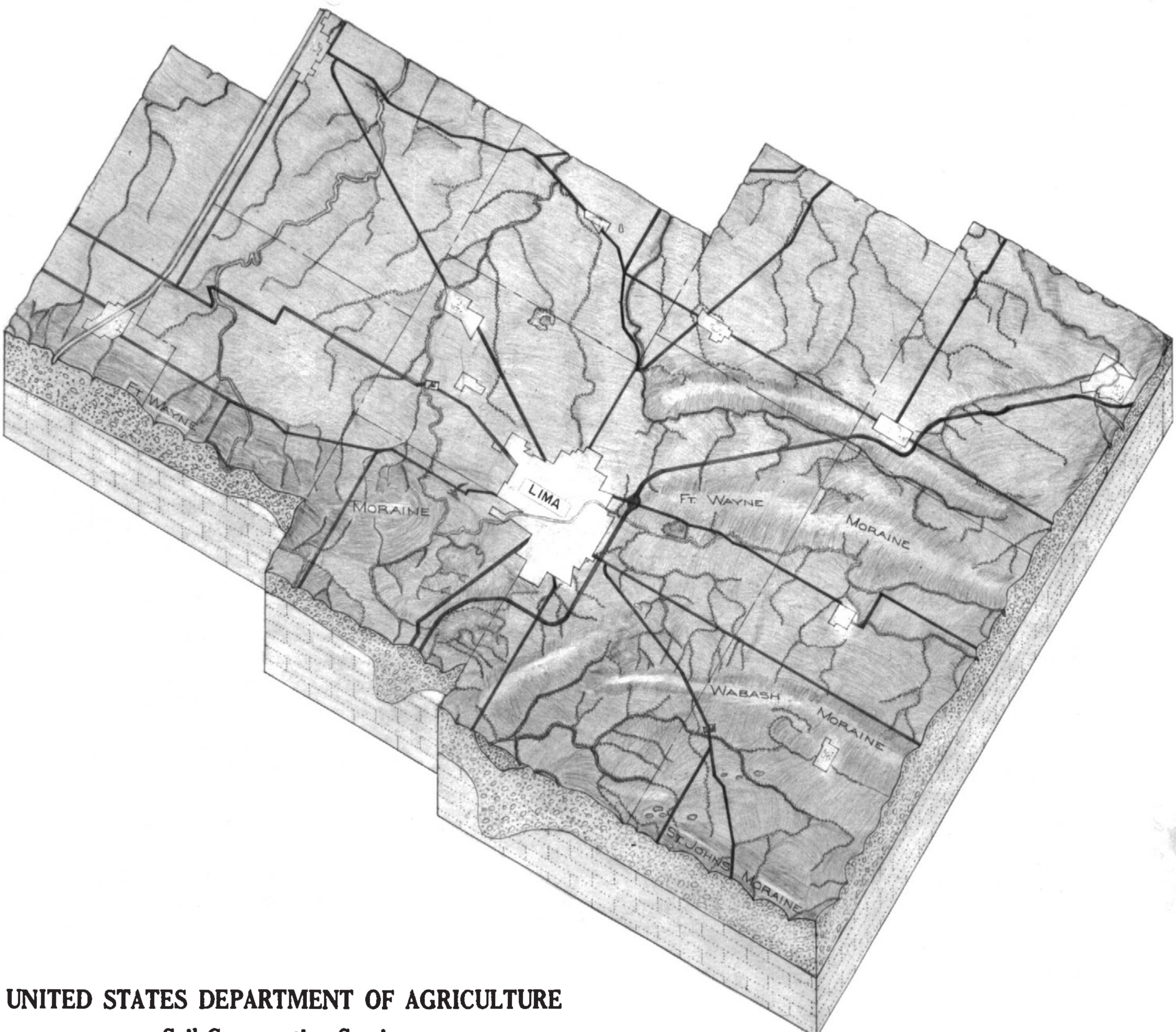
SOIL SURVEY

ALLEN COUNTY, OHIO



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
in cooperation with
OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Lands and Soil
and
OHIO AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Allen County, Ohio, will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; provide basic information for community planners, real estate agencies, land appraisers, and tax assessors; and add to our knowledge of soil science.

Locating Soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs. The "Guide to Mapping Units and Capability Units" at the end of the report will simplify the use of the map and the report. This guide gives the name of each soil and its map symbol, 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.

Finding Information

Special sections of the report will interest different groups of readers. The section "General Nature of the County" and the one entitled "Soil Associations" will be of interest mainly to those not familiar with the county.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of the Soils" and then turn to the section "Use and Management of Soils." In this way, they first identify the soils on their farm and then learn how these soils can be managed and what yields can be expected. The soils are grouped by capability classes, subclasses, and capability units.

Engineers and others who use soil as a material in construction will find helpful information in the section "Engineering Properties of the Soils."

People interested in science will find information about how the soils were formed and how they were classified in the section "Genesis, Morphology, and Classification of the Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending upon their particular interest. Subsections have been included in "Woodland and Windbreaks" and "Wildlife."

Technical Assistance

Compare the management practices that you are now using for the soils on your farm with those suggested in this report. Look at the fields for signs of runoff and erosion. Then decide whether or not you need to change your methods of farming. The choice, of course, must be yours. This survey will aid you in planning new methods, but it is not a plan of management for your farm or any other farm in the county.

The soil survey is not intended to be a source of all information needed for a successful farming operation. Information on crop varieties, fertilizer, soil conserving practices, and livestock management can be obtained from the Allen County extension agent.

Farmers in Allen County organized the Allen County Soil Conservation District. The district, through its district commissioners, arranges for farmers to receive technical help from the Soil Conservation Service and other agencies in planning good use and conservation of the soils on their farms. The soil survey is part of the technical assistance furnished to the Allen County Soil Conservation District.

* * * * *

Fieldwork on the soil survey was completed in 1960. Unless noted otherwise, all statements refer to conditions at the time of survey. The soil mapping was done by the Division of Lands and Soil, State of Ohio, in cooperation with the Soil Conservation Service and the Ohio Agricultural Experiment Station.

***Cover picture.*—Map of Allen County showing landforms and drainage.**

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Issued July 1965

SOIL SURVEY OF ALLEN COUNTY, OHIO

BY R. L. HEFFNER, SOIL CONSERVATION SERVICE, AND A. R. BROCK, R. L. CHRISTMAN, AND D. D. WATERS, OHIO DEPARTMENT OF NATURAL RESOURCES [1]

SURVEYED BY DEPARTMENT OF NATURAL RESOURCES, DIVISION OF LANDS AND SOIL, STATE OF OHIO

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH OHIO DEPARTMENT OF NATURAL RESOURCES, DIVISION OF LANDS AND SOIL, AND OHIO AGRICULTURAL EXPERIMENT STATION

ALLEN COUNTY, in the northwestern part of Ohio (fig. 1), occupies 410 square miles, or 262,400 acres. Lima, located near the center of the county, is the county seat and largest town. Smaller towns are Delphos, Bluffton, Beaverdam, Spencerville, Cairo, and Elida. In 1960 the population of the county was 103,691 and the population of Lima was 51,037.

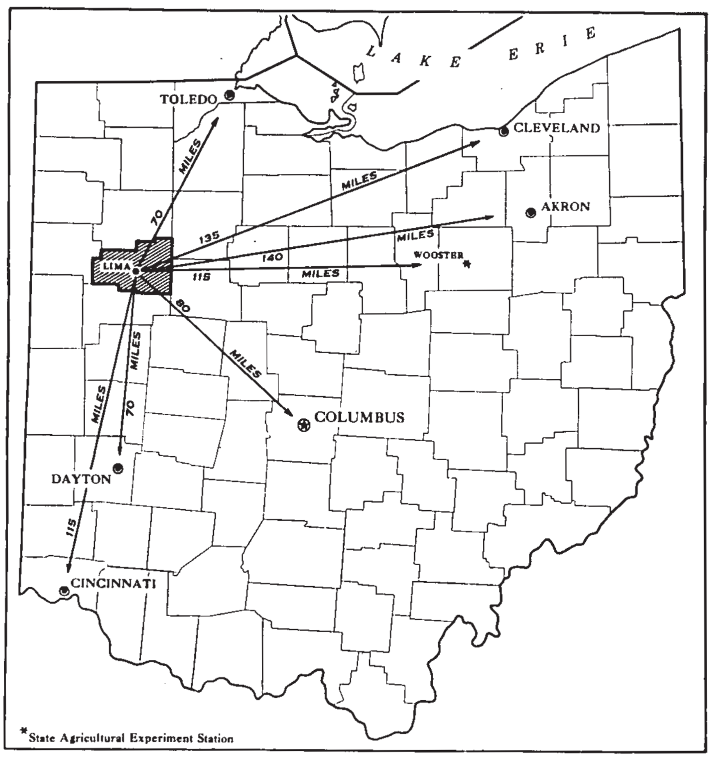

Figure 1.—**Location of Allen County in Ohio.**

[1] V. L. SIEGENTHALER, R. L. MEEKER, and G. M. SCHAFER, Soil Conservation Service, contributed to the report. A. R. BROCK was in charge of the field survey. Others on the field survey were D. E. GARNER and F. J. BAKER, Ohio Department of Natural Resources, and F. RUDOLPH and R. L. HEFFNER, Soil Conservation Service.

Agriculture is the main enterprise in this county. Corn is the principal crop, but soybeans, wheat, oats, and hay are grown extensively. The county normally receives enough rainfall for the crops that are grown. Periods of drought occur occasionally, but they are not frequent nor are they severe.

General Nature of the County

Allen County was formed in 1820 from Indian territory. It was first attached to Mercer County and later became an independent judicial unit. The original settlers were largely from Pennsylvania.

The first place settled was Ft. Amanda, which was built on the western bank of the Auglaize River in 1812. A shipbuilding industry was established the next year, and many ships were built for navigating Ohio streams. Lima was first surveyed in 1831. Mills, churches, and industries were established, and Lima soon became the center of business activity. Oil was discovered in 1885 near Lima, and for a time that city was known as the oil center of the United States. Large oil refineries and related industries were established at Lima. These had a great influence upon the future growth and industrialization of the town.

Climate [2]

The climate of Allen County and northwestern Ohio is characterized as continental, in the sense that the region is subject to wide extremes of temperature. In winter cold air advancing out of Canada brings occasional periods of zero weather, but in summer the area comes under the influence of masses of warm, moist air. Temperatures, on rare occasions, exceed 100°F. The largest amount of precipitation falls in June, and the smallest amount falls in February. A large part of the precipitation in winter is in the form of rain. The rain often falls on ground that is not frozen. Because Ohio is located on the eastern edge of the interior plains, it is spared the violent fluctuations of wetness and drought that characterize some

[2] L. T. PIERCE, State climatologist, helped prepare this section.

areas to the west and south. Precipitation is favorably distributed for the production of crops. In spring an ample amount of moisture is usually available for the germination of seed and the growth of plants. The driest season coincides with the harvesting period.

Allen County is on the eastern edge of the Corn Belt and at the southern edge of the old lake bottom that has tablelike terrain. The elevation rises from north to south, and as a result, areas from Lima south are sometimes several degrees warmer than the lakebed areas to the north. The difference in temperature is caused by cooler air sinking into the old lake bottom on calm nights. The annual total precipitation is nearly 2 inches greater in the southern than in the northern areas. The difference in rainfall is caused by the higher elevation in the south.

Table 1 shows temperature and precipitation data taken from records kept over a period of 30 years at Lima. These figures apply to the county as a whole, except that the daily minimum temperature is a degree or two lower in the northern part of the county, and the average precipitation is slightly less. The average annual temperature in Allen County is 51.4°F. The data are from records of the U.S. Weather Bureau and the Lima Association of Commerce.

The average growing season, or that period normally free from temperatures as low as 32°, is 161 days. It extends from May 3 to October 11. The season normally free from temperatures as low as 36°, when light frost can occur, extends from May 16 to September 29. A period from April 19 to October 24, 188 days, is free from temperatures as low as 28°. This growing season is ample for growing such crops as corn and soybeans without having to plant on dates when the risk of a later freeze exceeds 25 percent.

The moisture in the soil also goes through a seasonal cycle, which is generally favorable for crop production. Winter is the normal recharge season, and most soils are saturated with moisture, or nearly so, by the start of the growing season. If rainfall is normal in spring, current and stored moisture is generally ample until mid-July, but a moderate shortage develops during August and September. An actual drought during the period when plants are growing actively is a rarity, although a moderate deficit occurs occasionally during the critical silking period of corn.

The probability of receiving a beneficial amount of rainfall during the silking, or tasseling, period of corn is indicated by the following list. It shows the probabilities of getting the amounts indicated within the 3 weeks beginning July 26.

Amount	*Probability*	*Amount*	*Probability*
0.2 inch	99.1 percent	1.4 inches	66.8 percent
.4 inch	96.3 percent	2.0 inches	48.0 percent
.6 inch	91.9 percent	2.8 inches	28.6 percent
1.0 inch	80.1 percent	4.0 inches	11.8 percent

Early in the afternoon, the average relative humidity is about 50 percent in summer and as high as 70 percent in winter. It rises into the 80's and 90's at night throughout the year. In summer the sun shines about 70 percent of the possible time as compared with 40 percent or lower in winter. Tornadoes have occurred on rare occasions in Allen County, usually during the spring months. Damaging hailstorms occur much less frequently than in States to the west and south.

Physiography, Relief, and Drainage

Allen County is in the Central Lowlands, which includes most of the glaciated part of Ohio. More specifically, it straddles the Lake Plain and Till Plain areas of that region. The county was covered by several glaciers, but the Late Wisconsin drift covered all the material left by former glaciers. The county is covered by glacial drift, which ranges from a few feet to several hundred feet in thickness. This mantle of glacial drift overlies limestone bedrock throughout the county. In

TABLE 1.—*Temperature and precipitation at Lima, Allen County, Ohio*

[Based on records kept from 1926 to 1955]

Month	Temperature							Precipitation			
	Average daily maximum	Average daily minimum	Average	Highest		Lowest		Average	Average snow [1] and sleet	Driest year (1953)	Wettest year (1937)
				Temperature	Year	Temperature	Year				
	°F.	°F.	°F.	°F.		°F.		*Inches*	*Inches*	*Inches*	*Inches*
January	36. 9	21. 1	29. 0	71	1950	−20	1936	2. 70	5. 0	2. 91	7. 42
February	39. 0	22. 0	30. 5	70	1944	−15	1934	2. 01	4. 3	1. 22	2. 36
March	48. 3	28. 7	38. 5	82	1945	− 8	1948	3. 30	4. 0	4. 44	2. 33
April	60. 3	38. 0	49. 2	89	1930	12	1940	3. 40	. 6	2. 67	4. 43
May	72. 3	48. 5	60. 4	93	1934	27	1947+	3. 45	(2)	3. 22	2. 53
June	81. 9	58. 2	70. 1	101	1952	36	1929	4. 02	(2)	1. 86	5. 40
July	86. 6	62. 0	74. 3	109	1936	43	1940	3. 44	0	2. 19	7. 87
August	84. 0	60. 2	72. 1	103	1934	39	1946	3. 37	0	2. 61	6. 90
September	77. 6	53. 2	65. 4	101	1939	29	1942	3. 14	0	1. 74	6. 03
October	65. 8	42. 9	54. 4	92	1939	18	1952	2. 90	. 5	. 83	4. 71
November	50. 0	32. 7	41. 4	80	1950	− 1	1929	2. 66	2. 6	. 80	1. 65
December	38. 6	23. 5	31. 1	67	1941	−13	1950	2. 24	4. 8	2. 07	2. 68
Year	61. 8	40. 9	51. 4	109	1936	−20	1936	36. 63	21. 3	26. 56	54. 31

[1] Ten inches of snow equals approximately 1 inch of rain. [2] Trace.

most of the county, the underlying limestone is the Monroe formation (*14*),[3] but in the southeastern corner it is the Niagara formation. In several places there are outcrops of limestone (fig. 2). The more prominent outcrops are at Bluffton, south of Delphos, and east of Westminster. There is also a large quarry at Lima.

***Figure 2.*—Outcropping of limestone near the surface in an area south of Bluffton. The spade is touching bedrock.**

The relief of the county is mainly nearly level to undulating, but the places near the streams or in the morainic areas are steeper (fig. 3). The major part of the county is a till plain, but there are three end moraines in the county. In the moranic areas the relief is more pronounced, and erosion is more severe than on the plains. The end moraines were deposited when the ice remained stagnant during glaciation. The material carried by the glaciers was deposited as the glaciers melted. It formed moraines that run as bands across the county from east to west. Areas of sandy and gravelly outwash occur along the base of these moraines and on some of the higher parts of the moraines.

In the northern part of the county, the relief is more subdued than in the southern part. Prominent beach ridges of sandy or gravelly outwash, formed by wave action, parallel the moraines. After the glacier had receded to a point north of the area that is now Allen County, a large glacial lake was formed that extended from the northernmost parts of the county north and east to Lake Erie. The soils in this lakebed are generally high in content of clay, and relief is nearly level.

***Figure 3.*—Typical morainic topography in an area of the St. Johns moraine in the southeastern part of Allen County.**

Most of the county is part of the basin of the Maumee River; all the major rivers that flow through Allen County eventually drain into that river. A small part of the upper area of the watershed of the Scioto River, however, extends into the eastern edge of the county.

Most of the soils in Allen County are somewhat poorly drained to very poorly drained. The Blount soils are typical of the somewhat poorly drained soils, and the Pewamo soils are typical of the very poorly drained soils.

Industry

Industrial plants are numerous in Lima, and many oil companies and related industries are located there. Crude oil and gas from as far away as Texas are refined and processed in Lima, and numerous pipelines start and terminate in that city. Plants in Lima manufacture such items as heavy construction equipment, automobile engines, electric motors, machine tools, metal castings, rubber products, plastics, fertilizer, petroleum products, and dry ice and other carbonated products. The industries of Lima and the surrounding towns provide employment for thousands of people in the area.

Community Facilities

High schools and grade schools are well distributed throughout the county, and churches are also well located. Lima has two large hospitals and other medical clinics. Public libraries are located at Lima.

[3] Italic numbers in parentheses refer to Literature Cited, p. 98.

Transportation is good in this county. The county is crossed by three Federal highways, two of which run in an east-west direction. The third highway, Interstate 75, a four-lane divided freeway, runs from the south to the northeast, and a number of State highways transect the county. Several railroads pass through the county, and large truck depots are located in Lima. Lima is also served by an airline.

Several lakes near Lima are used for recreational purposes. Lima also maintains public picnic areas, and a few small parks are located in other parts of the county. In addition, the Ohio Highway Department maintains several small roadside parks. This county and surrounding counties are served by a television and a radio station located in Lima.

Agriculture

Indians were among the first to practice agriculture in the area that is now Allen County. They cultivated fields of corn on some of the bottom lands of streams. When white men came to the area, they cut most of the remaining heavy, deciduous forest. Now, much of the acreage is used for crops, and only about 10 percent of it remains in trees.

According to the U.S. Bureau of the Census, 206,047 acres was in farms in 1959. Of this, 150,338 acres was cropland, 18,364 was pasture, and 19,053 was woodland. The number of farms is decreasing, but the size of farms is increasing. There were 2,560 farms in the county in 1950, but the number had decreased to 1,755 by 1959. The average size of farms was 89 acres in 1950 as compared to 117 acres in 1959. The total amount of land in farms decreased nearly 22,000 acres between 1950 and 1960. This decrease is mainly the result of expanding urban population and the construction of new highways.

Of the 1,755 farms in the county, 1,423 are operated by owners or part owners, and the rest are generally operated by tenants. The largest numbers of farms are general and miscellaneous. There are also 460 cash-grain farms, 145 dairy farms, 55 poultry farms, and 301 livestock farms other than dairy and poultry farms.

The number of acres of corn harvested increased from 49,183 acres in 1950 to 53,158 in 1959. The acreage in soybeans also showed an increase in the same period—from 17,973 acres harvested to 33,671. In 1959, 22,427 acres of wheat and 17,343 acres of oats were harvested, a decrease since 1950. Alfalfa was grown for hay on only 5,667 acres, but clover was grown on 12,587 acres.

How Soils Are Mapped and Classified

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

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Hoytville and Pewamo, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their use and behavior. Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ only in texture of their surface layer. According to such differences, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Blount loam and Blount silt loam are two soil types in the Blount series. The difference in the texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Belmore loam, 0 to 2 percent slopes, is one of several phases of Belmore loam, a soil type that ranges from nearly level to strongly sloping.

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

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

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major soil series in it, and the names of the principal constituents are joined by a hyphen. There are no soil complexes mapped in Allen County. There are, however, undifferentiated mapping units. If two or more soils that do not occur in a regular geographic pattern have differences too slight to justify mapping them separately, they are mapped together in an undifferentiated mapping unit. An example is Haskins and Digby loams, over clay, 0 to 2 percent slopes. Also, on the soil map of this county, areas are shown that have been so disturbed by construction that they cannot be called soils. These areas are shown on the map like other mapping units, but they are given descriptive names, such as Borrow pits, Gravel pit, Made land, or Urban land, and are called land types rather than soils. In this report, spot symbols are used on the soil map to designate small areas of wet, sandy, or gullied soils.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups, and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

Soil Associations

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map at the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ from each other in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but several different patterns of soils. Each pattern, furthermore, contains several kinds of soils.

Each soil association is named for the major soil series in it, but as already noted, soils of other series may also be present. The major soils of one soil association may also be present in another association, but in a different pattern.

The general map showing patterns of soils is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use. The seven soil associations in this county, which are shown on the general map, are described in the following pages.

1. Montgomery-Blount Association

Very poorly drained, dark-colored soils on broad depressed flats

This association consists mainly of dark-colored, fine-textured soils on broad, depressed flats and in depressions on the glacial till plain (fig. 4). The Montgomery soils occupy nearly all of the acreage, but the slightly higher areas are occupied mostly by the Blount soils.

The Montgomery soils formed in water-laid, clayey material that was deposited in small lakes or ponds. They are dark colored, high in content of clay, and very poorly drained. These soils are limy below a depth of about 48 inches. The somewhat poorly drained Blount soils are lighter colored, less clayey, and less fertile than the Montgomery soils. The Blount soils have a surface layer of silt loam that is easier to till than that of the Montgomery soils. The Blount soils formed in glacial till that is limy at a depth of about 30 inches.

The soils of this association are used largely for grain, although some sugar beets are grown. For maximum yields, the soils require surface and tile drainage. The response to fertilizer is good. If they are managed well, the soils are highly productive.

2. Morley-Blount-Pewamo Association

Nearly level to gently sloping, moderately well drained and somewhat poorly drained, light-colored soils of till plains and moraines, and nearly level, very poorly drained, dark-colored soils in drainageways

In this association are nearly level to gently sloping, predominantly light-colored Morley and Blount soils and dark-colored Pewamo soils that are generally along drainageways in the uplands.

The Morley soils, which occur in the more sloping areas, are moderately well drained despite the fact that they have a subsoil that contains a fairly large amount of clay. Their surface layer is silt loam, and they formed in glacial till that is limy at a depth of about 24 inches. The Morley soils are low in natural fertility. The Blount soils are somewhat poorly drained, and they also have a silt loam surface layer. Their subsoil is limy at a depth of about 30 inches.

The Pewamo soils, in the depressed flats and upland drainageways, are dark colored and very poorly drained. Their surface layer is fine textured, and therefore, they are more difficult to till than the Morley and Blount soils. The subsoil of the Pewamo soils is limy at a depth of about 40 inches. The Pewamo soils are high in natural fertility.

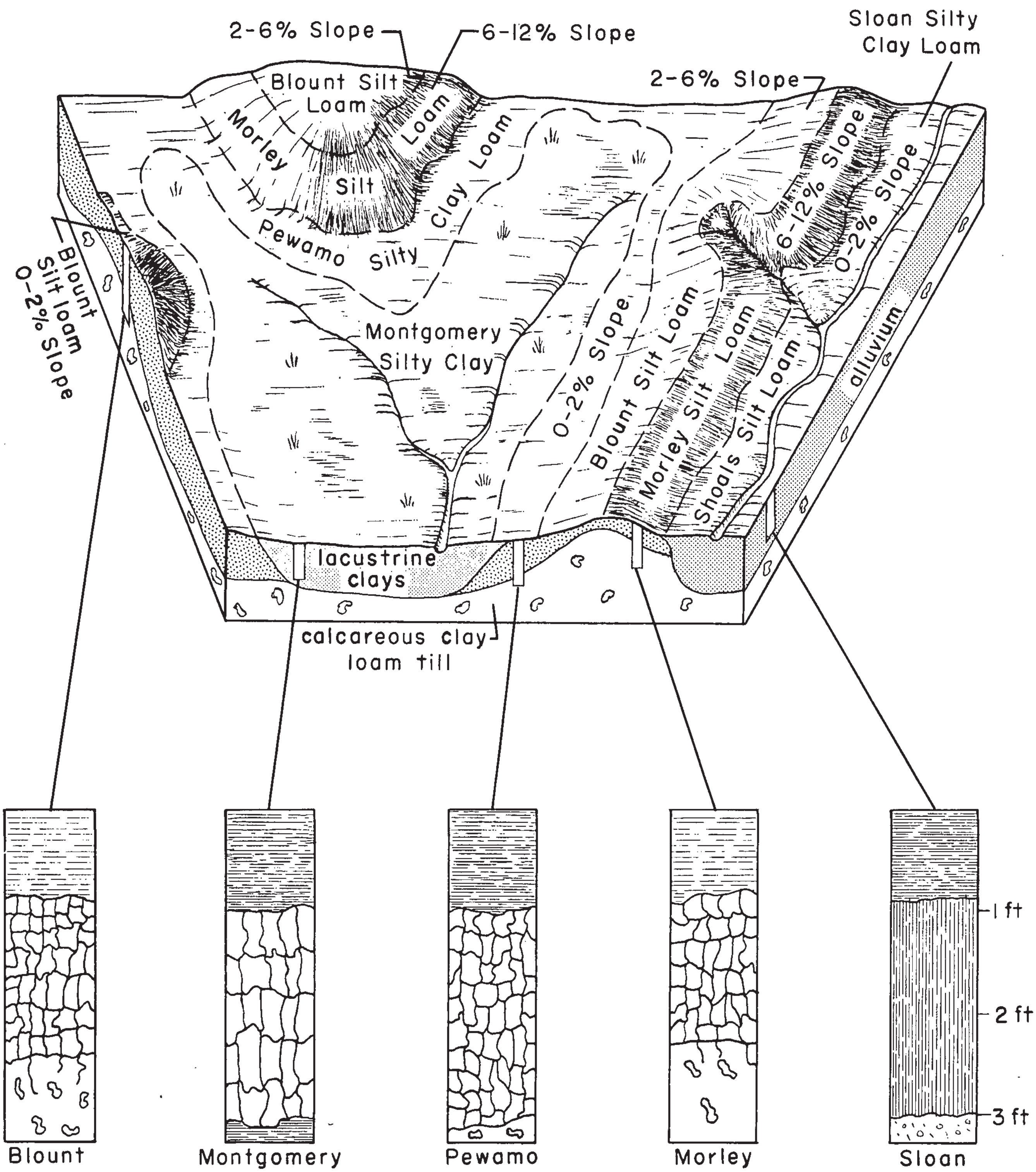

Figure 4.—**A schematic drawing showing the relationship of the soils of the Montgomery-Blount association to other soils of the county.**

Cash-grain and general farming are the major agricultural enterprises in this soil association. If the soils are properly managed, good yields can be obtained. Tile and surface drainage are needed for maximum production on the Blount and Pewamo soils, and the Morley soils need practices to control erosion. The Morley and Blount soils are somewhat low in natural fertility. Crops grown on them respond well to fertilizer.

3. Blount-Pewamo Association

Nearly level to gently sloping, somewhat poorly drained, light-colored soils of till plains, and very poorly drained, dark-colored soils in depressions

This association, one of the largest in the county, consists mainly of light-colored, somewhat poorly drained Blount soils and dark-colored, very poorly drained Pewamo soils. The Blount soils are on low knolls and ridges, and the Pewamo soils are in depressions (fig. 5). The proportion of each of these soils varies greatly within short distances. Minor areas of the Morley and Montgomery soils also occur within this association. The Morley soils occupy the escarpments and stronger slopes that border streams. The Montgomery soils are in depressions that contain water-deposited, clayey material.

The Blount soils formed in glacial till that is limy at a depth of about 30 inches. These soils are lower in content of organic matter and in natural fertility than the Pewamo soils. They have a surface layer of silt loam and are easier to till than the Pewamo soils. The Pewamo soils are high in natural fertility, but they are difficult to till because of their fine-textured surface layer.

Cash-grain farming is the dominant type of agriculture in the association, but in some areas the production of tomatoes and sugar beets is important. The soils need surface and tile drainage for maximum production. The response to fertilizer is good, particularly on the Blount soils, which are low in natural fertility. Under proper management the soils of this area are highly productive.

4. Morley-Blount Association

Gently sloping to steep, moderately well drained soils, and nearly level to gently sloping, somewhat poorly drained soils of till plains and moraines

In this soil association are gentle to steep, south-facing slopes of the moraines that bisect the county in an east-west direction. The soils of this association are also along the major streams where the relief is sloping to moderately steep (figs. 6 and 7). The Morley and Blount soils occupy the major part of the association. The Pewamo soils are in some drainageways and depressions.

The Morley soils have a surface layer of silt loam in areas where they have been protected from erosion. In places, however, they have eroded to the extent that the surface layer is made up of material that was formerly subsoil. Although the subsoil has a fairly high content of clay, the Morley soils are moderately well drained. They are low in organic matter and in natural fertility. The Morley soils formed in glacial till that is limy at a depth of about 24 inches.

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The Blount soils also have a surface layer of silt loam, but they are somewhat poorly drained. Their subsoil is limy at a depth of about 30 inches. They are higher in natural fertility than the Morley soils. The Blount soils of this association are generally more eroded than the Blount soils of other associations because this association is steeper.

Livestock and general farming are the leading agricultural enterprises in this association. Cash-grain farming is practiced to a minor extent. Some of the acreage remains in woodland and permanent pasture. If the steeper soils are farmed, they need intensive conservation practices, such as terracing and contouring. The nearly level soils and soils in depressions need tile drainage. Crops grown on the soils of this association respond favorably to fertilizer. However, the steep slopes limit cultivation in much of this soil association. In the steep areas permanent pasture and woodland may be the best uses.

5. Hoytville-Nappanee Association

Nearly level, dark-colored, very poorly drained soils on broad flats, and undulating to sloping, light-colored, somewhat poorly drained soils on adjacent low knolls

This soil association consists largely of nearly level Hoytville soils on broad flats and of undulating Nappanee soils on low knolls and in sloping areas near streams (fig. 8). The Hoytville soils are dark colored and very poorly drained, and the Nappanee soils are light colored and somewhat poorly drained. Minor soils in this association are the very poorly drained Toledo soils in depressions and the moderately well drained St. Clair soils on the escarpments and slopes near the streams.

The Hoytville soils formed in glacial till that was modified by water of the glacial lakes. Most of the Hoytville soils have a surface layer of silty clay loam or silty clay, but in some areas near the sandy beach ridges, the surface layer is silt loam. The subsoil is limy at a depth of about 40 inches. These soils are fairly high in content of organic matter and in natural fertility.

The Nappanee soils developed in glacial till that was modified by lake-laid sediment. Most of the Nappanee soils have a surface layer of silt loam. In some areas near the sandy soils of the beach ridges, however, their surface layer is loam. The subsoil is limy at a depth of about 24 inches. The Nappanee soils generally occur in small areas within larger areas of the Hoytville soils. They are low in content of organic matter and in natural fertility.

Cash-grain farming predominates in this soil association, but there is a considerable acreage of sugar beets and tomatoes. The soils contain more clay in their subsoil than the Blount and Pewamo soils; consequently, the problems of management are more difficult. Surface and tile drainage are most important if the soils are to produce maximum yields. The response to fertilizer is favorable, and if the soils are properly managed, they are moderately to highly productive.

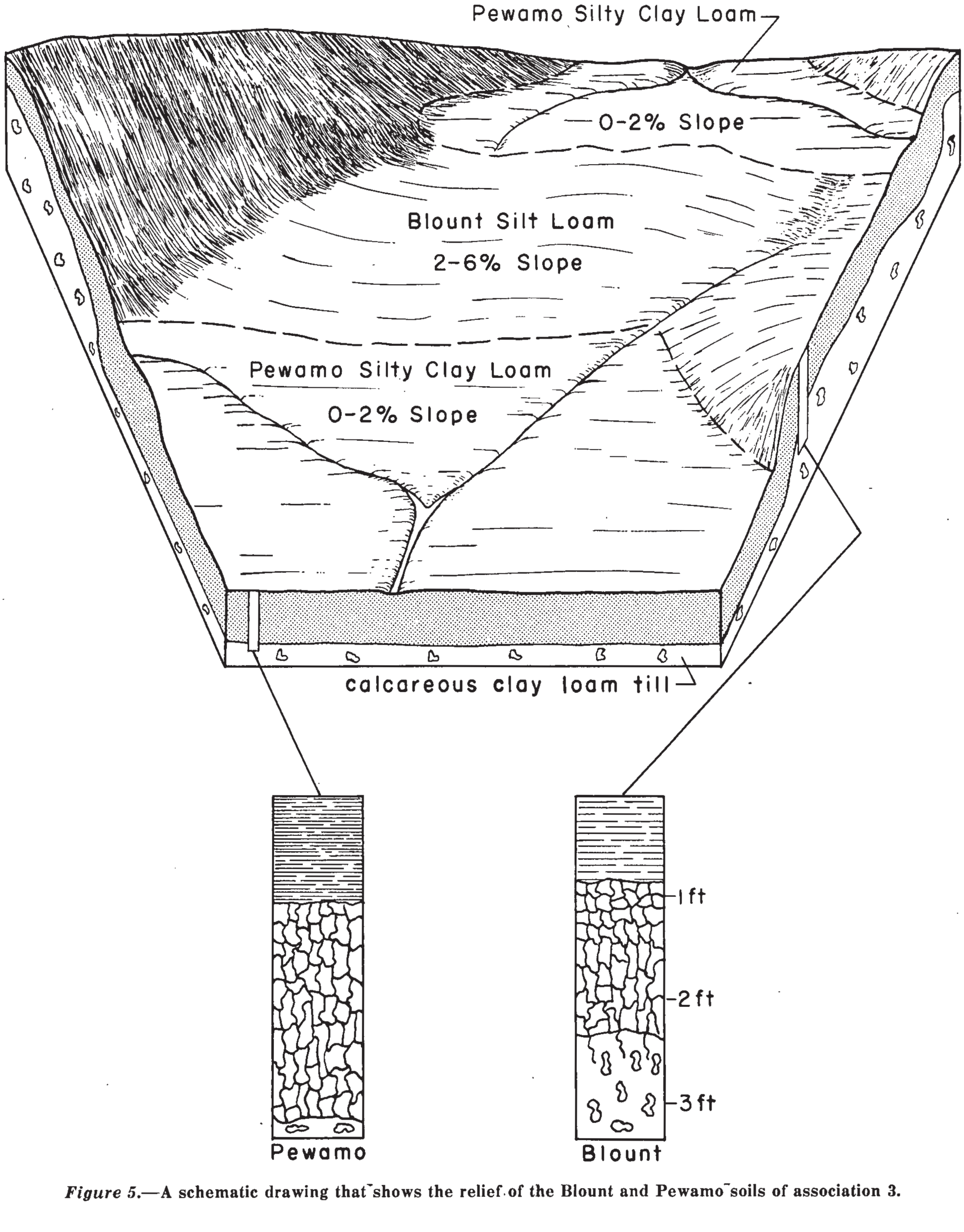

Figure 5.—A schematic drawing that shows the relief of the Blount and Pewamo soils of association 3.

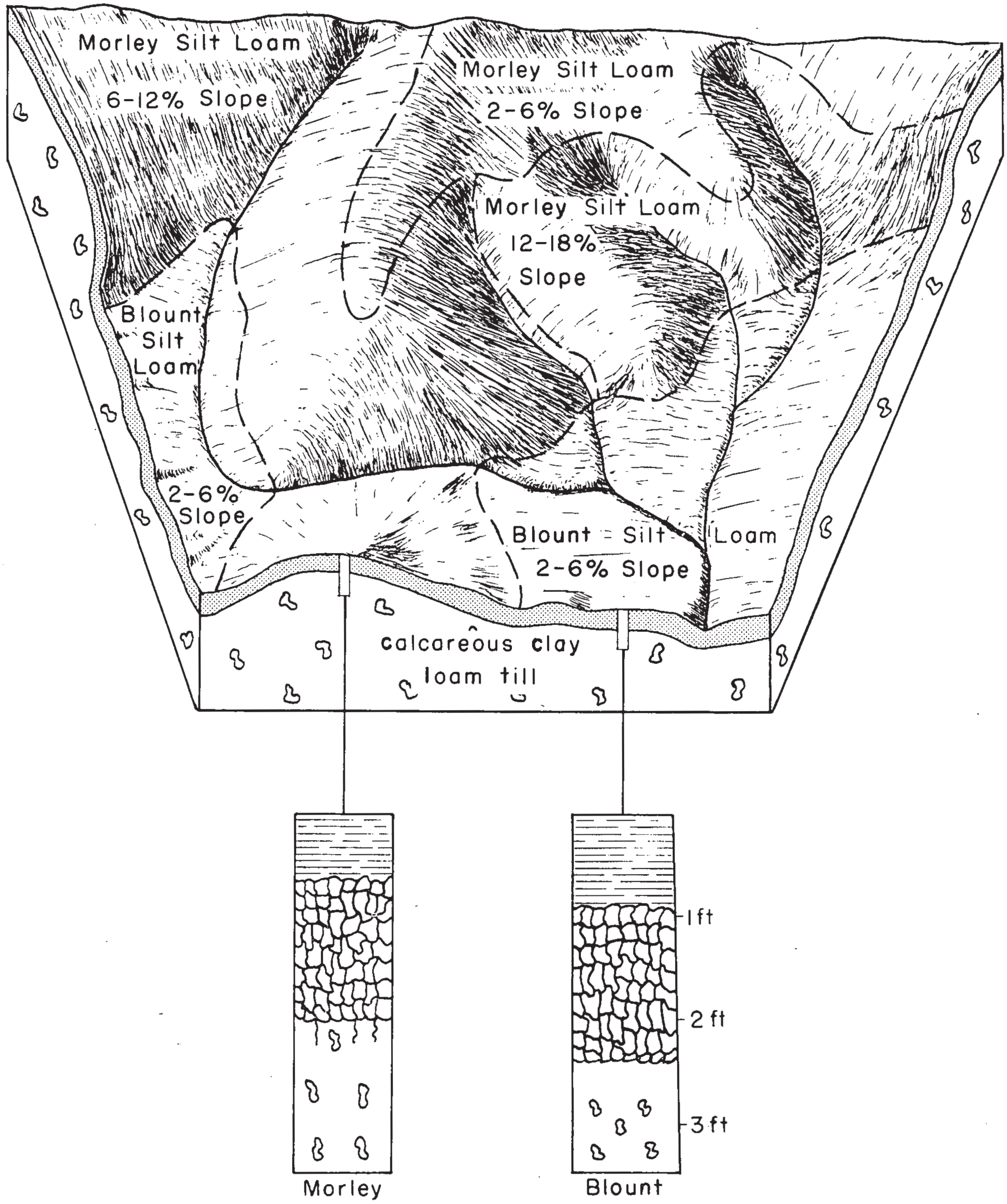

Figure 6.—**A schematic drawing that shows the relief of the Morley and Blount soils and their relationship to each other.**

Figure 7.—A morainic area in the southeastern part of Allen County. The Morley soils are in the steeper areas, and the Blount soils are in the more gently sloping areas.

6. Shoals-Sloan Association

Somewhat poorly drained and very poorly drained soils on flood plains

The soils of this soil association are on the flood plains of the rivers, creeks, and smaller streams of the county. They are most extensive along the Auglaize and Ottawa Rivers. The Shoals and Sloan soils are the most extensive in this association. The Shoals soils are nearly level to slightly depressional and are somewhat poorly drained. The Sloan soils are in lower positions than the Shoals and are very poorly drained.

The Shoals and Sloan soils developed in sediment that was washed from the glacial till soils of the uplands. They are subject to renewed flooding and deposition of sediment, which occurs more often in the nearly level to depressional areas than in the higher areas.

Minor soils of this association are of the Eel and Genesee series. These soils are nearly level to slightly elevated and are less subject to flooding than the Shoals and Sloan soils (fig. 9). The Eel soils are moderately well drained, and the Genesee soils are well drained.

The cleared areas of this association are used mainly for row crops and small grains. Many of the areas are farmed to corn year after year. Some of the cleared areas are in permanent pasture. The soils of this association respond well to tile drainage, and the response to fertilizer is good. In general, these soils are highly productive if they are properly managed, but some areas are affected by damaging floods and deposition of sediment.

7. Belmore-Haney-Digby-Millgrove Association

Nearly level to gently sloping, very poorly drained to well-drained, light-colored soils on beach ridges and stream terraces

This soil association occupies the beach ridges and remnants of beach ridges in the northern third of the county. It also occurs on the terraces along the rivers and large streams throughout the county. The topography is mainly nearly level to gently sloping, but some areas are strongly sloping. The main soils of this association are those of the Belmore, Haney, Digby, and Millgrove series (fig. 10), but Haskins soils are also present.

The soils of this association formed in water-deposited material consisting mainly of poorly assorted sand and gravel but that contains a considerable amount of silt and clay. Their surface layer is mainly of loamy texture, which allows good infiltration. The subsoil ranges from clay loam to loamy sand, and the content of gravel is variable.

The Belmore soils are well drained, and water moves through the soil material rapidly. These soils are droughty during prolonged dry periods. The Haney soils are moderately well drained and moderately permeable to moisture. During normal seasons they have an adequate supply of available moisture. The Digby soils are somewhat poorly drained, but they respond better to tile drainage than the somewhat poorly drained soils that have a clayey subsoil. The Millgrove soils are dark colored, very poorly drained, and moderately permeable to water. They are high in content of organic matter and are highly productive if they are drained. Tile drainage is very effective in removing excess water. Some of the Millgrove soils are underlain by clayey material within a depth of 48 inches.

Other soils that are common in this association and that occupy a considerable acreage are the Haskins. The Haskins soils are somewhat poorly drained and are underlain by clayey material at a depth of 31 inches.

Most of this soil association is used for general farming. Growing tomatoes, potatoes, and truck crops, however, are commercial enterprises in the northeastern part of the county. Some small areas are used as sources of gravel. Major problems in this soil association are wetness of the dark-colored, poorly drained soils and erosion and droughtiness of the light-colored, sloping soils.

Use and Management of Soils

In this section is a discussion of general management practices, including information about tillage, runoff and erosion, drainage, organic matter, and plant nutrients and lime. Then, the general management of the soils used for cropland and pastureland is described. Next, the system for classifying the soils into capability classes, subclasses, and units is explained, and the management for the soils of each capability unit is given. The estimated yields for each soil, under two levels of management, are given; and specialized crops grown in this county are discussed. Following this is a discussion of the use and management of the soils for woodland and windbreaks and for wildlife. Facts about the soils used for engineering are given, including information about urbanization and residential development. Finally, irrigation is discussed.

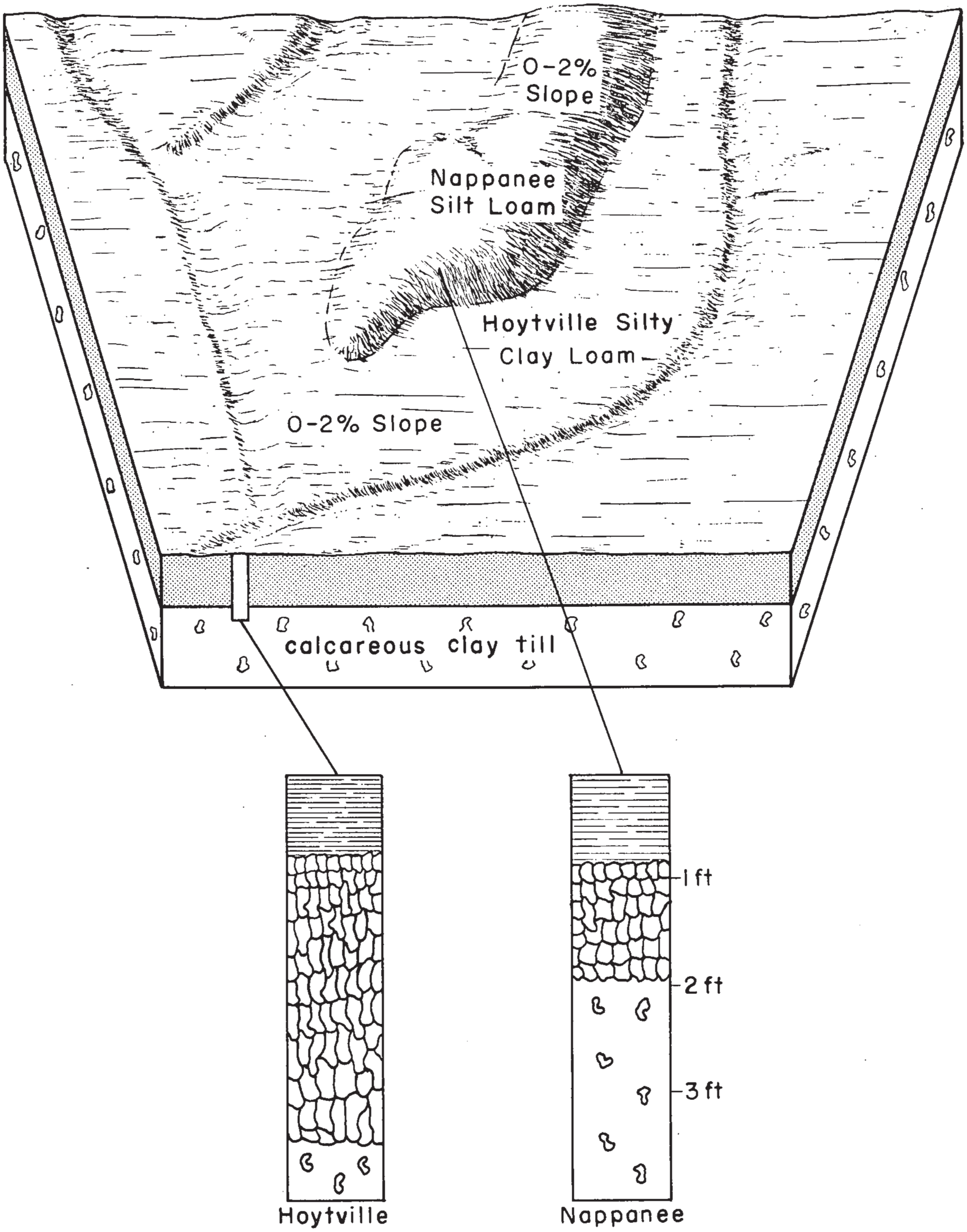

***Figure 8.*—A schematic drawing that shows the relief and relationship of the Hoytville and Nappanee soils.**

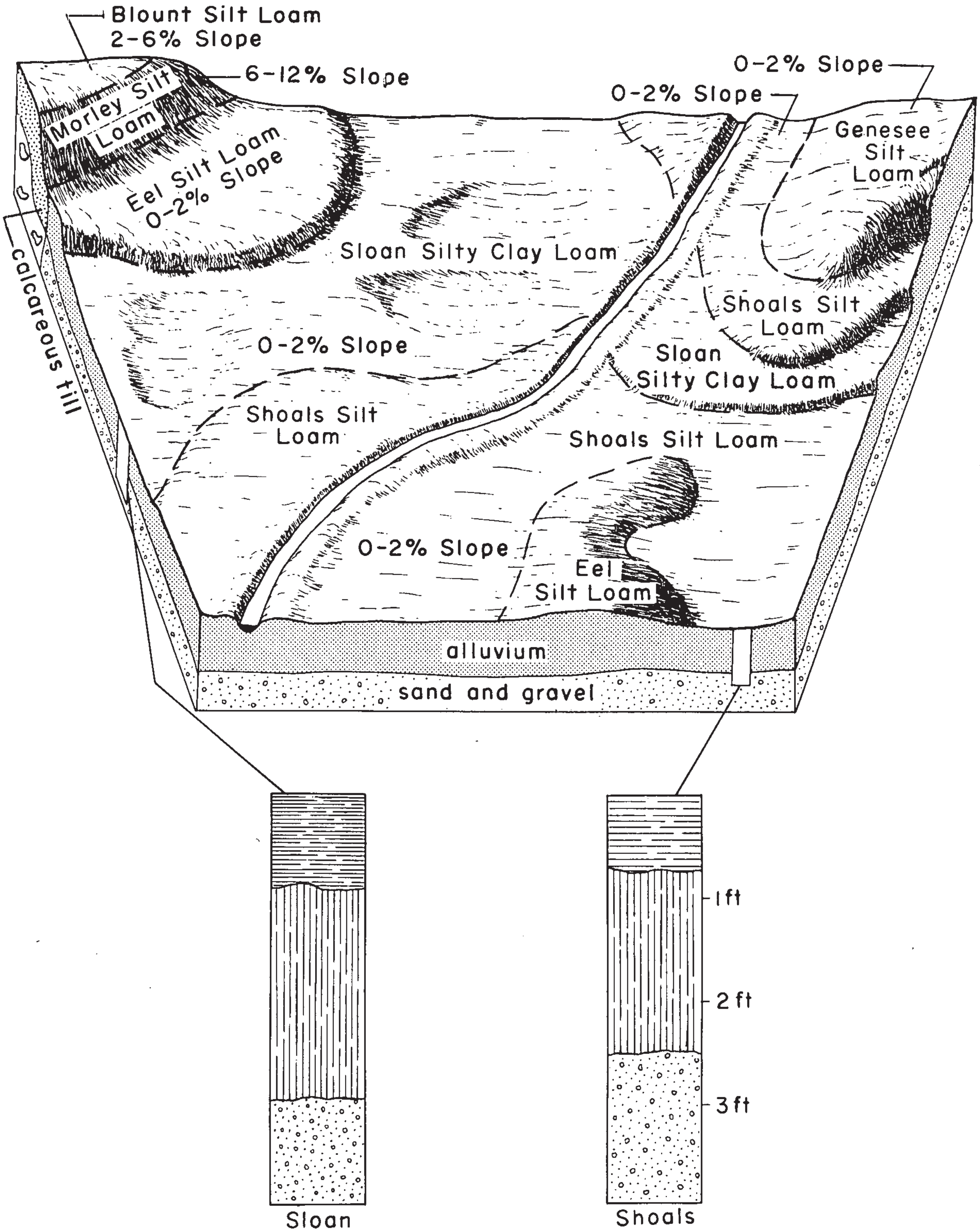

Figure 9.—A schematic drawing that shows the relationship of the soils formed in alluvium to drainage and to the soils of the uplands.

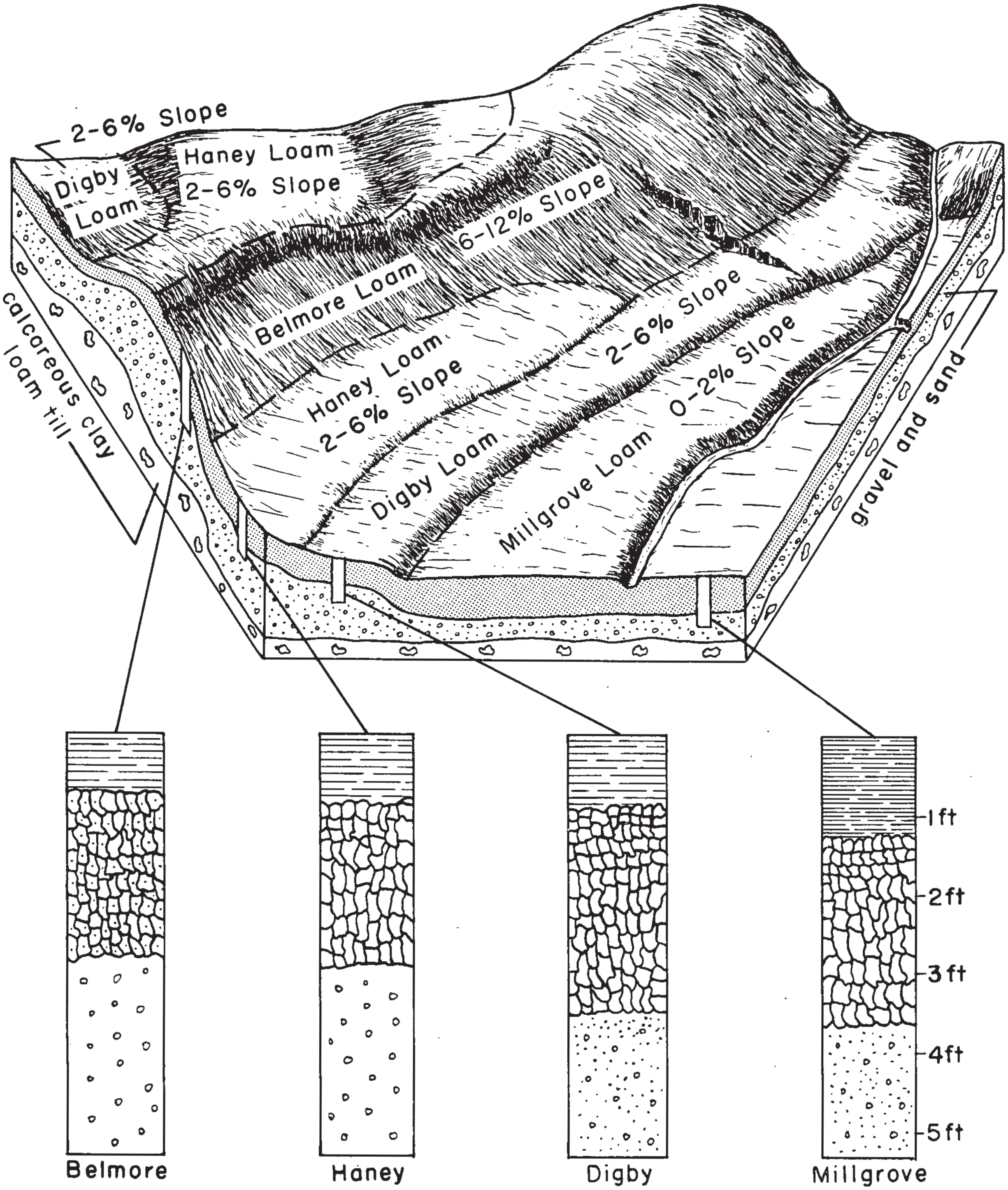

Figure 10.—**A schematic drawing that shows the relief and relationship of the Belmore, Haney, Digby, and Millgrove soils.**

General Management Practices [4]

Sound soil management requires the use of good methods of tillage; practices to control runoff and soil erosion; drainage to remove excess water from wet land; planting of legumes and management of residues, cover crops, and manure to furnish nitrogen and organic matter; addition of lime and fertilizer to control soil acidity and supply needed nutrients; and other practices to manage the particular soil and to control the water in it (*3*, *4*, *5*).

Tillage

Tillage is generally done to produce some or all of these results: (1) destroy competing vegetation; (2) mix organic matter with the soil; (3) improve aeration and encourage decay of organic matter; (4) roughen the soil surface to increase the intake of water; (5) mix lime or fertilizer with the soil; and (6) modify soil structure to improve granulation and tilth.

Heavy machines tend to pack the soil, and some soils are worked too much. Recent research shows that good yields require less tillage than many farmers have believed. Traffic on the soil makes it compact, slows the intake of water, increases runoff and erosion, decreases yields, and increases the cost of producing crops.

Much tillage is done to produce a good seedbed. A seedbed is needed, however, for only a few days. Then the soil functions as a rootbed. The requirements for the two often are not the same.

Some crops need a seedbed that is fine and compact; most growing plants need a rootbed that has stable soil aggregates and that is well aerated. The best tillage pulverizes and packs the soil about the seeds just enough to assure a stand. A loose, aggregated soil is less subject to erosion than a compact one.

Several devices and practices help obtain a crop with minimum tillage. Some machines work the soil in a narrow band just where seed is to be planted. Plow planting of corn decreases costs and generally maintains or increases yields (figs. 11 and 12). Chemicals control some kinds of weeds and leave the soil loose so water can get in. Smoothing of land improves surface drainage, aids the distribution of water, and helps obtain a good seedbed.

Control of runoff and erosion

Soils that have a good cover of grass or trees do not lose much soil material, although runoff is likely unless the soil is permeable enough to take in the water that falls. All sloping fileds are subject to erosion, and some erosion occurs even on the nearly level clay soils of Allen County. Clay and some organic matter are stirred up in the water that falls during a storm, and some of both is carried away even if the runoff is slow.

Sloping and moderately steep soils, of course, are more likely to erode than level soils. Erosion is severe on some of the rolling, complex slopes of the glacial moraines. Erodibility depends on soil characteristics. The Morley silt loams are erodible on gentle slopes because of their slowly permeable subsoil; therefore they require protection. Belmore loam is much more permeable and less subject to erosion on the same degree of slope. Little wind erosion occurs, although some of the sandy soils are subject to blowing if they are not protected.

Figure 11.—**Plow planting of corn after clover has been grown. Note the good soil aggregation and roughness of the surface.**

Figure 12.—**A closeup view of wheel-track planting. The soil material between the rows remains loose.**

Erosion can be partly controlled through a good cropping system, cover crops and sod crops, and applications of fertilizer and lime. Control on sloping fields also generally requires contour cultivation, stripcropping, grassed waterways (fig. 13), terraces, or diversions. One practice depends on another, and a combination needs to be developed to meet problems on the soils of each farm.

[4] GLEN L. BERNATH, agronomist; LEE L. BORTON, soil conservationist; VAUGHN L. SIEGENTHALER, soil scientists; and others helped prepare this section.

Figure 13.—**A grassed waterway in an area of Pewamo and Blount soils.**

Drainage

Somewhat poorly drained and poorly drained soils make up about 85 percent of the acreage in Allen County. These soils need drainage if the best yields are to be obtained. On some areas of such soils, an adequate drainage system is already installed. However, additional drainage is needed in many areas. Water stands too long after periods of wet weather on many areas of the soils that are described as poorly drained (fig. 14). A wet soil warms up slowly in spring, and as a result, tillage and crop growth are delayed.

Figure 14.—**A ponded area of Pewamo silty clay loam. Surface drainage would help solve the problem of ponding.**

The well drained and moderately well drained soils, as a rule, do not need to be drained artificially. Such soils are those of the Morley, St. Clair, Belmore, and Haney series. Drainage of wet spots, however, makes some fields more usable and productive.

Surface drains and subsurface drains are used. Surface drains are shallow ditches in low places or along the edges of shaped beds. Subsurface drains on present-day farms are mostly lines of buried tile. Both surface drains and subsurface drains need to empty into a ditch, and the outlet ditch provides some further subsurface drainage.

Some light-colored soils of the uplands, for example, those of the Blount and Nappanee series, need random or systematic surface drains to remove excess water. Most of the dark-colored soils need to be drained artificially to produce crops. Many of them need a combination of surface and subsurface drains. If only one kind of drain is installed where both are needed, the system is not effective.

Depth and spacing of tile depend on the soil, its history, and its future use. A farmer should obtain technical help in designing and constructing a drainage system that fits his soils and type of farm.

Although excess water needs to be removed from most soils of the county, water also needs to be conserved for growth of crops. The soils described as well drained or moderately well drained are likely to be too dry during part of a dry growing season. The Belmore, Spinks, and Fox soils are especially likely to contain too little moisture during dry weather. A good program of soil management helps to conserve soil moisture. Figures 15, 16, and 17 show representative practices of artificial drainage.

Figure 15.—**An open ditch being cleaned and enlarged to meet the required capacity. The spoil will be spread, and the ditchbanks will be seeded.**

Organic matter

Organic matter improves soil structure, adds some nutrients, increases aeration and water-holding capacity, and supplies food for micro-organisms.

Figure 16.—Aerial view showing the systematic layout of tile drainage in an area of Pewamo and Blount soils. The outlet for the open ditch is in the upper left of the picture, near the woods.

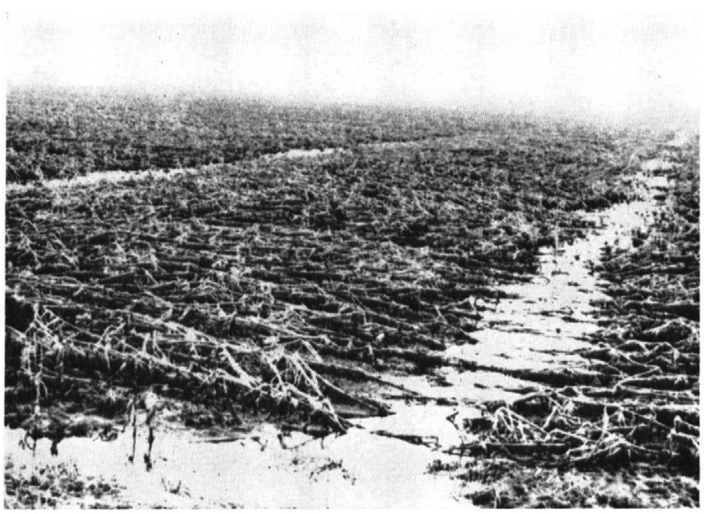

Figure 17.—A W-type surface drain in an area that was formerly ponded.

Most very dark colored soils, for example, those of the Pewamo series, contain from 4 to 7 percent organic matter. Light-colored soils contain much less; the Blount soils, for example, have from 1 to 3 percent organic matter in the surface soil.

The following practices help to maintain and possibly to increase the amount of organic matter in a soil.

Preserve and return all animal and crop residue to the soil. High-level crop yields obtained by a good fertilization program will help produce more residue to be returned to the soil.

Protect animal manure from rain and return it to the field. Many of the nutrients in manure can be lost if leaching is permitted.

Follow a rotation that includes meadow crops and winter cover crops. Use other practices to increase organic matter, control soil loss, and improve the physical condition of the soil.

Apply nitrogen fertilizer; accumulation of organic matter is related to the amount of nitrogen available (fig. 18).

Figure 18.—**A cover crop of ryegrass in corn. The area in the foreground was fertilized with nitrogen, and the area in the background was not.**

Plant nutrients and lime

A balanced program of fertilizing and liming is needed for successful farming in this county. Since the program depends on the soil, the drainage, and the cropping system, no attempt is made to give details here. Soil tests are generally needed, and can be obtained through the county agricultural extension agent. Some dealers who sell fertilizer or lime can also obtain soil tests.

Lime.—Most soils of the county are slightly acid or medium acid, and for most crops they need lime from time to time. Lime makes the soil less acid and supplies calcium. Dolomitic limestone also supplies magnesium. Lime is needed for most legumes, and especially for alfalfa or sweetclover.

The lime requirement depends on the soil and on its recent management. Generally, the light-colored soils, if they have not been limed for several years, need 3 or 4 tons per acre. Many of the dark-colored soils, such as those of the Hoytville series, need little or no lime.

Nitrogen.—The amount of available nitrogen is the factor that often limits crop yields in seasons of adequate rainfall. A corn crop of 100 bushels needs from 40 to 120 pounds of added nitrogen per acre. The exact amount that should be applied in fertilizer depends on the supply in the soil, the number of years that corn has been grown, and the yield expected.

Phosphorus.—Most of the soils contain a low or medium supply of available phosphorus, and they need to have more applied in fertilizer. As farmers improve their soil management, grow more row crops, and aim for high yields, they need to make sure the crop requirements for phosphorus will be met.

Potassium.—Most of the soils contain a medium to high amount of potassium, and deficiencies are not likely to be as critical as those of the other common plant nutrients. Some crops respond to applications of potassium if the whole program of management is good. Alfalfa or mixed hay requires more potassium but less nitrogen than corn.

Trace elements.—Although several elements are needed in small amounts for plant growth, deficiencies in this county generally are not serious. Deficiencies of boron, manganese, and perhaps of molybdenum can occur. A suspected deficiency should be checked by a soil test. Too much of a trace element is likely to be toxic to plants; therefore, the amount applied should be regulated with care.

General Management of Cropland

Most farmers in this county can maintain or increase the yields of row crops by using a suitable rotation and a good fertilization program. A rotation that provides 2 years of meadow in 4 for most of the sloping areas, and 1 year of green-manure crops or meadow crops in 4 on nearly level areas, provides adequate organic matter and maintains good soil tilth for most of the soils in the county. Some of the very poorly drained, nearly level soils, however, such as the Pewamo, Hoytville, and Millgrove, and some of the moderately well drained and well drained, nearly level soils, can be cropped continuously to corn if a high level of fertility is maintained and if large amounts of cornstalks or other plant residue are incorporated into the soil material. Sloping soils that are subject to erosion are not suited to continuous cropping. If an intensive rotation is to be successfully used, a high level of management is required, and all factors of soil management need to be in proper balance. The following practices apply to all soils used for row crops:

1. Return all crop residue to the soil. If animal manure is available, give first priority to eroded areas.
2. Use a good rotation to maintain tilth and productive capacity. A good rotation has many beneficial effects, such as improving the soil structure, controlling weeds, improving tilth, maintaining the content of organic matter, improving drainage, and controlling insects.
3. Use adequate measures to control erosion where needed. Damage from erosion is not easily repaired.
4. Provide adequate drainage if needed, and conserve soil moisture.
5. Provide an adequate supply of all plant nutrients according to the needs of the crop to be grown. Use limestone to correct the acidity of the soils.
6. Use green manure (fig. 19), cover crops, or sod crops where row crops are grown intensively.
7. Plow, plant, cultivate, and harvest at the right time to reduce cost and to improve the structure of the soil for plant growth. Timeliness of these operations is one of the most important of all farming operations.
8. Prepare seedbeds properly. Avoid excessive tilling in preparing the seedbed. Also, avoid working with heavy machinery if the soils are too wet.
9. Use the latest improved and recommended seed varieties that are suitable for your soils, and plant at recommended rates.
10. Control weeds, insects, and diseases by using herbicides, insecticides, and pesticides.
11. Use the latest fertilizer placement methods.

Figure 19.—**Plowing down a green-manure crop of mixed clover. This practice improves soil tilth, adds organic matter, and improves soil aggregation.**

General Management of Pastureland

Good improved permanent pastures are very effective in controlling erosion on sloping, eroded areas that are subject to further serious erosion. In the past many pastures received little care. It is worth while to maintain pastures at a high level of fertility if one has the livestock to utilize the forage. Yields on most of the present pastures in Allen County could be doubled or even tripled by using a few simple management practices. Most of the better soils in this county are used for row crops, but those soils are also well suited to pasture. Most of the present permanent pastures are on the poorer soils where there is a severe risk of erosion. Generally, these soils are eroded, low in fertility, and in poor tilth.

Soils that require drainage for field crops also need drainage for maximum yields of pasture. Soils that have a high content of clay in the surface layer and that remain wet in spring, such as Hoytville silty clay, are well suited to pasture. Grazing must be controlled in spring, however, to avoid compacting the soils. Including deep-rooted legumes in the pasture mixture increases the yields of forage late in summer and fall.

The kind of management to use in establishing or improving pasture depends primarily on the climate and on the characteristics of the soils. Where a pasture is to be established or improved on some of the better soils, a companion crop of oats or wheat may be seeded. The companion crop protects the new pasture seedlings, provides additional income when it is harvested, and protects the soils from erosion. On some of the more eroded soils, such as the steep Morley silt loams, seeding by the mulch method or using other practices to control erosion may be required. Practices to control erosion are discussed in the section "General Management Practices" under the heading "Control of Runoff and Erosion." During recent years there has been increased interest in direct seeding of pasture during the summer months. This method was very successful in this county when proper procedures were followed.

Like row crops, pastures need lime, fertilizer, improved varieties of seed, and good management. Listed below are some of the most important management practices to consider in the production of pasture.

1. Use grazing practices that permit maximum yields and utilization of all high-quality forage. Rotational grazing provides for the maximum utilization of available pasture.
2. Use practices that provide for continuous production of high-quality pasture throughout the season.
3. Use adequate safeguards to minimize the danger of bloat, poison chemicals, and weeds.
4. Use proper grazing and cutting methods for pasture to assure that legumes will become reestablished.
5. Add lime, and fertilize according to the needs of the crop to be grown. Most soils used for pasture and hay need annual applications of lime, phosphorus, and potash. Some also need nitrogen.
6. Use the latest recommended methods of seeding, the latest improved varieties of seed, and the latest recommended seeding rates.
7. Use proper methods of preparing the seedbed and proper seeding methods.
8. Use herbicides and insecticides to control weeds and insects.

For the latest recommendations covering specific methods, rates of seeding, variety of seeds, and seeding mixtures on specific tracts of land, contact a local representative of the Soil Conservation Service, the Extension Service, or the State Experiment Station.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest groupings are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. In Allen County there are no soils in class VIII.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes, there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited, mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is a climate that is too cold or too dry.

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

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIw-2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.

Class I. Soils that have few limitations that restrict their use. (No subclasses)
- Unit I-1: Nearly level, moderately well drained or well drained sandy loams, loams, and silt loams on terraces, on beach ridges, and along streams in the glaciated uplands.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe.—Soils subject to moderate erosion if they are not protected.
  - Unit IIe-1: Gently sloping, deep, moderately well drained soils of the outwash plains, outwash terraces, and beach ridges.
  - Unit IIe-2: Gently sloping, moderately deep, moderately well drained and well drained soils of stream terraces, beach ridges, and outwash plains.
  - Unit IIe-3: Gently sloping, moderately well drained and well drained loams or silt loams mainly on till plains or glacial moraines.
- Subclass IIw.—Soils that have moderate limitations because of excess water.
  - Unit IIw-1: Nearly level, deep, moderately well drained or well drained silt loams of the first bottoms of the major streams.
  - Unit IIw-2: Nearly level, deep, somewhat poorly drained soil of the first bottoms of the major streams.
  - Unit IIw-3: Nearly level or gently sloping, somewhat poorly drained soils of the outwash terraces or beach ridges.
  - Unit IIw-4: Nearly level or gently sloping, somewhat poorly drained soils of the glaciated uplands.
  - Unit IIw-5: Nearly level, dark-colored, very poorly drained soils of old lakebeds and outwash terraces.
  - Unit IIw-6: Nearly level, dark-colored, very poorly drained soils of outwash areas, beach ridges, and uplands.
  - Unit IIw-7: Nearly level, dark-colored, very poorly drained soils of the lakebeds.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe.—Soils subject to severe erosion if they are cultivated and not protected.
  - Unit IIIe-1: Sloping, shallow to moderately deep, moderately well drained and well drained loams mainly on terrace escarpments, beach ridges, and moraines.
  - Unit IIIe-2: Gently sloping to sloping, moderately well drained and imperfectly drained soils mainly on the till plain or on glacial moraines.
- Subclass IIIw.—Soils that have severe limitations because of excess water.
  - Unit IIIw-1: Nearly level or gently sloping, light-colored, somewhat poorly drained soils underlain by calcareous clay till or lacustrine clay.
  - Unit IIIw-2: Very dark colored, very poorly drained organic soil in nearly level areas or depressions.
  - Unit IIIw-3: Very poorly drained soils in nearly level areas or depressions that are ponded or subject to flooding.
- Subclass IIIs.—Soils that have severe limitations of moisture capacity or that are shallow over sand and gravel.
  - Unit IIIs-1: Nearly level or gently sloping, droughty, well-drained soils mainly on outwash terraces and beach ridges.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe.—Soils subject to very severe erosion if they are cultivated and not protected.
  - Unit IVe-1: Sloping to moderately steep, moderately well drained or well drained soils of the glacial till plain and outwash areas.

Class V. Soils not likely to erode that have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife food and cover. (None in Allen County)

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.
  - Unit VIe-1: Steep, moderately well drained soil of the glacial till plain and moraines.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.
- Subclass VIIe.—Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.
  - Unit VIIe-1: Moderately steep to very steep, moderately well drained soils in areas of moraines or on escarpments that border drainageways.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial production of plants; and restrict their use to recreation, wildlife, water supply, or esthetic purposes. (None in Allen County)

The total acreage of Allen County, exclusive of Borrow pits, Gravel pit, Made land, Quarry and ponds, reservoirs, rivers, and urban areas is about 245,000 acres. Of this total only 475 acres is in capability classes VI and VII, which are not suited to cultivation, because the soils are steep and have a severe hazard of erosion. About 90 percent of the rest of the acreage is in class II, nearly half of which consists of the nearly level and gently sloping Blount soils.

On more than 86 percent of the total acreage of Allen County, wetness is the primary hazard. Erosion is the primary hazard on about 13 percent of the acreage in the county. Only 774 acres is in capability class I, which has few or no limitations that restrict the use of the soils. The following list shows the acreage of each of the capability units in the county.

Capability unit	*Acreage*	*Capability unit*	*Acreage*
I-1	774	IIw-7	11, 435
IIe-1	2, 879	IIIe-1	492
IIe-2	2, 278	IIIe-2	11, 885
IIe-3	13, 159	IIIw-1	2, 864
IIw-1	1, 924	IIIw-2	55
IIw-2	4, 216	IIIw-3	10, 965
IIw-3	5, 881	IIIs-1	195
IIw-4	108, 243	IVe-1	1, 221
IIw-5	7, 534	VIe-1	362
IIw-6	58, 438	VIIe-1	113

Management by Capability Units

In the following pages the soils in each capability unit are listed and described briefly. In addition, some suggestions for the use and management of the soils in each unit are given.

Capability unit I-1

This unit consists of nearly level, moderately well drained or well drained soils on terraces, on beach ridges, and along streams in the glaciated uplands. Most of the soils occur in small, scattered areas throughout the county; there are very few large areas.

The soils of this unit have a surface layer of loam, silt loam, or fine sandy loam. Their subsoil is sandy clay loam, clay loam, or loam and generally contains some coarse sand and fine gravel. Below the subsoil is sand and gravel that contains some fine material. The following soils are in this unit:

Belmore loam, 0 to 2 percent slopes.
Haney fine sandy loam, 0 to 2 percent slopes.
Haney loam, 0 to 2 percent slopes.
Haney silt loam, 0 to 2 percent slopes.

These soils are deep and friable, have fair moisture-supplying capacity, and are easy to work. Internal drainage is medium to rapid. These soils are productive and high in fertility. Crops grown on them respond well to fertilization, liming, and good management.

On the soils that have been farmed for a long time without liming, a large application of lime is needed, but on most of the soils only a moderate application is necessary. Phosphorus and potassium generally need to be added to obtain maximum yields, but usually not in the amounts needed on many of the less fertile soils in the county. Nitrogen is also needed for good yields of corn. The content of organic matter is low to medium. Increasing the amount of organic matter in the soils will improve the moisture-supplying capacity and soil tilth. Most of the Belmore soil, because of its susceptibility to leaching, loses plant nutrients fairly rapidly.

Tile drainage is generally not required on the soils of this unit. In some places, however, the Haney soils have local wet spots that require tile drainage. Practices to conserve water are more important than drainage. Land smoothing may provide for a more uniform distribution of water on the surface. The soils of this unit are well suited to irrigation if an adequate supply of water is available.

The soils of this unit can be farmed intensively to row crops or specialized crops, providing the level of fertility is high. Normally, corn, small grains, and meadow crops are each grown for 1 year in the rotation. This cropping system maintains good tilth. These soils are also well suited to hay or pasture crops. Alfalfa or red clover, along with all the other meadow crops commonly grown in the county, are well suited to the soils of this unit. Trees are seldom planted on these highly productive soils.

Capability unit IIe-1

In this unit are gently sloping, moderately well drained, light-colored soils. The soils are on outwash terraces, beach ridges, or outwash plains in the lakebed area of the county and along streams in the glaciated uplands.

The soils of this unit have a surface layer of loam, silt loam, or fine sandy loam. The lower part of their profile contains fairly large amounts of sand and fine gravel. The following soils are in this unit:

Haney fine sandy loam, 2 to 6 percent slopes.
Haney loam, 2 to 6 percent slopes.
Haney silt loam, 2 to 6 percent slopes.
Tuscola loam, 2 to 6 percent slopes.
Tuscola silt loam, 2 to 6 percent slopes.

These are among the better agricultural soils in the county. They are deep and friable and are easily tilled. Permeability is moderate, moisture-supplying capacity is fair, and internal drainage is medium. The soils are high in fertility, and they are productive. Crops grown on them respond well to applications of fertilizer and lime, and to good management.

The soils in this group are generally low to medium in phosphorus and medium to high in potassium. They have good soil tilth and contain a medium amount of organic matter. Rotating crops, incorporating organic matter in the soils, and using good management are important factors in obtaining maximum yields.

One of the major limitations of these soils is the hazard of erosion. Where the Tuscola soils have long slopes and are farmed intensively, they erode readily. Terraces and contouring should be used wherever feasible. If terracing and contouring are not feasible, erosion should be controlled by a suitable rotation and good management. Random tile may be needed in some small, local, wet areas, but in most places tiling is not needed. In some areas the Haney soils are underlain by heavy clay at a depth of about 4 feet. During extremely wet periods, the gravelly layer may because saturated and temporarily waterlogged. Land smoothing, on most of these soils, provides a more even distribution of water on the surface, helps conserve moisture for plant growth, and improves the distribution of moisture in the soils for tillage. In extremely dry years these soils show damage from drought earlier than some of the closely associated, poorly drained soils. These soils are well suited to irrigation if an adequate supply of water is available.

All of the soils in this group are well suited to the row crops and pasture crops commonly grown in the county; most of the acreage is used for corn, soybeans, and other row crops. Where these soils are well fertilized with phosphorus and potassium, plus the amount of nitrogen needed, high yields of corn can be obtained. Under average management, without other practices to control erosion, 2 years of meadow in 4 is sufficient to control erosion. A more intensive rotation can be followed if proper practices to control erosion are used. Even though the soils are used mostly for row crops, high yields of hay and pasture are produced if the soils are properly managed. Excellent stands of alfalfa are possible. Specialized crops, such as tomatoes and sugar beets, are also suitable.

Although most of the acreage has been cleared for cultivation, these soils are well suited to trees. Black walnut, white ash, and white or red oak can be used for planting in open areas of the present stands. White pine or Austrian pine can be used for new plantings.

Capability unit IIe-2

This unit consists of gently sloping, moderately deep, moderately well drained and well drained loams and sandy loam. These soils are mainly on the crests of beach ridges, but in some places they are on stream terraces and outwash plains. The following soils are in this unit:

Belmore loam, 2 to 6 percent slopes.
Fox loam, 2 to 6 percent slopes.
Seward fine sandy loam, 2 to 6 percent slopes.

The Seward soil has more sand throughout its profile than the Fox and Belmore soils, but it contains fewer small pebbles and less coarse sand. It is underlain by clayey material at a depth of 18 to 44 inches.

The soils in this capability unit are moderately deep and friable. They are low in moisture-supplying capacity and are generally droughty in dry periods. These soils are easy to till, and they are easily penetrated by air and water. Natural fertility is low to moderate; plant nutrients are removed rapidly by leaching. These soils are acid; they are moderately to highly productive under good management. Crops grown on them give excellent response to fertilizer, lime, and good management.

If these soils are not fertilized, they are generally low to medium in phosphorus and medium to high in potassium. They are low in content of organic matter; therefore, it is important that organic matter be supplied to decrease the loss of soil nutrients by leaching. For maximum yields, the Seward soil, which is fairly sandy, needs a well-balanced program of adding fertilizer, lime, and organic matter. On that soil the fertilizer should be applied frequently in small amounts so that plants can make the maximum use of it and so that losses as the result of leaching will be reduced.

The hazard of erosion is the main limitation of these soils. If these soils are planted to row crops, the intensity of erosion is less than that on the glaciated soils of uplands, under similar conditions. Erosion can generally be controlled by a few simple practices, such as establishing terraces and diversions or by using a good rotation and improved tillage practices. In most places conserving soil moisture is as important as controlling erosion. Soil moisture can be conserved by adding more organic matter to the soils, by land smoothing that provides more even distribution of water, by improved tillage practices that increase the rate of infiltration, and by other measures that reduce runoff.

These soils are well suited to the row crops, small grains, hay crops, and pasture crops commonly grown in the county. Even though a large part of the acreage is cleared and farmed to row crops, excellent stands of hay and pasture crops can be obtained. Excellent stands of alfalfa can be grown if adequate amounts of phosphorus, potassium, and lime are applied. If good yields of corn are to be obtained, nitrogen must be applied. These soils are well suited to specialized crops, such as tomatoes and beets, and they are well suited to fruit trees. They are also suitable for irrigation if an adequate supply of water is available. Under average management, without other practices to control erosion, growing hay crops 2 years out of 4 is sufficient to control erosion. If terraces and diversions are used, a more intensive rotation can be followed.

Most of these soils have been cleared for farming, but they are well suited to trees. Black walnut, white ash, or red and white oak can be used for new plantings or for planting in open areas of existing woodlots.

Capability unit IIe-3

The soils of this capability unit are gently sloping and are moderately well drained and well drained. They are mainly on till plains or glacial moraines. Some of the soils are in the lakebed region in the northwestern corner of the county.

The surface layer of these soils is loam or silt loam that is as much as 10 inches thick. The texture of the subsoil is loam to clay. The subsoil is underlain by calcareous clay loam till. The following soils are in this unit:

Morley loam, 2 to 6 percent slopes.
Morley silt loam, 2 to 6 percent slopes.
Rawson loam, 2 to 6 percent slopes.
Rawson silt loam, 2 to 6 percent slopes.

These soils are moderately deep and friable and are fair in moisture-supplying capacity. Internal drainage is moderately slow to medium, and natural fertility is low. These soils are easy to till, however, and they are highly productive under good management.

The soils in this group are low to medium in phosphorus and medium to high in potassium. Most areas are low in content of organic matter. Periodic applications of lime are needed to correct soil acidity. Adding nitrogen and other plant nutrients, where needed, increases the productivity of these soils. In some areas the problem of tilth is serious. In such areas the soils generally tend to crust during dry seasons and to puddle during wet seasons because the surface layer is low in content of organic matter and poorly aggregated. Organic matter needs to be added, particularly to the Morley soils, by applying manure or by growing cover crops to be turned under as green manure.

The greatest problem in managing these soils is control of erosion. A heavy, compact subsoil, which restricts the percolation of water, causes these soils to erode easily. The soils have generally lost part of their surface layer, and the overall thickness of the profile is therefore less. As the surface layer becomes thinner, the amount of runoff increases and the soil holds less water. Erosion can be controlled by contour tillage and by terraces, diversions, and grassed waterways. The choice of practices varies with the length of slope and the lay of the land. If it is not feasible to use any of the measures named above, then erosion should be controlled by growing hay crops, in rotation much of the time. If these soils are farmed intensively to row crops, without appropriate conservation practices, considerable loss of surface soil and depletion of nutrients result. The timeliness and method of tillage are factors in controlling erosion.

In some places a random system of tile drainage is needed to eliminate small, local, wet spots. In some areas the Rawson soils have wet spots that are hard to drain. In places land smoothing will provide more even distribution of runoff and eliminate small depressions where water accumulates. Because of the decrease in moisture capacity caused by erosion, some areas may be droughty during dry periods.

The soils of this unit are suited to all of the row crops, small grains, and hay crops commonly grown in the county. If adequate amounts of nitrogen and other plant nutrients are applied, good yields of corn and soybeans are obtained. Excellent hay and pasture crops are produced if adequate supplies of lime and plant nutrients are available. Most areas of Morley soils, which make up the largest acreage of this unit, are presently being cropped without practices to control erosion. Under average management, without other practices to control erosion, a rotation that consists of 2 years of meadow in 4 helps to control erosion. If other practices to control erosion are used, a more intensive rotation can be followed.

Most of the acreage in this unit has been cleared for cultivation, and trees are seldom planted. White or red oak, white ash, or black walnut can be used, however, for planting in open areas of present stands. In new plantings, white pine, red pine, or Austrian pine should be the main kind of tree used.

Capability unit IIw-1

In this capability unit are nearly level, deep, moderately well drained or well drained silt loams on first bottoms along the major streams. These soils are composed of layers of recent alluvial material that has been deposited by streams. The following soils are in this unit:

Eel silt loam.
Genesee silt loam.

These soils are among the most productive in the county. They are deep and friable. Moisture-supplying capacity is good, and natural fertility is high. The soils are easy to till, and they have medium internal drainage, but they are flooded occasionally. Crops grown on them respond well to good management, but the response is less evident than it is on soils that are low in natural fertility.

In some places the soils that have been farmed intensively for a long time need lime, but in most places no lime is required. These soils are generally high in phosphorus and potassium, but if maximum yields are to be obtained, applications of phosphorus, potassium, and nitrogen are needed. Even though the response to fertilizer is less noticeable on these soils than on many of the other less fertile soils in the county, some fertilization is normally profitable.

The major problem in managing these soils is removing water caused by flooding. Most of the areas are too small to justify the cost of levees. Some areas of the Eel soil may have to be random tiled to eliminate small wet areas. Land leveling or smoothing some of the uneven areas will provide more even distribution of water and improve surface drainage.

Where these soils are in large, accessible areas, they are well suited to row crops or small grains. They are also well suited to crops grown for hay and pasture. The small or inaccessible areas are used for pasture or trees. The soils can be cropped intensively, although occasional floods may cause some damage to crops. Row crops or specialized crops can be grown year after year under a high level of management. A successful continuous cropping system depends upon the fertility program and the level of management. In a normal rotation, 1 year of meadow out of 4 is adequate to maintain good soil tilth and a satisfactory supply of organic matter. The grasses and clovers commonly grown in the county are suitable, and high yields are possible.

Trees are seldom planted on these soils. They are planted only in wet areas where planting is desirable or in areas that are already in woods. Black walnut, white oak, or white ash can be used to plant new areas or to fill open spaces in wooded areas.

Capability unit IIw-2

The only soil in this unit—Shoals silt loam—is light colored, nearly level, and somewhat poorly drained. It is in areas of the bottoms that border the major streams in the county.

In most places the texture of the surface layer is silt loam, but it varies within fairly short distances. The texture is normally variable throughout the entire profile. This soil formed in recently deposited alluvial material. In most areas the silty material is deep over fine sand and gravel, but in some areas fine sand and gravel are at a depth of 4 to 5 feet.

Moisture-supplying capacity is high, and internal drainage is slow or very slow. The productive capacity is high if this soil is drained and properly fertilized. Natural fertility is high; consequently, the response to fertilizer is less noticeable on this soil than on less fertile soils.

This soil is generally medium to high in phosphorus and potassium. It is neutral to slightly acid, and lime is needed only in small amounts. The content of organic matter is medium to high. Some damage may occur from flooding, but in most areas it is of minor importance.

Controlling water is the major problem in managing this soil. A large part of the acreage is in old oxbows or in low depressions on first bottoms. Consequently, the soil is subject to occasional flooding, and it remains ponded after the floodwaters have receded. In most places tile drains or open ditches (fig. 20) are needed to lower the water table.

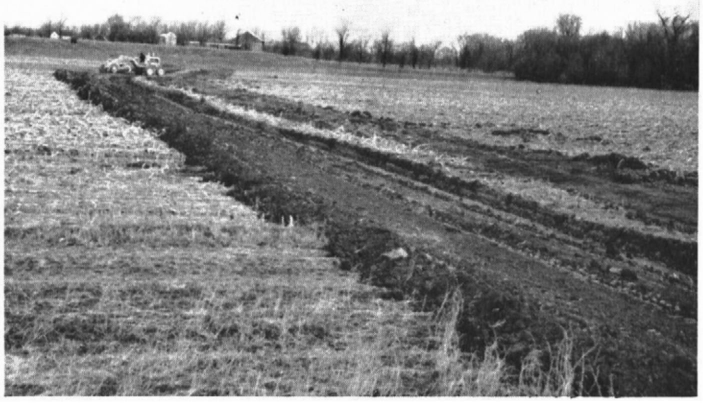

Figure 20.—**Constructing a shallow ditch with a road grader on an area of bottom land.**

This soil is well suited to row crops, such as corn and soybeans, but is of limited use for small grains and certain hay crops. A large part of the acreage has been cleared for crops. Oats and wheat are sometimes damaged by floods or stunted by the high water table. Hay and pasture crops, such as red clover, alsike clover, ladino clover, and bluegrass, are also suitable. Alfalfa normally heaves in winter and is drowned out during prolonged floods. In most odd areas that are not easily accessible, hay and pasture crops are grown. Under average management, 1 year of meadow in 4 is sufficient to maintain tilth. Row crops can be grown year after year if cover crops are used. Cover crops help to eliminate some of the wet, boggy conditions that are normally present in spring and fall, and they supply organic matter that can be turned under.

Planting trees is seldom recommended because of the high potential of these soils for agriculture.

Capability unit IIw-3

The soils in this unit are light-colored, nearly level or gently sloping, somewhat poorly drained loams, silt loams, and fine sandy loams. They occur in lakebed or upland areas on outwash terraces or beach ridges. These soils formed mainly in outwash of silt, sand, or gravel. The following soils are in this unit:

Digby fine sandy loam, 0 to 2 percent slopes.
Digby fine sandy loam, 2 to 6 percent slopes.
Digby loam, 0 to 2 percent slopes.
Digby loam, 2 to 6 percent slopes.
Digby silt loam, 0 to 2 percent slopes.
Digby silt loam, 2 to 6 percent slopes.
Kibbie loam, 0 to 2 percent slopes.
Kibbie silt loam, 0 to 2 percent slopes.
Rimer and Tedrow loamy fine sands, over clay, 0 to 2 percent slopes.
Rimer and Tedrow loamy fine sands, over clay, 2 to 6 percent slopes.

The Digby soils have a medium-textured subsoil and are underlain by silted sand and gravel at a depth of 24 inches or more. The Kibbie soils, on the other hand, are composed mostly of water-deposited silt and fine sand. The Rimer and Tedrow soils have a high content of sand in the upper part of their profile, and clayey material is at a depth of 18 to 42 inches.

These soils are moderately deep and deep, and they are friable. Moisture-supplying capacity is fair to high. These soils are easily tilled, and internal drainage is medium to slow. Natural fertility is low; therefore, crops grown on these soils respond well to fertilizer and to good management. The Digby and Kibbie soils are highly productive under good management, but the Rimer and Tedrow soils are only moderately productive.

Occasionally, applications of lime are needed on the soils of this unit. The supply of available phosphorus ranges from low to medium, and that of potassium, from medium to high. The more sandy Rimer and Tedrow soils are slightly lower in available plant nutrients than the other soils. Where an intensive rotation consisting mainly of a row crop such as corn is followed, an adequate amount of nitrogen should be added. The content of organic matter is low to medium. Under most systems of farming, incorporating an adequate amount of organic matter into the soils is necessary.

The major problem in managing these soils is poor drainage. In some areas of the Digby soils, the water level can be lowered by constructing ditches, but on most of these soils tile drainage is needed. The Rimer and Tedrow soils present a problem in tiling because of their variable depth to clayey material. Smoothing uneven areas improves the drainage and the distribution of water.

The soils of this unit are well suited to all of the row crops, small grains, hay crops, and pasture crops commonly grown in the county. Most of the soils can be cropped fairly intensively to row crops if proper management is practiced. If adequate amounts of plant nutrients, especially nitrogen, are added, excellent yields of corn can be obtained. These soils are also well suited to specialized crops, such as tomatoes, potatoes, and sugar beets. If enough water is available, the soils are well suited to irrigation. Under average management, 1 year of meadow in 4 is sufficient to help control erosion and to maintain tilth.

These soils are well suited to trees. New plantings, however, are generally not recommended, because the soils are well suited to cultivated crops.

Capability unit IIw-4

This capability unit contains the largest acreage in the county. The soils in this unit are light colored, nearly level or gently sloping, somewhat poorly drained fine sandy loams, loams, and silt loams of the glaciated uplands. The following soils are in this unit:

Blount loam, 0 to 2 percent slopes.
Blount loam, 2 to 6 percent slopes.

Blount silt loam, 0 to 2 percent slopes.
Blount silt loam, 2 to 6 percent slopes.
Haskins and Digby fine sandy loams, over clay, 0 to 2 percent slopes.
Haskins and Digby fine sandy loams, over clay, 2 to 6 percent slopes.
Haskins and Digby loams, over clay, 0 to 2 percent slopes.
Haskins and Digby loams, over clay, 2 to 6 percent slopes.
Haskins and Digby silt loams, over clay, 0 to 2 percent slopes.
Haskins and Digby silt loams, over clay, 2 to 6 percent slopes.

The Haskins and Digby soils formed in outwash material deposited over calcareous till. They are associated mainly with the Blount soils. The Blount soils have a fine-textured, compact subsoil that restricts the movement of water and air and the penetration of roots. They occur in the wet areas of uplands.

The soils of this unit are moderately deep and friable, and their moisture-supplying capacity is medium to moderately high. Internal drainage is slow to medium, and natural fertility is medium. These soils are easy to till, and they are moderately productive. Crops grown on them respond well to good management.

Available phosphorus generally ranges from low to medium, and potassium is medium to high. The content of organic matter is low, and, therefore, incorporating organic matter into the soils is a useful practice. These soils are normally slightly acid to medium acid; they need lime for maximum yields. If proper amounts of lime and fertilizer are added and other necessary management practices are followed, crops respond well. If such row crops as corn are grown, an adequate amount of nitrogen needs to be applied for high yields. On the Blount soils it is worth while to provide an adequate drainage system, to correct acidity, to apply a large amount of fertilizer, and to use other good management.

Drainage is the major problem in managing these soils. The fine-textured, compact subsoil in the Blount soils causes those soils to become waterlogged during wet periods. Tile drainage, supplemented by surface drainage, is necessary for maximum yields, except where there is adequate natural surface drainage. These soils warm up slowly in spring; as a result, planting is delayed. Drainage should be accompanied by good management that includes liming and heavy fertilization.

Some small, wet areas of the Haskins and Digby soils are hard to tile drain because of the uneven depth to the fine-textured underlying material. Tile should be placed in those spots to obtain the best drainage. The distribution of water can be improved and the soils can be made easier to work by land smoothing. Smoothing operations should be repeated whenever the surface becomes uneven.

The sloping soils in this unit are generally subject to erosion. It may be necessary to install simple practices to control erosion on some of these areas. Normally, the rows or other means of removing excess water should be on a slight grade so that excess water will be removed from the surface.

Under proper management these soils are well suited to all the row crops, small grains, and hay crops commonly grown in the county. Most of the acreage has been cleared, but there are still some good stands of timber. If proper amounts of fertilizer and lime are applied, fairly good yields of corn can be obtained. If hay or pasture crops are grown, especially alfalfa, lime is generally required for high sustained yields. Under average management, without other practices to control erosion, 2 years of meadow in 4 will be adequate to control erosion and to maintain good soil tilth. If proper practices to control erosion are used, a more intensive rotation can be followed.

If plantings in open areas of woodlots are desired, white ash, white elm, or soft maple can be used. If new plantings are desired (although generally not advisable), white, red, or Austrian pine can be used for the basic planting.

Capability unit IIw-5

This unit consists of dark-colored, nearly level, very poorly drained loams and silt loams and of a silty clay loam. These soils are in the lakebed region in the northern part of the county and on outwash terraces of the major streams. The following soils are in this unit:

Colwood loam.
Colwood silt loam.
Millgrove loam.
Millgrove loam, over clay.
Millgrove silt loam.
Millgrove silt loam, over clay.
Millgrove silty clay loam.

The Millgrove soils occupy the largest acreage in this unit. In most places they are underlain by outwash sand and gravel, but a few areas are underlain by lacustrine clay or till at a depth of 24 to 48 inches. The Colwood soils are underlain by fine sand and silt.

The soils of this unit are deep. They are among the most productive soils in the county. Moisture-supplying capacity is high, and internal drainage is medium to moderately slow. Natural fertility is high, and crops grown on these soils respond well to good management.

On some areas small applications of lime are needed to correct acidity. If these soils are farmed intensively, it is important to supply the proper amount of nitrogen to corn crops and to use proper tillage practices. Good soil tilth ought to be maintained by using good management and by supplying organic matter. If the soils are used intensively for row crops, the level of fertility should be high before the first row crops are planted; that is, it should be such that about 90 bushels of corn per acre can be produced.

Drainage is the main problem in managing these soils. In most places the soils can be adequately drained by lowering the grade of the nearby ditch, as is done in some areas of Millgrove soils, or by installing an adequate tile drainage system. The soils of this unit are generally subject to ponding and need an adequate surface drainage system. For maximum yields, tile drainage is generally required in combination with other drainage. The Millgrove soils, over clay, which make up only a small part of this unit, are difficult to drain because the fine-textured, impermeable material is at varying depths ranging from 24 to 48 inches. However, any type of drainage system is of some help.

These soils are well suited to all of the row crops, small grains, hay crops, and pasture crops commonly grown in the county. Most of the acreage has been cleared of original vegetation and is farmed to row crops. Under proper management excellent yields of corn can be obtained. Even though these soils are productive and give excellent stands of the adapted crops, it is necessary to fertilize them properly and to practice good management to obtain maximum yields. Generally, 1 year of meadow in 4 is enough to maintain good soil tilth and satisfactory structure. If row crops are grown year after year, the soils tend to become less easy to work unless cover crops, minimum tillage, and adequate fertilizer are used. Small grains, alfalfa, and other hay and pasture crops make excellent yields on these soils. Some areas are used for specialized crops, such as tomatoes and sugar beets, and good yields are obtained. Establishing new plantings of trees is generally not advisable.

Capability unit IIw-6

The soils of this unit are dark-colored, nearly level, very poorly drained silt loams, silty clay loams, and silty clays. These soils are in areas of outwash, on beach ridges, and on uplands. The following soils are in this unit:

Lenawee silt loam.
Millgrove silty clay loam, over clay.
Millgrove silty clay.
Pewamo silt loam.
Pewamo silty clay.
Pewamo silty clay loam.

These soils are moderately deep and deep. Moisture-supplying capacity is high, and internal drainage is slow. Natural fertility is high. The response to drainage and other good management practices is excellent. These soils are generally in good tilth, but the silty clay loams and the silty clays, known locally as jackwax, are more difficult to till than the other soils.

In most places the level of phosphorus and potassium is high, but in a few places it is medium. These soils are neutral to slightly acid; an occasional light application of lime is needed in places. In some areas where the soil material is fine textured, maintenance of good tilth is a problem. The soils of this unit are generally high in content of organic matter, but it is necessary to maintain the supply if good tilth is to be maintained. Applying nitrogen fertilizer to corn results in excellent yields. Yields of 100 to 125 bushels per acre of corn can be obtained if good management is used.

Poor drainage is the main limitation of these soils. Because the soils are in low areas, much of the runoff from higher areas runs onto them, and in places they become ponded. In most places adequate surface drainage should be the first step in improving drainage. The high concentration of water causes the soils to need internal drainage as well as surface drainage. Installing surface drains does not eliminate the need for tile drains. A good system of shallow surface drains needs to be supplemented by tile drainage. The spacing of tile can be wider in soils of this unit than in the light-colored associated soils. The response to tiling is good to excellent.

Under proper management these are among the most productive soils in the county. They are suited to all of the crops commonly grown in the county. Under a high level of management, they can be farmed fairly intensively to row crops. If these soils are farmed intensively, fertilizer should be applied according to the needs of the crop to be grown. If these soils are not adequately drained, a poor stand of oats results in some years, and lodging may be a problem with wheat. Good stands of hay and pasture crops can be grown. If the soils are not fertilized, 1 year of a green-manure crop plowed under, or 1 year of meadow, every 4 years, is adequate to maintain the supply of organic matter and good soil tilth.

Most areas of these soils are used for general farming, but the soils are also suited to trees. Establishing new plantings of trees, however, is usually not advisable.

Capability unit IIw-7

This unit consists of dark-colored, nearly level soils that are very poorly drained. These soils are in the lakebed area in the northwestern part of the county. They formed in clay till in areas where water was ponded. The following soils are in this unit:

Hoytville silt loam.
Hoytville silty clay.
Hoytville silty clay loam.

These soils are deep and have high moisture-supplying capacity. Runoff is very slow or ponded, and internal drainage is slow or very slow. Most of the soils are somewhat difficult to till because of the fine texture of their surface layer. The soils are highly productive, however, if they are drained and managed properly. Natural fertility is high; therefore, crops that are grown on these soils respond less well to fertilizer than they do on some of the less fertile soils.

These soils are generally high in phosphorus and potassium, and they are neutral to slightly acid. As a rule, no more than 1 ton of lime per acre every 4 to 6 years is needed. Enough plant nutrients to meet the needs of the crop to be grown should be supplied under all kinds of cropping systems. If these soils are used intensively for corn and other row crops, nitrogen fertilizer and organic matter should be added. Good tilth cannot be maintained under intensive cropping unless the level of organic matter is kept high. Minimum or limited tillage should be used.

Poor drainage is the dominant limitation of these soils. Ditches and tile have been used to improve drainage, but in many places the drainage system is inadequate. In most places it is necessary to prepare a topographic map of the farm before surface and subsurface drainage can be planned. A combination of tile and surface drains appears to be the best to use. In large areas a tile system other than random tiling is generally needed for best results. Land smoothing is often used to eliminate the small puddles caused by uneven tillage. It is especially useful in improving a field for sugar beets, which are particularly sensitive to excess water.

All of the crops commonly grown in the county are suitable for these soils, but crops are damaged by excess moisture in some years. Most of the acreage is used fairly intensively for row crops or small grains. Some specialized crops, such as sugar beets and tomatoes, are grown; their yields are normally medium to high. Lodging of wheat is only a minor problem if the crop is fertilized properly and if improved varieties are grown.

Excellent yields of corn can be obtained where the proper amounts of nitrogen and other plant nutrients are supplied.

Corn can be grown intensively if the level of fertility is kept high. Under average management 1 year of meadow in 4 is adequate to maintain good soil structure. Good hay and pasture crops can be grown on these soils. In some places the yield of alfalfa will be increased by adding lime. Small grains are well adapted, provided they are not injured by water standing in small depressions.

Most of the acreage in this unit has been cleared and is used for general farming, but the soils are also suited to trees. New plantings of trees, however, are generally not advisable. If plantings are desired for windbreaks, arborvitae, Norway spruce, and Austrian pine can be used.

Capability unit IIIe-1

The soils in this group are mainly light-colored, sloping, moderately well drained and well drained, shallow to moderately deep loams. They are in the lakebed region, on terrace escarpments, beach ridges, and moraines, and they are also on low knolls associated with the terraces of major streams. The soils are underlain by outwash material that in some places is coarse sand and in other places is stratified sand and gravel or a mixture of sand and gravel that contains fine material. In places the sandy or gravelly material is fairly near the surface, and therefore, droughtiness may be a serious limitation. The following soils are in this unit:

Belmore loam, 6 to 12 percent slopes, moderately eroded.
Casco and Fox soils, 6 to 12 percent slopes, moderately eroded.
Haney loam, 6 to 12 percent slopes, moderately eroded.

These soils are friable and are shallow to moderately deep. Internal drainage is rapid, and moisture-supplying capacity is fair. Natural fertility is moderate. These soils are easily tilled. They are productive if they are fertilized properly and if there is enough moisture.

Where these soils have not been fertilized, they are low to medium in phosphorus and medium to high in potassium. They are low in content of organic matter; therefore, organic matter should be supplied.

The major limitation of these soils is the hazard of erosion. Most of the surface layer has been lost through erosion. Therefore, controlling erosion is of primary importance. Some areas of these soils are large enough that mechanical practices, such as terracing, can be used for controlling erosion, but most of them are too small. In small areas where it is not feasible to use mechanical practices, special emphasis should be placed on manuring, liming, mulching, minimum tillage, and fertilizing.

The soils of this unit are suited to the row crops, small grains, hay crops, and pasture crops commonly grown in the county. Under proper management good yields can be obtained, but during dry periods, shallow-rooted hay and pasture crops may be damaged by drought. If the soils are managed properly, however, they can be made much less droughty. Under average management, without other practices to control erosion, 3 years of meadow in 5 is adequate to control erosion. With proper practices to control erosion, a more intensive rotation can be used. These soils are well suited to irrigation if an adequate supply of water is available and if erosion is controlled.

Most of the acreage has been cleared of its original vegetation. The soils are well suited to trees. Where plantings of trees in open areas of existing stands are desired, black, red, or white oak, or sugar maple can be used. If plantings in new areas are desired, Austrian pine, white pine, black oak, or red oak can be used.

Capability unit IIIe-2

This capability unit consists of light-colored, gently sloping to sloping, moderately well drained and imperfectly drained soils. Most of these soils are on the till plain or on glacial moraines, but a small acreage is in the lakebed region in the northwestern corner of the county.

The surface layer of most of these soils is silt loam, and most of the soils have a heavy, compact subsoil. The subsoil is loam to clay and is underlain by calcareous clay loam to clay till or lacustrine clay. The following soils are in this unit:

Blount silt loam, 2 to 6 percent slopes, moderately eroded.
Morley silt loam, 2 to 6 percent slopes, moderately eroded.
Morley silt loam, 6 to 12 percent slopes.
Morley silt loam, 6 to 12 percent slopes, moderately eroded.
Rawson loam, 6 to 12 percent slopes, moderately eroded.
St. Clair silt loam, 2 to 6 percent slopes.

These soils are moderately deep and friable. Moisture-supplying capacity is fair, and internal drainage ranges from medium to slow. Natural fertility is low, but these soils are moderately productive under good management.

These soils are generally acid. They are low to medium in phosphorus, low to high in potassium, and very low in content of organic matter. An initial application of 3 to 5 tons of lime is normally required to correct the acidity. Then, maintenance applications are needed periodically. The soils need to be fertilized properly if good yields are to be obtained. A rotation that provides for incorporating organic matter into the soils is necessary to improve soil tilth and keep farming economical.

The major limitation of these soils is the hazard of erosion. Much of the surface layer has already been lost through erosion, and yields have been reduced considerably. Practices that control erosion are needed, for example, contouring, terracing, mulching, and using long rotations. Internal drainage is sharply retarded by the compact layer of clay or till beneath the Rawson soil. Therefore, the Rawson soil tends to waterlog, and there may be seep areas at the surface. Small areas of the Blount soil may need random tile that will eliminate local wet spots. Where the soils of this unit are in small areas, they may be left in meadow or grass for a longer time than the surrounding better soils. If row crops are grown, mulching critical areas with manure or straw, where feasible, helps to control erosion.

The soils of this unit will support all of the row crops, small grains, hay crops, and pasture crops commonly grown in the county, but their use for row crops is limited. Most of the eroded soils should be kept in small grains and long-term meadow or in permanent pasture. If the eroded soils are well managed and are fertilized properly, they can occasionally be farmed to row crops. In most areas erosion can be controlled by using a rotation in which meadow crops are grown 3 years in 5, without other practices to control erosion. Severely eroded spots should be left in permanent vegetation because they will not give an economical return when used for row crops, small grains, or hay.

These soils are well suited to trees, and some areas have never been cleared. Where plantings of trees in open areas of existing stands are desired, black oak, red oak, or sugar maple can be used. In areas where new plantings are desired, black oak, red oak, black locust, or Austrian or white pine can be planted.

Capability unit IIIw-1

In this unit are light-colored, nearly level or gently sloping, somewhat poorly drained soils that have a surface layer of loam or silt loam. Most of these soils are underlain by calcareous lacustrine clay or clay till. The following soils are in this unit:

Nappanee loam, 0 to 2 percent slopes.
Nappanee silt loam, 0 to 2 percent slopes.
Nappanee silt loam, 2 to 6 percent slopes.
Randolph silt loam, 0 to 2 percent slopes.

The Nappanee soils are mainly on low knolls of the lake plains, but a few areas are along streams. The Randolph soil is generally on low terraces along some of the streams in the eastern part of the county. It is underlain by limestone.

The soils of this unit are friable and are shallow to moderately deep. Moisture-supplying capacity is fair to moderately high. These soils are slow to dry out and warm up in spring; as a result, tillage and planting are delayed. Natural fertility is low to moderate. The soils are only moderately productive; crops grown on them respond favorably to fertilizer and good management.

These soils are generally low in content of organic matter, in phosphorus, and in potassium. Areas that have not been limed range from slightly acid to medium acid. Lime is normally required for good stands of meadow. For economical yields, these soils require good drainage; they also need to be limed and fertilized properly, and improved rotations used that include meadow. Ample manure should be used when it is available.

The major limitation of these soils is wetness. Because of the fine texture of the subsoil, internal drainage is slow, and runoff is slow on the nearly level soils. Tile drainage is needed, but surface drainage should also be used in some areas. In places limestone is too near the surface of the Randolph soil for tile to be used. In those areas surface drainage may be the only feasible method of drainage.

Some areas of these soils have enough slope that erosion control is needed in addition to drainage. Structures built to control erosion should be on a slight grade.

Most of the crops commonly grown in the county are suitable for the soils of this unit. Only low to medium yields can be expected, however, unless improved management is used. The use of the soils for row crops is limited; every rotation should provide for a large proportion of meadow that includes legumes. Fair to good stands of meadow can be obtained if proper measures are used. Good yields of wheat have been obtained. To maintain good tilth, 2 years of meadow in 4 is usually required. A desirable rotation is one that provides for a maximum return of organic matter to the soils.

Most of the acreage has been cleared. White ash, red maple, and sycamore can be used where plantings of trees in open areas of existing stands are desired. Where new plantings are desired, white ash, red maple, sycamore, arborvitae, Austrian pine, and spruce can be planted.

Capability unit IIIw-2

Linwood muck is the only soil in this capability unit. It is a very dark colored, very poorly drained organic soil in nearly level areas or depressions in the southeastern part of the county. The organic layer ranges from 12 to 42 inches in thickness and overlies fine sandy loam to silty clay loam.

This soil is friable and is shallow to moderately deep. Moisture-supplying capacity is high. Internal drainage is very slow because of the high water table. If this soil is drained, it is highly productive, especially for specialized crops and truck crops.

This soil ranges from slightly acid to medium acid. Applications of phosphorus and potash are generally needed for high yields. In some places adding nitrogen fertilizer in areas where corn is grown has increased yields.

Wetness is the major problem in managing this soil, but establishing adequate surface drainage and outlets for tile is difficult. In dry weather this soil is subject to erosion by wind.

Linwood muck is well suited to corn and soybeans. These crops make good yields under proper management, but wheat and oats tend to lodge. If this soil is drained, it is well suited to truck crops.

Capability unit IIIw-3

This unit consists of very poorly drained silty clay loams and silty clays in nearly level areas or depressions. These soils have a fine-textured subsoil. They formed under ponded conditions. The following soils are in this unit:

Millsdale silty clay loam.
Montgomery silty clay.
Montgomery silty clay loam.
Sloan silty clay loam.
Sloan silty clay loam, over limestone.
Toledo silty clay loam.
Wabash silty clay.

Most of these soils are deep and have high moisture-supplying capacity. The shallower Sloan and Millsdale soils, however, have only fair moisture-supplying capacity; they are underlain by limestone bedrock at a depth of 20 to 42 inches. The soils of this unit have very slow internal drainage. Their fine-textured surface layer makes them somewhat difficult to till, but they are highly productive under good management. Natural fertility is high; therefore, the response to fertilizer is less on these soils than on less fertile soils.

The soils of this unit are generally high in phosphorus and potassium. They range from neutral to slightly acid, and normally little lime is required. The content of organic matter is high and should be kept high for good tilth. Maintaining good tilth is a major problem on these soils. The soils must be limed and fertilized properly for high yields.

Drainage is the dominant limitation on these soils. The Millsdale, Sloan, and Wabash soils are on the bottom lands and are flooded occasionally. Some form of drainage has been installed in most of the areas, but in most places drainage is inadequate. Drainage is accomplished best by using both tile and surface drains. Because the areas are nearly level, a survey is commonly needed to determine the best place for outlets. In some places, however, a satisfactory outlet for tile cannot be obtained, and it may be necessary to use surface drainage without tiling. On the Millsdale soil and on the Sloan soil that is shallow over limestone, tile drainage may not be feasible.

The kinds of crops to be grown on these soils are influenced by the amount of ponding that takes place during rainy periods. The Toledo soil is less likely to be ponded than the other soils of this unit. Small grains may be drowned out by standing water. Maintaining good tilth is necessary if these areas are to be cropped intensively. Working these soils when they are wet or allowing the supply of organic matter to become depleted damages the soil structure and lowers crop yields. Under average management 1 year of meadow in 4 is adequate to maintain good soil structure, the content of organic matter, and good tilth. Then, good yields of hay and pasture crops can be obtained. In some places higher yields of alfalfa can be obtained by applying lime.

Most of the acreage is used intensively for corn and small grains. Some specialized crops, such as sugar beets and tomatoes, are grown, and yields are normally medium to high.

Even though most of these soils have been cleared and are used for crops, they are suited to trees. Replanting these areas to trees is usually not advisable, because of the high value of the soils for crops.

Capability unit IIIs-1

The soils in this unit are nearly level or gently sloping, well drained, and droughty. Their surface layer is silt loam or loamy fine sand, and it is underlain by gravel and sand. The soils are on outwash terraces, beach ridges, or small, localized knobs in areas of moraines. The following soils are in this unit:

Casco silt loam, 0 to 6 percent slopes.
Spinks loamy fine sand, 2 to 6 percent slopes.

These soils are friable and easy to till. Moisture-supplying capacity is low, and internal drainage is rapid. Under good management these soils are only moderately productive. Natural fertility is low, and the response to lime and fertilizer is good. Plant roots penetrate the Spinks soil to a greater depth than they do the Casco soil, and the Spinks soil appears to be damaged less readily by drought than the Casco soil.

These soils are generally slightly acid to medium acid, low to medium in phosphorus, and medium to high in potassium. Where they have been cropped, the soils need to be limed and fertilized properly. The content of organic matter needs to be maintained to improve the available moisture supply. If fertilizer is applied, small amounts should be added annually or in frequent applications to minimize losses from leaching.

Measures to conserve water are important on these soils. Droughtiness is a major problem, and it is generally a factor that controls crop yields. Such practices as plowing under green-manure or cover crops, mulching, and using minimum tillage are useful. Rapid permeability and susceptibility to leaching cause these soils to lose plant nutrients and organic matter rapidly. Where the soils have an uneven surface, land smoothing can be used to provide more even distribution of water. These soils respond well to irrigation if a supply of water is available.

Where these soils are farmed, they are suited to all the row crops commonly grown in the county. If they are well managed and are fertilized properly, fair to good yields of row crops can be obtained. Good hay and pasture crops can be grown, and a large part of the acreage is used for those crops. Lime is generally required if good yields of hay and pasture crops are to be obtained. These soils are especially well suited to crops that mature before dry weather. Under average management, without other practices to control erosion, 2 years of meadow in 4 is adequate to control erosion. If proper practices to control erosion are used, a more intensive rotation can be followed. A large part of the Casco soil has been used as a source of sand and gravel, and other deposits of sand and gravel are available in this soil.

Trees are seldom planted on these soils. If new plantings or plantings in open areas of existing stands are desired, however, black walnut or black oak can be used.

Capability unit IVe-1

In this unit are sloping to moderately steep, moderately well drained or well drained soils that have a surface layer of silt loam or loam. These soils are in morainic areas of the glacial till plain and along narrow escarpments of the terraces and major streams. They formed in till or outwash material over sand and fine gravel. The following soils are in this unit:

Belmore loam, 12 to 18 percent slopes, moderately eroded.
Morley silt loam, 12 to 18 percent slopes, moderately eroded.
Morley soils, 6 to 12 percent slopes, severely eroded.
St. Clair silt loam, 6 to 12 percent slopes, moderately eroded.

These soils are low in production potential. Their moisture-supplying capacity is low, and crops are likely to be damaged from lack of moisture in periods of dry weather. Natural fertility is moderate. Crops grown on these soils respond to fertilizer and to proper management, but the risk of erosion is high if row crops are grown.

These soils have lost much of their plants nutrients as the result of erosion. They are low in phosphorus, in potassium, and in content of organic matter, and they are generally acid. Most of the present plow layer is a mixture of clayey material from the original surface layer and subsoil. The clayey plow layer has created a tillage problem. If the soils are to be improved for crops, they must be fertilized properly and managed intensively.

Most of the acreage is in sloping, narrow bands bordered on both sides by nearly level areas of other soils. The erosion that has occurred is generally the result of farming these soils in the same way as the surrounding soils. Probably the simplest method of handling the areas is to leave them in meadow and to reseed them when the surrounding soils are in small grains.

The soils of this unit are limited in use. Crops grown for hay and pasture are the most suitable. Wheat and oats or other grains are grown when the stand of hay or pasture needs to be reestablished. Row crops are not suitable, because of the hazard of erosion. If the soils are limed and fertilized properly, fair to good yields of hay and pasture crops can be obtained.

These soils are well suited to trees or wildlife. For planting trees in open areas of existing stands, black oak, red oak, or sugar maple can be used. In areas where new plantings are desired, black oak, red oak, black locust, or Austrian or white pine can be planted.

Capability unit VIe-1

The only soil in this unit—Morley silt loam, 18 to 25 percent slopes, moderately eroded—is steep and moderately well drained. It is in areas of the glacial till plain and moraines. Most areas of this soil are small, and they occur as escarpments or sharp breaks at the heads of drainageways.

The surface layer of this soil is thin and consists of silt loam. The subsoil is compact clay and is underlain by clay loam till. The hazard of erosion is severe.

This soil is moderately deep. Natural fertility and moisture-supplying capacity are low. The soil is too steep to be suitable for tilled crops.

This soil is among the least productive of the soils in the county, but it is not extensive. It can be used for pasture if it is in a convenient location. It cannot be depended upon for pasture in dry weather, however, unless deep-rooted legumes are grown. Deep-rooted legumes grow moderately well. The soil generally has enough lime that legumes other than alfalfa will grow. Some phosphorus and potash may improve the growth of pasture crops if the soil moisture is plentiful.

Little of the acreage is cultivated because there is a hazard of further erosion. Ordinarily, this soil should be kept in pasture or woods, but some areas can be used for hay. The trash mulch method of tillage should be used when seeding meadow or improving pasture. Some areas, especially those near streams, can be developed as habitats for wildlife. If trees are to be planted in open areas of existing stands, black oak, red oak, or sugar maple can be used. In areas where new plantings are desired, black oak, red oak, or Austrian or white pine can be planted.

Capability unit VIIe-1

The soils in this unit are moderately steep to very steep, moderately well drained, light-colored silt loams. They are in areas of moraines or on escarpments that border drainageways. These soils formed in silty clay loam or clay till. The following soils are in this unit:

Morley silt loam, 25 to 35 percent slopes, moderately eroded.
St. Clair silt loam, 12 to 25 percent slopes, moderately eroded.

These soils are low in productivity and of limited use for crops. Moisture supplying capacity and natural fertility are low.

Probably all of the acreage should be in trees or developed for wildlife habitats; therefore, it is generally not necessary to apply fertilizer.

These soils ought to be in permanent vegetation at all times, and the vegetation should be protected from fire or overgrazing. If an area is in a pasture that consists mainly of other soils, it may be well to give it some particular attention, such as treatment with fertilizer, mulching lightly with manure, and controlling grazing.

Where plantings of trees in open areas of existing stands are desired, black oak, red oak, or sugar maple can be used. In areas where new plantings are desired, black oak, red oak, or Austrian or white pine can be planted.

Estimated Yields [5]

Table 2 shows for each soil in the county, estimates of the average yields per acre of the principal farm crops. The yields listed are those expected at two levels of management when weather conditions are average. Years when no crops were harvested, because of unfavorable weather conditions during the growing season, were excluded from the yield estimates.

Although these are estimates, they appear to be as accurate a guide as can be obtained without detailed and lengthy investigations. They are useful in showing the relative productivity of the soils, the response of the soils to management, and the relationship of the soils to each other.

Yields listed in columns A are those that can be expected over a period of years under an average level of management. An average level of management consists of practices that were generally followed by the majority of the farmers in the county at the time of the survey. The type of farming enterprise, the past management practices, and the weather all affect yields.

The yields listed in columns B are those that can be expected under improved management. On cropland, improved management consists of cultivating on the contour; using high-yielding varieties of seed; constructing terraces, diversions, and grassed waterways; establishing surface and subsurface drainage; growing cover crops and green-manure crops; controlling pests and diseases; maintaining good tilth; applying fertilizer and lime according to recommended rates; and following other recommended practices to conserve soil and water. The yields are also affected by many other factors, such as the kind of soil, timeliness of planting, cultivation, seedbed preparation, minimum tillage, and type of agricultural implements. Irrigation has not been considered in these estimates. The cost of production and profit to be derived under either level of management depend upon the prevailing economic conditions.

The estimates of yields in columns B are not the maximum yields that can be obtained. They are yields that could be obtained by many farmers if improved management practices were followed. Some farmers in the county may have reached or exceeded these yields at the present time.

[5] LEE L. BORTON, GLEN E. BERNATH, and RALPH L. MEEKER, Soil Conservation Service; and CALVIN LEIMBACH, Allen County extension agent, helped prepare this section. Information was also obtained from the Paulding County Soil Survey Report (2).

TABLE 2.—*Estimated average acre yields of principal crops*

[Yields in columns A can be expected under the average management now commonly used in the county; those in columns B can be expected under improved methods of farm management. Absence of a yield figure means that the crop is not commonly grown under the management level indicated or that that particular soil is not suited to the specific crop. Miscellaneous land types are not listed in the table]

Soil	Corn		Soybeans		Wheat		Oats		Mixed hay	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Belmore loam, 0 to 2 percent slopes	62	112	28	41	35	47	52	87	2. 4	4. 6
Belmore loam, 2 to 6 percent slopes	60	110	27	40	33	45	50	85	2. 3	4. 5
Belmore loam, 6 to 12 percent slopes, moderately eroded	45	90	21	31	26	37	40	70	1. 9	4. 1
Belmore loam, 12 to 18 percent slopes, moderately eroded	40	------	16	------	22	------	35	60	1. 8	3. 8
Blount silt loam, 0 to 2 percent slopes	55	95	22	34	27	37	42	78	1. 6	3. 6
Blount silt loam, 2 to 6 percent slopes	55	95	22	32	25	36	40	75	1. 5	3. 5
Blount silt loam, 2 to 6 percent slopes, moderately eroded	50	85	19	30	21	31	38	72	1. 4	3. 4
Blount loam, 0 to 2 percent slopes	60	100	23	38	28	38	42	80	1. 7	3. 7
Blount loam, 2 to 6 percent slopes	57	96	22	36	26	37	40	78	1. 6	3. 6
Casco silt loam, 0 to 6 percent slopes	40	80	24	31	32	43	48	70	2. 3	4. 4
Casco and Fox soils, 6 to 12 percent slopes, moderately eroded	32	68	21	26	25	37	41	64	2. 1	4. 1
Colwood silt loam	85	120	28	42	32	50	60	86	2. 4	5. 0
Colwood loam	85	120	28	42	34	50	60	86	2. 4	5. 0
Digby loam, 0 to 2 percent slopes	63	113	26	39	32	42	44	85	2. 0	4. 4
Digby loam, 2 to 6 percent slopes	60	110	25	36	30	40	42	80	1. 8	4. 2
Digby silt loam, 0 to 2 percent slopes	62	113	26	38	38	41	43	84	1. 9	4. 4
Digby silt loam, 2 to 6 percent slopes	59	108	25	35	29	40	42	82	1. 8	4. 2
Digby fine sandy loam, 0 to 2 percent slopes	67	117	25	35	32	42	45	86	2. 1	4. 5
Digby fine sandy loam, 2 to 6 percent slopes	63	113	24	34	30	40	43	85	2. 0	4. 4
Eel silt loam	68	111	26	40	------	------	------	------	2. 1	4. 3
Fox loam, 2 to 6 percent slopes	65	90	20	30	26	38	44	72	2. 5	4. 7
Genesee silt loam	80	110	28	42	------	------	------	------	2. 2	4. 5
Haney loam, 0 to 2 percent slopes	65	115	28	38	32	46	49	86	2. 1	4. 9
Haney loam, 2 to 6 percent slopes	60	110	27	37	30	45	47	83	2. 0	4. 5
Haney loam, 6 to 12 percent slopes, moderately eroded	48	85	19	28	25	35	38	72	1. 8	4. 0
Haney silt loam, 0 to 2 percent slopes	65	115	26	36	31	45	47	85	2. 1	4. 7
Haney silt loam, 2 to 6 percent slopes	62	113	25	35	30	41	45	83	2. 0	4. 5
Haney fine sandy loam, 0 to 2 percent slopes	62	113	27	37	31	44	51	87	2. 1	4. 8
Haney fine sandy loam, 2 to 6 percent slopes	60	112	25	37	30	44	49	85	2. 0	4. 7
Haskins and Digby loams, over clay, 0 to 2 percent slopes	58	95	26	38	28	40	44	80	2. 0	4. 0
Haskins and Digby loams, over clay, 2 to 6 percent slopes	55	90	24	37	28	40	40	75	1. 7	3. 8
Haskins and Digby silt loams, over clay, 0 to 2 percent slopes	58	95	21	33	25	37	37	71	1. 6	3. 8
Haskins and Digby silt loams, over clay, 2 to 6 percent slopes	50	90	20	32	24	36	34	69	1. 5	3. 7
Haskins and Digby fine sandy loams, over clay, 0 to 2 percent slopes	60	98	23	37	27	37	39	78	1. 9	4. 0
Haskins and Digby fine sandy loams, over clay, 2 to 6 percent slopes	58	95	22	35	22	33	37	75	1. 8	3. 9
Hoytville silty clay loam	80	115	28	40	28	42	48	80	2. 2	5. 0
Hoytville silt loam	80	116	30	41	30	45	51	85	2. 3	5. 1
Hoytville silty clay	80	113	28	40	28	42	46	78	2. 1	4. 8
Kibbie silt loam, 0 to 2 percent slopes	60	100	26	38	30	40	43	80	1. 8	4. 3
Kibbie loam, 0 to 2 percent slopes	62	108	26	39	31	41	43	82	1. 9	4. 3
Lenawee silt loam	78	116	28	42	28	45	51	85	2. 3	5. 1
Linwood muck	90	121	37	47	------	------	------	------	------	------
Millgrove silt loam	85	119	36	46	33	45	55	90	2. 4	5. 3
Millgrove loam	90	121	37	47	35	47	57	92	2. 5	5. 5
Millgrove silty clay loam	82	118	35	45	33	45	54	87	2. 3	5. 2
Millgrove silty clay	80	116	35	45	32	43	53	85	2. 2	5. 1
Millgrove loam, over clay	87	118	36	46	34	46	53	88	2. 4	5. 4
Millgrove silt loam, over clay	83	115	35	46	32	45	51	87	2. 4	5. 2
Millgrove silty clay loam, over clay	80	113	35	45	32	44	50	86	2. 3	5. 1
Millsdale silty clay loam	65	105	28	40	30	46	50	80	3. 0	4. 5
Montgomery silty clay	75	110	28	38	24	44	50	80	3. 0	4. 5
Montgomery silty clay loam	75	110	28	38	24	44	50	80	3. 0	4. 5
Morley silt loam, 2 to 6 percent slopes	55	85	20	32	26	38	40	78	2. 0	3. 5
Morley silt loam, 2 to 6 percent slopes, moderately eroded	53	80	20	32	26	38	46	75	2. 0	3. 5
Morley silt loam, 6 to 12 percent slopes	48	82	14	30	24	35	41	75	1. 9	3. 5
Morley silt loam, 6 to 12 percent slopes, moderately eroded	40	78	12	26	21	31	34	65	1. 7	3. 5
Morley soils, 6 to 12 percent slopes, severely eroded	31	------	------	------	19	25	30	60	1. 5	3. 5
Morley silt loam, 12 to 18 percent slopes, moderately eroded	30	------	------	------	19	27	28	58	1. 5	3. 5
Morley silt loam, 18 to 25 percent slopes, moderately eroded	------	------	------	------	------	------	------	------	1. 3	2. 9
Morley silt loam, 25 to 35 percent slopes, moderately eroded	------	------	------	------	------	------	------	------	------	------
Morley loam, 2 to 6 percent slopes	55	88	20	34	26	39	50	81	2. 0	3. 6
Nappanee silt loam, 0 to 2 percent slopes	55	85	22	30	24	34	42	72	2. 0	3. 5
Nappanee silt loam, 2 to 6 percent slopes	50	80	20	30	24	34	40	70	2. 0	3. 5
Nappanee loam, 0 to 2 percent slopes	55	85	22	32	25	36	41	74	2. 0	3. 5

TABLE 2.—*Estimated average acre yields of principal crops*—Continued

Soil	Corn		Soybeans		Wheat		Oats		Mixed hay	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*
Pewamo silty clay loam	80	117	28	40	28	46	56	80	2.3	5.0
Pewamo silt loam	80	117	28	40	28	46	56	80	2.4	5.2
Pewamo silty clay	78	115	28	40	28	46	56	80	2.2	4.8
Randolph silt loam, 0 to 2 percent slopes	55	90	24	32	26	34	42	72	2.0	4.0
Rawson loam, 2 to 6 percent slopes	62	107	22	36	26	39	41	76	2.0	4.3
Rawson loam, 6 to 12 percent slopes, moderately eroded	44	86	12	26	19	29	32	62	1.7	3.8
Rawson silt loam, 2 to 6 percent slopes	60	105	21	35	25	38	42	78	2.0	4.3
Rimer and Tedrow loamy fine sands, over clay, 0 to 2 percent slopes	57	88	23	34	23	34	37	75	1.7	3.5
Rimer and Tedrow loamy fine sands, over clay, 2 to 6 percent slopes	56	82	22	32	21	32	34	73	1.6	3.5
St. Clair silt loam, 2 to 6 percent slopes	50	80	18	28	26	38	43	71	1.8	3.9
St. Clair silt loam, 6 to 12 percent slopes, moderately eroded	43	64	13	23	19	28	30	60	1.4	3.4
St. Clair silt loam, 12 to 25 percent slopes, moderately eroded	------	------	------	------	15	25	23	44	1.2	2.4
Seward fine sandy loam, 2 to 6 percent slopes	57	84	20	34	26	34	41	74	1.9	3.5
Shoals silt loam	75	100	26	38	------	------	------	------	2.5	4.8
Sloan silty clay loam	80	114	28	42	------	------	------	------	2.0	4.5
Sloan silty clay loam, over limestone	80	110	28	40	------	------	------	------	2.0	4.8
Spinks loamy fine sand, 2 to 6 percent slopes	45	75	18	26	26	38	43	72	1.9	3.5
Toledo silty clay loam	75	110	28	38	24	44	50	78	2.2	4.5
Tuscola loam, 2 to 6 percent slopes	60	110	26	38	30	45	47	83	2.0	4.5
Tuscola silt loam, 2 to 6 percent slopes	60	108	24	35	30	44	45	83	2.0	4.4
Wabash silty clay	75	110	28	40	------	------	------	------	3.0	4.5

The estimates are based on information obtained from farmers, the county agricultural extension agent, Soil Conservation Service personnel, and others who have knowledge of the crops and soils. They are also based on field observations made for 3 to 5 years during the course of the soil survey.

Specialized Crops

Tomatoes and sugar beets are the two most important specialized crops grown in the county. No attempt will be made in this section to give specific practices, fertilization rates, or seeding varieties for these crops. If more specific information concerning the growing of these crops is desired, a technician of the Soil Conservation Service, of the Agricultural Extension Service, or of the State Experiment Station can be contacted. In addition, most canning companies and companies that process sugar beets maintain laboratories and a staff of fieldmen who make specific recommendations for the growing of these crops.

The investment in labor and machinery, and the other costs of growing specialized crops, are higher than for general farm crops. A much higher level of management is required to grow these crops than to grow general crops. Presently the labor cost for picking tomatoes can be 10 to 20 percent of the total cost of producing the crop. The high value of the specialty crops makes the use of good soil management and cultural practices a necessity. Therefore, special attention to drainage and tillage is needed.

Tomatoes are grown more extensively than other specialized crops in this county. Although they are grown in all parts of the county, most of them are grown in the northern townships. There are many soils in the county well suited to tomatoes, but only a small acreage is used at the present time. Fertile soils well supplied with fertilizer and organic matter give the highest yields. Tomatoes have a long growing season, and they need plenty of available nutrients over a long period. They should generally be grown in rotation with other field crops because they add little organic matter to the soil.

In Ohio, sugar beets are produced mainly in the northwestern counties. Allen County is about the southernmost area in which they are grown. The plants need a fairly cool climate and a well-distributed average rainfall of 30 to 40 inches. The soils on which sugar beets are grown need to be high in moisture-supplying capacity, high in content of organic matter, and near neutral in reaction. Sugar beets are a high-value crop, but they also require a large investment of cash and labor. They fit into most rotations easily, but they should not be grown 2 years in succession on the same soils. Good soil aeration is necessary for growing them.

Woodland and Windbreaks

The woodland of this county occupies approximately 24,000 acres, or about 9 percent of the total land area. On the basis of direct financial return, this woodland is not important. More important is the value of woodland as a source of fuel and timber for farm use, a place for recreation, and a habitat for wildlife.

Woodlots are a source of fuel, of rough construction timber for use on the farm, and of food in the form of nuts and maple sirup. Only a small amount of maple sirup is produced for sale, but fireplace wood is in increasing demand and is becoming a more important source of income.

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Because the population of the county is steadily increasing, there is a greater need for recreational facilities. Wooded areas provide places for camping, hiking, and hunting. Idle land in urban areas could be planted to trees, which would increase the value of the land and provide desirable recreational areas.

Timber types

This county lies within the Central Hardwoods region. As the name implies, the Central Hardwoods region contains trees that are predominantly deciduous, or hardwoods. The composition of the woodland vegetation consists of tree associations within two series. These are the swamp forest series and the beech-maple series (*11*).

Trees of the swamp forest series are suited to poorly drained soils that lack good aeration. On the wetter soils the primary species are white elm, white ash, black ash, red maple, and silver maple. On soils where drainage has been improved, secondary species have invaded the swamp forest. Pin oak and swamp white oak are the most prominent of these secondary species. In some areas other secondary species—the hickories, basswood, and black walnut—become abundant to the extent that they may be dominant in the stand. If the soils are sufficiently drained, the swamp forest community of trees eventually becomes a beech-maple or oak-hickory community.

Trees of the beech-maple series are suited to better drained soils that have good aeration than they are to poorly drained soils. The better drained soils of the moraines, valley walls, escarpments, kames, and eskers in this county originally supported species of the beech-maple series.

In general, at the time this area was settled, the dominant woodland vegetation on the various soil associations was either of the swamp forest or of the beech-maple series. Following is a listing of the soil associations where each of these two series was dominant, the name of the forest association on each, and the associating species.

Soil association	*Forest association*	*Associating species*
SWAMP FOREST SERIES		
Shoals-Sloan association.	Black and peach-leaved willow-cottonwood-sycamore.	White elm, white ash, red ash, boxelder, and hackberry.
Hoytville-Nappanee association.	White elm-white ash and black ash-silver maple. Swamp white oak.	Red maple, pin oak, and bur oak.
Blount-Pewamo association.	White elm-white ash and black ash-silver maple. Swamp white oak-hickory. Bur oak.	Pignut hickory, bitternut hickory, basswood, and black walnut.
Montgomery-Blount association.	White elm-white ash and black ash-silver maple. Swamp white oak-hickory. Bur oak.	Red maple and pin oak.
BEECH-MAPLE SERIES		
Belmore-Haney-Digby-Millgrove association.	Beech-maple, maple, oak-hickory.	Red maple, white elm, shagbark hickory, shellbark hickory, white ash, and basswood.
Morley-Blount-Pewamo association.	Beech-maple, maple, white oak-beech.	Red maple, white elm, shagbark hickory, shellbark hickory, white ash, and basswood.
Morley-Blount association.	Beech-maple, maple, white oak-beech.	Red maple, white elm, shagbark hickory, shellbark hickory, white ash, and basswood.

Windbreaks.—Farmsteads in this county would benefit from windbreak plantings. A well-placed planting of trees gives protection from wind and helps keep the house, barn, and livestock warmer in winter and early in spring. It also helps keep drives, lanes, and highways from being blocked by snow. Windbreaks of evergreens add beauty to the farmstead and to the landscape.

The prevailing winds in this county are from the southwest. Therefore, the trees should be planted on the west and south sides of the farmstead, about 75 to 100 feet from the major farm buildings. If trees are planted too close, snow may be dumped on buildings and drives in winter, and air drainage will be poor in summer.

The most suitable species for planting on the soils in this county are Norway spruce, Austrian pine, and white pine. Arborvitae is well adapted to wetter sites and areas where a close spacing of trees is necessary. The ideal windbreak is composed of three to five rows of trees. The first and fifth rows are planted to Norway spruce; the third, or middle row, to Austrian pine; and the second and fourth rows, to white pine. Arborvitae, or white-cedar, can be substituted for Norway spruce and planted on the windward side. The kinds of trees in the windbreak should be mixed to help control disease.

Management of woodland and windbreaks

Proper management is needed if maximum production of woodland is to be obtained. Many wooded tracts in this county can be brought to maximum production in a relatively short time if appropriate practices are used. Others require a much longer time, particularly those wooded tracts composed of trees that are small in diameter.

A most important woodland practice is the elimination of livestock grazing (fig. 21). Removing diseased trees, cull trees, and grapevines is important also. Crop trees of desirable species should be selected and pruned to encourage them to make maximum growth. This, along with other woodland practices, improves the condition of the woodland and, in turn, promotes maximum timber production and good monetary returns.

Further information concerning woodland practices, reforestation, and marketing and use of wood products can be obtained by consulting the local farm forester, Division of Forestry, Ohio Department of Natural Resources, located at Celina; the Department of Forestry of the Ohio Agricultural Experiment Station, Wooster; and the local technicians of the Soil Conservation Service at Lima.

Figure 21.—**Woodland of beech, sugar maple, and white oak. This area was protected from grazing; consequently, many of the trees are large in diameter.**

Wildlife

When white settlers first came to the area that is now Allen County, they found a vast wilderness that consisted mainly of deciduous forest. The northern part of the county, where the Hoytville and Nappanee soils occur, they called the Great Black Swamp because of the wet soils and type of vegetation and wildlife. That area extends westward and northeastward to Lake Erie. Fish, game birds, and game animals were abundant in the Great Black Swamp, as well as in the rest of the county. Bear and cougar were common, and elk and bison had been in the area only a few years earlier. Rabbits, squirrels, raccoons, quail, and pigeons were numerous.

After the white settlers came, farmsteads and villages, and then urban areas replaced the wilderness. Because of the change in their environment, most of the original kinds of wildlife underwent drastic changes in distribution and in numbers. Bear, cougar, and most of the deer, which had once been common, disappeared. An example of an area that changed drastically as the result of urbanization is the area around Lima. The population of that city increased from 300 in 1831 to about 51,000 in 1960.

Recently, the demand for wildlife has increased (*10*). Because of the rapid expansion of urban areas, however, suitable habitats for wildlife are disappearing. If the areas are to be improved so that they will again support large numbers of animals and birds, careful management and planning are required, and adequate cover, food, and water must be made available.

Kinds of wildlife in the county.—The area around Delphos, in the old lakebed area, is considered among the better ones for pheasants in the State. It has an estimated population of 40 to 80 birds per square mile, as compared to the rest of the county, which has a pheasant population of about 5 to 20 birds per square mile. Pheasants generally thrive wherever small grains and row crops are grown, if adequate water is available. Any practices that encourage pheasants also benefit rabbits, quail, and other kinds of wildlife.

Rabbits are common throughout the county. Quail are more abundant than they formerly were, although they were almost extinct at one time. Brush piles and brier patches, if controlled, provide good cover for rabbits and quail. Soils that are too steep or irregular for farming can be planted to pines or to other plants that provide food and cover.

The population of squirrels and raccoons can be increased under proper management. The farm woodlots are well suited to those animals. Leaving vines near the edges of the woods, and den trees in the interior enhances the habitat for those animals.

Fishing, as a recreational activity, has become more important each year. The seven reservoirs in Lima offer many opportunities for managing fish and waterfowl. In the past the rivers of the county were also well supplied with fish, but they have since become polluted and filled with sediment as the result of erosion. Ducks and geese were also common, but they are now much less numerous.

Managing areas for wildlife.—Adequate cover, food, and water can be provided for wildlife by planting shrubs and perennials in odd areas, around ponds, along ditches, and in forested area. Cropland also ought to be fertilized properly so that the plant cover will be improved and thus provide food and cover.

The wildlife population on the Nappanee, Hoytville, Blount, and Pewamo soils is fairly large, and it can be increased with a minimum amount of effort because of the large drainage ditches in that area. These soils are normally farmed intensively. The Nappanee and Hoytville soils are fertile, and they would support a large population of wildlife under proper management. Areas of these soils could be made more suitable for wildlife by seeding and maintaining the ditchbanks and planting trees and other vegetation to provide cover in border areas, travel lanes, and small cover patches.

In the part of the county where the Blount and Pewamo soils occur, there is already a favorable habitat for wildlife. Where these soils are farmed, the same practices as those used to provide food and cover on the Nappanee and Hoytville soils are generally applicable.

Many areas of sloping, eroded Morley soils have limitations that restrict their use for crops, and these areas could be improved so that they will provide food and cover. The Morley soils are generally low in fertility, and for those soils improved practices are necessary to increase the wildlife population. Improving the areas for wildlife involves use of such practices as growing crops that do not require cultivation and protecting the areas from grazing by livestock. In addition, it involves planting cover patches and providing travel lanes. In the southeastern part of the county also, large areas used for pasture need to have travel lanes, cover patches, and food patches provided. Also, many farms have odd areas, not accessible to machinery, that can be used by wildlife.

The following are some of the practices that may be used to encourage wildlife:

1. Use improved crop rotations that maintain the

fertility of the soils and that provide adequate food and cover for wildlife.

2. Protect young birds and animals in pastures and hayfields by delaying mowing and use of a flushing bar until after the young are able to fend for themselves.
3. Improve the vegetative cover by planting shrubs and other kinds of vegetation in areas where adequate food and cover are lacking. This generally applies in areas of permanent pasture. Patches that provide food and cover can be planted to annuals, grasses, legumes, shrubs, and trees.
4. Protect existing woodland from fire and grazing. Plant border areas to provide cover, and leave den trees.
5. Where cover is not adequate in existing fields, provide hedgerow plantings, such as multiflora rose, that can be used as travel lanes, as nesting areas, or as an emergency supply of food in winter. Other odd areas or the areas that border wooded tracts can also be planted.
6. Seed and maintain ditchbanks, and keep trees cut along the edges of ditches. These practices not only help to maintain the ditches but also provide nesting cover for wildlife.
7. Plant eroded areas or small, steep areas to trees or shrubs. Use of a number of different kinds of woody species is desirable.
8. Stock farm ponds with fish, and manage and maintain the population of fish. Control aquatic weeds, and plant surrounding areas to plants that are suitable for wildlife food and cover.
9. Plant trees and shrubs in odd areas along streams to control erosion of the streambank. Such plantings also provide food and cover for wildlife.
10. Where eroded and rundown areas are reverting to brush, control part of the brush by using a chemical spray, or plow the areas and reseed to patches that will provide food.

For additional information about managing wildlife areas, farmers, members of hunting and fishing clubs, and other interested persons can contact the local game protector, the county extension agent, or a representative of the Soil Conservation Service.

Engineering Properties of the Soils [6]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, structures for erosion control, drainage systems, and sewage disposal systems. The properties most important to the engineer are permeability to water, shear strength, consolidation characteristics, texture, plasticity, and reaction. Depth of unconsolidated materials and relief are also important.

The information in this report can be used to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils that will help in planning agricultural drainage systems, farm ponds, irrigation systems, waterways, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways and airports and assist in planning detailed investigations of selected locations.
4. Locate probable sources of gravel, sand, and other material suitable for construction.
5. Correlate performance of engineering structures with soil mapping units, and thus develop information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soil units for cross-country movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that will be more useful to engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

It is not intended that this report will eliminate the need for on-site sampling and testing of the soils. It should be used primarily in planning more detailed field investigations to determine the in-place condition of the soil at the proposed site of construction.

Some of the terms used by the agricultural soil scientist may be unfamiliar to the engineer, and some words may have special meanings in soil science. These terms are defined in the Glossary at the end of the report.

Engineering classification systems

Two systems of classifying soils, the AASHO and the Unified, are in general use among engineers. Both will be used in this report. Following is a description of these classification systems. Additional information is given in the PCA Soil Primer (*9*).

AASHO Classification System.—Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system, classification is based on the gradation, liquid limit, and plasticity index of the soil. Highway performance has been related to this system of classification. In the AASHO system all soil materials are classified in seven principal groups. The groups range from A–1 (gravelly soils of high bearing capacity, the best soils for subgrade) to A–7 (clayey soils having low strength when wet, the poorest soils for subgrade). Within each group, the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. The group index number is given in parentheses after the soil group symbol, as in table 3.

Unified Classification System.—Some engineers pre-

[6] ARNOLD F. KLEINHENZ, State conservation engineer, Soil Conservation Service, helped prepare this section.

fer to use the Unified soil classification system established by the Waterways Experiment Station, Corps of Engineers (*17*). This system is based on identification of soils according to their texture and plasticity and their performance as engineering construction materials. In the Unified system soil materials are identified as coarse grained (eight classes), fine grained (six classes), or highly organic. The classification of the tested soils according to the Unified system is given in table 3, and the estimated classification of all the soils is given in table 4.

Engineering test data

Soil samples from 10 of the principal soil series in the county were tested by standard AASHO procedures to help evaluate the soils for engineering purposes. Only selected layers of each soil were sampled. The results of these tests are given in table 3.

The engineering soil classifications shown in table 3 are based on data obtained by grain-size analysis and by tests to determine liquid limit and plastic limit. The grain-size analysis was made by using a combination of the sieve and hydrometer methods. Table 3 shows the percentage of particles passing No. 4, No. 10, and No. 40 sieves and the percentage of silt and clay. The percentage of clay obtained by the hydrometer method should not be used in naming textural classes of soils.

The tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a solid to a semisolid or plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content, expressed as a percentage of the oven dry weight of the soil, at which the soil material passes from a solid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which the soil material is in a plastic condition. Some silty and sandy soils are nonplastic; that is, they will not become plastic at any moisture content.

Table 3 also gives moisture-density, or compaction, data for the tested soils. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in earthwork, for as a rule, soil material is most stable if it is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Descriptions of soils for engineering

Most of the problems in highway construction are caused by certain undesirable properties of the soil material and by lack of adequate drainage. Table 4 shows some estimated soil properties that are important in the construction of highways, and it also gives estimated AASHO and Unified classifications for the soils. The data are based on the results of laboratory tests, on experience with the same kinds of soils in other counties, and on information in other parts of this report.

Permeability, expressed in inches per hour, refers to the movement of water through the soil material in place. It depends largely upon the texture and structure of the soil material.

The available moisture capacity, expressed in inches of water per inch of soil depth, is of particular value to engineers concerned with irrigation. It is the approximate amount of capillary water in the soil when wet to field capacity. When the soil is air dry, this amount of water will wet the soil material described to a depth of 1 inch without deeper percolation.

The shrink-swell potential is a rating of the ability of soil material to change volume when subjected to changes in moisture. Those soils rated high in shrink-swell potential are normally undesirable for engineering structures. That is because the increase in volume when the dry soil is wet is usually accompanied by a loss in bearing capacity.

In general, soils classified as CH and A–7 have a high shrink-swell potential. Clean sand and gravel (single grain structure) and those containing small amounts of nonplastic to slightly plastic fines, as well as most other nonplastic to slightly plastic soil material, have a low shrink-swell potential.

Engineering interpretations

Table 5 indicates the suitability of the soils for various engineering uses. It also names the soil features and problems that affect the use of the soils and gives some suggestions regarding highway and conservation engineering.

In table 5 the suitability as a source of topsoil refers to suitability of the soil material for growing grass or other plants on the slopes of cuts and fills. The ratings depend primarily upon the natural fertility of the soil material and on the content of organic matter, texture, and presence or absence of large pieces of stone.

The suitability of a soil as a source of sand and gravel depends on the amount, quality, and accessibility of granular (coarse-grained) material. A rating of good does not necessarily mean that commercial operations would be profitable in all areas of that particular soil. In some areas the layers of sand or gravel are only 2 to 3 feet thick, or other considerations might make it impractical to remove the sand and gravel commercially.

Where there is a high water table or flooding, road fill is generally needed. The features considered in rating the suitability of a soil for road fill are plasticity, content of water, compaction characteristics, and erodibility. The presence of rock within the normal depth of excavation where a road is to be built was also considered. Well-graded, coarse-grained material or mixtures of clay and coarse-grained material are desirable for road fill. Highly plastic, clayey soils; poorly graded, silty soils; and organic soils are difficult to compact and are low in stability. Consequently, they are undesirable for road fill.

TABLE 3.—*Engineering test data and classification*

[Absence of data indicates

Soil name, location, and sample number	Horizon	Depth	Particle-size distribution (percentage)			
			3/8 inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)
Blount silt loam:		*Inches*				
SW¼NW¼ sec. 32, Jackson Twp., T. 3 S., R. 8 E. AL-105.	Ap	0-9	100	99	99	93
	B22t	9-28	100	99	99	99
	C2	28-60	100	98	96	89
NE¼SE¼ sec. 16, Amanda Twp., T. 4 S., R. 5 E. AL-111.	Ap	0-8	100	99	99	97
	B22t	8-32	100	99	99	98
	C2	32-88	100	99	98	94
Eel silt loam:						
NE¼NE¼ sec. 32, Amanda Twp., T. 3 S., R 5 E. AL-112.	Ap	0-8	----------	----------	----------	100
	C4G	8-85	100	99	99	98
Genesee silt loam:						
NE¼NW¼ sec. 32, Amanda Twp., T. 3 S., R. 5 E. AL-113.	Ap	0-8	----------	----------	----------	100
	C3	8-46	----------	----------	100	99
	C6	46-96	----------	----------	----------	100
Haskins loam:						
NE¼SW¼ sec. 9, Monroe Twp., T. 2 S., R. 7 E. AL-115.	Ap	0-8	100	98	95	86
	3gt	8-31	100	97	93	80
	IIIC	32-46	100	98	96	89
Montgomery silty clay loam:						
SE¼SE¼ sec. 23, Spencer Twp., T. 3 S., R. 4 E. AL-117.	Ap	0-9	----------	100	99	98
	B23gt	9-42	----------	100	100	99
Morley silt loam:						
SW¼NE¼ sec. 31, Auglaize Twp., T. 4 S., R. 8 E. AL-102.	Ap	0-6	100	99	98	94
	B22t	6-20	----------	----------	100	99
	C	25-73	95	92	87	79
Rawson loam:						
SE¼SW¼ sec. 18, American Twp., T. 3 S., R. 6 E. AL-123.	Ap	0-8	98	96	94	81
	B22	8-32	97	93	83	55
	IIC1	38-44	99	97	94	88
Seward fine sandy loam:						
SW¼SE¼ sec. 22, Perry Twp., T. 4 S., R. 7 E. AL-119.	Ap	0-9	100	99	99	95
	B21	9-31	----------	100	100	94
	IIB22t	31-37	100	98	97	93
Sloan silt loam:						
NE¼NW¼ sec. 32, Amanda Twp., T. 3 S., R. 5 E. AL-114.	Ap	0-8	----------	100	100	99
	C2g	8-45	----------	100	100	99
	C3g	45-88	----------	100	99	91
Spinks loamy fine sand:						
NW¼SW¼ sec. 5, Richland Twp., T. 2 S., R. 8 E. AL-116.	Ap	0-9	----------	----------	100	97
	A2 and Bt	9-36	----------	----------	100	97
	A2 and Bt	36-86	----------	----------	100	96

[1] Test data for Allen County, Ohio, soils are from results of tests made by Ohio State University Soil Laboratory and Ohio Department of Highways Testing Laboratory in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

[2] The terms "silt" and "clay" are used as defined by engineers. The silt size is 0.074 to 0.005 millimeter, and the clay size is less than 0.005 millimeter.

[3] Based on AASHO Designation T 99-57, Method A *(1)*.

Natural material suitable for a base course is not abundant in this county, but some soils contain such material. The Fox and Casco soils are underlain by fairly well washed, stratified gravel and sand. They are generally on terraces along the Auglaize River in the southeastern part of the county. The Belmore and Haney soils are underlain by fine gravel and sand, which in most places contain varying amounts of silt and clay. The Digby and Millgrove soils are also underlain by fine gravel and sand, but they have a seasonally high or perched water table and are therefore considered imperfectly drained or very poorly drained. All of the soils underlain by fine gravel and sand mixed with silt are on beach ridges, stream terraces, and outwash plains in areas that are scattered across the county. The Spinks soils, on knolls of sand, are a good source of sand, and the Seward and Rimer soils, on ridges and knolls, on outwash plains, and on stream terraces, contain a limited supply.

The determination of whether the soil material is suitable for road fill is based on the estimated AASHO classifications given in table 4. Coarse-textured material is rated good, and fine-textured material is rated fair to poor. The soil material rated fair is silt that has low *of soil samples from 11 soil profiles* [1]

that layer was not sampled]

Particle-size distribution (percentage)—Continued			Maximum density [3]	Optimum moisture [3]	Liquid limit	Plasticity index	Classification		
No. 200 (0.074 mm.)	Silt [2]	Clay [2]					Unified [4]	AASHO [5]	Ohio [6]
			Lbs. per cu. ft.	*Percent*					
76	40	36			28	5	ML–CL	A–4(8)	A–4a.
84	34	50			33	11	CL	A–6(8)	A–6a.
77	32	45			27	8	CL	A–4(8)	A–4b.
88	55	33			27	6	ML–CL	A–4(8)	A–4a.
92	40	52			57	32	CH	A–7–6(20)	A–7–6.
82	42	40			32	13	CL	A–6(9)	A–6a.
96	55	41	102	20	40	16	ML–CL	A–6(10)	A–6b.
85	45	40	106	18	36	16	CL	A–6(10)	A–6b.
87	43	44	104	19	38	16	CL	A–6(10)	A–6b.
74	43	31	112	15	29	11	CL	A–6(8)	A–6a.
88	44	44	107	16	43	21	CL	A–7–6(13)	A–7–6.
52	34	18			21	2	ML	A–4(3)	A–4a.
61	21	40			33	14	CL	A–6(7)	A–6a.
73	32	41			31	12	CL	A–6(8)	A–6a.
90	26	64			42	12	ML	A–7–6(9)	A–7–6.
92	21	71			43	18	ML–CL	A–7–6(12)	A–7–6.
79	38	41			30	6	ML	A–4(8)	A–4a.
95	31	64	104	20	51	26	CH	A–7–6(17)	A–7–6.
67	28	39	118	14	31	12	CL	A–6(7)	A–6a.
50	30	20	117	14	(7)	(7)	SM	A–4(3)	A–4a.
30	9	21	112	16	29	9	SC	A–2–4(0)	A–2–4.
78	31	47	110	17	33	12	CL	A–6(9)	A–6a.
42	13	29			20	2	SM	A–4(1)	A–4a.
40	8	32			20	3	SM	A–4(1)	A–4a.
82	27	55			32	14	CL	A–6(10)	A–6a.
92	42	50			41	14	ML–CL	A–7–6(10)	A–7–6.
85	46	39			40	15	ML–CL	A–6(10)	A–6a.
47	27	20			23	3	ML	A–4(2)	A–4a.
25	18	7	115	12	(7)	(7)	SM	A–2–4(0)	A–3a.
23	15	8	117	10	(7)	(7)	SM	A–2–4(0)	A–3a.
26	17	9	117	12	(7)	(7)	SM	A–2–4(0)	A–3a.

[4] Based on the "Unified Soil Classification System" (*17*). Soil Conservation Service and Bureau of Public Roads have agreed to consider that all soil having plasticity indexes within two points from the A-line are to be given a borderline classification.

[5] Based on AASHO Designation M 145–49 (*1*).

[6] Based on "Classification of Soils," Ohio State Highway Testing Laboratory, Feb. 1, 1955.

[7] Nonplastic.

plasticity; the material rated poor is plastic clay that loses strength when wet. However, in areas where the soil material freezes to a depth greater than 6 inches or where the water table is within 3 feet of the subgrade surface, the silt should be rated poor instead of fair because it is susceptible to damage by freezing and thawing.

In the column "Soil Features Affecting Engineering Practices—Highway Location" are given qualities of the soils that might influence the selection of routes and highways, including secondary roads, streets, or lanes in parks. The features considered detrimental are a high water table, flooding, seepage, plastic soil material, the presence of muck, peat, or rock, unstable slopes, and material that is susceptible to frost action.

The vertical alinement, or placement, of the roadway is affected primarily by local drainage and by the stability of the soil material. For satisfactory drainage to be provided in areas that are occasionally or seasonally flooded, or where the water table is high, the surface of the pavement should be built at least 3 feet above the highest point reached by high water or above the highest level reached by the ground water table. Interceptor ditches or underdrains help control seepage. Seepage over impermeable strata in the back slopes of cuts may

TABLE 4.—*Brief description of the soils of Allen*

Map symbol	Soil	Description of soil and site	Depth to seasonally high water table	Depth to bedrock	Depth from surface
				Feet	*Inches*
Bm	Belmore loam, 0 to 2 percent slopes.	Light-colored, well-drained, loamy soils over sandy and gravelly material. Normally, no obstacles for grading, but a few large boulders and some cobbles are present. On beach ridges, terraces, and outwash plains.	4 feet or more	More than 8	0–8
					8–25
BmB	Belmore loam, 2 to 6 percent slopes.				
					25–40
BmC2	Belmore loam, 6 to 12 percent slopes, moderately eroded.				
					40+
BmD2	Belmore loam, 12 to 18 percent slopes, moderately eroded.				
Bo	Blount silt loam, 0 to 2 percent slopes.	Light-colored, imperfectly drained soils of the glacial till plains developed in calcareous clay loam till. The water table is at or near the surface during winter and spring.	At or near surface.	More than 15	0–8
					8–14
BoB	Blount silt loam, 2 to 6 percent slopes.				
					14–28
BoB2	Blount silt loam, 2 to 6 percent slopes, moderately eroded.				28+
Bn	Blount loam, 0 to 2 percent slopes.				
BnB	Blount loam, 2 to 6 percent slopes.				
CaB	Casco silt loam, 0 to 6 percent slopes.	Silty and loamy soils underlain by well-washed gravel and sand at a depth of 10 to 24 inches, on stream terraces in the southeastern part of the county. Some large boulders and cobbles below a depth of 2 feet. In areas of the Casco and Fox soils mapping unit, the two soils are intermingled. Estimated data for the Fox soils is given under the Fox series.	6 feet or more	More than 8	0–8
					8–18
CfC2	Casco and Fox soils, 6 to 12 percent slopes, moderately eroded.				18+
Cw	Colwood silt loam.	Dark-colored, lake-laid soils developed in calcareous fine sand and silt. A high water table during spring and winter.	At surface or just below.	More than 15	0–9
Co	Colwood loam.				9–45
					45+
Ds	Digby silt loam, 0 to 2 percent slopes.	Light-colored, imperfectly drained, loamy soils over sandy and gravelly material. The water table is at or near the surface during winter and spring. On beach ridges, stream terraces, and outwash plains.	At or near surface.	More than 8	0–8
					8–35
DsB	Digby silt loam, 2 to 6 percent slopes.				
					35+
Db	Digby fine sandy loam, 0 to 2 percent slopes.				
DbB	Digby fine sandy loam, 2 to 6 percent slopes.				
Dm	Digby loam, 0 to 2 percent slopes.				
DmB	Digby loam, 2 to 6 percent slopes.				
Em	Eel silt loam.	Moderately well drained soil of the first bottoms. The water table is normally not a problem. No bedrock or boulders. Subject to occasional flooding.	Subject to flooding.	More than 4	0–9
					9–45
FoB	Fox loam, 2 to 6 percent slopes.	Silty and loamy soils underlain by well-washed gravel and sand at a depth of 24 to 42 inches; on stream terraces in southeastern part of county. Some large boulders or cobbles below a depth of 3 to 4 feet.	5 feet or more	More than 8	0–8
					8–27
					27–35
					35+
Gn	Genesee silt loam.	Well-drained, medium-textured soil of the first bottoms. The water table normally is not a problem. Subject to occasional flooding.	Subject to flooding.	More than 4	0–9
					9–45

See footnotes at end of table.

County and their estimated physical properties

Classification			Percentage passing sieve—			Permea-bility	Available moisture capacity	Reaction	Shrink-swell potential
USDA	Unified	AASHO	No. 4	No. 10	No. 200				
						Inches per hour	*Inches per inch of soil*	*pH value*	
Loam	ML	A-4	90-100	80-95	55-75	2. 5-9. 5	0. 15-0. 17	6. 1-6. 5	Low.
Sandy clay loam	SC	A-2 or A-6	90-100	85-100	30-50	1. 7-2. 5	0. 14-0. 18	6. 1-6. 5	Moderate to low.
Clay loam	CL	A-6	90-100	80-100	55-85	1. 7-2. 5	0. 14-0. 18	6. 1-6. 5	Moderate to low.
Loamy sand	SM	A-2	90-100	80-100	10-35	4. 5-10. 0	0. 02-0. 05	(1)	Low.
Silt loam	ML	A-4	95-100	95-100	70-90	0. 5-1. 5	0. 18-0. 22	5. 6-6. 5	Low.
Silty clay loam	CL	A-6 or A-7	95-100	95-100	80-95	0. 1-0. 5	0. 17-0. 21	5. 6-6. 0	Moderate to low.
Clay	CH	A-7	95-100	95-100	80-95	0. 05-0. 2	0. 15-0. 18	6. 1-7. 3	High.
Clay loam	CL	A-6 or A-7	95-100	90-100	70-85	0. 01-0. 10	0. 10-0. 14	(1)	Moderate.
Silt loam	ML	A-4	85-100	80-100	65-100	1. 5-5. 0	0. 18-0. 22	5. 6-6. 5	Low.
Gravelly clay	GC or SC	A-6 or A-7	60-85	50-80	35-50	0. 5-3. 5	0. 09-0. 12	6. 1-6. 5	Moderate.
Gravel and sand	GW or GM	A-1	40-75	10-60	5-25	10+	0. 01-0. 03	(1)	None.
Silt loam	ML	A-4	95-100	95-100	80-100	0. 5-2. 5	0. 19-0. 23	6. 1-7. 3	Low.
Clay loam	CL	A-6	95-100	95-100	70-85	0. 1-0. 5	0. 16-0. 19	6. 6-7. 3	Moderate to low.
Silt loam	ML	A-4	95-100	95-100	75-95	1. 0-2. 0	0. 18-0. 22	(1)	Low.
Loam	ML	A-4	95-100	85-95	60-75	1. 0-9. 5	0. 14-0. 16	5. 6-6. 5	Low.
Clay loam	CL	A-6	95-100	90-100	65-85	1. 0-3. 0	0. 14-0. 18	5-1-6. 5	Moderate to low.
Loamy sand and gravel.	GM or SM	A-1 or A-2	50-100	30-90	15-30	2. 5-5. 50	0. 04-0. 08	(1)	None.
Silt loam	ML or CL	A-4 or A-6	95-100	95-100	70-90	0. 2-2. 5	0. 18-0. 22	6. 1-7. 8	Low.
Silt loam	ML or CL	A-4 or A-6	95-100	95-100	80-95	0. 2-2. 0	0. 16-0. 20	6. 1-7. 8	Low.
Loam	ML	A-4	85-100	80-95	55-75	1. 5-5. 0	0. 14-0. 18	5. 6-6. 5	Low.
Sandy clay loam	SC or CL	A-6, A-4	85-100	80-100	35-60	1. 0-3. 8	0. 14-0. 18	5. 6-6. 0	Moderate to low.
Gravelly clay	GC, SC	A-2 or A-7	40-80	30-70	20-50	0. 5-2. 5	0. 07-0. 10	5. 6-6. 5	Moderate.
Sand and gravel	GW-GM or SW-SM.	A-1	30-90	10-60	5-15	10+	0. 01-0. 03	(1)	None.
Silt loam	ML or CL	A-4 or A-6	95-100	95-100	70-90	0. 2-2. 5	0. 18-0. 22	6. 1-7. 8	Low.
Silt loam	CL, ML	A-4 or A-6	95-100	90-100	70-90	0. 2-3. 0	0. 16-0. 20	6. 1-7. 8	Low.

728-170—65——4

TABLE 4.—*Brief description of the soils of Allen*

Map symbol	Soil	Description of soil and site	Depth to seasonally high water table	Depth to bedrock	Depth from surface
				Feet	*Inches*
Hf HfB Ha HaB Hd HdB HdC2	Haney silt loam, 0 to 2 percent slopes.[2] Haney silt loam, 2 to 6 percent slopes. Haney fine sandy loam, 0 to 2 percent slopes. Haney fine sandy loam, 2 to 6 percent slopes. Haney loam, 0 to 2 percent slopes. Haney loam, 2 to 6 percent slopes. Haney loam, 6 to 12 percent slopes, moderately eroded.	Light-colored, moderately well drained loamy soils over sandy and gravelly material; calcareous clay or clay loam till at a depth of 48 inches or more; water table normally is below a depth of 30 inches. On beach ridges, stream terraces, and outwash plains.	3 feet or more	More than 8	0–9 9–36 36+
Hm HmB	Haskins and Digby silt loams, over clay, 0 to 2 percent slopes. Haskins and Digby silt loams, over clay, 2 to 6 percent slopes.	Haskins: Light-colored, imperfectly drained, medium-textured soils 18 to 36 inches deep over calcareous clay or clay loam till. Water table is at or near the surface during winter and spring. Normally, no bedrock or boulders. On beach ridges, stream terraces, and outwash plains.	At or near surface.	More than 8	0–8 8–31 31+
Hh HhB Hk HkB	Haskins and Digby fine sandy loams, over clay, 0 to 2 percent slopes. Haskins and Digby fine sandy loams, over clay, 2 to 6 percent slopes. Haskins and Digby loams, over clay, 0 to 2 percent slopes. Haskins and Digby loams, over clay, 2 to 6 percent slopes.	Digby, over clay: Light-colored, imperfectly drained, loamy soils over sandy and gravelly material; calcareous clay or clay loam material at a depth of 36 to 48 inches. Water table is at or near surface during winter and spring.	At or near surface.	More than 8	0–8 8–35 35–48 48+
Hs Hv Ht	Hoytville silt loam [3]. Hoytville silty clay loam. Hoytville silty clay.	Dark-colored, very poorly drained soils developed in calcareous fine silty clay loam or clay till. The water table is at or near the surface during winter and spring. Few boulders; normally, no bedrock. On lake plains in the northwestern part of county.	At or near surface.	More than 8	0–9 9–40 40+
Ks Kb	Kibbie silt loam, 0 to 2 percent slopes. Kibbie loam, 0 to 2 percent slopes.	Light-colored, imperfectly drained soils developed in calcareous lacustrine fine sands and silt. The water table is at or near the surface during winter and spring. Normally, no bedrock or boulders.	At or near surface.	More than 15	0–8 8–36 36+
Ln	Lenawee silt loam.	Dark-colored, very poorly drained soil developed in clay loam lacustrine deposits. The water table is at or near the surface during winter and spring. Normally, no bedrock or boulders.	At or near surface.	More than 15	0–9 9–45 45+
Lw	Linwood muck.	Very dark colored, very poorly drained soil developed in organic material that is 12 to 42 inches thick over fine sandy loam to silty clay loam mineral material. May be ponded during winter and spring. In depressions in southeastern part of county.	At or near surface to ponded.	More than 8	0–16 16–22 22+
Mf Mc Mh	Millgrove silt loam, over clay. Millgrove loam, over clay. Millgrove silty clay loam, over clay.	Dark-colored, very poorly drained, medium-textured soils 24 to 48 inches thick over calcareous clay or clay loam till. The water table is at or near the surface during winter and spring. Normally, no bedrock or boulders. At the base of beach ridges and in depressions on outwash plains.	At or near surface.	More than 15	0–10 10–36 36+

See footnotes at end of table.

County and their estimated physical properties—Continued

Classification			Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Shrink-swell potential
USDA	Unified	AASHO	No. 4	No. 10	No. 200				
						Inches per hour	*Inches per inch of soil*	*pH value*	
Loam	ML	A-4	95–100	85–95	55–75	1. 0–9. 5	0. 16–0. 18	6. 1–6. 5	Low.
Sandy clay loam	SC or CL	A-6 or A-4	95–100	85–100	35–55	0. 8–2. 5	0. 14–0. 18	5. 6–6. 0	Moderate to low.
Loamy sand and gravel.	GM or SM	A-1 or A-2	50–100	30–90	15–30	2. 5–5. 5	0. 04–0. 08	(1)	Low.
Loam	ML	A-4	95–100	85–95	55–75	1. 0–10. 0	0. 14–0. 18	5. 6–6. 0	Low.
Clay loam	CL	A-6	95–100	90–100	60–85	0. 2–1. 0	0. 14–0. 18	6. 1–6. 5	Moderate to low.
Clay or clay loam till.	CL or CH	A-6 or A-7	95–100	90–100	70–95	0. 5–0. 20	0. 08–0. 12	(1)	High to moderate.
Loam	ML	A-4	95–100	85–95	60–75	1. 0–9. 5	0. 14–0. 16	5. 6–6. 5	Low.
Clay loam	CL	A-6	95–100	90–100	65–85	1. 0–3. 0	0. 14–0. 18	5. 1–6. 5	Moderate to low.
Loamy sand and gravel.	GM or SM	A-1 or A-2	50–100	30–90	15–30	2. 5–5. 5	0. 04–0. 08	(1)	None.
Clay	CH or MH	A-7	85–100	80–100	70–100	. 05	0. 15–0. 18	(1)	High.
Silty clay loam	CL	A-6 or A-7	95–100	95–100	80–90	0. 5–3. 0	0. 16–0. 20	6. 1–7. 3	Moderate.
Clay	CH	A-7	95–100	95–100	80–95	0. 08–0. 40	0. 15–0. 18	6. 6–7. 3	High.
Clay	CH	A-7	95–100	95–100	80–95	0. 04–0. 20	0. 08–0. 12	(1)	High.
Silt loam	ML	A-4	95–100	95–100	70–80	0. 2–3. 0	0. 19–0. 23	6. 1–6. 5	Low.
Silty clay loam	CL	A-6	95–100	95–100	80–90	0. 10–1. 5	0. 19–0. 22	6. 1–6. 5	Moderate.
Silt loam	ML	A-4	95–100	95–100	75–95	0. 7–4. 0	0. 18–0. 22	(1)	Low.
Silt loam	ML	A-4	95–100	95–100	75–90	0. 50–3. 0	0. 19–0. 23	6. 1–7. 3	Low.
Silty clay loam	CL or CH	A-6 or A-7	95–100	95–100	80–95	0. 10–0. 5	0. 17–0. 20	6. 6–7. 3	Moderate to high.
Silty clay loam	CL	A-6	95–100	95–100	80–95	0. 05–0. 20	0. 14–0. 17	(1)	Moderate.
Muck	Pt	(4)	-------	-------	-------	0. 5–3. 0	0. 20–0. 25	6. 6–7. 3	Low.
Silty clay loam	CL	A-6 or A-7	95–100	95–100	80–100	0. 1–1. 2	0. 18–0. 22	7. 4–7. 8	Moderate to high.
Sandy loam	SM	A-2 or A-4	95–100	85–100	25–45	1. 50–3. 0	0. 10–0. 14	(1)	Low.
Loam	ML or CL	A-4	95–100	85–95	60–75	1. 0–3. 5	0. 16–0. 20	6. 6–7. 3	Low.
Clay loam	CL	A-6	95–100	90–100	65–85	0. 3–1. 8	0. 14–0. 18	6. 6–7. 3	Moderate.
Clay loam or clay	CH or CL	A-7	95–100	90–100	70–95	0. 02–0. 1	0. 08–0. 12	(1)	Moderate to high.

TABLE 4.—*Brief description of the soils of Allen*

Map symbol	Soil	Description of soil and site	Depth to seasonally high water table	Depth to bedrock	Depth from surface
				Feet	*Inches*
Md Mb Mg Mk	Millgrove silt loam. Millgrove loam. Millgrove silty clay loam. Millgrove silty clay.	Dark-colored, very poorly drained, loamy soils over sandy and gravelly material; calcareous clay or clay loam till at a depth of 48 inches or more. The water table is at or near the surface during winter and spring. At the base of beach ridges and on depressed flats of outwash plains.	At or near surface.	More than 15	0–10 10–40 40+
Ml	Millsdale silty clay loam.	Dark-colored, very poorly drained, fine-textured soil material underlain by limestone bedrock at a depth of 20 to 42 inches. The water table is at or near the surface during winter and spring. On first bottoms; subject to flooding.	At or near surface.	20 to 42 inches.	0–8 8–36 36+
Mn Mm	Montgomery silty clay loam. Montgomery silty clay.	Dark-colored, very poorly drained, lake-laid deposits of silty clay or clay in localized areas on till and outwash plains. The water table is at or near the surface during winter and spring. Subject to ponding.	At or near surface.	More than 6	0–9 9–50 50+
MrB MrB2 MrC MrC2 MsC3 MrD2 MrE2 MrF2 MoB	Morley silt loam, 2 to 6 percent slopes. Morley silt loam, 2 to 6 percent slopes, moderately eroded. Morley silt loam, 6 to 12 percent slopes. Morley silt loam, 6 to 12 percent slopes, moderately eroded. Morley soils, 6 to 12 percent slopes, severely eroded. Morley silt loam, 12 to 18 percent slopes, moderately eroded. Morley silt loam, 18 to 25 percent slopes, moderately eroded. Morley silt loam, 25 to 35 percent slopes, moderately eroded. Morley loam, 2 to 6 percent slopes.	Light-colored, moderately well drained soils developed in calcareous clay loam till. Severe hazard of erosion on steep slopes. No bedrock; occasional boulders. Drainage no problem except for an occasional seep spot. Commonly in sloping areas along streams, across the southern face of the Wabash terminal moraine and over most of the kamey part of the St. Johns terminal moraine.	30 inches or more.	More than 15	0–6 6–12 12–24 24+
Np NpB Na	Nappanee silt loam, 0 to 2 percent slopes.[6] Nappanee silt loam, 2 to 6 percent slopes. Nappanee loam, 0 to 2 percent slopes.	Light-colored, imperfectly drained soils developed in calcareous fine silty clay loam or clay till. The water table is at or near the surface during winter and spring. On lake plains in the northern part of the county.	At or near surface.	More than 20	0–8 8–22 22+
Pa Pm Pc	Pewamo silt loam.[7] Pewamo silty clay loam. Pewamo silty clay.	Dark-colored, very poorly drained soils developed in calcareous clay loam till. The water table is at or near the surface during winter and spring. Few boulders; no bedrock. On glacial till plains.	At or near surface.	More than 15	0–9 9–40 40+
Ra	Randolph silt loam, 0 to 2 percent slopes.	Light-colored, imperfectly drained soil formed in old alluvium 20 to 42 inches thick over limestone bedrock. The water table is at or near the surface during winter and spring. Adjacent to a few streams in the northeastern part of county.	At or near surface.	20 to 42 inches.	0–8 8–36 36+
RsB RmB RmC2	Rawson silt loam, 2 to 6 percent slopes. Rawson loam, 2 to 6 percent slopes. Rawson loam, 6 to 12 percent slopes, moderately eroded.	Light-colored, moderately well drained, medium-textured soils 18 to 36 inches deep over calcareous clay or clay loam till. Drainage no problem, except for an occasional seep spot. On beach ridges and stream terraces.	3 feet or more	More than 5	0–8 8–18 18–36 36+

See footnotes at end of table.

County and their estimated physical properties—Continued

Classification			Percentage passing sieve—			Permea-bility	Available moisture capacity	Reaction	Shrink-swell potential
USDA	Unified	AASHO	No. 4	No. 10	No. 200				
						Inches per hour	*Inches per inch of soil*	*pH value*	
Silt loam	ML, OL	A–4	95–100	90–100	75–95	1. 0–2. 75	0. 18–0. 21	6. 1–6. 5	Low.
Clay loam	CL	A–6	95–100	90–100	60–85	0. 5–2. 0	0. 14–0. 18	6. 6–7. 3	Moderate.
Loamy sand and gravel.	GM or SM	A–1 or A–2	50–100	30–90	10–30	2. 0–8. 0	0. 04–0. 08	(1)	Low.
Silty clay loam	CL	A–6 or A–7	95–100	95–100	85–95	0. 3–2. 0	0. 18–0. 22	6. 1–7. 3	Moderate.
Clay	CH	A–7	95–100	95–100	85–95	0. 02–0. 10	0. 14–0. 18	6. 6–7. 3	High.
Bedrock								(5)	None.
Silty clay	CL	A–7	95–100	95–100	80–95	0. 2–2. 0	0. 15–0. 18	6. 1–6. 5	Moderate to high.
Clay	CH	A–7	95–100	95–100	80–95	0. 02–0. 08	0. 14–0. 18	6. 6–7. 3	High.
Silty clay	CH	A–7	95–100	95–100	80–95	0. 02–0. 08	0. 10–0. 14	(1)	High.
Silt loam	ML	A–4	95–100	95–100	70–90	0. 5–2. 0	0. 18–0. 22	5. 6–6. 5	Low.
Silty clay loam	CL	A–6	95–100	95–100	80–95	0. 2–0. 8	0. 18–0. 21	5. 6–6. 0	Moderate.
Clay	CH	A–7	95–100	95–100	80–95	0. 07–0. 2	0. 15–0. 18	6. 1–6. 5	High.
Clay loam	CL or CH	A–6 or A–7	90–100	95–100	60–85	0. 01–0. 15	0. 10–0. 14	(1)	Moderate to high.
Silt loam	ML or CL	A–4 or A–6	95–100	95–100	70–90	0. 5–2. 0	0. 18–0. 22	5. 6–6. 5	Low.
Clay	CH	A–7	95–100	95–100	85–100	0. 05–0. 15	0. 15–0. 18	6. 1–6. 5	High.
Clay	CH	A–7	90–100	80–100	75–100	0. 04–0. 10	0. 08–0. 12	(1)	High.
Silty clay loam	CL	A–6 or A–7	95–100	95–100	80–90	0. 5–3. 5	0. 18–0. 22	6. 1–7. 3	Moderate.
Clay	CH	A–7	95–100	95–100	80–95	0. 08–0. 50	0. 15–0. 18	6. 6–7. 3	High.
Clay loam	CL or CH	A–6 or A–7	95–100	90–100	70–85	0. 04–0. 25	0. 10–0. 14	(1)	Moderate.
Silt loam	ML	A–4	95–100	90–100	70–90	0. 5–2. 5	0. 18–0. 22	6. 1–6. 5	Low.
Clay loam or clay	CL or CH	A–6, A–7	95–100	85–100	60–95	0. 2–2. 5	0. 15–0. 19	6. 1–6. 5	Moderate to high.
Limestone bedrock								(5)	
Loam	ML	A–4	95–100	85–95	55–75	0. 5–3. 5	0. 14–0. 18	6. 1–6. 5	Low.
Sandy loam	SM or SC	A–2, A–4	95–100	85–100	25–45	0. 2–2. 5	0. 10–0. 14	5. 6–6. 0	Low.
Clay loam	CL	A–6	95–100	90–100	65–85	0. 1–2. 5	0. 15–0. 18	6. 1–6. 5	Moderate.
Clay	CH	A–7	95–100	90–100	70–85	0. 04–0. 1	0. 08–0. 12	(1)	High.

TABLE 4.—*Brief description of the soils of Allen*

Map symbol	Soil	Description of soil and site	Depth to seasonally high water table	Depth to bedrock	Depth from surface
				Feet	*Inches*
Rt RtB	Rimer and Tedrow loamy fine sands, over clay, 0 to 2 percent slopes. Rimer and Tedrow loamy fine sands, over clay, 2 to 6 percent slopes.	Rimer: Light-colored, imperfectly drained, sandy soils on calcareous clay or clay loam at a depth of 18 to 36 inches. The water table is at or near the surface during winter and spring. When saturated, these soils are unstable. No boulders.	At or near surface.	More than 20.	0–8 8–36 36+
		Tedrow, over clay: Light-colored, imperfectly drained, sandy soils over clay at a depth of 36 to 60 inches. The water table is at or near the surface during winter and spring. When saturated, these soils are unstable. No boulders.	At or near surface.	More than 20.	0–9 9–36 36+
ScB ScC2 ScD2	St. Clair silt loam, 2 to 6 percent slopes. St. Clair silt loam, 6 to 12 percent slopes, moderately eroded. St. Clair silt loam, 12 to 25 percent slopes, moderately eroded.	Light-colored, moderately well drained soils formed in calcareous fine silty clay loam or clay till. Drainage no problem, except for an occasional seep spot. The steeper slopes are subject to erosion. On slopes adjacent to streams that dissect the lake plains.	2 feet or more.	More than 15.	0–7 7–16 16–20 20+
SdB	Seward fine sandy loam, 2 to 6 percent slopes.	Light-colored, moderately well drained, sandy soil over calcareous clay or clay loam at a depth of 18 to 44 inches. Drainage no problem, except for an occasional seep spot. No boulders.	30 inches or more.	More than 20.	0–8 8–24 24–40 40+
Sh	Shoals silt loam.	Light-colored, imperfectly drained, medium-textured soil of the first bottoms. The water table is at or near the surface during winter and spring. Subject to frequent flooding.	At or near surface.	More than 4.	0–8 8+
Sm	Sloan silty clay loam.	Dark-colored, very poorly drained, medium-textured soil of the first bottoms. The water table is at or near the surface during winter and spring. Subject to frequent flooding.	At or near surface.	More than 3½.	0–10 10+
Sn	Sloan silty clay loam, over limestone.	Dark-colored, very poorly drained, medium-textured soil of the first bottoms. The water table is at or near the surface during winter and spring. Subject to frequent flooding. Limestone bedrock is at a depth of 20 to 24 inches.	At or near surface.	20 to 24 inches.	0–10 10–24 24+
SpB	Spinks loamy fine sand, 2 to 6 percent slopes.	Light-colored, deep, well-drained sandy soil that occupies knolls.	6 feet or more.	More than 20.	0–8 8–65 65+
To	Toledo silty clay loam.	Dark-colored, very poorly drained soil developed in calcareous lacustrine clay. The water table is at or near the surface during winter and spring. No boulders.	At or near surface.	More than 30.	0–9 9–50 50+
TtB TsB	Tuscola silt loam, 2 to 6 percent slopes. Tuscola loam, 2 to 6 percent slopes.	Light-colored, moderately well drained soils developed in calcareous fine sand and silt. Drainage not a problem, except for an occasional seep spot. Normally, no bedrock or boulders.	30 inches or more.	More than 20.	0–8 8–20 20–45 45+
Wa	Wabash silty clay.	Dark-colored, very poorly drained, fine-textured soil of the first bottoms. The water table is at or near the surface during winter and spring. Subject to severe flooding and ponding.	At or near surface.	More than 4.	0–9 9+

[1] Calcareous.

[2] Engineering test data from a Haney soil sampled in Van Wert County were used as a basis for these estimates.

[3] Engineering test data from a Hoytville soil sampled in Wood County were used as a basis for making these estimates.

[4] Not classified. Remove.

County and their estimated physical properties—Continued

Classification: USDA	Classification: Unified	Classification: AASHO	Percentage passing sieve—No. 4	Percentage passing sieve—No. 10	Percentage passing sieve—No. 200	Permeability	Available moisture capacity	Reaction	Shrink-swell potential
						Inches per hour	*Inches per inch of soil*	*pH value*	
Fine sandy loam	SM or ML	A-4	95-100	95-100	40-55	0. 75-4. 5	0. 12-0. 15	6. 1-6. 5	Low.
Sandy loam	SM or SC	A-4	95-100	95-100	35-50	0. 20-1. 5	0. 10-0. 14	6. 1-7. 3	Low.
Clay loam or clay	CL or CH	A-6, A-7	95-100	90-100	70-95	0. 05-0. 20	0. 08-0. 12	([1])	Moderate to high.
Loamy fine sand	SM	A-2	95-100	90-100	15-35	0. 20-3. 5	0. 08-0. 15	6. 1-6. 5	Low.
Fine sand	SP or SM	A-2 or A-3	95-100	90-100	0-35	5. 0-10. 0	0. 04	6. 1-6. 5	Low.
Clay	CH	A-7	95-100	90-100	70-100	0. 05-0. 10	0. 03-0. 10	([1])	High.
Silt loam	ML or CL	A-4 or A-6	95-100	95-100	70-90	0. 50-2. 5	0. 18-0. 22	5. 6-6. 0	Low.
Clay	CH	A-7	95-100	95-100	85-100	0. 05-0. 15	0. 14-0. 18	6. 1-6. 5	High.
Clay	CH	A-7	95-100	95-100	85-100	0. 05-0. 15	0. 14-0. 18	6. 1-6. 5	High.
Clay	CH	A-7	95-100	90-100	85-100	0. 05-0. 10	0. 08-0. 12	([1])	High.
Fine sandy loam	SM or ML	A-4	95-100	95-100	40-55	0. 75-4. 5	0. 12-0. 18	6. 1-6. 5	Low.
Loamy fine sand	SM	A-2, A-4	95-100	95-100	15-45	0. 20-3. 5	0. 08-0. 12	5. 6-6. 0	Low.
Fine sandy loam	SM or ML	A-4	95-100	95-100	40-55	0. 1-2. 5	0. 12-0. 16	6. 1-6. 5	Low.
Clay loam	CL or CH	A-6 or A-7	95-100	90-100	70-85	0. 05-0. 20	0. 08-0. 11	([1])	Moderate to high.
Silt loam	ML or CL	A-4 or A-6	95-100	95-100	75-95	0. 15-2. 5	0. 18-0. 22	6. 1-6. 5	Low to moderate.
Silt loam	ML or CL	A-4 or A-6	95-100	95-100	80-100	0. 10-1. 5	0. 16-0. 20	6. 1-7. 8	Low to moderate.
Silty clay loam	CL	A-6	95-100	90-100	80-95	0. 20-3. 0	0. 18-0. 21	6. 1-7. 8	Moderate.
Silty clay loam	CL	A-6	95-100	95-100	80-95	0. 04-1. 0	0. 16-0. 20	6. 1-7. 3	Moderate.
Silty clay loam	CL	A-6	95-100	90-100	80-95	0. 20-3. 0	0. 18-0. 21	6. 1-7. 8	Moderate.
Silty clay loam	CL	A-6	95-100	95-100	80-95	0. 04-1. 0	0. 16-0. 20	6. 1-7. 3	Moderate.
Limestone bedrock.									
Loamy fine sand	SM	A-2 or A-4	95-100	95-100	15-40	5. 0-12. 0	0. 04-0. 08	6. 1-7. 3	Low.
Loamy sand or sandy loam.	SM	A-2 or A-4	95-100	95-100	15-45	1. 50-6. 50	0. 04-0. 08	6. 1-7. 3	Low.
Fine sandy loam	SM or ML	A-2 or A-4	95-100	95-100	25-55	6. 00-12. 0	0. 08-0. 12	([1])	Low.
Silty clay loam	CL	A-6 or A-7	95-100	95-100	85-95	0. 15-1. 5	0. 18-0. 21	6. 1-6. 5	Moderate.
Clay	CH	A-7	95-100	95-100	80-95	0. 01-0. 08	0. 14-0. 17	6. 6-7. 3	High.
Clay	CH	A-7	95-100	95-100	80-95	0. 01-0. 06	0. 12-0. 15	([1])	High.
Loam	ML	A-4	95-100	95-100	65-75	0. 20-3. 0	0. 14-0. 18	6. 1-6. 5	Low.
Loam	ML	A-4	95-100	95-100	65-75	0. 10-1. 0	0. 12-0. 16	6. 1-6. 5	Low.
Very fine sandy loam.	SM	A-2 or A-4	95-100	95-100	35-50	0. 8-3. 0	0. 10-0. 14	6. 6-7. 3	Low.
Silt loam	ML	A-4	95-100	95-100	75-95	0. 10-1. 0	0. 16-0. 20	([1])	Low.
Silty clay	CH	A-7	95-100	99-100	80-95	0. 15-1. 5	0. 15-0. 18	6. 3-7. 8	High.
Silty clay	CH	A-7	95-100	99-100	80-95	0. 01-0. 05	0. 15-0. 17	6. 3-7. 8	High.

[5] Limestone.

[6] Engineering test data for a Nappanee soil sampled in Van Wert County were used as a basis for making these estimates.

[7] Engineering test data for a Pewamo soil sampled in Hancock County were used as a basis for making these estimates.

TABLE 5.—*Interpretation of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting engineering practices	
	Topsoil	Sand	Gravel	Road fill	Highway location	Dikes or levees
Belmore (Bm, BmB, BmC2, BmD2).	Surface layer fair.	Fair; well-graded [1] fine gravel and sand with some silt below a depth of 2 to 3½ feet.	Good below a depth of 2 to 3½ feet; contains a few thin strata of fine gravel and sand.	Good; good compaction and stability of silt.	Good drainage; source of subgrade below a depth of 2 to 3½ feet; material above 2 to 3½ feet is highly susceptible to frost action.	Good stability; material below a depth of 2 to 3½ feet has moderately rapid permeability when compacted.
Blount (Bn, BnB, Bo, BoB, BoB2).	Fair to good	Not suitable	Not suitable	Subsoil and substratum poor.	Seasonal high water table; susceptible to frost action.	Good stability; fair compaction.
Casco (CaB, CfC2).	Surface layer fair.	Fair; well-graded gravel and sand below a depth of 1 to 2 feet.	Good; well-graded gravel and sand below a depth of 1 to 2 feet.	Good; good stability and compaction.	Good drainage; highly susceptible to frost action above a depth of 1 to 2 feet; material below a depth of 1 to 2 feet is not susceptible to frost action and is a good source of subgrade.	Good stability; low shrink-swell potential; rapid permeability if compacted.
Colwood (Co, Cw)	Upper 1 to 2 feet good.	Not suitable	Not suitable	Poor; poor stability; generally wet; highly erodible on slopes.	High water table; highly susceptible to frost action.	Poor stability; generally wet; highly erodible on slopes; medium shrink-swell potential.
Digby (Db, DbB, Dm, DmB, Ds, DsB).	Surface layer fair.	Fair; well-graded fine gravel and sand with some silt below a depth of 3 feet.	Fair; gravel below a depth of 3 feet is mostly fine and contains sand and some silt.	Good; good compaction and stability; seasonally wet.	Seasonal high water table; highly susceptible to frost action in upper 3 feet; good source of subgrade below a depth of 3 feet.	Good stability; material below a depth of 3 feet has moderately rapid permeability when compacted.
Digby, over clay (Hh, HhB, Hk, HkB, Hm, HmB).	Surface layer fair.	Poor; thin sandy layer between a depth of about 3 and 4 feet.	Poor; variable amounts of fine gravel in sandy layer.	Fair; material in upper 3 to 4 feet has good stability; material below is plastic clay; seasonally wet.	Seasonal high water table; plastic clay below a depth 3 to 4 feet; highly susceptible to frost action.	Material in upper 3 to 4 feet has good stability; substratum has high shrink-swell potential.

[1] Well-graded soil material consists of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. In contrast, poorly graded soil material consists mainly of

properties of soils in Allen County, Ohio

Soil features affecting engineering practices—Continued						
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversion ditches	Waterways	Sewage disposal field
Reservoir area	Embankment					
Excessive rate of seepage.	Good stability; material at a depth of 2 to 3½ feet has moderately rapid permeability when compacted.	Good natural drainage.	High infiltration rate; medium water-holding capacity.	Slopes generally short; soil properties favorable.	Moderate erodibility; medium water-holding capacity.	Moderately rapid permeability; good drainage; well suited.
Very slow rate of seepage.	Good stability; material has very slow permeability when compacted.	Somewhat poor natural drainage; slow permeability; artificial drainage satisfactory.	Moderately slow infiltration; slow permeability; moderately high water-holding capacity.	Nearly level to gently sloping; generally not needed.	Slightly susceptible to erosion; soil properties favorable.	Slow permeability; seasonal high water table; generally not suited.
Excessive rate of seepage.	Soil material gravelly; rapid permeability when compacted.	Good natural drainage; not needed.	Medium to rapid water intake rate; low water-holding capacity.	Shallow to gravel and sand; slopes are generally short and irregular.	Slight to moderate erodibility; low water-holding capacity; vegetation difficult to establish.	Rapid permeability; good natural drainage; well suited.
Sandy seams result in medium to high rate of seepage; water table naturally high.	Poor stability and strength; slow permeability when compacted; highly erodible on slopes.	Moderately permeable; seasonal high water table; if adequate outlets are available, subsurface drainage is satisfactory.	Medium water intake rate; high water-holding capacity.	Not needed, because the soils are nearly level.	Disturbed soil is highly erodible.	Depressional relief; seasonal high water table; generally not suited.
Excessive rate of seepage.	Good stability; material below a depth of 3 feet has moderately rapid permeability when compacted.	Seasonal high water table; moderate permeability.	Medium water intake rate; medium water-holding capacity.	Not needed, because soils do not have strong slopes.	Moderate erodibility.	Seasonal high water table; moderate permeability; questionable suitability.
Upper 3 to 4 feet has medium to high seepage rate; material below has very slow seepage rate.	Good stability; slow permeability when compacted; material below a depth of 3 to 4 feet has high shrink-swell potential.	Seasonal high water table; slow permeability below a depth of 3 to 4 feet.	Medium water intake rate; medium water-holding capacity.	Generally not needed, because soil is nearly level.	Moderate erodibility.	Seasonal high water table; slow permeability below a depth of 1½ to 3 feet; generally not suited.

particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

TABLE 5.—*Interpretation of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting engineering practices	
	Topsoil	Sand	Gravel	Road fill	Highway location	Dikes or levees
Eel (Em)	Good to a depth of 2 to 3 feet.	Not suitable	Not suitable	Poor; poor compaction; low stability.	Seasonal high water table; subject to flooding; susceptible to frost action.	Low stability; poor compaction.
Fox (FoB)	Surface layer fair.	Fair; well-graded gravel and sand below a depth of 2 to 3½ feet.	Good; mostly medium and fine gravel below a depth of 2 to 3½ feet.	Subsoil fair to good; substratum good.	Good drainage; low susceptibilbility to frost action below a depth of 2 to 3½ feet.	Good stability; moderately rapid permeability; low shrink-swell potential below a depth of 2 to 3½ feet.
Genesee (Gn)	Good to a depth of 2 to 3 feet.	Not suitable	Not suitable	Fair; fair stability and strength; susceptible to frost action.	Good drainage; seasonal high water table; subject to flooding.	Fair stability and compaction; moderate shrink-swell potential.
Haney (Ha, HaB, Hd, HdB, HdC2, Hf, HfB).	Surface layer fair.	Fair; well-graded fine gravel and sand with some silt below a depth of 3 feet.	Good below a depth of 3 feet; has a few thin strata of silt.	Good; good stability and compaction.	Fair drainage; material above 3 feet is highly susceptible to frost action; source of subgrade below a depth of 3 feet.	Good stability; material below a depth of 3 feet has moderately rapid permeability when compacted.
Haskins (Hh, HhB, Hk, HkB, Hm, HmB).	Surface layer fair.	Poor; material above a depth of 1½ to 3 feet is about 40 percent sand and 60 percent silt and clay.	Not suitable	Good in upper 1½ to 3 feet; material below is plastic clay that is seasonally wet.	Seasonal high water table; plastic clay below a depth of 1½ to 3 feet; highly susceptible to frost action.	Material in upper 1½ to 3 feet has good stability and moderate shrink-swell potential; material below has fair stability and high shrink-swell potential.
Hoytville (Hs, Ht, Hv).	Surface layer good.	Not suitable	Not suitable	Poor; plastic clay; poor stability; highly compressible; poor workability.	Seasonal high water table; plastic soil material; moderately susceptible to frost action.	Very slow permeability; poor stability; high shrink-swell potential; cracks when dry.
Kibbie (Kb, Ks)	Surface layer fair.	Not suitable	Not suitable	Poor; poor stability; seasonally wet; highly erodible on slopes.	Seasonal high water table; highly susceptible to frost action.	Poor stability; highly erodible on slopes; medium shrink-swell potential.

properties of soils in Allen County, Ohio—Continued

Soil features affecting engineering practices—Continued							
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversion ditches	Waterways	Sewage disposal field
Reservoir area	Embankment					
Medium seepage rate; subject to flooding.	Low stability; moderate permeability when compacted.	Moderate permeability; fair natural drainage.	Good infiltration rate; moderate permeability; moderately good drainage; high water-holding capacity.	Terraces not needed; diversions may be needed adjacent to higher areas.	Slightly susceptible to erosion; soil properties favorable.	Permeable; seasonal high water table and occasional flooding; generally not suited.
Excessive rate of seepage.	Good strength and stability; material in upper 2 to 3½ feet slowly permeable when compacted.	Not suited	Medium infiltration rate; medium to low water-holding capacity.	Soil properties favorable; no limitations.	Moderately to highly erodible; moderate water-holding capacity.	Moderately rapid permeability; good drainage; well suited.
Medium rate of seepage; subject to flooding.	Fair stability; moderate permeability when compacted.	Moderate permeability; good natural drainage; drainage generally not needed.	Good infiltration rate; moderate permeability; high water-holding capacity.	Terraces not needed; diversions may be needed to remove runoff from adjacent higher areas.	Slightly susceptible to erosion.	Moderately permeable; seasonal high water table; occasional flooding; generally not suited.
Excessive rate of seepage.	Good stability; material below a depth of 3 feet has moderately rapid permeability when compacted.	Moderately good natural drainage; moderately rapid permeability.	High water intake rate; medium water-holding capacity.	Slopes generally short; soil properties favorable.	Moderate erodibility; medium water-holding capacity.	Moderately rapid permeability; fairly good drainage; generally well suited.
Upper 1½ to 3 feet has medium seepage rate; material below has very slow seepage rate.	Good stability; compacted; slow permeability; substratum has high shrink-swell potential.	Seasonal high water table; slow permeability below a depth of 1½ to 3 feet.	Medium to high water intake rate; medium water-holding capacity; slow permeability below a depth of 1½ to 3 feet.	Generally not needed, because of relief; soil favorable.	Moderately erodible.	Seasonal high water table; slow permeability below a depth of 1½ to 3 feet; generally not suited.
Very slow rate of seepage.	Fair stability in low fills; high shrink-swell potential; cracks when dry; very slow permeability when compacted.	Seasonal high water table; slow permeability.	Moderate water intake rate; medium to high water-holding capacity; slow permeability.	Not suited, because of relief.	Very slight erodibility.	Seasonal high water table; slow permeability; not suited.
Sandy seams result in medium to high rate of seepage.	Poor stability and strength; slow permeability when compacted; highly erodible on slopes.	Seasonal high water table; moderate permeability.	Medium water intake rate; high water-holding capacity.	Generally not suited, because of relief; soil properties favorable.	Undisturbed soil is moderately erodible; disturbed soil is highly erodible.	Seasonal high water table; moderate permeability; questionable suitability.

TABLE 5.—*Interpretation of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting engineering practices	
	Topsoil	Sand	Gravel	Road fill	Highway location	Dikes or levees
Lenawee (Ln)	Surface layer good.	Not suitable	Not suitable	Fair; fair stability and strength; low to medium plasticity; generally wet.	High water table; highly susceptible to frost action.	Fair stability; slow permeability when compacted; high shrink-swell potential.
Linwood (Lw)	Upper 1 to 3½ feet fair; organic soil; easily eroded by wind when dry.	Not suitable	Not suitable	Not suitable; upper 1 to 3½ feet is unstable organic material; material below has poor to fair stability; generally wet.	High water table; organic soil; unstable.	Organic material is unstable and generally wet; material below has poor to fair stability.
Millgrove (Mb, Md, Mg, Mk).	Upper 1 to 2 feet good.	Fair; material below a depth of 3 to 4 feet is well-graded sand and gravel with some silt.	Poor to fair; variable amount of fine gravel in material below a depth of 3 to 4 feet.	Fair; fair stability and compaction above a depth of 3 to 4 feet, good stability below; wet in many places.	High water table; material above a depth of 3 to 4 feet is highly susceptible to frost action; source of subgrade below a depth of 3 to 4 feet.	Fair stability above a depth of 3 to 4 feet, good below; medium shrink-swell potential; material below a depth of 3 to 4 feet has moderately rapid permeability when compacted.
Millgrove, over clay (Mc, Mf, Mh).	Upper 1 to 2 feet good.	Poor; most areas have a thin strata of sandy material at a depth of 2 to 4 feet.	Not suitable	Fair; wet in many places; fair stability and strength; plastic clay occurs below a depth of 2 to 4 feet.	Seasonal high water table; plastic clay below a depth of 2 to 4 feet; highly susceptible to frost action.	Fair stability; very slow permeability when compacted; material below a depth of 2 to 4 feet has high shrink-swell potential and cracks when dry.
Millsdale (Ml)	Good	Not suitable	Not suitable	Poor; generally wet; poor stability; limestone at a depth of 1½ to 3½ feet.	High water table; susceptible to frost action; limestone at a depth of 1½ to 3½ feet.	Poor stability; medium shrink-swell potential; limestone at a depth of 1½ to 3½ feet.
Montgomery (Mm, Mn).	Surface layer fair; poor workability.	Not suitable	Not suitable	Poor; poor to fair stability; generally wet; plastic soil material.	Seasonal high water table; plastic soil material; moderately susceptible to frost action.	Poor stability; intermittently wet; high shrink-swell potential; very slow permeability; cracks when dry.

properties of soils in Allen County, Ohio—Continued

Soil features affecting engineering practices—Continued							
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversion ditches	Waterways	Sewage disposal field
Reservoir area	Embankment					
Thin sand seams in some areas may cause some seepage; fair suitability.	Fair strength and stability; slow permeability when compacted.	Seasonal high water table; moderately slow permeability; with adequate outlets, subsurface drainage is satisfactory.	Medium water intake rate; high water-holding capacity.	Not suited, because of relief.	Slight erodibility; seasonally wet.	Seasonal high water table; moderately slow permeability; not suited.
Organic material has rapid permeability; high water table; springs occur in some places; moderate to slow seepage below the organic material.	Organic material not suitable for embankments; material below has poor to fair stability.	High water table; moderately rapid permeability above a depth of 1½ to 3½ feet; moderate to slow below; tile placed in unstable organic material may settle unevenly.	High water intake rate; high water-holding capacity.	Terraces not needed, because of relief; diversions needed in most places to remove runoff from nearby higher areas.	Highly erodible; soil favorable for seeding; wet in many places.	High water table; depressional relief; not suited.
Excessive rate of seepage.	Good stability; material below a depth of 3 to 4 feet has moderately rapid permeability when compacted.	Seasonal high water table; moderate permeability.	Medium water intake rate; medium water-holding capacity.	Not needed, because of relief.	Moderately erodible; wet in many places.	Seasonal high water table; moderate permeability; not suited.
Medium seepage rate above a depth of 2 to 4 feet.	Fair stability; very slow permeability when compacted; material below a depth of 2 to 4 feet has high shrink-swell potential and cracks when dry.	Seasonal high water table; slow permeability below a depth of 2 to 4 feet.	Medium water intake rate; medium water-holding capacity.	Not needed, because of relief.	Moderately erodible; wet in many places.	Seasonal high water table; slow permeability below a depth of 2 to 4 feet; not suited.
Medium to high seepage rate; limestone at a depth of 3 to 4 feet.	Poor stability; slow permeability when compacted.	High water table; moderately slow permeability; generally receives runoff from nearby areas.	Moderately slow permeability; medium water intake rate; medium water-holding capacity.	Nearly level; not needed.	Slightly susceptible to erosion; soil favorable.	Seasonal high water table; moderate permeability; low relief; limestone at a depth of 3 to 4 feet; not suited.
Very slow rate of seepage.	Poor stability; high shrink-swell potential; cracks when dry.	Slow permeability; seasonal high water table.	Medium infiltration rate; high water-holding capacity.	Not needed, because of relief.	Slight erodibility; wet in many places.	Seasonal high water table; slow permeability; not suited.

TABLE 5.—*Interpretation of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting engineering practices	
	Topsoil	Sand	Gravel	Road fill	Highway location	Dikes or levees
Morley (MoB, MrB, MrB2, MrC, MrC2, MrD2, MrE2, MrF2, MsC3).	Surface layer fair to good.	Not suitable	Not suitable	Fair; fair stability and compaction properties.	Moderately good drainage; highly susceptible to frost action.	Fair stability; fair to good compaction; high shrink-swell potential.
Nappanee (reddish subsoil variant) (Na, Np, NpB).	Surface layer fair.	Not suitable	Not suitable	Fair to poor; plastic soil material; unstable slopes if not adequately drained; high compressibility.	Seasonal high water table; plastic soil material; susceptible to frost action.	Very slow permeability; fair stability; high shrink-swell potential; cracks when dry.
Pewamo (Pa, Pc, Pm).	Upper 1 foot good.	Not suitable	Not suitable	Poor; fair stability and compaction; wet in many places.	Seasonal high water table; moderately susceptible to frost action.	Fair stability and compaction; high shrink-swell potential.
Randolph (Ra)	Surface layer good.	Not suitable	Not suitable	Fair; fair stability; limestone at a depth of 1½ to 3½ feet.	Seasonal high water table; limestone at a depth of 1½ to 3½ feet; susceptible to frost action.	Fair stability; medium shrink-swell potential.
Rawson (RmB, RmC2, RsB).	Surface layer fair.	Poor; sandy material in upper 1½ to 3 feet contains about 35 to 50 percent silt and clay.	Not suitable	Fair; material above a depth of 1½ to 3 feet has good stability; plastic clay below has fair stability.	Highly susceptible to frost action; plastic soil material below a depth of 1½ to 3 feet.	Material above a depth of 1½ to 3 feet has good stability and moderate shrink-swell potential; material below has fair stability and high shrink-swell potential.
Rimer (Rt, RtB)	Surface layer good.	Fair; clay below a depth of 1½ to 3 feet; sandy material contains 30 to 45 percent silt and clay.	Not suitable	Fair; upper 1½ to 3 feet has good stability and is well suited; plastic clay below a depth of 1½ to 3 feet.	Plastic clay below a depth of 1½ to 3 feet is moderately susceptible to frost action; seasonal high water table.	Material above a depth of 1½ to 3 feet has moderately rapid permeability when compacted; material below has high shrink-swell potential and cracks when dry.

properties of soil in Allen County, Ohio—Continued

Soil features affecting engineering practices—Continued						
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversion ditches	Waterways	Sewage disposal field
Reservoir area	Embankment					
Very slow rate of seepage.	Good stability; slow permeability when compacted; high shrink-swell potential.	Good natural drainage; moderately slow permeability.	Medium infiltration rate; medium to rapid runoff; medium water-holding capacity.	Rolling topography; moderately erodible; soil favorable.	Moderately to highly susceptible to erosion; subsoil is fine textured.	Moderately slow permeability; questionable suitability.
Very slow rate of seepage.	Fair stability; moderate erodibility; high shrink-swell potential; cracks when dry; very slow permeability.	Seasonal high water table; very slow permeability.	Moderately slow infiltration rate; very slow permeability; medium water-holding capacity.	Nearly level to gently rolling; moderately erodible.	Slightly susceptible to erosion; fine-textured subsoil causes poor tilth.	Slow permeability; seasonal high water table; not suited.
Very slow rate of seepage.	Fair stability; slow permeability; high shrink-swell potential.	Poor natural drainage; moderately slow permeability.	Moderate infiltration rate; high water-holding capacity.	Not needed, because of relief.	Slightly susceptible to erosion; soil material favorable.	Seasonal high water table; slow permeability; not suited.
Limestone at a depth of 1½ to 3½ feet; excessive seepage rate unless blanketed and compacted.	Fair stability; slow permeability when compacted.	Somewhat poor natural drainage; moderate permeability; limestone at a depth of 1½ to 3½ feet.	Medium infiltration rate; medium water-holding capacity.	Generally not needed, because of relief; limestone at at a depth of 1½ to 3½ feet.	Slightly susceptible to erosion; soil material favorable.	Seasonal high water table; limestone at a depth of 1½ to 3½ feet; effluent may penetrate the rock and contaminate the water supply; questionable suitability.
Medium seepage rate above a depth of 1½ to 3 feet; slow seepage rate below.	Slow permeability when compacted; good stability; material below a depth of 1½ to 3 feet has high shrink-swell potential and cracks when dry.	Few seepy spots occur in some areas; otherwise fairly good natural drainage.	High water intake rate; medium water-holding capacity.	Slopes generally short and irregular; soil material favorable.	Moderate erodibility.	Slow permeability below a depth of 1½ to 3 feet; questionable suitability.
Upper 1½ to 3 feet is rapidly permeable; material below is slowly permeable.	Material above a depth of 1½ to 3 feet has moderately rapid permeability when compacted; material below has high shrink-swell potential and cracks when dry.	Seasonal high water table; slow permeability below a depth of 1½ to 3 feet.	High water intake rate; medium water-holding capacity.	Generally not needed, because of relief; soil material favorable.	Moderate erodibility.	Seasonal high water table; slow permeability below a depth of 1½ to 3 feet; generally not suited.

TABLE 5.—*Interpretation of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting engineering practices	
	Topsoil	Sand	Gravel	Road fill	Highway location	Dikes or levees
St. Clair (ScB, ScC2, ScD2).	Poor	Not suitable	Not suitable	Poor; fair stability; highly compressible; plastic clays.	Plastic soil material; moderately susceptible to frost action.	Slow permeability; fair stability; high shrink-swell potential; cracks when dry.
Seward (SdB)	Surface layer fair.	Fair; clay below a depth of 1½ to 3 feet; sandy material contains 15 to 55 percent silt and clay.	Not suitable	Fair; upper 1½ to 3½ feet has good stability and is well suited; plastic clay below a depth of 1½ to 3 feet.	Plastic clay below a depth of 1½ to 3½ feet is moderately susceptible to frost action.	Material above a depth of 1½ to 3½ feet has moderately rapid permeability when compacted; material below has high shrink-swell potential, and cracks when dry.
Shoals (Sh)	Upper 2 to 3 feet good.	Not suitable	Not suitable	Poor to fair; fair stability and compaction; wet in many places.	Seasonal high water table; subject to flooding; highly susceptible to frost heaving.	Fair stability and compaction; medium shrink-swell potential.
Sloan (Sm)	Upper 2 to 3 feet good.	Not suitable	Not suitable	Poor; fair stability and compaction; generally wet.	High water table; highly susceptible to frost action; subject to flooding.	Fair stability and compaction; medium shrink-swell potential.
Sloan, over limestone (Sn).	Good to a depth of 1½ to 3½ feet.	Not suitable	Not suitable	Poor; rock at a depth of 1½ to 3½ feet; soil material above has fair stability; generally wet.	High water table; rock at a depth of 1½ to 3½ feet; occasionally flooded; highly susceptible to frost action.	Fair stability; intermittently wet; medium shrink-swell potential.
Spinks (SpB)	Fair to poor; somewhat too sandy.	Fair; mostly poorly graded fine sand.	Not suitable	Fair; good stability; fair bearing strength; unprotected slopes highly erodible.	No restrictions	Rapid permeability when compacted; susceptible to piping.
Tedrow, over clay (Rt, RtB).	Surface layer good.	Fair; clay below a depth of 3 to 5 feet; sandy material contains as much as 35 percent silt and clay.	Not suitable	Fair; material in upper 3 to 5 feet has good stability and is well suited; plastic clay below a depth of 3 to 5 feet.	Seasonal high water table; plastic clay below a depth of 3 to 5 feet is moderately susceptible to frost action.	Material in upper 3 to 5 feet is stable and has moderately rapid permeability when compacted; material below has high shrink-swell potential; cracks when dry.

properties of soils in Allen County, Ohio—Continued

Soil features affecting engineering practices—Continued						
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversion ditches	Waterways	Sewage disposal field
Reservoir area	Embankment					
Very slow rate of seepage.	Fair stability; impervious when compacted; high shrink-swell potential; cracks when dry.	Fairly good natural drainage; a few seepy areas.	Slow water intake rate; medium water-holding capacity.	Clay subsoil at a shallow depth.	Disturbed soil material is highly erodible.	Slow permeability; generally not suited.
Upper 1½ to 3½ feet is rapidly permeable; material below is slowly permeable.	Material above a depth of 1½ to 3½ feet has moderately rapid permeability when compacted; material below has high shrink-swell potential and cracks when dry.	Good natural drainage.	High water intake rate; low water-holding capacity.	Slopes are generally short and irregular; soil material suitable.	Moderately erodible.	Slow permeability below a depth of 1½ to 3½ feet; questionable suitability.
Subject to flooding; slow rate of seepage.	Fair stability; slow permeability when compacted.	Seasonal high water table; moderate permeability; good outlets not available.	High infiltration rate; somewhat poor natural drainage; high water-holding capacity.	Not needed, because of relief.	Slightly susceptible to erosion; soil material favorable.	Moderate permeability; seasonal high water table; occasional floods; generally not suited.
Subject to flooding; slow rate of seepage.	Fair stability; slow permeability when compacted.	High water table much of the year; slow to moderate permeability; good outlets not available.	High infiltration rate; poor natural drainage; high water-holding capacity.	Not needed, because of relief.	Slightly susceptible to erosion; soil material favorable.	Slow to moderate permeability; high water table; occasional floods; not suited.
Floods occasionally; variable seepage rate, but generally medium to high because of ununderlying limestone.	Fair stability; medium shrink-swell potential; rock at a depth of 1½ to 3½ feet.	High water table; rock at a depth of 1½ to 3½ feet; moderate permeability; good outlets generally not available.	High water intake rate; medium water-holding capacity.	Not needed, because of relief.	Slight erodibility; soil material favorable; generally wet.	Occasionally flooded; rock at a depth of 1½ to 3½ feet; high water table; not suited.
Excessive seepage rate.	Rapid permeability when compacted; susceptible to piping.	Not needed; good natural drainage.	High water intake rate; low water-holding capacity.	Slopes generally short and irregular; soil material suitable.	Highly erodible, but little runoff; low water-holding capacity.	Good drainage; rapid permeability; effluent may contaminate shallow water supply, but generally well suited.
Upper 3 to 5 feet has rapid permeability; material below has slow permeability.	Material in upper 3 to 5 feet has moderately rapid permeability when compacted; material below has high shrink-swell potential; cracks when dry.	Seasonal high water table; slow permeability below a depth of 3 to 5 feet.	High water intake rate; medium water-holding capacity.	Generally not needed, because of slope; soil material favorable.	Moderate erodibility.	Seasonal high water table; slow permeability below a depth of 3 to 5 feet; generally not suited.

TABLE 5.—*Interpretation of engineering*

Soil series and map symbol	Suitability as source of—				Soil features affecting engineering practices	
	Topsoil	Sand	Gravel	Road fill	Highway location	Dikes or levees
Toledo (To)	Surface ayer fair; poor workability.	Not suitable	Not suitable	Poor; poor stability; generally wet; plastic soil material.	Seasonal high water table; plastic soil material; moderately susceptible to frost action.	Poor stability; intermittently wet; high shrink-swell potential; cracks when dry.
Tuscola (TsB, TtB).	Surface layer good.	Not suitable	Not suitable	Poor; poor to fair stability; fair compaction; highly erodible on slopes of cuts and fills.	Highly susceptible to frost action.	Poor stability; medium shrink-swell potential; slow permeability when compacted.
Wabash (Wa)	Fair; poor workability.	Not suitable	Not suitable	Poor; poor stability, generally wet; plastic soil material.	Occasionally flooded; high water table; plastic soil material; moderately susceptible to frost action.	Slow permeability; poor stability; intermittently wet; high shrink-swell potential; cracks when dry.

cause sliding of the overlying material. If serious enough, the sliding sometimes influences both the location and the cross section design of the roadway. Some areas of bottom lands are flooded each year. A continuous embankment may be needed to raise the roadway in those lowlands above the level reached by high water. Some soils that have a high water table can be made more suitable for roads and also more suitable as a source of borrow material by building drainage ditches before earthwork is started. Underdrains may be required where either a perched or a normal water table might make the soil material unstable.

In soils that are not susceptible to frost action, not more than 10 percent of the soil material passes a No. 200 sieve. Soils that are high in silt or very fine sand are more susceptible to damaging frost action, that is, damage from frost heaving and subsequent frost boils, than soils that contain a mixture of clay, silt, and coarse material.

Though reference is not made in table 5 to winter grading, suitability for winter grading may be inferred from the data showing particle-size distribution given in table 3. Suspending earthwork in winter to prevent using frozen material for embankments is not always economically feasible, although it might be desirable to do so. Earthwork can be done in gravelly or sandy material that does not contain more than a small proportion of silt and clay, provided the soil material is compacted and frozen material is excluded.

Soil features that affect the application of practices that control water are also given in table 5. These practices include use of dikes or levees, farm ponds, agricultural drainage, irrigation, terraces, diversions, and waterways. The features that affect these practices are evaluated on the basis of estimates given in table 4, on actual test data for some of the soils, and on field experience.

Soil drainage and the construction of farm ponds, diversion ditches, and waterways are the most important agricultural engineering practices used in this county. Terraces and diversions are used and waterways are established on the sloping or strongly sloping soils of the uplands. Waterways are also established in areas of gently sloping or nearly level soils of the uplands and terraces.

All the imperfectly drained and poorly drained soils of first bottoms, stream terraces, and uplands must be drained before crops can be grown satisfactorily. The best drainage is provided by a drainage system consisting of lines of the proper size tile placed at intervals suitable for the particular soils. It includes adequate surface drainage. A random system of tiling is adequate for removing water in wet spots in large areas of Morley and St. Clair soils.

For Millgrove soils, Linwood muck, and other very poorly drained soils, open ditches provide the best drainage. Good outlets are difficult to obtain, however, for soils in low areas. A tile system may be used for

properties of soils in Allen County, Ohio—Continued

Soil features affecting engineering practices—Continued						
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversion ditches	Waterways	Sewage disposal field
Reservoir area	Embankment					
Very slow rate of seepage.	Poor stability; high shrink-swell potential; cracks when dry.	Slowly permeable; seasonal high water table.	Medium water intake rate; high water-holding capacity; slow permeability.	Not needed, because of relief.	Slight erodibility; wet in many places.	Seasonal high water table; slow permeability; not suited.
Sandy seams result in excessive rate of seepage.	Poor stability; medium shrink-swell potential; slow permeability when compacted; highly erodible slopes.	Fairly good natural drainage; generally not needed.	Medium water intake rate; high water-holding capacity.	Soil material favorable; slopes generally short and irregular.	Undisturbed soil material is moderately erodible; disturbed soil material is highly erodible.	Good drainage, moderate permeability; generally well suited.
Very slow seepage; occasionally flood.	Poor stability; high shrink-swell potential; cracks when dry.	Seasonal high water table; slow permeability; occasionally flooded; good outlets not available; generally flooded.	Slow water intake rate; medium water-holding capacity.	Terraces not needed, because of relief; diversions generally needed to remove runoff from nearby higher areas.	Slight erodibility; wet in many places.	Occasionally flooded; seasonal high water table; slow permeability; not suited.

draining mucky areas, but the tile are difficult to keep at proper grade in such areas, and mucky soils are also much less stable than mineral soils.

Characteristics of the soils to consider where terraces, diversions, and waterways are to be constructed are given in table 5. In sloping areas of cropland, terraces shorten the slope. They also slow runoff and reduce soil erosion. Diversion ditches are used to intercept surface and subsurface water on hillsides. They protect the soils that lie immediately below the soils on hillsides, such as soils of first bottoms and stream terraces. As a result, those soils do not receive runoff from the higher areas. The ditches should be as deep as feasible so that they will intercept most of the subsurface water.

Soil characteristics and hazards pertaining to the construction of farm ponds are shown for each series. The soils that formed in alluvium on first bottoms and the soils of stream terraces, which are underlain in most places by sand and gravel, are generally not suitable for the construction of farm ponds. This is because of rapid permeability of the underlying material. Some soils of first bottoms may be used for farm ponds, however, if extraordinary precautions are taken during construction of the pond. If sealing agents, such as bentonite, are used, some ponds may be successfully constructed on these soils.

Soils of the Shoals and Sloan series contain thin, sandy layers, or lenses, in places. In those soils detailed borings should be made so that sites where there are sand lenses can be avoided. In many places lenses in the material underlying a pond reservoir can be sealed by thoroughly mixing the sandy material with finer textured material, compacting it, and using suitable additives.

The Pewano, Blount, Morley, Nappanee, and St. Clair soils, all on uplands, have many good sites for farm ponds if the topography is favorable. These soils are deep and contain material that is suitable for embankments.

Shown in the column headed "Irrigation" are the properties of the soils that affect irrigation. There is little irrigation in the county at the present time, but there will probably be more in the future. Additional facts about irrigating the soils can be found in the section headed "Irrigation."

In the column headed "Sewage Disposal Field" the suitability of the soils for disposal fields and the characteristics of the soils that affect their suitability are given. Additional information about the suitability of the soils for septic tanks is given under "Urbanization and Residential Development."

Urbanization and Residential Development

The use of soils for urbanization is becoming more important every year in this county. If present trends continue, it will become a major use within the next 10 or 15 years. Urban areas are encroaching on agricultural areas. Lima, which is centrally located, has numerous industries that have been built on land that was formerly agricultural, and the smaller towns, too, have a definite effect upon the agricultural land in this county.

Statistics show that the new growth around city areas is seven times more rapid in the urban fringe area than in the central part. Developers, highway planners, and industrial users usually look first at the most arable land for proposed sites. They consider the best land because it presents fewer problems, and therefore, construction costs will be lower. A shopping center may take 100 or more acres out of agricultural production, and new freeways may require 50 to 80 acres per mile. This expansion from the city affects tax rates, land values, and employment opportunities.

One of the tools available for working with problems of urbanization is a soil survey. Mapping the soils on a scale of 4 inches to 1 mile does not provide the degree of accuracy necessary to predict the exact behavior of every parcel of land that might be selected as a building lot, because small areas of different soils may be included in a delineation. However, the soil maps that accompany this report can be used as a general guide to the nature of soils in a given location. The maps will show where difficulties are most likely to be encountered and areas that should be investigated further. Examples of soils that would present difficulties are those that occur on flood plains, soils that have a fairly impermeable subsoil, and soils where limestone is near the surface.

By using a soil survey, the basic criteria for planning land use can be established. It is sometimes possible to choose less productive soils for factories, homesites, and new highways and to leave more productive land for agriculture. Soil surveys can be used by zoning commissions to avoid developing houses on flood plains. Real estate organizations can use soil survey information in selling farmland or residential sites. Use of such information can also prevent many serious sewage disposal problems in newly developed areas. Flooding around homes, as well as sewage smells, cracked walls, and poor lawns and shrubs can be traced to the soil and its characteristics. In most instances these problems can be eliminated if a soil map is used during the planning and construction stages of development.

No attempt will be made in this report to give specific recommendations for a specific building site; only general suggestions can be made. Table 5 shows the ratings of the soils in the county for nonagricultural uses. The person who plans a development in an area that may have some soil problems should contact a qualified soil scientist, who can make accurate interpretations of the soil qualities and prepare a detailed soil map if it is needed.

In planning the construction and development of homes, whether of a single homesite or of homes in a proposed community, the characteristics of the soils should be studied and evaluated. For the majority of the soils in this county, there is a drainage problem. The soils at the site should have enough slope to provide good surface drainage, but not so much slope that erosion cannot be controlled. In areas where the water table is seasonally or permanently high, subsurface drainage is needed to remove excess water. In soils that receive runoff from higher areas, the water should be intercepted and disposed of through ditches or other channels. Residences should not be built on flood plains. All of the streams in this county overflow their banks at times in winter and spring, and water spreads across the floors of the stream valleys (fig. 22). This is a natural phenomenon, and it is very expensive to adequately protect any flood plain from inundation. Most homeowners and builders cannot afford such an undertaking.

***Figure 22.*—A residential area in Lima flooded during a heavy rain. The homes in this area were built on flood plains without regard for adequate removal of runoff.**

Other important factors to consider when building, besides the characteristics of the soils, are the source and availability of the water supply; whether an area is influenced by runoff, overflow, or ponding; the depth of the soil to bedrock; and the characteristics of the subsoil and the substratum. 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 a municipal water system, an adequate supply of good water must be available. The Ohio Department of Natural Resources, Division of Water, can provide information concerning the supply of ground water. The county or State Department of Health should be contacted for information about the purity of the proposed water supply.

Before actual construction begins, the surface soil should be removed from the foundation site and from other areas to be covered with fill and pushed aside and stockpiled. After the building has been completed and the site has been rough graded, the original surface soil can be spread uniformly over the area as a final grading process. This is better than using the material from the subsoil for lawns, flowers, shrubs, and landscaping. In the following paragraphs the suitability of various soils for building sites is indicated. This discussion should not be construed as a recommendation for choosing or rejecting a particular site. The statements are intended merely to show some of the problems that may confront the builder or homeowner.

Suitability of the soils for building sites.—Some of the permeable, well-drained soils of Allen County are particularly well suited to homesites. These are the soils of the Belmore, Casco, Fox, Haney, Rawson, Seward, Spinks, and Tuscola series. These soils have a low water table and good drainage, and they provide adequate filter beds for septic tank effluent.

The Morley and St. Clair soils have a low water table, and ponding is not a problem. Their clay subsoil, however, is slowly permeable, and effluent from septic tanks filters through it slowly. Consequently, adequate drainage fields for septic tanks should be provided before construction is started. The Morley and St. Clair soils provide some of the better building sites if they are in areas where there are centralized or municipal sewage disposal systems. Some areas, however, are steep enough that measures to control erosion are needed.

The Haskins, Digby, Kibbie, and Rimer soils offer fairly good building sites if they can be tile drained. A perched water table is common in these soils in winter and spring, but because these soils are sandy and gravelly, tile drainage is effective in removing excess water. Because of the seasonal high water table, septic tanks generally do not function properly throughout the entire year. These soils are rarely ponded or flooded.

The Blount and Nappanee soils are somewhat poorly drained, and they have a slowly permeable, clayey subsoil and a high water table in winter and spring. Although the perched water table may be at or near the surface in wet seasons, these soils do not normally pond or become flooded. Poor overall grading, however, which can lead to inadequate surface drainage, commonly causes severe and frequent flooding in some residential areas. In planning a homesite on the Blount or Nappanee soils, suitable surface and subsurface drainage should be provided. In addition, the suitability for installing sewage disposal units should be investigated carefully.

The Pewamo, Hoytville, Millgrove, Colwood, Lenawee, Toledo, and Montgomery soils are very poorly drained, and they are in nearly level or depressed areas. In general, they are poorly suited to building sites. All of these soils are subject to ponding; consequently, a large amount of fill is required to elevate the building site above the ponding level. A seasonal high water table, very slow runoff, and difficult drainage are characteristic of these soils. Developing adequate drainage fields for septic tanks and constructing year-round dry basements are difficult because of the high water table. The Montgomery soils contain a large amount of clay, and they are extremely subject to ponding.

The soils of the first bottoms, those of the Genesee, Eel, Shoals, Sloan, and Wabash series, make poor building sites. Although the Genesee and Eel soils have good drainage and permeability, they are subject to flooding.

The Randolph and Millsdale soils are underlain by limestone bedrock at a depth of 20 to 42 inches. In this county the Millsdale soils are on first bottoms and are subject to flooding. They are also very poorly drained, very slowly permeable, and extremely difficult to drain. As a result, they make some of the poorest building sites in the county. The Randolph soils have a seasonal high water table and are shallow over bedrock, but they are generally not subject to ponding and flooding.

Linwood muck is probably the poorest soil for building sites in the county. It is in acute depressions, where it receives runoff from the higher areas around it. Therefore, it is extremely difficult to drain. In addition, the mineral material of silt and fine sand beneath the muck is saturated with water during most of the year and lacks foundation strength. Individual sewage disposal systems are difficult to install and maintain.

Irrigation

So far there has been little irrigation in Ohio, but it will probably increase. For those who consider installing irrigation, the following should be taken into account:

1. Are the soils capable of sustaining high yields under irrigation?
2. Is there enough water of good quality that is free of salts or other harmful material?
3. Are capital and labor adequate for installing and maintaining the system?
4. Is it feasible to control erosion on the soils if they are irrigated?
5. Will the soils be adequately drained if they are irrigated?
6. Can the soils be kept in good tilth under irrigation?
7. Can you get water rights?
8. Can you control plant diseases and insects, which sometimes increase when water is applied?
9. Are there likely to be good markets and processing facilities for the product obtained through the use of irrigation?

To make irrigation pay, a high level of fertility has to be maintained. Merely adding water does not mean an increase in yields. Also among the many more intensive practices required under irrigation is a change in plant population. Under irrigation a greater number of plants should be grown in a specified area. This is a means of increasing profits.

The person who wants to irrigate must be familiar with the soils. The following is a list of soil types that appear to be suitable for irrigation.

Belmore loam.
Casco silt loam.
Colwood loam.
Colwood silt loam.
Digby fine sandy loam, loam, and silt loam.
Fox loam.
Genesee silt loam.
Haney fine sandy loam, loam, and silt loam.
Haskins and Digby fine sandy loams, loams, and silt loams over clay.
Kibbie loam and silt loam.
Millgrove loam, silt loam, and silty clay loam.
Millgrove loams, silt loams, and silty clay loams, over clay.
Rawson loam and silt loam.
Rimer and Tedrow loamy fine sands, over clay.
Seward fine sandy loam.

Spinks loamy fine sand.
Tuscola loam and silt loam.

In addition to the soil types named, the more nearly level Morley soils can be adapted easily to irrigation, and probably there are other soils that could be irrigated. Where soils are less than well drained, however, there are definite problems that must be overcome before irrigation is feasible. If the reader refers to table 5 in the section "Engineering Properties of the Soils," he will find additional information that will show him which soils are suitable for irrigaton.

Descriptions of the Soils

This section describes the soil series and mapping units of Allen County. The soil series is discussed first, and a representative profile of one soil type is described. Then, each mapping unit, or individual soil, of the series is described. Following the name of the mapping unit is the symbol that identifies it on the map at the back of the report. Table 6, which shows the approximate acreage and proportionate extent of the soils in the county, is also in this section.

TABLE 6.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Belmore loam, 0 to 2 percent slopes	243	0.1
Belmore loam, 2 to 6 percent slopes	1,515	.6
Belmore loam, 6 to 12 percent slopes, moderately eroded	189	.1
Belmore loam, 12 to 18 percent slopes, moderately eroded	44	(1)
Blount silt loam, 0 to 2 percent slopes	38,206	14.5
Blount silt loam, 2 to 6 percent slopes	70,761	27.0
Blount silt loam, 2 to 6 percent slopes, moderately eroded	848	.3
Blount loam, 0 to 2 percent slopes	288	.1
Blount loam, 2 to 6 percent slopes	709	.3
Borrow pits	72	(1)
Casco silt loam, 0 to 6 percent slopes	117	(1)
Casco and Fox soils, 6 to 12 percent slopes, moderately eroded	54	(1)
Colwood silt loam	214	.1
Colwood loam	156	(1)
Digby loam, 0 to 2 percent slopes	2,352	.9
Digby loam, 2 to 6 percent slopes	1,733	.7
Digby silt loam, 0 to 2 percent slopes	799	.3
Digby silt loam, 2 to 6 percent slopes	199	.1
Digby fine sandy loam, 0 to 2 percent slopes	176	.1
Digby fine sandy loam, 2 to 6 percent slopes	121	(1)
Eel silt loam	1,467	.5
Fox loam, 2 to 6 percent slopes	108	(1)
Genesee silt loam	461	.2
Gravel pit	115	(1)
Haney loam, 0 to 2 percent slopes	426	.2
Haney loam, 2 to 6 percent slopes	2,533	1.0
Haney loam, 6 to 12 percent slopes, moderately eroded	249	.1
Haney silt loam, 0 to 2 percent slopes	52	(1)
Haney silt loam, 2 to 6 percent slopes	214	.1
Haney fine sandy loam, 0 to 2 percent slopes	53	(1)
Haney fine sandy loam, 2 to 6 percent slopes	131	(1)
Haskins and Digby loams, over clay, 0 to 2 percent slopes	1,119	.4
Haskins and Digby loams, over clay, 2 to 6 percent slopes	1,939	.7
Haskins and Digby silt loams, over clay, 0 to 2 percent slopes	463	.2
Haskins and Digby silt loams, over clay, 2 to 6 percent slopes	295	.1
Haskins and Digby fine sandy loams, over clay, 0 to 2 percent slopes	68	(1)
Haskins and Digby fine sandy loams, over clay, 2 to 6 percent slopes	130	(1)
Hoytville silty clay loam	7,616	2.9
Hoytville silt loam	142	(1)
Hoytville silty clay	3,721	1.4
Kibbie silt loam, 0 to 2 percent slopes	191	.1
Kibbie loam, 0 to 2 percent slopes	58	(1)
Lenawee silt loam	119	(1)
Linwood muck	55	(1)
Made land	589	.2
Millgrove silt loam	3,055	1.2
Millgrove loam	1,350	.5
Millgrove silty clay loam	1,946	0.7
Millgrove silty clay	47	(1)
Millgrove loam, over clay	631	.2
Millgrove silt loam, over clay	260	.1
Millgrove silty clay loam, over clay	288	.1
Millsdale silty clay loam	341	.1
Montgomery silty clay	1,115	.4
Montgomery silty clay loam	964	.4
Morley silt loam, 2 to 6 percent slopes	13,067	5.0
Morley silt loam, 2 to 6 percent slopes, moderately eroded	5,736	2.2
Morley silt loam, 6 to 12 percent slopes	219	.1
Morley silt loam, 6 to 12 percent slopes, moderately eroded	5,022	1.9
Morley soils, 6 to 12 percent slopes, severely eroded	63	(1)
Morley silt loam, 12 to 18 percent slopes, moderately eroded	1,041	.4
Morley silt loam, 18 to 25 percent slopes, moderately eroded	402	.1
Morley silt loam, 25 to 35 percent slopes, moderately eroded	71	(1)
Morley loam, 2 to 6 percent slopes	277	.1
Nappanee silt loam, 0 to 2 percent slopes	2,254	.8
Nappanee silt loam, 2 to 6 percent slopes	488	.2
Nappanee loam, 0 to 2 percent slopes	56	(1)
Pewamo silty clay loam	58,296	22.2
Pewamo silt loam	208	.1
Pewamo silty clay	1,471	.6
Quarry	205	.1
Randolph silt loam, 0 to 2 percent slopes	74	(1)
Rawson loam, 2 to 6 percent slopes	374	.1
Rawson loam, 6 to 12 percent slopes, moderately eroded	161	.1
Rawson silt loam, 2 to 6 percent slopes	76	(1)
Rimer and Tedrow loamy fine sands, over clay, 0 to 2 percent slopes	48	(1)
Rimer and Tedrow loamy fine sands, over clay, 2 to 6 percent slopes	262	.1
St. Clair silt loam, 2 to 6 percent slopes	33	(1)
St. Clair silt loam, 6 to 12 percent slopes, moderately eroded	117	(1)
St. Clair silt loam, 12 to 25 percent slopes, moderately eroded	42	(1)
Seward fine sandy loam, 2 to 6 percent slopes	656	.2
Shoals silt loam	4,591	1.7
Sloan silty clay loam	8,150	3.1
Sloan silty clay loam, over limestone	98	(1)
Spinks loamy fine sand, 2 to 6 percent slopes	78	(1)
Toledo silty clay loam	212	.1
Tuscola loam, 2 to 6 percent slopes	59	(1)
Tuscola silt loam, 2 to 6 percent slopes	41	(1)
Urban land	5,808	2.2
Wabash silty clay	238	.1
Ponds, reservoirs, rivers	1,299	.5
Total	262,400	100.0

[1] Less than 0.05 percent.

The description of the soil profile is a record of the soil layers and their characteristics as they occur in the field. The profiles of all the soils in the same series are similar to the profile described for the series. A more technical description of soil profiles is given in the section "Genesis, Morphology, and Classification of the Soils."

Belmore Series

The Belmore series consists of nearly level to strongly sloping, light-colored, well-drained soils on beach ridges, stream terraces, and outwash plains. These soils developed in loamy outwash over gravel and sand that contain a fairly large amount of loamy material and silt. The underlying material is at a depth of 40 inches or more. The Belmore soils generally occur near the moderately well drained Haney, the somewhat poorly drained Digby, and the very poorly drained Millgrove soils.

The Belmore soils are droughty during prolonged dry periods. They do not require drainage. Most of the rainfall is absorbed, and movement of water through the solum is moderately rapid. These soils are well suited to irrigation; they are very productive if they are irrigated.

Because these soils are easy to work and warm up early in spring, they are well suited to early truck crops, wheat, and alfalfa. The fairly small amount of water held during the latter part of the growing season, however, limits the growth of crops that require a long growing season, such as corn and soybeans. Medium yields for general farm crops are common, and a good response to fertilizer can be expected.

Representative profile of a Belmore loam:

0 to 8 inches, dark grayish-brown, friable loam; slightly acid.
8 to 11 inches, yellowish-brown, friable loam; slightly acid.
11 to 25 inches, dark-brown, firm sandy clay loam; slightly acid.
25 to 40 inches, dark-brown, firm gravelly sandy clay loam; slightly acid.
40 inches +, pale-brown fine gravel and sand that contains some silt and clay; calcareous.

The texture of the surface layer ranges from loam to sandy loam, but the areas of sandy loam are too small to be mapped separately. The color of the surface layer is dark brown in some areas. The depth to limy material ranges from 40 to about 60 inches. In most places the underlying fine gravel and sand exhibit some degree of stratification. Clay or clay loam, calcareous till, or lacustrine clay are below a depth of 4 feet in some places.

Belmore loam, 0 to 2 percent slopes (Bm).—This nearly level soil most commonly occurs on the tops of the larger beach ridges. In places it is on the higher parts of the stream terraces and outwash plains. It retains moisture somewhat better than the more sloping areas. This soil is well suited to all the crops commonly grown in the area. In a few places spots of sandy soils that are too small to be mapped separately are included. (Capability unit I–1)

Belmore loam, 2 to 6 percent slopes (BmB).—This is the most extensive Belmore soil mapped in this county. It is generally on the crests of beach ridges, but a few areas are on the gently sloping parts of the stream terraces and outwash plains (fig. 23). This soil is well suited to the crops common to the area, but it is subject to erosion. In a few places spots of sandy soils that are too small to be mapped separately are included. (Capability unit IIe–2)

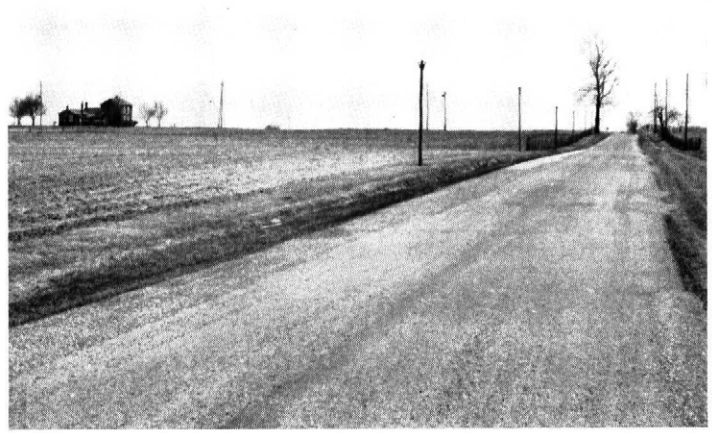

Figure 23.—**A typical area of Belmore loam, 2 to 6 percent slopes, in the northwestern part of Allen County, north of Delphos. The picture was taken looking south toward a beach ridge.**

Belmore loam, 6 to 12 percent slopes, moderately eroded (BmC2).—Most of this soil is on the steeper flanks of the beach ridges and on the terrace slopes adjacent to streams. About half of the original surface layer has been lost through erosion; as a result, the present plow layer is composed partly of material that was formerly subsoil. Cultivation is somewhat restricted because of the slope and hazard of erosion. Included are a few slightly eroded areas that are too small to be mapped separately. (Capability unit IIIe–1)

Belmore loam, 12 to 18 percent slopes, moderately eroded (BmD2).—This soil is mainly on the terrace breaks adjacent to stream bottoms. These areas are short and narrow; therefore they can rarely be farmed as separate units. About half of the original surface layer has been lost through erosion, and as a result, the present plow layer is composed partly of material that was formerly subsoil. Intensive measures to control erosion must be applied if crops are to be grown. A few fairly steep areas that are too small to be mapped separately are included in the mapped areas of this soil. (Capability unit IVe–1)

Blount Series

In the Blount series are nearly level to sloping, light-colored, somewhat poorly drained soils on till plains and moraines. The soils developed in clay loam or silty clay loam glacial till. The Blount soils generally occur near the very poorly drained Pewamo soils (fig. 24), which are in lower lying areas, and with the moderately well drained, sloping Morley soils.

The Blount soils are slow in permeability and high in moisture-supplying capacity. They are low to medium in content of organic matter and in natural fertility. Because the soils are normally medium to strongly acid, periodic applications of lime are needed.

These soils are used mainly for grain crops and occasionally for pasture or trees. The sloping areas are likely to erode if they are cultivated intensively without measures to control erosion. Wetness is the major problem on the nearly level to gently sloping, slightly eroded soils; therefore, drainage is needed to obtain maximum yields.

Figure 24.—**An area of Blount silt loam, with an area of Pewamo silty clay loam in the drainageways.**

Representative profile of a Blount silt loam:

0 to 10 inches, dark grayish-brown, friable silt loam; slightly acid.
10 to 11 inches, light yellowish-brown, friable clay loam with a few, faint, brownish-yellow mottles; medium to strongly acid.
11 to 17 inches, brown, firm clay loam with common, distinct, yellowish-brown mottles; strongly acid.
17 to 25 inches, dark grayish-brown, very firm clay with common, distinct, strong-brown mottles; slightly acid.
25 to 38 inches +, dark-brown, firm silty clay loam till with common, distinct, olive-gray mottles; calcareous.

The surface layer ranges from silt loam to loam. The depth to mottling ranges from about 8 to 15 inches, and the depth to calcareous till, from 18 to about 36 inches.

Where the Blount soils occur on the kamey part of the St. Johns moraine in the southwestern part of Auglaize Township and in the extreme southeastern part of Perry Township, they are underlain in a few places by thin seams of sand and fine gravel. These areas are slightly better drained than most other areas of the Blount soils. In some places the soils on this moraine also have a fairly large amount of large stones and boulders that occur as a thin mantle immediately over or within the first 18 inches of the calcareous glacial till.

Blount silt loam, 0 to 2 percent slopes (Bo).—This nearly level soil is generally in areas of the glacial till plains. It also occurs, less commonly, on the tablelike flats on top of the sloping areas of the moraines. This soil is generally associated with the Pewamo soils. If it is drained, it is moderately well suited to the crops commonly grown in the area.

In a few places spots of sandy soils that are too small to be mapped separately are included in the mapped areas of this soil. (Capability unit IIw-4)

Blount silt loam, 2 to 6 percent slopes (BoB).—This soil is mainly on the gently sloping parts of moraines, but a few gently sloping areas are adjacent to stream bottoms. It is most commonly associated with the Morley soils. If it is drained, this soil is moderately well suited to all the crops commonly grown in the county.

Small areas of Blount silt loam, 0 to 2 percent slopes, are included in the mapped areas of this soil. Also included are a few spots of sandy soils. The included areas are too small to be mapped separately. (Capability unit IIw-4)

Blount silt loam, 2 to 6 percent slopes, moderately eroded (BoB2).—This soil generally has stronger slopes than the other Blount soils mapped in the county. It is mainly adjacent to stream valleys. About half of the original surface layer has been lost through erosion; therefore, the present plow layer is composed partly of material that was formerly subsoil. Drainage and measures to control erosion are needed to obtain maximum yields. A few areas of Morley soils, too small to be mapped separately, are included in the mapped areas of this soil. (Capability unit IIIe-2)

Blount loam, 0 to 2 percent slopes (Bn).—This soil is generally at a slightly higher elevation than the Blount silt loams. It is commonly adjacent to areas of those soils, and it also occurs next to beach ridges. The surface layer contains more sand than that of the Blount silt loams. As a result, this soil is easier to till. The loamy material is 18 inches or less thick. If this soil is drained, it is moderately well suited to all the crops commonly grown in the area. In a few places spots of sandy soils that are too small to be mapped separately are included. (Capability unit IIw-4)

Blount loam, 2 to 6 percent slopes (BnB).—This gently sloping soil is on low ridges and knolls on till plains and moraines. It is generally adjacent to the Blount silt loams, and it is also near the soils of beach ridges and terraces. This soil has more sand in the plow layer than the Blount silt loams. The loamy material is less than 18 inches thick. If the soil is drained, it is moderately well suited to all the crops commonly grown in the county. Included in the mapped areas of this soil are sandy areas that are too small to be mapped separately. (Capability unit IIw-4)

Borrow Pits (Bp)

This miscellaneous land type is made up of excavated areas from which the soil material has been removed for use in the building of highways and in other construction. As a result, the original soil profiles have been altered in some places, and in other areas little soil material remains.

Casco Series

The Casco series consists of light-colored, well-drained, shallow soils on stream terraces along the Auglaize River. These soils are also scattered across the kamey portion of the St. Johns moraine. They developed in silty or loamy outwash underlain by calcareous, stratified sand and gravel at a depth of 10 to 24 inches. The Casco soils generally are near the Fox soils.

The Casco soils are fairly low in natural fertility and generally need small applications of lime. They are easily worked, but they are droughty. Runoff is moderately slow to rapid, and permeability is rapid. These soils are well drained, but the steeper areas are subject to severe erosion.

The Casco soils are generally cultivated, but the steeper areas are in permanent pasture and trees. Many areas of

Casco soils have been exploited as gravel pits because these soils are underlain by clean gravel. Some of these areas are small, but it is not uncommon to find many of them on one farm. Most of the gravel pits, however, have long been exhausted.

Representative profile of a Casco silt loam:

0 to 5 inches, dark-brown, friable silt loam; medium to slightly acid.
5 to 12 inches, dark yellowish-brown, friable silty clay loam containing a few pebbles as much as 1 inch in diameter; medium acid.
12 to 18 inches, dark-brown, firm clay to clay loam containing a few pebbles and stones as much as 5 inches in diameter; slightly acid.
18 to 23 inches, dark-brown, friable gravelly clay loam containing fragments of gravel and limestone rock as much as 10 inches in diameter; calcareous.
23 to 29 inches +, loose gravelly coarse sandy loam; calcareous.

The depth to calcareous gravel and sand ranges from 10 to 24 inches, and the thickness of the upper layers varies accordingly. In places the underlying gravel and sand are not stratified. Also, in a few places there is a layer of reddish-brown sandy clay loam or gravelly clay loam above the underlying gravel and sand.

Casco silt loam, 0 to 6 percent slopes (CaB).—This nearly level to gently sloping soil is in areas of stream terraces, generally adjacent to the stream valleys. Most of the gentle slopes are short and are rarely farmed as a unit. Droughtiness is the main problem in managing this soil.

This soil is well suited to small grains and alfalfa. It is not well suited to corn and soybeans, but those crops are commonly grown. Periodic applications of lime and a complete fertilizer are needed for maximum yields. Included in the mapped areas of this soil are a few moderately eroded areas that are too small to be mapped separately. (Capability unit IIIs–1)

Casco and Fox soils, 6 to 12 percent slopes, moderately eroded (CfC2).—This undifferentiated mapping unit contains both Casco and Fox soils. The soils of the two series occur in such an irregular pattern that it would have been difficult to map them separately. A representative profile of a Fox soil is described under the Fox series. The soils of this mapping unit are mainly on the short terrace breaks adjacent to stream valleys and are generally associated with the Morley soils.

Casco and Fox soils, 6 to 12 percent slopes, moderately eroded, are droughty. Runoff is rapid and consequently causes erosion. Much of the original surface layer has been lost through erosion, and as a result, the present plow layer is composed of a mixture of material from the original surface layer and from the subsoil. These soils are used mainly for pasture and trees, but a few small areas are used for field crops. A few areas where the slope is more than 12 percent are included in the mapped areas of these soils. (Capability unit IIIe–1)

Colwood Series

In the Colwood series are dark-colored, very poorly drained soils on broad flats of the lake plain. The soils developed in silty or loamy material underlain by stratified silt and fine sand that contains some clay. These soils are generally near the Tuscola and Kibbie soils, which are better drained. In places the Colwood soils also occur near soils of stream terraces and beach ridges.

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The Colwood soils are high in content of organic matter and in natural fertility. They are highly productive, and lime is needed in only a few places. Runoff is ponded to very slow, permeability is moderate, and moisture-supplying capacity is very high.

These soils are used chiefly for cultivated crops; few areas are used for pasture or as woodland. The Colwood soils are easily tilled, and crops grown on them respond well to good management. Effective drainage can be achieved by properly placed tile lines.

Representative profile of a Colwood silt loam:

0 to 9 inches, very dark gray, friable silt loam; slightly acid to neutral.
9 to 20 inches, dark grayish-brown, friable loam mottled with yellowish brown; neutral.
20 to 40 inches, light brownish-gray, friable sandy clay loam mottled with yellowish brown; neutral.
40 to 50 inches +, gray, stratified fine sand, very fine sand, and silt with thin lenses of clay; a few brownish-yellow and light yellowish-brown mottles; friable; calcareous.

The texture of the surface layer ranges from silt loam to loam, and that of the subsoil, from loam or very fine sandy loam to sandy clay loam. The depth to limy material is generally about 40 inches, but in some areas the limy material is as deep as 60 inches.

Colwood silt loam (Cw).—This is the most extensive soil of the Colwood series. It is on the broad flats of the lake plains, near beach ridges and areas of outwash material. Associated with this soil are the Tuscola, Kibbie, and Hoytville soils. This soil responds well to tile drainage. It is easily tilled and is well suited to all the crops commonly grown in the county. Included in the mapped areas of this soil are a few areas of Lenawee soils that are too small to be mapped separately. (Capability unit IIw–5)

Colwood loam (Co).—This soil is generally on the flats of the lake plains near the base of beach ridges, but it also occurs on the very slight rises of the lake plains, near the Hoytville soils. This soil contains more sand in its surface layer than Colwood silt loam. It responds well to tile drainage and is well suited to all the crops commonly grown in the county. A few areas of Millgrove soils, which are too small to be mapped separately, are included. (Capability unit IIw–5)

Digby Series

The Digby series consists of light-colored, somewhat poorly drained soils on beach ridges, outwash plains, and stream terraces. These soils developed in loamy material that is underlain by poorly sorted gravel and sand at a depth of 24 to 48 inches or more. Some of the Digby soils are underlain by clay at a depth of 36 to 48 inches. These soils are mapped with the Haskins soils as undifferentiated units and are described under the Haskins series. The Digby soils generally occur near the moderately well drained Haney soils and the poorly drained Millgrove soils.

Surface drainage is slow to moderate. Permeability is somewhat restricted, and consequently, these soils may be saturated for short intervals, especially during excessively wet periods. Wetness is more severe in areas where the underlying material is glacial till, rather than gravel and sand. The Digby soils respond better to tile drainage than most of the other light-colored, somewhat poorly drained soils mapped in the county because Digby soils have sand in the subsoil and are underlain by sandy and gravelly material. Moisture-supplying capacity is moderate, and the content of organic matter is low. Regular applications of lime and fertilizer are needed for maximum yields.

Most of the acreage of Digby soils is cultivated. Much of the acreage on beach ridges is managed intensively for truck farming. Crops grown on these soils respond well to good management.

Representative profile of Digby loam:

0 to 9 inches, dark grayish-brown, friable loam; slightly acid.
9 to 17 inches, brown, friable clay loam with brownish mottles; strongly acid.
17 to 35 inches, brown to dark grayish-brown, firm sandy clay loam with yellowish-brown and strong-brown mottles; medium acid.
35 to 60 inches +, gray gravelly loamy sand; loose; neutral.

The texture of the surface layer is loam, silt loam, or fine sandy loam. The subsoil is dominantly clay loam or sandy clay loam, but it ranges to heavy loam or heavy sandy loam. The thickness of the underlying sandy and gravelly deposits ranges from 1 foot to several feet. Fine-textured glacial till or lake-laid material is normally below a depth of 48 inches. Some of the Digby soils, however, are underlain by fine-textured material at a depth of 36 to 48 inches and are mapped with the Haskins soils as undifferentiated units.

Digby loam, 0 to 2 percent slopes (Dm).—This is the most extensive soil of the Digby series. It is normally on low-lying, secondary beach ridges and on slightly elevated flats on the stream terraces. In most places this soil is near the Haney and Millgrove soils, but in some places it is near the Haskins soils. If this soil is drained, it is moderately well suited to all the crops commonly grown in the county. (Capability unit IIw–3)

Digby loam, 2 to 6 percent slopes (DmB).—This soil generally occurs near the base of gently sloping flanks of beach ridges and on stream terraces and outwash plains. Common associates are the Haskins, Millgrove, and Haney soils. This soil is moderately well suited to all the crops commonly grown in the area if it has been tile drained. Crops grown on it respond well to good management. (Capability unit IIw–3)

Digby silt loam, 0 to 2 percent slopes (Ds).—This nearly level soil is generally on the slightly elevated areas of outwash plains and stream terraces, but in places it occurs on elevated flats of large beach ridges. It is normally associated with the Millgrove, Hoytville, and Pewamo soils. This soil has less sand in the surface layer than Digby loam. It is moderately well suited to all the crops commonly grown in the county if it has been tile drained. Crops grown on this soil respond well to good management. (Capability unit IIw–3)

Digby silt loam, 2 to 6 percent slopes (DsB).—This genlty sloping soil is mainly in areas of outwash plains and stream terraces, but it is also in isolated areas on till and lake plains and in a few places on beach ridges. It is associated with the Haney, Millgrove, Haskins, Blount, Nappanee, Hoytville, and Pewamo soils. This soil has less sand in the surface layer than Digby loam. It is moderately well suited to all the crops commonly grown in the area if it has been tile drained. Included in the mapped areas of this soil are a few moderately sloping and moderately eroded areas that are too small to be mapped separately. (Capability unit IIw–3)

Digby fine sandy loam, 0 to 2 percent slopes (Db).—This soil is on slightly elevated flats in the northeastern part of the county. It is commonly associated with the Rimer, Tedrow, Seward, and Spinks soils and with the sandy outwash soils of the till plains. This soil has more fine sand in the surface layer than Digby loam, and as a result, it is easy to till. It is moderately well suited to all the crops commonly grown in the county, but tile drainage is needed for maximum yields. (Capability unit IIw–3)

Digby fine sandy loam, 2 to 6 percent slopes (DbB).—This gently sloping soil occurs mainly on stream terraces in association with the Haney, Belmore, Blount, and Morley soils. It is easy to till and is moderately well suited to all the crops commonly grown in the area. Tile drainage, however, is needed for the best yields. (Capability unit IIw–3)

Eel Series

In the Eel series are light-colored, moderately well drained soils on the slightly elevated parts of flood plains. These soils occur more commonly along large streams than along small ones. They developed in medium-textured, alluvial material that washed mainly from highly calcareous glacial till soils of the uplands. They generally occur near the well-drained Genesee and the imperfectly drained Shoals soils. In some places they are near the Sloan soils.

Runoff is slow, permeability is moderate, and moisture-supplying capacity is high. Natural fertility is moderately high; lime is seldom needed.

The areas of Eel soils that are accessible and large enough to till are used for cash-grain or general farming. Small areas that are not easily accessible are generally in pasture or trees, or they remain idle. Flooding is a major threat, especially in winter and spring. As a result, wheat and similar crops are not suitable.

Representative profile of Eel silt loam:

0 to 8 inches, dark grayish-brown, friable silt loam; neutral.
8 to 24 inches, dark-brown, friable silt loam; neutral to slightly acid.
24 to 46 inches +, dark-brown, friable silt loam with many gray and dark-gray mottles; slightly acid.

The texture of the soil material in the profile ranges from loam or silt loam to silty clay loam. In most areas the soil material is stratified; the lower strata range from medium textured to sandy.

Eel silt loam (Em).—This is the only Eel soil mapped in the county. It is on the elevated parts of the first bottoms and is flooded occasionally in winter and spring. This soil needs tile drainage only in small wet areas. It is well suited to all tbe crops commonly grown in the county, except wheat, which occasionally may be flooded. Crops grown on this soil respond well to good management.

The mapped areas of Eel silt loam have a texture that is nearly silty clay loam, and there are numerous inclusions of Eel silty clay loam. Also included are small sandy areas that are too small to be mapped separately and a few spots where the slope is as much as 4 percent. (Capability unit IIw–1)

Fox Series

The Fox series consists of light-colored, well-drained soils, mainly on the stream terraces along the Auglaize River. The soils are also on kames of the St. Johns moraine. They developed in silty or loamy outwash underlain by stratified, calcareous gravel and sand at a depth of 24 to 42 inches. These soils generally occur near the Casco, Morley, and Blount soils, and with soils of the first bottoms.

The Fox soils are moderately permeable, and their moisture-supplying capacity is low to moderate. Runoff is slow to moderate. Natural fertility is low; therefore, regular applications of lime and fertilizer are needed for the best yields. These soils are somewhat droughty.

The Fox soils are easily worked; they are well suited to early truck crops. Most of the areas are cultivated and are used for general farming.

Representative profile of Fox loam:

0 to 8 inches, dark grayish-brown, friable loam; slightly acid.
8 to 11 inches, brown, friable loam; slightly acid.
11 to 27 inches, dark yellowish-brown to dark-brown, firm sandy clay loam; medium acid.
27 to 35 inches, very dark grayish-brown, very firm gravelly clay; slightly acid.
35 to 46 inches +, stratified, loose gravel and sand; calcareous.

Fox loam, 2 to 6 percent slopes (FoB).—This is the only Fox soil mapped in the county. It is subject to erosion if it is cultivated. In some years this soil is subject to drought, and it is therefore not so well suited to corn and soybeans as most of the other soils in the county.

Included in the mapped areas of this soil are a few areas of Fox silt loam and of Fox sandy loam. Also included are some nearly level Fox soils. The included areas are too small to be mapped separately. (Capability unit IIe–2)

Genesee Series

In the Genesee series are brown, well-drained, nearly level to gently sloping soils on the slightly elevated areas of the flood plains. The soils are more commonly along large streams than along small ones. These soils developed in mildly alkaline, medium-textured, alluvial material that washed from highly calcareous glacial till soils of the uplands. They generally occur near the Eel and Shoals soils.

The Genesee soils are subject to occasional flooding in winter and spring. Runoff is slow, permeability is moderate, and moisture-supplying capacity is high. Agricultural drainage is not needed for maximum yields. Although flood-control measures are desirable, they are not generally practical. These soils are easy to work, and crops grown on them respond well to good management.

Representative profile of Genesee silt loam:

0 to 9 inches, dark-brown, friable silt loam; slightly acid to mildly alkaline.
9 inches +, dark-brown, friable silt loam or loam; slightly acid to mildly alkaline.

Genesee silt loam (Gn).—This is the only soil of the Genesee series mapped in the county. It is highly productive and is well suited to all the crops commonly grown in the county. Most areas of this soil are nearly level, but some small areas have slopes of 2 to 4 percent.

A few acres of a very dark brown silt loam, not extensive enough to be mapped separately, are included in some of the mapped areas of this soil. Also included are small areas of Genesee loam and Genesee silty clay loam. (Capability unit IIw–1)

Gravel Pit (Gp)

This miscellaneous land type consists of open excavations in which the upper layers of the soils have been removed so that the underlying gravelly material can be excavated. It is on gravelly beach ridges and in areas of local outwash. This land type is generally associated with soils of the Belmore, Casco, and Fox series.

Haney Series

In the Haney series are light-colored, moderately well drained soils on beach ridges, stream terraces, and outwash plains. The soils developed in medium-textured to moderately coarse textured outwash or beach deposits over poorly sorted calcareous gravel and sand. The gravel and sand are generally at a depth of 24 to 42 inches. These soils generally occur near the well-drained Belmore, the somewhat poorly drained Digby, and the very poorly drained Millgrove soils.

The Haney soils are not droughty during seasons of normal rainfall. Runoff is slow to medium, and permeability and moisture-supplying capacity are moderate. Except in an occasional seep spot, tile drainage is not needed. These soils are low in content of organic matter. They are also low in phosphorus and medium in potassium. They are generally slightly acid.

The Haney soils are used almost entirely for cultivated crops. They are well suited to specialty crops, such as ornamental crops and truck crops, because they are easy to work. Crops grown on these soils respond well to good management.

Representative profile of a Haney loam:

0 to 11 inches, dark grayish-brown, friable loam; slightly acid.
11 to 18 inches, dark-brown, friable loam that contains some fine gravel; medium acid.
18 to 36 inches, yellowish-brown clay loam that contains considerable fine gravel; dark grayish-brown and light brownish-gray mottles; medium acid in upper part and slightly acid in lower part.
36 to 42 inches +, mottled yellowish-brown, yellow, gray, and strong-brown, gravelly and sandy material that contains considerable silt and clay; calcareous.

The texture of the subsoil ranges from clay loam to sandy clay loam. Depth to the underlying gravelly and sandy material ranges from 24 to 42 inches, but it is generally between 28 and 36 inches. Fine-textured glacial till or lake-laid material is below a depth of 48 inches in some places.

Haney loam, 0 to 2 percent slopes (Hd).—This soil is on elevated flats on the beach ridges, stream terraces, and outwash plains. It is generally associated with the

Digby and Belmore soils. This soil is well suited to all the crops commonly grown in the county. Tile drainage is needed only in excessively wet spots.

Included in the mapped areas of this soil are a few areas of fine sandy loam. Also included are a few areas of a reddish soil of the Vaughnsville series, which is not mapped in this county. The included areas are too small to be mapped separately. (Capability unit I–1)

Haney loam, 2 to 6 percent slopes (HdB).—This is the most extensive Haney soil mapped in Allen County. It is commonly along the flanks of beach ridges, but in places it is on stream terraces. Associated with it are the Belmore and Digby soils. This soil is well suited to all the crops commonly grown in the county. Tile drainage is needed only in some seep spots.

Included in the mapped areas of this soil are a few moderately eroded areas and a few areas of fine sandy loam. In some areas on the beach ridges a reddish soil of the Vaughnsville series, which is not mapped in this county, is included. The included areas are too small to be mapped separately. (Capability unit IIe–1)

Haney loam, 6 to 12 percent slopes, moderately eroded (HdC2).—This moderately sloping soil is mainly on stream terraces. It is associated with the Belmore and Digby soils and with soils of the first bottoms. About half of the original surface layer has been lost through erosion, and therefore the present plow layer is composed partly of material that was formerly subsoil. Because of the slope and degree of erosion, the cropping system should be less intensive than that used for other soils of the Haney series.

Included in the mapped areas of this soil are a few areas of silt loam and fine sandy loam and some slightly eroded areas. In some places on beach ridges, a reddish soil of the Vaughnsville series, which is not mapped in Allen County, is included. The included areas are too small to be mapped separately. (Capability unit IIIe–1)

Haney silt loam, 0 to 2 percent slopes (Hf).—This soil is normally on the slightly elevated flats on the stream terraces and outwash plains in the southeastern part of the county. It is commonly associated with the Digby, Haskins, and Blount soils. This soil has less sand in the surface layer than Haney loam. However, it is well suited to all the crops commonly grown in the county. (Capability unit I–1)

Haney silt loam, 2 to 6 percent slopes (HfB).—This gently sloping soil is on stream terraces and outwash plains, where it is generally associated with the Belmore, Digby, Blount, and Morley soils. In some places it is near soils of the first bottoms. This soil is well suited to all the crops commonly grown in the county. Tile drainage is needed only in seep spots. Included in the mapped areas of this soil are a few moderately eroded areas that are too small to be mapped separately. (Capability unit IIe–1)

Haney fine sandy loam, 0 to 2 percent slopes (Ha).—This soil is on slightly elevated flats on the stream terraces and outwash plains in the southeastern part of the county. It is most commonly associated with the Belmore, Digby, Millgrove, and Montgomery soils, but in places it is near the Rimer, Tedrow, and Seward soils. This soil has more fine sand in the surface layer than Haney loam, and therefore it is easy to till. It is well suited to all the crops commonly grown in the county. (Capability unit I–1)

Haney fine sandy loam, 2 to 6 percent slopes (HaB).—This gently sloping soil is on stream terraces and outwash plains in the southeastern part of the county. It is most commonly associated with the Belmore, Digby, Blount, Morley, and Montgomery soils, but in places it is near the Rimer, Tedrow, and Seward soils. This soil is well suited to all the crops commonly grown in the county. Included in the mapped areas of this soil are a few small areas of sandy loam and a few small areas that are moderately eroded. (Capability unit IIe–1)

Haskins Series

The Haskins series consists of light-colored, somewhat poorly drained soils on beach ridges or remnants of beach ridges, on stream terraces, and on some of the high parts of moraines. These soils developed in medium-textured, lake-laid material or local outwash, 18 to 36 inches thick. They are underlain by calcareous, lacustrine clay or clay loam or by calcareous glacial till of clay loam texture. The Haskins soils generally occur near the moderately well drained or well drained Rawson soils and are also near the very poorly drained Millgrove soils that are underlain by clay.

The Haskins soils are not mapped separately in this county. They are mapped with the Digby soils as undifferentiated units, because the Haskins and Digby soils that overlie clay are so intermingled and occur in such an irregular pattern that it would have been difficult to map them separately. A representative profile of a Digby loam that is underlain by sand is described under the Digby series.

Runoff is slow. Permeability is moderate in the subsoil but very slow in the fine-textured underlying material. Consequently, the soils become saturated during wet periods, and drainage is needed. For best results, tile should be placed on or above the compact underlying material. The natural fertility and content of organic matter are fairly low; as a result, the soils need regular applications of lime and fertilizer for the best yields.

The Haskins soils are used mainly for cultivated crops and occasionally for pasture and trees. They are easy to till, and crops grown on them respond well to good management.

Representative profile of a Haskins loam:

0 to 8 inches, dark grayish-brown; friable loam that contains a few small pebbles; strongly acid.

8 to 14 inches, brown, friable loam mottled with yellowish brown; contains a few small pebbles; strongly acid.

14 to 27 inches, yellowish-brown to dark grayish-brown, friable sandy clay loam mottled with brown to very dark brown; contains some small pebbles; strongly acid in upper part and slightly acid to neutral in lower part.

27 to 31 inches, dark yellowish-brown, very firm heavy sandy clay loam mottled with yellowish brown, very dark brown, and dark brown; neutral.

31 to 49 inches +, dark grayish-brown, compact clay loam glacial till with numerous fragments of shale and limestone; mottled with yellowish brown; calcareous.

The reaction of the surface layer ranges from neutral to strongly acid. In most places the texture of the subsoil is sandy clay loam to clay loam, but in some places it is loam. Depth to the fine-textured glacial till or lake-laid material ranges from 18 to 36 inches, but in most places it is between 24 and 36 inches. Fine or mediumsized gravel generally occurs throughout the soil profile in variable amounts.

Haskins and Digby loams, over clay, 0 to 2 percent slopes (Hk).—This undifferentiated mapping unit contains Haskins soils, Digby soils, or both. These soils are somewhat similar in their characteristics. They overlie clay and occur in such an intermingled pattern that it was not practicable to separate them. These soils generally are on low-lying beach ridges in the northern part of Allen County, where they occur near the Nappanee, Blount, and Hoytville soils and with the Millgrove soils that overlie clay. The soils of this mapping unit are easy to till. If they are drained, they are moderately well suited to all the crops commonly grown in the area. (Capability unit IIw–4)

Haskins and Digby loams, over clay, 2 to 6 percent slopes (HkB).—These soils are on the gentle slopes of low-lying beach ridges and on terraces along the larger streams where outwash deposits are shallow. They are also in some isolated areas on the higher parts of the glacial till plains. They occur near the Blount, Hoytville, and Pewamo soils, and the Millgrove soils that overlie clay. If the soils of this mapping unit are drained, they are easy to till and are moderately well suited to all the crops commonly grown in the county. Included are a few moderately eroded areas that are too small to be mapped separately. (Capability unit IIw–4)

Haskins and Digby silt loams, over clay, 0 to 2 percent slopes (Hm).—These soils are on low-lying beach ridges, on remnants of beaches, and in areas on the till plains where deposits of outwash are shallow. They occur near soils of the Nappanee, Blount, Hoytville, and Pewamo series. These soils have less sand in the surface layer than the Haskins and Digby loams. If these soils are drained, they are moderately well suited to all the crops commonly grown in the county. (Capability unit IIw–4)

Haskins and Digby silt loams, over clay, 2 to 6 percent slopes (HmB).—These soils are mainly in gently sloping areas of beach remnants, shallow stream terraces, and outwash plains, where they are near the Blount and Hoytville soils. They are also in small areas scattered across the glacial till plains and moraines, where they are near the Blount soils. They have less sand in their surface layer than the Haskins and Digby loams. If these soils are drained, they are moderately well suited to all the crops commonly grown in the area. (Capability unit IIw–4)

Haskins and Digby fine sandy loams, over clay, 0 to 2 percent slopes (Hh).—The soils of this mapping unit are mainly in the northern part of the county, where they are near the sandy soils of the Rimer, Tedrow, and Seward series. These soils contain more fine sand than the Haskins and Digby loams. If they are drained, they are moderately well suited to all the crops commonly grown in the county. (Capability unit IIw–4)

Haskins and Digby fine sandy loams, over clay, 2 to 6 percent slopes (HhB).—These soils are mainly on the gently sloping parts of stream terraces and outwash plains, where they are generally associated with the sandy soils of the Rimer, Tedrow, and Seward series. The soils of this mapping unit contain more fine sand than the Haskins and Digby loams and therefore they are easier to till. If they are drained, they are moderately well suited to all the crops commonly grown in the area. (Capability unit IIw–4)

Hoytville Series

In the Hoytville series are deep, dark-colored, very poorly drained soils on the broad flats of lake plains in the northern part of Marion Township, in the western part of Sugar Creek Township, and in the extreme northwestern part of Monroe Township. These soils developed in fine-textured glacial till that has been reworked by the waters of glacial lakes. Some of the soils have an overburden of coarser textured material, as much as 12 inches thick, that overlies the clay till. The depth to calcareous material is normally 38 to 50 inches. The Hoytville soils occur near the imperfectly drained Nappanee soils and the moderately well drained St. Clair soils.

Runoff is ponded or very slow, permeability is slow or very slow, and moisture-supplying capacity is high. The natural fertility is high; lime is needed only occasionally.

Most of these soils are used for cash-grain farming. The main crops are corn, soybeans, wheat, oats, and hay. Some specialty crops, such as tomatoes, sugar beets, and pumpkins, are grown.

Tile drainage is needed to farm these soils successfully. Because the soil material has good structure, tile are effective in removing excess water. Surface drains help remove excess surface water, reduce ponding, and aid drainage. Poor tilth can be caused by excessive cultivation or by cultivating the soils when they are wet. Consequently, the effectiveness of tile is reduced, tillage is difficult, and crop yields are lowered. The Hoytville soils are generally plowed in fall because they are wet in spring.

Representative profile of a Hoytville silty clay loam:

0 to 8 inches, very dark gray, firm silty clay loam; slightly acid to neutral.
8 to 22 inches, dark-gray, very firm silty clay with dark yellowish-brown and dark grayish-brown mottles; neutral.
22 to 48 inches, gray, very firm silty clay with light olive-brown mottles; neutral.
48 to 68 inches, gray, very firm clay till with yellowish-brown mottles and many small fragments of shale and limestone; calcareous.
68 inches +, brown, firm silty clay loam till with yellowish-brown mottles; calcareous.

The texture of the surface layer ranges from silt loam to silty clay. The depth to calcareous material ranges from 32 to about 65 inches, but in most places it is between 38 and 50 inches.

Hoytville silty clay loam (Hv).—This is the most extensive Hoytville soil mapped in the county. It is generally on the broad flats of lake plains. If this soil has been drained, it is well suited to all the crops commonly grown in the area. Included in the mapped areas of this soil are a few gently sloping areas that are too small to be mapped separately. (Capability unit IIw–7)

Hoytville silt loam (Hs).—This soil is commonly associated with the more sandy soils of beach ridges. It has less clay in the surface layer than Hoytville silty clay loam, and as a result, it is somewhat easier to till. If it has been drained, Hoytville silt loam is well suited to all the crops commonly grown in the area. (Capability unit IIw–7)

Hoytville silty clay (Ht).—This soil is generally on broad, depressed flats of lake plains. Its surface layer contains more clay than that of Hoytville silty clay loam. As a result, this soil is more difficult to till and does not respond to tile drainage so well. It is difficult to keep in good tilth. If it is in good tilth, however, and if it has been drained, Hoytville silty clay is well suited to all the crops commonly grown in the county. (Capability unit IIw–7)

Kibbie Series

In the Kibbie series are light-colored, somewhat poorly drained soils on low knolls of the lake plains. These soils are also near the soils of beach ridges, stream terraces, and outwash plains. They developed in stratified, water-laid silt and fine sand. They generally occur near the Tuscola and Colwood soils.

Runoff is slow, permeability is moderate, and moisture-supplying capacity is moderately high. Applications of lime and fertilizer are needed for maximum yields.

Most areas of Kibbie soils are used for cash-grain farming or for general farming. These soils dry out slowly and warm up slowly in spring. Tile drainage is needed. If drainage is adequate, the movement of air and water is good. Crops grown on these soils respond well to good management.

Representative profile of a Kibbie silt loam:

0 to 6 inches, very dark grayish-brown, friable silt loam; slightly acid.
6 to 10 inches, yellowish-brown, friable silt loam with a few light yellowish-brown mottles; medium acid.
10 to 29 inches, grayish-brown to dark grayish-brown, firm clay loam with many strong-brown and yellowish-brown mottles; medium acid to slightly acid.
29 to 35 inches, grayish-brown, firm silty clay loam with yellowish-brown mottles; neutral,
35 to 52 inches +, mottled, yellowish-brown, friable silt loam with laminations of fine sand; calcareous.

The texture of the subsoil is light clay loam, loam, light sandy clay loam, silt loam, light silty clay loam, or heavy fine sandy loam, depending upon the thickness of the layers and the sequence in which the material was deposited. Depth to mottling ranges from 6 to about 15 inches. Depth to calcareous material ranges from 24 to 48 inches, but in most places it is between 34 and 45 inches.

Kibbie silt loam, 0 to 2 percent slopes (Ks).—This is the most extensive Kibbie soil mapped in the county. It is generally on low knolls of lake plains, but in some places it is on outwash plains. If it is drained, this soil is easy to till and is moderately well suited to all the crops commonly grown in the county. (Capability unit IIw–3)

Kibbie loam, 0 to 2 percent slopes (Kb).—This soil is generally on the slightly elevated flats of the lake plains and stream terraces. In some places it is also on till plains and near soils of the beach ridges. This soil has more sand in its surface layer than Kibbie silt loam, and as a result, it is easier to till. If it is drained, it is moderately well suited to all the crops commonly grown in the area. Included in the mapped areas of this soil are a few small areas of Kibbie fine sandy loam and of Tuscola loam that are too small to be mapped separately. (Capability unit IIw–3)

Lenawee Series

The Lenawee series consists of dark-colored, very poorly drained soils on the flats of lake plains and near soils of the outwash plains. These soils developed in stratified, lake-laid sediment of silty clay loam and clay loam that contain thin layers of fine sand, silt, and clay. In Allen County the Lenawee soils have a thin covering of silt loam, a material slightly coarser textured than that in the surface layer of most other Lenawee soils. These soils generally occur near the Toledo and Colwood soils.

Runoff is ponded or very slow, permeability is slow, and moisture-supplying capacity is high. The Lenawee soils are high in natural fertility; they need lime only occasionally. Tile drainage is needed to obtain maximum yields. These soils respond well to tiling, and they are easily tilled.

Representative profile of Lenawee silt loam:

0 to 9 inches, very dark grayish-brown, very friable silt loam; neutral.
9 to 19 inches, very dark gray, firm silty clay loam with dark-brown mottles in lower part; neutral.
19 to 50 inches +, yellowish-brown, firm silty clay loam with gray and dark-gray mottles; layers of fine sand, silt, and clay; neutral above 50 inches and calcareous below.

The thickness and texture of the stratified layers vary. However, a moderately fine texture is dominant.

Lenawee silt loam (Ln).—This is the only soil of the Lenawee series mapped in this county. It is generally on the flats of lake plains where it is associated with soils of beach ridges and with sandy soils. If this soil is drained, it is easy to till and is well suited to all the crops grown in the area. (Capability unit IIw–6)

Linwood Series

The Linwood series consists of very dark colored, very poorly drained soils that developed in 12 to 42 inches of muck over fine sandy loam to light silty clay loam. The original vegetation was probably sedges and reeds and possibly a very sparse growth of swamp trees.

The Linwood soils are difficult to drain because they are in extremely depressed positions where suitable outlets for tile drains are lacking. If these soils are not adequately drained, they remain idle. If they are drained, they have a very high production potential, particularly for specialty crops and truck crops. As is true of most organic soils, the Linwood soils are subject to wind erosion and to fires in dry weather.

Representative profile of Linwood muck:

0 to 16 inches, black, very friable muck; neutral.
16 to 20 inches, mottled, light-gray and light olive-brown, firm silty clay loam; mildly alkaline.
20 inches +, mottled dark-gray and olive-brown fine sandy loam or loam; calcareous.

Linwood muck (Lw).—This is the only soil of the Linwood series mapped in Allen County. It is wet, and drainage is needed to obtain maximum yields. (Capability unit IIIw–2)

Made Land (Ma)

This miscellaneous land type consists of areas where the soil material has been disturbed, moved, leveled, or artificially filled with earth or trash, or both, in such a manner as to alter the original soil profile. These areas contain a mixture of parent material and of material from the original surface layer and subsoil. The agricultural value is variable.

In most places Made land is adjacent to areas of Urban land. Because of its variability, it was not placed in a capability unit.

Millgrove Series

The Millgrove series consists of dark-colored, very poorly drained soils on broad flats of stream terraces, on outwash plains, and in nearly level areas near beach ridges. These soils developed in loamy material, which overlies poorly sorted gravelly sand to sandy loam or gravelly loam that is generally at a depth of about 36 inches. Some of the Millgrove soils are underlain at a depth of 24 to 60 inches by calcareous, lake-laid clay or glacial till of clay loam texture. The Millgrove soils are mainly near the well drained Belmore, the moderately well drained Haney, and the somewhat poorly drained Digby soils.

Surface drainage is very slow, permeability is moderate, and moisture-supplying capacity is high. These soils are easy to till. They are high in content of organic matter, and they are highly productive.

The Millgrove soils are well suited to all the crops commonly grown in the county. Specialty crops, such as tomatoes and sugar beets, are also suitable. Tile drainage is needed for maximum yields. Because the subsoil and underlying material are sandy, tiling is very effective in removing the excess water from those Millgrove soils that are not underlain by clay. If tile are used to drain the soils that are underlain by clay, they should be placed on or above the clay.

Representative profile of Millgrove silt loam:

0 to 8 inches, very dark grayish-brown, friable silt loam; slightly acid to neutral.
8 to 16 inches, very dark grayish-brown, friable clay loam with yellowish-brown mottles and numerous fine pebbles; neutral.
16 to 29 inches, dark grayish-brown, friable sandy clay loam with yellowish-brown mottles and some fine gravel; neutral to mildly alkaline.
29 to 36 inches, grayish-brown, friable clay loam with brownish-yellow mottles and many fragments of limestone; mildly alkaline.
36 to 42 inches +, light-gray to brown, very friable gravelly loam with olive-yellow mottles and many fragments of limestone; calcareous.

Representative profile of Millgrove loam, over clay:

0 to 9 inches, very dark gray, friable loam; neutral.
9 to 24 inches, dark grayish-brown, firm clay loam with dark yellowish-brown and yellowish-brown mottles and some fine gravel; neutral to slightly acid.
24 to 36 inches, grayish-brown, friable sandy clay loam with yellowish-brown mottles and a fairly large amount of fine gravel; neutral.
36 to 42 inches +, grayish-brown, very firm clay till with yellowish-brown mottles; calcareous.

The texture of the surface layer ranges from loam to silty clay. Depth to the underlying calcareous material ranges from 24 to 48 inches, but in most places it is between 30 to 42 inches. In some areas compact lake-laid clay or glacial till of clay loam texture is beneath the coarse-textured material, below a depth of 24 inches.

Millgrove silt loam (Md).—This is the most extensive Millgrove soil mapped in the county. It is generally at the base of beach ridges and on the broad flats of outwash plains, where it is associated with the Digby and Hoytville soils. If this soil is drained, it is well suited to all the crops commonly grown in the county. Included in the mapped areas of this soil are a few areas of a dark-colored Digby silt loam, which are too small to be mapped separately. (Capability unit IIw-5)

Millgrove loam (Mb).—This soil is mainly on the flats of outwash plains near the Digby soils, but in some places it is also along the base of beach ridges. Its surface layer contains more sand than that of Millgrove silt loam. If Millgrove loam is drained, it is well suited to all the crops commonly grown in the area. A few areas of a dark-colored Digby loam and some areas of a Millgrove fine sandy loam, which are too small to be mapped separately, are included. (Capability unit IIw-5)

Millgrove silty clay loam (Mg).—This soil is on slightly depressed flats of the outwash plains and stream terraces. Its associates are soils of the Pewamo and Blount series. This soil has more clay in the surface layer than Millgrove silt loam. If Millgrove silty clay loam is drained, it is well suited to all the crops commonly grown in the county. (Capability unit IIw-5)

Millgrove silty clay (Mk).—This soil is in low depressions on the till plains in the northeastern part of the county. It is generally associated with the Pewamo and Blount soils. This soil has more clay in the surface layer than Millgrove silt loam, and therefore it is more difficult to till. In addition, it does not respond so well to tile drainage, and good tilth is much more difficult to maintain. If Millgrove silty clay is drained, it is moderately well suited to all the crops commonly grown in the county. (Capability unit IIw-6)

Millgrove loam, over clay (Mc).—This soil is generally along the base of beach ridges or on low-lying beach ridges in the northwestern part of the county. Its associates are the Digby, Haskins, and Hoytville soils. This soil is easily worked, and crops grown on it respond well to good management. If it has been adequately drained, this soil is well suited to all the crops commonly grown in the area. (Capability unit IIw-5)

Millgrove silt loam, over clay (Mf).—This soil is generally along the base of beach ridges and on the broader flats of the outwash plains. It is associated with the Haskins, Digby, and Hoytville soils. The surface layer contains less sand than that of Millgrove loam. If this soil is adequately drained, it is well suited to all the crops commonly grown in the area. A few gently sloping areas, too small to be mapped separately, are included. (Capability unit IIw-5)

Millgrove silty clay loam, over clay (Mh).—This soil is generally adjacent to beach ridges and in the depressed flats on outwash plains, where it is associated with the Hoytville soils. It has more clay in the surface layer than Millgrove loam, and as a result, it is more difficult to till. If this soil is adequately drained, it is well suited to all the crops commonly grown in the area. (Capability unit IIw-6)

Millsdale Series

In the Millsdale series are dark-colored, very poorly drained soils that developed in fine-textured material. This material is underlain by limestone bedrock at a depth of 20 to 42 inches. The Millsdale soils occur near the light-colored, imperfectly drained Randolph soils and the Sloan soils.

Runoff and permeability are very slow, and moisture-supplying capacity is high. These soils contain a large amount of organic matter, and they seldom need lime.

Most of the acreage is in pasture, brush, or woods, but a few areas are used for field crops. These soils need to be drained to be successfully farmed. An adequate tile system, however, is difficult or impractical to install because the limestone bedrock is near the surface. If the Millsdale soils are drained, they make moderately high yields.

Representative profile of Millsdale silty clay loam:

0 to 9 inches, very dark brown, firm silty clay loam; neutral to slightly acid.
9 to 32 inches, very dark gray to dark gray, very firm silty clay with dark-brown and yellowish-brown mottles; neutral.
32 inches +, limestone bedrock.

Depth to limestone bedrock ranges from 20 to 42 inches, but in most places bedrock is at a depth between 30 and 36 inches.

Millsdale silty clay loam (Ml).—This is the only Millsdale soil mapped in this county. If it is drained, good yields are obtained. Included in the mapped areas of this soil are areas of Millsdale silt loam and a Millsdale silty clay, which are too small to be mapped separately. (Capability unit IIIw–3)

Montgomery Series

In the Montgomery series are dark-colored, very poorly drained soils, mainly in ponded areas. These soils developed in stratified clay and silt that was laid down in the shallow water of small lakes or ponds on the glacial till plains and outwash plains. They are generally underlain by calcareous glacial till at a depth of 60 inches or more, but in some places they are underlain by sandy and gravelly outwash. In most places these soils occur near the Blount and Pewamo soils, but they also occur near the coarser textured soils of outwash plains and of areas of valley fill.

Runoff is ponded or very slow, permeability is very slow or slow, and moisture-supplying capacity is high. The Montgomery soils are high in natural fertility, and they need lime only occasionally.

Tile drainage is needed to obtain maximum yields. The subsoil has good structure, and tile are effective in removing excess water from within the soil material. Surface ditches remove excess surface water, and they therefore help in overcoming the problem of wetness. Because the surface layer contains a large amount of clay, good tilth is difficult to maintain. Poor tilth can be caused by excessive cultivation or by cultivating the soils when they are wet. Consequently, the effectiveness of tile is reduced, tillage is difficult, and crop yields are lowered.

Representative profile of Montgomery silty clay:

0 to 7 inches, very dark grayish-brown, firm silty clay; neutral.
7 to 20 inches, dark gray to very dark gray, very firm clay with dark grayish-brown, dark-brown, and dark yellowish-brown mottles; mildly alkaline.
20 to 60 inches, gray, plastic silty clay with yellowish-brown and brownish-yellow mottles; mildly alkaline.
60 to 66 inches +, mottled grayish-brown and yellowish-brown, compact stratified sand and gravel with some silt and clay; calcareous.

The texture of the surface layer ranges from silty clay to silty clay loam. In places the subsoil is clay, but in other places it is silty clay. In places the underlying calcareous material is glacial till or sandy and gravelly outwash.

Montgomery silty clay (Mm).—This is the most extensive soil of this series mapped in the county. It is generally in ponded areas of the till plains and outwash plains. If this soil is drained and in good tilth, it is well suited to all the crops commonly grown in the county. (Capability unit IIIw–3)

Montgomery silty clay loam (Mn).—This soil is generally in ponded areas of the till plains and outwash plains. It is commonly surrounded by the Blount and Pewamo soils and by the sandier soils of the outwash plains. This soil has less clay in the surface layer than Montgomery silty clay; as a result, it is easier to till and responds better to tile drainage. If Montgomery silty clay loam is drained, it is well suited to all the crops commonly grown in the area. Included in the mapped areas of this soil are a few areas of Montgomery silt loam that are too small to be mapped separately. (Capability unit IIIw–3)

Morley Series

The Morley series consists of gently sloping to steep, light-colored, moderately well drained soils (fig. 25) in areas adjacent to streams that dissect the glacial till plains and in the steep parts of the terminal moraines. These soils have a surface layer of silt loam or loam and a subsoil of silty clay or clay. They developed in glacial till that is calcareous at a depth of 18 to 34 inches. The underlying calcareous glacial till has a texture of silty clay loam or clay loam. The Morley soils occur near the light-colored, somewhat poorly drained Blount soils and the dark-colored, very poorly drained Pewamo soils.

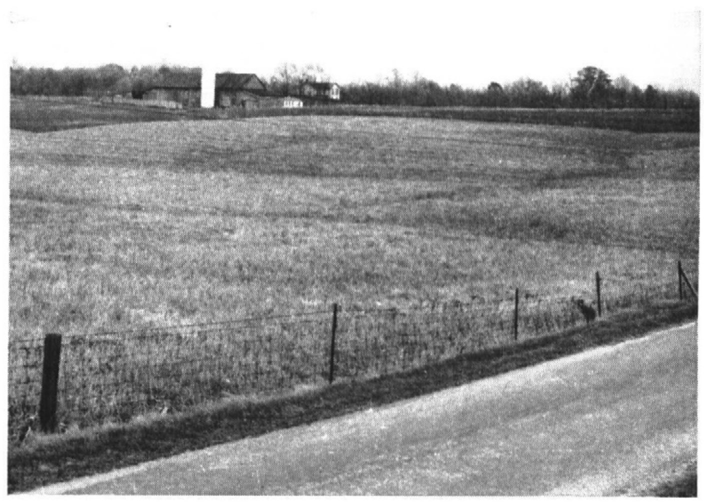

Figure 25.—**An area of Morley silt loam that is gently sloping to steep.**

Runoff is medium to rapid, permeability is slow to moderately slow, and moisture-supplying capacity is moderately high. These soils are slightly acid to medium acid. They are low in natural fertility and in content of organic matter. Regular applications of lime and fertilizer are needed to obtain maximum yields.

These soils are used mainly for cultivated crops. In areas that are too steep for cultivation, they are in permanent pasture, brush, or trees. Generally, drainage is no problem, except in an occasional seep spot, which can be drained easily. Erosion can be a severe hazard, especially where it is uncontrolled. In moderately steep and steep areas, much of the rainfall runs off rather than soaking into the soils. As a result, the soils are droughty late in the growing season and perhaps throughout the entire growing season in years of below-normal rainfall.

Representative profile of a Morley silt loam:

0 to 6 inches, dark grayish-brown, friable silt loam; slightly acid.
6 to 11 inches, brown, very firm silty clay that contains a few small fragments of rock; medium acid.
11 to 16 inches, brown, very firm clay that contains a few small fragments of rock; strongly acid.
16 to 21 inches, dark-brown, very firm silty clay with yellowish-brown mottles; a few small fragments of rock; neutral.
21 to 27 inches +, grayish-brown, very firm clay loam with yellowish-brown mottles; contains numerous fragments of shale, limestone, and granite; calcareous.

In places the texture of the surface layer is loam. That of the subsoil ranges from silty clay loam to clay. The surface layer is as much as 12 inches thick in places, and the thickness of the combined surface layer and subsoil ranges from 18 to 34 inches. The underlying calcareous glacial till has a texture of silty clay loam or clay loam.

Where the Morley soils occur on the kamey part of the St. Johns moraine in the southwestern part of Auglaize Township and in the extreme southeastern part of Perry Township, they are underlain in a few places by thin seams of sand and fine gravel. These areas are slightly better drained than most other areas of the Morley soils. In some places in the soils on this moraine, there is a fairly large amount of large stones and boulders immediately over or within the uppermost 18 inches of the calcareous glacial till.

Morley silt loam, 2 to 6 percent slopes (MrB).—This is the most extensive soil of the Morley series mapped in the county. It is mainly in gently sloping areas adjacent to streams and on moraines. In most places it is associated with the Blount soils, but in some places it is near the Pewamo soils in small drainageways on the uplands. This soil is moderately well suited to all the crops commonly grown in the area. Included in the mapped areas of this soil are a few nearly level areas that are too small to be mapped separately. (Capability unit IIe–3)

Morley silt loam, 2 to 6 percent slopes, moderately eroded (MrB2).—This soil is generally on long, gentle slopes near the stream valleys on the southern face of the Wabash moraine and on the kamey part of the St. Johns moraine. Its associates are the Blount soils and the more sloping and severely eroded Morley soils. Nearly half of the original surface layer has been lost through erosion, and as a result, the present plow layer is made up partly of material that was formerly subsoil. If erosion is controlled, this soil is moderately well suited to most of the crops commonly grown in the county. (Capability unit IIIe–2)

Morley silt loam, 6 to 12 percent slopes (MrC).—This soil is generally not cultivated and is along the breaks from the uplands to the flood plains. It is in trees and pasture in areas along the southern face of the Wabash moraine and on the kamey part of the St. Johns moraine. Common associates are the more eroded Morley soils. Cultivation is limited because of the steep slope and the hazard of erosion. (Capability unit IIIe–2)

Morley silt loam, 6 to 12 percent slopes, moderately eroded (MrC2).—This soil occurs along the breaks to flood plains and on moraines, generally in association with the gently sloping and strongly sloping Morley soils. Its slopes are moderately long. About half of the original surface layer has been lost through erosion; as a result, the present plow layer is composed partly of material that was formerly subsoil. Cultivation is limited because of the steep slope and the hazard of erosion. (Capability unit IIIe–2)

Morley soils, 6 to 12 percent slopes, severely eroded (MsC3).—These soils are along the southern face of the Wabash moraine, where they are cultivated or intensively pastured. They are also on the St. Johns moraine and along some of the breaks from the uplands to the flood plains. Their main associates are the moderately eroded Morley soils. In most places the slopes are long, and those areas have been cultivated intensively without measures to control erosion. As a result, nearly all of the original surface layer has been lost through erosion, and the present plow layer is made up largely of material that was formerly subsoil.

These soils are suited to only limited use for cultivated crops. Row crops should be grown only when measures are used to control erosion. (Capability unit IVe–1)

Morley silt loam, 12 to 18 percent slopes, moderately eroded (MrD2).—This soil is in strongly sloping areas of the St. Johns moraine and along breaks from the uplands to the flood plains. It is generally associated with moderately sloping and moderately steep Morley soils. Because of excessive cultivation, about half of the original surface layer has been lost through erosion, and as a result, the present plow layer is made up partly of material that was formerly subsoil. In areas on the St. Johns moraine, the slopes are irregular; consequently, it is difficult to use farm implements.

This soil is well suited to meadow crops, but the growing of grain crops is severely limited. Included in the mapped areas of this soil are a few slightly eroded and severely eroded areas that are too small to be mapped separately. (Capability unit IVe–1)

Morley silt loam, 18 to 25 percent slopes, moderately eroded (MrE2).—This soil is mainly in steep, irregular areas on the kamey part of the St. Johns moraine, but it is also along some of the breaks from the uplands to the flood plains. It is associated with the strongly sloping and steep Morley soils.

This soil has been cultivated and pastured fairly intensively. About half of the original surface layer has been lost through erosion, and the present plow layer is made up largely of material that was formerly subsoil. Although the sequence of horizons is much the same as that in the profile described, the thickness of horizons is considerably less. The thickness of the combined surface layer and subsoil is generally about 18 inches.

This soil is well suited to pasture and trees, but it is too steep for cultivation. Included in the mapped areas are a few slightly eroded areas that are too small to be mapped separately. (Capability unit VIe–1)

Morley silt loam, 25 to 35 percent slopes, moderately eroded (MrF2).—This soil is in steep, irregular areas on the kamey part of the St. Johns moraine and on sharp escarpments adjacent to stream bottoms. It is associated with strongly sloping Morley soils.

About half of the original surface layer has been lost through erosion; therefore, the uppermost 8 inches is composed largely of material that was formerly subsoil. Although the sequence of horizons is essentially the same as that in the profile described, the thickness of these horizons is considerably less. The maximum depth of the solum is generally about 15 inches.

This soil is best suited to trees. It can also be used for pasture if grazing is controlled. Included in the mapped areas of this soil are areas of very steep, severely eroded Morley silt loams that are too small to be mapped separately. (Capability unit VIIe–1)

Morley loam, 2 to 6 percent slopes (MoB).—This soil is mainly in fairly small, isolated areas on the high parts of moraines, but it is also on outwash plains and stream terraces near sandier soils. Its associates are mainly the Blount soils, but in some places it is associated with the Digby and Haney soils. This soil has more sand in the surface layer than the Morley silt loams, and therefore it is easier to till. The thickness of the sandy overburden is less than 18 inches.

This soil is moderately well suited to all the crops commonly grown in the county. A few areas of Rawson and Seward soils, too small to be mapped separately, are included in the mapped areas of this soil. (Capability unit IIe–3)

Nappanee Series

In the Nappanee series are nearly level to gently sloping, light-colored, somewhat poorly drained soils along streams and on low knolls of the lake plains. These soils developed in calcareous clay or heavy clay loam till that has been altered by lake-laid sediment. The Nappanee soils occur near the very poorly drained Hoytville soils and the moderately well drained St. Clair soils.

Runoff is slow to medium, permeability is very slow or slow, and moisture-supplying capacity is moderately high. These soils are slightly acid and somewhat low in natural fertility. Regular applications of lime and fertilizer are needed.

These soils are commonly managed like the Hoytville soils because they occur as fairly small areas within larger areas of the Hoytville soils. Drainage is required for successful crop production, but the Nappanee soils do not respond well to tile drainage. Tiling is effective if other good management is followed, but the lines need to be closely spaced. Because the movement of water and air through the soil material is slow, the soils are slow to dry out and warm up in spring. As a result, early tillage is frequently delayed. Crops may be damaged from too much water in spring and not enough moisture late in summer. Frequent growing of grasses and deep-rooted legumes in the cropping system improves soil structure and tilth and promotes better drainage.

Representative profile of a Nappanee silt loam:

- 0 to 8 inches, dark grayish-brown, friable silt loam; slightly acid.
- 8 to 10 inches, grayish-brown, firm silty clay with yellowish-brown mottles; slightly acid.
- 10 to 19 inches, dark grayish-brown, very firm clay with dark-brown and dark yellowish-brown mottles; neutral.
- 19 to 26 inches, grayish-brown, very firm clay with dark-brown and dark yellowish-brown mottles; calcareous.
- 26 to 40 inches +, dark-brown, very firm clay with grayish-brown and yellowish-brown mottles; calcareous.

The texture of the surface layer is silt loam or loam, and in places the thickness is as much as 12 inches. Depth to limy material ranges from about 16 to 36 inches.

Nappanee silt loam, 0 to 2 percent slopes (Np).—This is the most extensive Nappanee soil mapped in the county. It is generally on low knolls of the lake plains, near the Hoytville soils. If this soil is drained, it is fairly well suited to the crops commonly grown in the county. Spots of Nappanee silty clay loam, too small to be mapped separately, are included. (Capability unit IIIw–1)

Nappanee silt loam, 2 to 6 percent slopes (NpB).—This soil is generally in gently sloping areas adjacent to streams, where it is associated with the Hoytville and St. Clair soils. If the soil is drained, it is fairly well suited to the crops commonly grown in the area. A few small areas of severely eroded and moderately sloping Nappanee and St. Clair soils are included in the mapped areas of this soil. (Capability unit IIIw–1)

Nappanee loam, 0 to 2 percent slopes (Na).—This soil occurs on the low knolls of the lake plains in association with soils of the beach ridges. It has more sand in the surface layer than Nappanee silt loam. The loam overburden is as much as 18 inches thick in some places. If this soil is drained, it is moderately well suited to all the crops commonly grown in the county. (Capability unit IIIw–1)

Pewamo Series

The Pewamo series consists of deep, dark-colored, very poorly drained soils on broad, depressed flats and along upland drainageways of the till plains. These soils developed in glacial till of clay loam texture that is calcareous at a depth of about 50 inches. The Pewamo soils occur near the somewhat poorly drained Blount soils and the moderately well drained Morley soils.

Runoff and permeability are very slow; moisture-supplying capacity is high. Natural fertility is high, and lime is needed only occasionally.

The Pewamo soils are mainly in cultivation, but a small acreage is in permanent pasture or trees. Cash-grain farming and general farming are both common.

Tile drainage is needed to farm these soils successfully. Because the soil material has good structure, tile lines are effective in removing excess water. Establishing surface drains to remove surface water and to reduce ponding helps in reducing wetness. Poor tilth can be caused by excessive grain cropping, by tilling the soils too much, or by cultivating when the soils are wet. Poor tilth reduces the effectiveness of tile, makes tillage difficult, and lowers crop yields.

Representative profile of Pewamo silty clay loam:

0 to 8 inches, very dark gray, firm silty clay loam; slightly acid to neutral.
8 to 28 inches, dark-gray, very firm silty clay with brown, reddish-brown, and yellowish-brown mottles; neutral.
28 to 54 inches, gray, very firm silty clay with grayish-brown and yellowish-brown mottles; neutral to mildly alkaline.
54 to 66 inches +, light-gray, very firm silty clay loam with dark yellowish-brown and brown mottles; calcareous.

The texture of the surface layer is silt loam, silty clay, or silty clay loam. Depth to the limy underlying material ranges from 30 to 60 inches but is about 50 inches in most places.

Pewamo silty clay loam (Pm).—This is the most extensive Pewamo soil mapped in the county. It is generally on broad flats of the till plains and along upland drainageways. In most places it is associated with the Blount soils, but in some places it is near the Morley soils. On ground moraines this soil is intermingled with the Blount soils in an intricate pattern. This complicates drainage and management.

Where this soil occurs along upland drainageways, it is difficult to drain. Water concentrates rather quickly in the drainageways because it runs from the adjacent areas of Morley and Blount soils. Tile will generally handle excess internal water. Surface water tends to collect in the lower areas, however, and in such areas surface drainage is required.

If this soil is adequately drained, it is well suited to all the crops commonly grown in the area. Included in the mapped areas close to the lake plain are areas of Hoytville soils that are too small to be mapped separately. (Capability unit IIw–6)

Pewamo silt loam (Pa).—This soil is generally in small areas on the flats of those till plains that are associated with the soils of outwash plains. It has less clay in the surface layer than Pewamo silty clay loam, and it is, therefore, easier to till. If Pewamo silt loam is drained, it is well suited to all the crops commonly grown in the area. Included in the mapped areas of this soil are spots of Pewamo silty clay loam that are too small to be mapped separately. (Capability unit IIw–6)

Pewamo silty clay (Pc).—This soil is generally on depressed flats of till plains, where it is associated with the Blount and Montgomery soils. This soil has more clay in the surface layer than Pewamo silty clay loam, and as a result, it is more difficult to till. It is also more difficult to drain than that soil, and it does not respond so well to tiling because it is in depressions and has a large content of clay. If Pewamo silty clay is in good tilth and is drained, it is moderately well suited to all the crops commonly grown in the area. (Capability unit IIw–6)

Quarry (Qu)

This miscellaneous land type consists of open excavations from which rock products (limestone) have been taken for road construction and for building and industrial purposes. The soil and other material overlying the desired bedrock have been removed. Such areas have no significant agricultural value.

Randolph Series

In the Randolph series are light-colored, somewhat poorly drained, nearly level soils on low terraces adjacent to some of the streams. These soils developed in deposits of glacial till or old alluvium. They are underlain by limestone bedrock at a depth of 20 to 42 inches. These soils are generally near the very poorly drained Millsdale and Sloan soils of the bottom lands. The Randolph soils are only slightly higher than the flood plains, and therefore they are subject to flooding.

Runoff and permeability are slow. These soils are slightly acid to medium acid. Natural fertility is low; regular applications of lime and fertilizer are needed to obtain maximum yields. Tile drainage is desirable, but it may be difficult or economically impractical to establish, because the limestone bedrock is so near the surface.

Representative profile of a Randolph silt loam in permanent pasture:

0 to 5 inches, very dark grayish-brown, friable silt loam; neutral.
5 to 9 inches, grayish-brown, friable silt loam with a few yellowish-brown mottles; slightly acid to neutral.
9 to 14 inches, dark grayish-brown, firm silty clay loam with dark yellowish-brown mottles; slightly acid.
14 to 28 inches, dark-brown, firm silty clay to clay loam with yellowish-brown mottles; neutral.
28 to 40 inches, dark grayish-brown, very firm silty clay with brown mottles; neutral.
40 inches +, weathered limestone bedrock.

Depth to the underlying limestone ranges from 20 to 42 inches. It is fairly variable within short distances.

Randolph silt loam, 0 to 2 percent slopes (Ra).—This is the only Randolph soil mapped in the county. It is on low stream terraces adjacent to soils of the bottom lands. If it is drained and protected from flooding, this soil is moderately well suited to all the crops commonly grown in the area. (Capability unit IIIw–1)

Rawson Series

In the Rawson series are light-colored, moderately well drained and well drained soils on or near beach ridges, remnants of beach ridges, stream terraces, and in some places, the higher parts of terminal moraines. These soils developed in 18 to 36 inches of medium-textured material that contains a fairly large amount of sand and gravel. This material overlies calcareous, lake-laid clay, clay loam, or clay till. The Rawson soils occur near the somewhat poorly drained Haskins soils and those very poorly drained Millgrove soils that overlie clay.

Runoff is medium to rapid, and moisture-supplying capacity is moderate. Permeability is moderate in the solum and very slow in the heavy underlying layer. These soils are slightly acid to medium acid and low in natural fertility. Regular applications of lime and fertilizer are needed for maximum yields.

The Rawson soils are fairly well suited to specialty crops, truck crops, small grains, and alfalfa, but corn and soybeans may be damaged by lack of moisture late in the growing season. Crops grown on these soils respond well to good management, and yields are moderately good.

The movement of water in these soils is restricted by the dense, compact underlying material. Consequently, the soil material becomes temporarily saturated during excessively wet periods, and the use of farm implements is limited. Tiling is needed only in wet spots.

Representative profile of a Rawson loam:

0 to 8 inches, dark-brown, very friable loam; slightly acid to neutral.
8 to 16 inches, brown, very friable sandy loam with some fine gravel; medium acid.
16 to 27 inches, dark-brown, friable sandy loam with some gravel; medium acid.
27 to 23 inches, very dark gray, firm sandy clay loam with dark-brown and dark reddish-brown mottles and some fine gravel; slightly acid.
32 to 38 inches, dark grayish-brown, very firm clay with yellowish-brown mottles; neutral.
38 inches +, gray, very firm and compact silty clay with yellowish-brown mottles; calcareous glacial till.

The texture of the surface layer in the mapped areas is loam or silt loam, but some areas of coarser texture are included. The color of the surface layer is brown or dark grayish brown in some areas. The amount of gravel in the profile is variable. Depth to the compact, fine-textured, limy material ranges from 18 to 36 inches, but in most places it is more than 24 inches.

Rawson loam, 2 to 6 percent slopes (RmB).—This is the most extensive Rawson soil mapped in the county. It is generally on stream terraces, but it is also in small areas on beach ridges and on the high parts of moraines. This soil is most commonly associated with the Haney, Haskins, and Digby soils. It is easy to till and is moderately well suited to all the crops commonly grown in the county. A few spots of nearly level fine sandy loam and some moderately eroded areas, too small to be mapped separately, are included. (Capability unit IIe–3)

Rawson loam, 6 to 12 percent slopes, moderately eroded (RmC2).—This moderately sloping soil is on stream terraces and on terrace breaks adjacent to the soils of the bottom lands. Its main associates are soils of the Belmore and Haney series. About half of the original surface layer has been lost through erosion, and as a result, the present plow layer is composed partly of material that was formerly subsoil.

This soil is limited in its suitability for grain crops because of the slope and degree of erosion. Included in the mapped areas of this soil are areas, too small to be mapped separately, of Haskins soils that have slopes of 2 to 6 percent and of Rawson soils that have slopes of 12 to 18 percent. (Capability unit IIIe–2)

Rawson silt loam, 2 to 6 percent slopes (RsB).—This gently sloping soil occurs generally on outwash plains in close association with the Haney, Haskins, and Morley soils of the till plains and moraines. It has less sand in the surface layer than the Rawson loams. Rawson silt loam, 2 to 6 percent slopes, is moderately well suited to all the crops commonly grown in the area. Nearly level areas that are too small to be mapped separately are included. (Capability unit IIe–3)

Rimer Series

In the Rimer series are light-colored, coarse-textured, somewhat poorly drained soils on low ridges and knolls of the lake plain, on outwash plains, on stream terraces, and in places on beach ridges. These soils are underlain by compact, lake-laid clay or glacial till of clay loam or clay texture at a depth of 18 to 42 inches. Part of the subsoil developed in the underlying fine-textured material. The Rimer soils occur near the light-colored, moderately well drained Seward soils and the dark-colored, very poorly drained Millgrove soils that overlie clay.

The Rimer soils are not mapped separately in this county but are mapped with the Tedrow soils as undifferentiated units. The subsoil of the Rimer soils developed in the underlying clay. In contrast, the Tedrow soils over clay lack a developed subsoil, and they consist of sandy material that is deeper than 36 inches over clay. For a representative profile of a Tedrow soil, see the "Tedrow Series."

Runoff is slow. The soils are slightly acid, and they are low in natural fertility. Crops grown on them respond well to regular applications of lime and fertilizer. Permeability is moderately rapid above the compact substratum. At the substratum the downward flow of water is sharply restricted. In wet weather percolation is restricted and the overlying sand becomes temporarily saturated.

The Rimer soils are used mainly for cash-grain farming. Tile drainage is needed to farm them successfully. Tiling is effective in removing excess water if the tile are placed on or just above the compact substratum. Sometimes these soils are droughty late in the growing season.

Representative profile of a Rimer loamy fine sand:

0 to 9 inches, dark grayish-brown, loose loamy fine sand; slightly acid.
9 to 20 inches, pale-brown, loose loamy fine sand with yellowish-brown and grayish-brown mottles; slightly acid.
20 to 30 inches, brown, very friable loamy fine sand with yellowish-brown and dark yellowish-brown mottles; slightly acid.
30 to 36 inches, gray, friable sandy clay loam with yellowish-brown and grayish-brown mottles; slightly acid.
36 to 42 inches +, gray, very compact silty clay; calcareous.

Depth to the fine-textured, calcareous material ranges from 18 to 42 inches, but in most places it is between 28 and 36 inches.

Rimer and Tedrow loamy fine sands, over clay, 0 to 2 percent slopes (Rt).—These soils are generally in sandy parts of the lake plains, but they are also on outwash plains and near soils of beach ridges. In most places they are near Millgrove loams, over clay, and Toledo silty clay loams. These soils are easy to till. If they are drained, they are moderately well suited to all the crops commonly grown in the area. (Capability unit IIw–3)

Rimer and Tedrow loamy fine sands, over clay, 2 to 6 percent slopes (RtB).—These soils occur mainly in sandy areas of the lake plains in association with the Seward and Spinks soils. They are easy to till. If they are drained, they are moderately well suited to all the crops commonly grown in the county. (Capability unit IIw–3)

St. Clair Series

The St. Clair series consists of light-colored, moderately well drained silt loams on slopes and breaks along streams that dissect the lake plain. These soils developed in fine-textured material over heavy clay loam or clay till that has been altered by the addition of lacustrine sediment. The St. Clair soils occur near the somewhat poorly drained Nappanee and the very poorly drained Hoytville soils.

Runoff is medium to rapid, and permeability is very slow or slow because of the fine texture of the subsoil. These soils are slightly acid and low in natural fertility. They have a limited supply of organic matter. The more sloping areas are subject to erosion if they are cultivated. The included areas of severely eroded, clayey soils are difficult to work, and they supply only a moderate amount of moisture for plants.

Most of the acreage is cultivated. The more sloping areas are used as woodland, are in permanent pasture, or are idle.

Representative profile of a St. Clair silt loam:

0 to 7 inches, grayish-brown, friable silt loam; slightly acid.
7 to 12 inches, brown, firm silty clay; medium acid.
12 to 16 inches, yellowish-brown, very firm clay; slightly acid.
16 to 22 inches, mottled dark-brown and yellowish-brown, very firm clay; slightly acid.
22 to 28 inches +, mottled dark-brown and grayish-brown, very compact clay till; calcareous.

In some areas these soils are medium to strongly acid to a depth of about 20 inches.

St. Clair silt loam, 2 to 6 percent slopes (ScB).—This soil is in areas adjacent to stream valleys, where it is associated with the Nappanee and Hoytville soils. Tiling is needed only in seep spots. This soil is moderately well suited to the crops that are commonly grown in the county. Some moderately eroded areas that are too small to be mapped separately are included. (Capability unit IIIe–2)

St. Clair silt loam, 6 to 12 percent slopes, moderately eroded (ScC2).—This is the most extensive St. Clair soil mapped in the county. It is in areas adjacent to streams and is associated with the Nappanee soils. About half of the original surface layer has been lost through erosion; as a result, the present plow layer is made up partly of material that was formerly subsoil.

Use of this soil for grain crops is severely restricted by the hazard of erosion. Included in the mapped areas of this soil are some areas of strongly sloping St. Clair soils that are too small to be mapped separately. (Capability unit IVe–1)

St. Clair silt loam, 12 to 25 percent slopes, moderately eroded (ScD2).—This soil is in fairly steep areas adjacent to stream valleys. These areas are short, abrupt breaks that in places grade to escarpments. This soil is generally associated with the Nappanee soils. About half of the original surface layer has been lost through erosion; as a result, the uppermost 8 inches is made up partly of material that was formerly subsoil. Although the sequence of horizons is much the same as in the profile described, the thickness of the profile is considerably less. The maximum thickness of the combined surface layer and subsoil is only about 15 inches.

This soil is too steep and the hazard of erosion is too great for grain crops to be grown. It is better suited to permanent pasture or trees. Some severely eroded areas are included in the mapped areas of this soil. (Capability unit VIIe–1)

Seward Series

The Seward series consists of light-colored soils that are moderately well drained. The soils are mainly on pronounced ridges and knolls of the lake plain, but they are also on stream terraces and outwash plains. They developed in sand about 18 to 44 inches thick that is underlain by calcareous, lake-laid clay or glacial till of clay loam texture. These soils occur near the somewhat poorly drained Rimer soils and the very poorly drained Millgrove soils over clay. They are also near the Spinks soils.

Runoff is slow. Permeability is rapid above the compact, underlying clay or clay loam, but below it is very slow. The Seward soils are slightly acid to medium acid and low in natural fertility. They are easy to till, and crops grown on them respond well to regular applications of lime and fertilizer.

These soils are used principally for cultivated crops, and they are well suited to truck crops and nursery stock. They become saturated during periods of heavy rainfall, but generally they drain reasonably soon without tile. These soils tend to be droughty late in summer. Large additions of organic matter, however, increase the water-holding capacity.

Representative profile of a Seward fine sandy loam:

0 to 9 inches, dark grayish-brown very friable fine sandy loam; slightly acid.
9 to 20 inches, yellowish-brown to dark yellowish-brown, very friable fine sandy loam; medium acid.
20 to 31 inches, mottled pale-brown, strong-brown, and yellowish-brown, very friable fine sandy loam; slightly acid.
31 to 37 inches, dark-brown, very firm clay with gray mottles; neutral.
37 inches +, mottled dark grayish-brown and yellowish-brown, firm clay loam (calcareous glacial till).

In some areas the sandy subsoil contains a layer of silt or clay. This layer is ½ inch to 1 inch thick.

Seward fine sandy loam, 2 to 6 percent slopes (SdB).—This is the only Seward soil mapped in the county. It is mainly in gently sloping areas of sandy deposits on the lake plain and on the periphery of outwash plains close to moraines. Its most common associates are the Rimer and Spinks soils. This soil is moderately well suited to all the crops commonly grown in the area.

Included in the mapped areas of this soil are a few small areas of a Seward soil that has slopes of 0 to 2 percent, and other areas of a Seward soil that has slopes of 6 to 12 percent. Also included are some areas of sandy loam and loamy fine sand. The included areas are too small to be mapped separately. (Capability unit IIe–2)

Shoals Series

In the Shoals series are light-colored, somewhat poorly drained, nearly level soils of the flood plains. These soils developed in mildly alkaline and medium-textured, recent alluvium that washed from calcareous soils of the uplands. They occur near the well drained Genesee, the moderately well drained Eel, and the very poorly drained Sloan soils.

Runoff is very slow, and permeability is moderate. These soils are high in natural fertility, and they rarely need lime.

Drainage and flooding are the major problems in managing these soils. Tile drainage is needed for maximum yields, but suitable tile outlets are difficult to establish. The Shoals soils are subject to flooding in winter and early in spring. If they are drained and protected from flooding, good yields are obtained. If they cannot be drained, and if flooding cannot be lessened, these soils are used for trees or permanent pasture.

Representative profile of Shoals silt loam:

0 to 8 inches, dark grayish-brown, friable silt loam; slightly acid.
8 to 14 inches, dark-brown, friable silt loam mottled with dark gray; neutral.
14 to 24 inches +, dark-gray, friable silt loam mottled with yellowish brown; neutral.

In most places the texture of the material beneath the surface layer is silt loam, but in some areas it is light silty clay loam. In many places strata of sandy loam, loam, or clay loam are below a depth of 20 inches.

Shoals silt loam (Sh).—This is the only Shoals soil mapped in the county. If it is drained and protected from flooding, it is easy to work. This soil is suited to all the crops commonly grown in the county.

Numerous areas of Shoals silty clay loam and a Shoals loam are included in the mapped areas of this soil. Also included are areas of Shoals silt loam and silty clay loam that have slopes of 2 to 6 percent. The included areas are too small to be mapped separately. (Capability unit IIw–2)

Sloan Series

The Sloan series consists of dark-colored, very poorly drained soils in nearly level to depressed areas of flood plains. These soils developed in recent alluvium. The alluvium washed from calcareous soils that developed in glacial drift of the uplands. These soils occur near the well drained Genesee, the moderately well drained Eel, and the somewhat poorly drained Shoals soils.

Runoff is very slow or ponded, permeability is moderate, and moisture-supplying capacity is high. These soils are high in content of organic matter and in natural fertility. Most areas do not need lime.

The Sloan soils are used mainly for trees or pasture, or they are idle. They are subject to flooding, and they are among the last soils to drain after the floodwaters have subsided. The production of crops is often curtailed because of floods in winter and spring, but flooding can be expected at any time of the year. Tile drainage is required to obtain maximum yields, but adequate outlets are difficult to obtain. If these soils are adequately drained and protected from floods, good yields of corn and other general crops can be obtained.

Representative profile of Sloan silty clay loam:

0 to 9 inches, very dark gray, friable silty clay loam; neutral.
9 to 40 inches +, dark-gray, firm silty clay loam mottled with dark grayish brown and light olive brown; neutral.

The color of the surface layer ranges from black to dark gray. In some areas the texture of the material beneath the surface layer is loam, silt loam, or light clay loam. The material below a depth of 30 inches is stratified in some places. Some areas of the Sloan soils are underlain by limestone bedrock at a depth of 20 to 42 inches.

Sloan silty clay loam (Sm).—This soil is generally associated with the Shoals and Wabash soils. If it can be drained and protected from flooding, good yields can be obtained.

Included in the mapped areas of this soil are numerous areas of a Sloan silt loam. Also included are areas where the slope is between 2 and 6 percent. The included areas are too small to be mapped separately. (Capability unit IIIw–3)

Sloan silty clay loam, over limestone (Sn).—The profile of this soil is similar to the one described as representative of the series, but limestone bedrock is at a depth of 20 to 42 inches. This soil is difficult to tile drain because bedrock is near the surface. It is generally in permanent pasture, trees, or brush. If it is drained and protected from flooding, this soil is very productive. (Capability unit IIIw–3)

Spinks Series

In the Spinks series are gently sloping, light-colored, well-drained soils on knolls of sand. These soils developed in neutral to mildly alkaline, deep sand. In their subsoil are thin bands of slightly finer textured material.

Infiltration and permeability are rapid. The root zone is deep, and most of the moisture present in the soil material is available to plants. Therefore, these soils are less droughty than the Casco soils, but they are more droughty than most of the light-colored soils in the county.

The Spinks soils are easy to till and are well suited to specialty crops. Crops grown on them respond well to applications of fertilizer and to good management.

Representative profile of a Spinks loamy fine sand:

0 to 9 inches, dark grayish-brown, very friable loamy fine sand; slightly acid to neutral.
9 to 74 inches, light yellowish-brown fine sand with discontinuous bands of strong-brown and yellowish-red loamy fine sand or fine sandy loam; slightly acid to neutral.
74 inches +, mottled grayish-brown and yellowish-brown fine sandy loam; calcareous.

Depth to the bands of fine-textured material is variable, but it is normally between 30 and 60 inches. The bands range in texture from loamy sand to loam. The subsoil is medium acid in some places.

Spinks loamy fine sand, 2 to 6 percent slopes (SpB).—This is the only Spinks soil mapped in the county. It is commonly associated with the Seward soils. This soil is moderately well suited to all the crops commonly grown in the area. (Capability unit IIIs–1)

Tedrow Series

In the Tedrow series are deep, sandy, somewhat poorly drained soils. The Tedrow soils in Allen County overlie clay at a depth between 36 and 60 inches. The uppermost 20 inches of their profile is loamy sand or loamy fine sand, but below that depth the texture is sand or fine sand. These soils do not have a textural B horizon, and they are mottled below a depth of 8 to 16 inches. The Tedrow soils are not mapped separately in this county but are mapped with the Rimer soils as undifferentiated units.

Representative profile of a Tedrow loamy fine sand from Paulding County:

0 to 9 inches, dark-brown to dark grayish-brown, very friable loamy fine sand; slightly acid.
9 to 20 inches, yellowish-brown to strong-brown, very friable loamy sand with yellowish-red mottles; slightly to medium acid.
20 to 36 inches, pale-brown to light yellowish-brown, loose loamy sand to sand with light-gray and yellowish-red mottles; slightly acid to medium acid.
36 to 60 inches +, light brownish-gray, loose loamy sand to sand with brown mottles; slightly acid in the upper part, but grades to calcareous with increasing depth.

The depth to the calcareous material ranges from 4 to 7 feet, but in most places it is about 5 feet. The Tedrow soils in Allen County are underlain by clay at a depth between 3 and 5 feet.

Toledo Series

The Toledo series consists of dark-colored, very poorly drained soils on nearly level to slightly depressed flats of the lake plains. These soils developed in lake-laid deposits of clay and silt. They occur near the poorly drained or very poorly drained Hoytville soils.

Surface drainage is ponded or very slow, permeability is very slow or slow, and moisture-supplying capacity is high. These soils are high in natural fertility; they need lime only occasionally.

Most of the acreage is cultivated. Tile drainage is needed, however, to farm these soils successfully. If the soils are drained, they are productive. Because the soil structure is good, tile are effective in removing excess water. Surface drains are also needed to remove surface water. Good tilth is difficult to maintain; therefore, these soils should not be tilled frequently nor worked when they are wet.

Representative profile of Toledo silty clay loam:

0 to 8 inches, very dark grayish-brown, friable silty clay loam; slightly acid.
8 to 14 inches, very dark gray, very firm silty clay with yellowish-brown mottles; neutral.
14 to 42 inches, gray, very firm silty clay with yellowish-brown and reddish-brown mottles; neutral.
42 to 50 inches +, light brownish-gray, very firm stratified clay and silt mottled with brownish yellow and yellowish brown; calcareous.

The color of the surface layer ranges from very dark grayish brown to black. Depth to the limy stratified material is normally about 40 inches, but it ranges from 24 to about 50 inches.

Toledo silty clay loam (To).—This is the only Toledo soil mapped in the county. It generally occurs near the Hoytville soils. If this soil is drained, it is well suited to all the crops commonly grown in the county.

Included in the mapped areas of this soil are small areas of Lenawee and Hoytville soils. Also included are areas of Toledo silt loams and Toledo silty clays. The included areas are too small to be mapped separately. (Capability unit IIIw–3)

Tuscola Series

The Tuscola series consists of light-colored, moderately well drained soils on low knolls of the lake plains and in small areas on moraines. In some places these soils occur near soils of the beach ridges and stream terraces. These soils developed in medium-textured material over lake-laid, stratified silt and fine sand that contains some clay. The Tuscola soils occur near the very poorly drained Colwood and the somewhat poorly drained Kibbie soils.

Runoff is slow, permeability is moderate, and moisture-supplying capacity is high. These soils are fairly low in natural fertility; they need applications of lime periodically. Tile drainage is not needed. The Tuscola soils are used principally for cash-grain or general farm crops. Crops grown on them respond well to good management.

Representative profile of a Tuscola loam:

0 to 8 inches, dark grayish-brown, very friable loam; slightly acid to neutral.
8 to 11 inches, dark-gray, very friable loam with yellowish-brown mottles; neutral.
11 to 15 inches, yellowish-brown, friable loam with coatings of dark grayish brown; neutral.
15 to 27 inches, brown, friable loam with yellowish-brown mottles; neutral.
27 to 36 inches, pale-brown, very friable very fine sandy loam with yellowish-brown mottles; mildly alkaline.
36 to 46 inches, light brownish-gray, very friable very fine sandy loam with yellowish-brown mottles; mildly alkaline.
46 to 60 inches +, light brownish-gray, very friable, stratified silt and very fine sand with some clay; calcareous.

The texture of the surface layer ranges from loam to silt loam, and that of the subsoil, from sandy loam to light silty clay loam or silt loam. The texture of the subsoil depends on the thickness and sequence of the layers of silt and sand. Depth to the underlying limy material ranges from 24 to about 50 inches.

Tuscola loam, 2 to 6 percent slopes (TsB).—This soil is easy to till and is moderately well suited to all the crops commonly grown in the county. Included in the mapped areas of this soil are areas of Kibbie soils that are too small to be mapped separately. (Capability unit IIe–1)

Tuscola silt loam, 2 to 6 percent slopes (TtB).—This soil is on lake plains and outwash plains, and in some places it is on the high parts of moraines. It is generally associated with the Kibbie, Blount, and Morley soils. This soil has less sand in the surface layer than Tuscola loam. It is fairly easy to till and is moderately well suited to all the crops commonly grown in the area. Some areas of Kibbie soils, too small to be mapped separately, are included in the mapped areas of this soil. (Capability unit IIe–1)

Urban Land (Ur)

Urban land is a miscellaneous land type that includes areas occupied by cities and towns. It is not practical to map the highly populated areas or areas covered extensively with buildings. Urban land has not been classified in a capability unit.

Wabash Series

In the Wabash series are dark-colored, very poorly drained soils in the lowest positions on the flood plains. These soils developed in recent alluvium that was washed from calcareous soils of the glaciated uplands. They generally occur near the Sloan soils.

Runoff is ponded or very slow, permeability is very slow, and moisture-holding capacity is very high. The Wabash soils are high in natural fertility.

These soils are mainly in trees or permanent pasture; they are rarely used for cultivated crops. If they are drained and protected from flooding, however, moderately good yields are obtained. Flooding in winter and spring is frequent and severe. These soils remain ponded long after the floodwaters have subsided; therefore, it is difficult to work them at a time when they are not wet. It is also difficult to install an adequate drainage system and to maintain good tilth. The response to tiling is only fair because of the large amount of clay and the lack of suitable outlets for tile.

Representative profile of Wabash silty clay:

0 to 9 inches, very dark gray, very firm silty clay; slightly acid to neutral.

9 to 28 inches, dark-gray, very firm silty clay with brown, reddish-brown, and yellowish-brown mottles; neutral.

28 to 45 inches +, mottled gray and yellowish-brown, very firm silty clay; neutral to mildly alkaline.

Wabash silty clay (Wa).—This is the only Wabash soil mapped in the county. It is rarely cultivated because of problems of drainage and flooding. Included are a few areas of Sloan soils that are too small to be mapped separately. (Capability unit IIIw–3)

Genesis, Morphology, and Classification of the Soils

In this section the factors of soil formation are discussed, with particular emphasis on the formation of the soils in Allen County. Then the system of classification is described, and the soil series in the county are placed in great soil groups. First, the great soil group is described, and then each series in the group is discussed briefly. A technical profile description is given for each soil series. These technical descriptions are more detailed than the descriptions given in the section "Descriptions of the Soils." The colors given in the descriptions are for the soil when moist.

A number of the soils for which technical descriptions are given were sampled in the field, and the samples of the individual horizons were analyzed in the laboratory. All samples are identified by a symbol using the letters AL plus a profile number. Reference is made to these profile numbers throughout the discussions of the soil series. The laboratory data obtained for the analyzed profiles are given in table 7 in the section "Laboratory Determinations," which follows the technical descriptions.

Factors of Soil Formation

Soils are continuous over the land surface of the earth, except on steep and rugged mountains, in areas of perpetual ice and snow, and in extreme deserts. They are formed by the forces of weathering and soil development acting upon materials that have been deposited or accumulated by geologic activity. Soil formation proceeds as steps or stages, none of which are distinct. It could be said that there are two major stages in the formation of soils—first, the accumulation of parent material, and then, the weathering of the parent material that results in the formation of soil horizons within the profile (*13*). The characteristics of a soil at any given place depend upon the interrelationships of (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. These five factors are called the soil-forming factors. Because different factors dominate from place to place, many kinds of soils have formed. These soil-forming factors control the rate and effects of the physical and chemical processes that function within the soil profile to produce horizon differentiation.

The changes that occur in the soil system are of four basic kinds: additions, removals, transfers, and transformation (*15*). The intensity of the soil-forming processes, now and in the past, has determined the degree of horizon differentiation and the present soil characteristics.

Climate and vegetation are the active factors in soil formation. Less is known of the micro-organisms, earthworms, and other plants and animals living in the soil than about plants and animals on the surface, but they probably have an influence on soil composition and supply of organic matter equal to that of vegetation. The vegetation and animal and microbial life, influenced by the climate, act upon the parent material and slowly change it to a natural body that has genetically related horizons. Soils differ on a regional basis, largely because of the influence of climate and vegetation.

The effects of climate and vegetation upon soil development are modified by the nature of the parent material and by the relief, which, in turn, influences drainage. The parent material and relief influence the kind of soil profile that is formed, and in some places they dominate the soil-forming factors.

Finally, time is required before the parent material can be transformed into soil material. It takes long periods for weathering, leaching, translocation of soil particles, formation of soil structure, and other soil-forming processes to make distinct horizons in soil parent material.

The differences among the soils of this county have resulted chiefly from the influence of parent material and relief. The soil-forming factors of climate and vegetation have strongly influenced the development of the soils, but those factors are nearly uniform throughout the county. Therefore, few of the soil differences within the county can be attributed to them.

All of the county was covered by ice as the result of the Wisconsin glaciation, and the soils have formed since the glacier retreated. Studies indicate that the interval of time since the retreat of the glacier has been short enough so that differences in time have not had any marked effect that would account for variations in the soils. Therefore the nature of the parent material and relief are the major factors that account for the differences among soils in the county.

Parent material

The parent material in which the soils of this county formed is largely of glacial origin. The county was covered by glaciers during several stages of the Pleistocene age. The present surficial material of the county is of Wisconsin age (*7*). Before glaciation took place, the area that is now Allen County was probably a nearly level plain with limestone bedrock near the surface. Now the county is underlain by limestone at variable depths. Over most of the county, the Monroe group of limestone predominates, but a small area in the southeastern corner of the county is underlain by Niagara limestone (*14*).

The limestone bedrock is covered by a layer of moderately fine textured till except in the northwestern corner of the county, where it is covered by fine-textured till. The thickness of this till ranges from a few feet to several hundred feet. The thickest till is in preglacial valleys of the Teays River system. Most of the county is covered by 50 feet of till.

When the last glacier receded from the area, it left a series of end moraines across the county. In general these extend in an east-west direction (*7*). These moraines appear as areas of low, rolling hills that run in bands across the county. Three major moraines were left in the county. These are the Ft. Wayne, the Wabash, and the St. Johns. The cover picture shows the location of these moraines. Radiocarbon dates from northern Ohio and adjacent Indiana suggest that the glacier retreated from this area about 15,000 years ago (*8*).

As the last glacier receded, melt waters were ponded by an ice front that remained at the Defiance moraine for an extended period. At least two glacial lake stages, Lake Maumee and Lake Whittlesey, covered or partly covered the northern part of the county. Though most of the soils in the northern part of the county are underlain by till, these lake stages had an influence upon their present characteristics. The till deposited in this area was reworked and modified to some extent by wave action of the glacial lakes. Prominent ridges were left in the northern part of the county where these glacial lakes occurred. The beach ridges can readily be observed between Delphos and Columbus Grove. Several secondary beach ridges were deposited to the south of the main ridge and occur in a band that parallels the main ridge from east to west (*6*).

The soils in the northwestern corner of the county developed mainly in fine-textured till that was slightly modified by wave action of the glacial lakes. In most places the content of clay in the till is about 45 percent. The content of calcium carbonate is about 22 percent. The relief is nearly level except along the major drainageways. The Hoytville soils are dominant.

Associated with this nearly level area are areas of outwash and lacustrine materials. These areas are at the outer perimeter of the glacial lake and occur in bands that extend across the northern part of the county. The soils on the beach ridges and outwash plains are generally very sandy and gravelly. In places they are underlain by fine-textured till or lacustrine material. The lacustrine parent material includes both medium- and fine-textured deposits. The relief is nearly level or gently sloping.

The major part of the county, that area south of the lake plain, consists of soils derived predominantly from moderately fine textured till. The content of clay in the calcareous till, as sampled below the solum, commonly ranges from 31 to 38 percent, and the content of calcium carbonate ranges from 16 to 28 percent. The Blount, Morley, and Pewamo soils are dominant in this area. The relief ranges from nearly level on the Pewamo soils to gently undulating to steep on the Blount and Morley soils. Associated with the till plain are local areas of outwash, terraces, and alluvium along the major streams. There are also occasional areas of shallow depressions where there are fine-textured lacustrine deposits.

Relief

Relief has affected the formation of soils in this county, chiefly through its effect on the action of water on or in the soil. The degree of profile development in a soil, within a given time, on a given parent material, and under the same type of vegetation, depends largely on the amount of water that passes through the soil material. For example, runoff on the steeper slopes removes the surface soil and prevents the formation of a deep soil. Relief controls and modifies the effectiveness of the active factors of soil formation through its control of runoff, erosion, depth of water table, internal drainage, leaching, and accumulation and removal of organic matter. A large amount of organic matter in the Humic Gley soils is mainly a result of their topographic position. These soils remain wet for long periods, and the accumulation of organic matter is thereby increased.

In general, the relief in this county ranges from nearly level in areas of the lake plain and parts of the till plain to undulating in the morainic areas. There are some steeply sloping areas, however, on moraines and along escarpments.

Vegetation

The original vegetation in Allen County was principally deciduous forest. On the lake plain and the more poorly drained parts of the till plain a deciduous swamp forest predominated (*10*). The trees common on the poorly drained and very poorly drained soils were black and white ash, American elm, shagbark hickory, basswood, swamp white oak, pin oak, sycamore, silver maple, and cottonwood. Scattered throughout the swamp forest were occasional grassy openings and wet areas where sedges and grasses that tolerate water were dominant.

On the better drained, more sloping areas, the soils supported a somewhat different kind of deciduous forest. In that forest such species as beech, basswood, white oak, red oak, and sugar maple were dominant in the original stand.

Climate

The climate under which the soil material has accumulated and existed since deposition is an active factor in soil formation. The climate influences the rate of plant growth, the amount of water available to plants, the removal of material by leaching, and the temperature of the soils. This county has a temperate, humid, continental type of climate. More information about the climate is given in the section "General Nature of the County."

Climatic factors that are important in soil formation are precipitation, temperature, and the evapotranspiration ratio. In an area the size of this county, the climate is fairly uniform and thus has little direct effect upon the variations among the soils of the county. Soil differences within a local area are determined more by differences in vegetation, parent material, relief and drainage, and the age of the soil material than by differences in climate. The climatic factors, however, are interrelated with the types of vegetation and, on a regional basis, determine the kinds of soil that develop.

Time

The length of time required for the formation of horizons in a soil depends upon the other soil-forming factors, particularly upon the effects of relief and parent material. Differences in weathering and development of soils cannot be correlated exactly with age in this area, because other soil-forming factors affect or modify the rate of weathering and other processes.

The age of the lake plain area in the northern part of the county is believed to be about 13,000 years, and that of the till plain, about 15,000 years. The soils of the county have been developing a relatively short time, compared to those on till from former glaciations or those in unglaciated areas. This accounts in part for the shallow depth of leaching and also for the less acid reaction of some of the soils of the county.

Classification of Soils

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 (*15*, *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 relatively 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 are placed in only three orders, whereas thousands of soil types are recognized in the lowest category.

In the use of the soil classification system, the categories of order, great soil group, series, and type have been given the most attention. The categories of suborder and family have never been fully developed and therefore are seldom used. The classification of soils by soil types and soil series is most important within counties. The subsequent grouping of the series into great soil groups has been found most useful for comparing the characteristics of the series of the county and for relating them to the soils of other counties, States, or regions.

A great soil group is a broad group of soils that have major profile characteristics in common; that is, all members of the group have the same number and kind of definitive horizons. Such horizons need not be expressed to the same degree in every soil but must be present in all areas. Thus, a given definitive horizon may be faint in some members of a great soil group and prominent in other members of the same group. Every soil series classified in a great soil group must have certain horizons in its profile, expressed to some degree.

The soil series in this county are classified in four great soil groups. Some of the series have characteristics typical of the soils in one great soil group, but they also have some characteristics that are typical of or transitional to another great soil group. These series are classified in intergrades rather than in the central concept of their great soil group. The following list gives the great soil group of each series in the county and indicates those series that are intergrading toward another group:

Great soil group	*Series*
Gray-Brown Podzolic	Belmore, Blount,[1] Casco, Digby,[1] Fox, Haney, Haskins,[1] Kibbie,[1] Morley, Nappanee,[1] Randolph,[1] Rawson, Rimer,[1] St. Clair, Seward, Spinks,[2] Tuscola.
Regosol	Tedrow.[1]
Humic Gley	Colwood,[3] Hoytville, Lenawee, Millgrove, Millsdale, Montgomery, Pewamo, Sloan,[3] Toledo, Wabash.[3]
Alluvial	Eel, Genesee, Shoals.
Bog	Linwood.

[1] Intergrading toward Low-Humic Gley soils.
[2] Intergrading toward Regosols.
[3] Lacks a textural B horizon.

Gray-Brown Podzolic soils

Gray-Brown Podzolic soils developed under deciduous forest in a humid, temperate climate. In undisturbed areas they have a thin, dark-colored A1 horizon and an eluviated A2 horizon. The A2 horizon is light colored—generally gray, grayish brown, or pale brown.

The B horizon contains more clay than the A2 horizon because of eluviation from the A2 horizon. The B horizon is one of higher chroma; brown, yellowish brown, or strong brown are the most common colors.

The profile of Gray-Brown Podzolic soils also has a characteristic pattern of reaction and base saturation. These soils are more acid in the lower part of the A horizon and upper part of the B horizon than they are in the lower part of the B horizon. The reaction is generally slightly acid to strongly acid in the uppermost horizons and medium acid to neutral in the lower part of the profile. The pattern of base saturation is similar. A base saturation value of as low as 30 percent may occur in the lower A and upper B horizons, but the base saturation in the lower B horizon is seldom below 50 percent.

The soils of the central concept of the Gray-Brown Podzolic group are those of the Belmore, Casco, Fox, Haney, Morley, Rawson, St. Clair, Seward, and Tuscola series. Of these, the Belmore, Casco, and Fox soils, which occur on the sand and gravelly beach ridges and outwash areas, are well drained. The other soils of this group are mottled in the lower part of their profile, which indicates that they developed under somewhat restricted drainage and are therefore only moderately well drained.

BELMORE SERIES

The Belmore soils developed in gravelly and sandy outwash that contains some silt, the same kind of material in which the Haney, Digby, and Millgrove soils developed. Belmore loam is the only soil type of the Belmore series mapped in the county, but there are a few acres of Belmore sandy loam that are too small to be mapped separately. Belmore sandy loam is typical of the well-drained Gray-Brown Podzolic soils developed in gravelly and sandy material. A profile of a Belmore sandy loam, sample number AL–97, in a fairly large area of outwash in the northeastern part of the county, was sampled. The B horizon has a large enough accumulation of clay to make its texture sandy clay loam and sandy clay. The underlying sandy loam and loamy sand is apparent in the mechanical analysis of the C horizon.

Profile of a Belmore sandy loam in a cultivated field where the slope is 3 percent. (AL–97; Monroe Township, NW¼SE¼ sec. 12):

Ap—0 to 11 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine and medium, granular structure; friable; abundant roots; few small pebbles up to 4 millimeters in diameter; pH 5.3; abrupt, smooth boundary.

B1—11 to 18 inches, dark yellowish-brown (10 YR 4/4) sandy loam; moderate fine and medium, subangular blocky structure; friable; abundant roots; some fine gravel; pH 5.8; diffuse, wavy boundary.

B21—18 to 26 inches, dark-brown (10YR 4/3) sandy loam; weak, fine and medium, subangular blocky structure; friable; plentiful roots; much fine gravel; pH 6.0; clear, irregular boundary.

B22t—26 to 30 inches, very dark grayish-brown (10YR 3/2) sandy clay loam; moderate, medium, subangular blocky structure; friable; plentiful roots; high content of fine gravel; pH 6.2; clear, irregular boundary.

B23t—30 to 36 inches, dark-brown (10YR 4/3) sandy clay loam; moderate, medium and coarse, angular blocky structure; friable; few roots; much fine gravel; pH 6.3; gradual, wavy boundary.

B24t—36 to 41 inches, dark grayish-brown (10YR 4/2) sandy clay; weak, medium and coarse, angular blocky structure; firm; few roots; much fine gravel; tongues of this horizon extend into the underlying horizons as far as 1 foot; pH 6.6; clear, irregular boundary.

IIC1—41 to 47 inches; water-laid, fine gravelly coarse sandy loam; single grain; loose; calcareous; diffuse, wavy boundary.

IIC2—47 to 53 inches, water-laid, fine gravelly coarse loamy sand; single grain; loose; no roots; calcareous.

CASCO SERIES

The profile of a Casco silt loam, sample number AL–96, is typical of the well-drained, shallow Gray-Brown Podzolic soils developed in silty and loamy outwash. The outwash is underlain by well-washed, calcareous gravel and sand at a depth of 10 to 24 inches. The soil was sampled on a stream terrace adjacent to the Auglaize River. Fairly strong horizonation is indicated by the clay texture of the B2 horizon, as compared to the silt loam texture of the Ap horizon and the silty clay loam texture of the B1 horizon. The B1 horizon has the minimum pH value.

Profile of a Casco silt loam in a cultivated field where the slope is 1 percent. (AL–96; Auglaize Township, SE¼SE¼ sec. 17):

Ap—0 to 5 inches, dark-brown (10YR 4/3) silt loam; moderate, fine and medium, granular structure; friable; abundant roots; few pebbles; pH 6.2; abrupt, smooth boundary.

B21t—5 to 12 inches, dark yellowish-brown (10YR 4/4) silty clay loam; weak, fine, subangular blocky structure; friable; abundant roots; few pebbles up to 1 inch in diameter; pH 5.8; gradual, wavy boundary.

B22t—12 to 18 inches, dark-brown (7.5YR 3/2) clay; weak, medium and coarse, subangular blocky structure; firm; clay films on the faces of peds; few pebbles and stones up to 5 inches in diameter; pH 6.3; clear irregular boundary.

B23t—18 to 23 inches, dark-brown (10YR 4/3 and 7.5YR 3/2) gravelly clay loam; massive; plentiful roots; contains fine and coarse gravel and fragments of limestone up to 10 inches in diameter; calcareous; clear, wavy boundary.

IIC—23 to 29 inches, gravelly coarse sandy loam; single grain; loose; calcareous.

FOX SERIES

The Fox soils developed in outwash material similar to that in which the Casco soils developed. Fox loam is the only soil type of this series mapped in the county, but there are a few acres of Fox fine sandy loam in areas too small to be mapped separately. A Fox fine sandy loam, sample number AL–98, was sampled on a stream terrace along the Auglaize River. The coarse-textured, calcareous substratum of this soil is at a depth of 24 to 42 inches, unlike that of the Casco silt loam, which is at a depth of 10 to 24 inches. As in the Casco soil, the lower part of the B horizon is clay, and the upper part of the solum is coarser textured. The minimum pH value is in the B21 horizon.

Profile of a Fox fine sandy loam is a cultivated field where the slope is 3 percent. (AL–98; Auglaize Township, NW¼NW¼ sec. 21):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; moderate, fine and medium, granular structure; friable; abundant roots; pH 6.2; abrupt, smooth boundary.

B1—8 to 11 inches, brown (10YR 5/3) loam; weak, fine and medium, angular blocky structure; friable; plentiful roots; pH 6.1; gradual, wavy boundary.

B21t—11 to 17 inches, dark yellowish-brown (10YR 4/4) sandy clay loam; moderate, medium and coarse, angular blocky structure; firm; plentiful roots; many wormholes; pH 5.8; gradual, wavy boundary.

B22t—17 to 22 inches, dark-brown (10YR 4/3) sandy clay loam; moderate, coarse, angular blocky structure that breaks to moderate, medium, angular blocky; firm; few small fragments of limestone, quartz, and shale as much as 3 millimeters in diameter; pH 6.0; clear, wavy boundary.

B23t—22 to 27 inches, dark-brown (10YR 4/3) sandy clay loam; moderate, medium and coarse, angular blocky structure; firm; plentiful roots; many small pebbles as much as one-half inch in diameter; pH 5.8; clear, wavy boundary.

B24t—27 to 35 inches, very dark grayish-brown (10YR 3/2) gravelly clay; weak, medium and coarse, subangular blocky structure; very firm; plentiful roots; tongues extend as far as 15 inches into the underlying material; considerable gravel; pH 6.1; abrupt, irregular boundary.

IIC1—35 to 40 inches, coarse sandy loam stratified with sand and fine gravel as much as 1½ inches in diameter; massive and single grain; loose; calcareous; gradual, irregular boundary.

IIC2—40 to 46 inches, stratified coarse loamy sand and gravel with gravel and cobbles as much as 5 inches in diameter; single grain; loose; calcareous.

HANEY SERIES

The Haney soils developed on beach ridges in gravelly and sandy outwash that contains some silt. They are similar to the Belmore soils, but the lower part of their profile is mottled, and they are moderately well drained. The soils of the Haney series were not sampled for laboratory analysis, but field descriptions and investigations indicate that the maximum amount of clay is in the lower part of the B horizon. The minimum pH value is in the upper part of the B horizon. In most places the C horizon is sandy loam.

Profile of a Haney loam in a cultivated field where the slope is 2 to 6 percent. (Field description; Marion Township, SE¼SE¼ sec. 24):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; moderate, medium, granular structure; friable; few fine pebbles; slightly acid; abrupt, smooth boundary.

A2—8 to 11 inches, dark grayish-brown (10YR 4/2) loam; weak, medium, platy structure; friable; few fine pebbles; medium acid; clear, wavy boundary.

B1—11 to 18 inches, dark-brown (7.5YR 4/4) loam; weak, fine and very fine, subangular blocky structure; friable; few fine pebbles; medium acid; diffuse, wavy boundary.

B21t—18 to 24 inches, yellowish-brown (10YR 5/4) clay loam with few, fine, distinct, dark grayish-brown (10YR 4/2) mottles; moderate, medium, subangular blocky structure; common fine pebbles; firm; medium acid; diffuse, wavy boundary.

B22t—24 to 36 inches, yellowish-brown (10YR 5/4) clay loam with common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, fine and medium, subangular blocky structure; firm; fine pebbles present in larger numbers than in horizons above; slightly acid; diffuse, irregular boundary.

IIC—36 to 42 inches, mottled, yellowish-brown (10YR 5/8), yellow (10YR 7/6), gray (10YR 5/1), and strong-brown (7.5YR 5/6) gravelly and sandy material containing a considerable amount of silt and clay; massive; unstratified; calcareous.

MORLEY SERIES

The Morley soils developed in moderately fine textured till like that in which the Blount and Pewamo soils developed. They are better drained than those soils, however, primarily because of the slope. The profiles of a Morley silt loam and a Morley loam, sample numbers AL–93 and AL–121, respectively, are typical of the moderately well drained Gray-Brown Podzolic soils. These Morley soils are generally gently sloping to steep, and they are adjacent to streams that dissect the glacial till plains. They are also in areas of terminal moraines.

The permeability of these soils is slow. Most profiles have mottling in the lower part. Depth to carbonates varies, but it is commonly between 22 and 26 inches. Leaching extends to a depth of 34 inches in places. It extends to a depth of at least 18 inches in nearly all areas, except those that are steep or eroded. The underlying material is clay loam or silty clay loam till. The amount of clay in the underlying material is generally about 31 to 36 percent. The Morley soils have a strongly developed B horizon, as is shown in the profiles described. The maximum amount of clay in the B horizon rarely exceeds 50 percent. The minimum pH value is generally in the B horizon. In many places it is in the B22 horizon, which is the same horizon in which the maximum clay occurs.

Profile of a Morley silt loam in a pastured meadow where the slope is 2 percent. (AL–93; Jackson Township, NE¼NE¼ sec. 13):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium and coarse, granular structure; friable; abundant roots; pH 6.4; abrupt, smooth boundary.

B21t—6 to 11 inches, brown (10YR 5/3) silty clay with dark-brown (10YR 4/3) coatings on the peds; moderate, fine and medium, subangular blocky structure; very firm; abundant roots; many wormholes; few small rock fragments; pH 5.6; gradual, wavy boundary.

B22t—11 to 16 inches, brown (10YR 5/3) clay with dark yellowish-brown (10YR 4/4) coatings on the peds; moderate, medium and coarse, angular blocky structure; very firm; plentiful roots; few small fragments of rock; pH 5.3; gradual, irregular boundary.

B23t—16 to 21 inches, dark-brown (10YR 4/3) silty clay with few, fine, distinct, yellowish-brown (10YR 5/6) mottles; very firm; few small fragments of rock; few wormholes; pH 6.8; clear, irregular boundary.

C—21 to 27 inches, grayish-brown (10YR 5/2) clay loam with few, fine, distinct, yellowish-brown (10YR 5/6) mottles; very firm and compact; few roots; massive; numerous fragments of shale, limestone, and granite up to 3 inches in diameter; calcareous glacial till.

Profile of a Morley loam in a meadow on the Wabash terminal moraine where the slope is 4 percent. (AL–121; Auglaize Township, SW¼NW¼ sec. 8):

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam; weak, very fine and fine, granular structure; very friable; abundant roots; pH 6.4; abrupt, smooth boundary.

B1—6 to 8 inches, dark-brown (10YR 4/3) clay loam; weak, fine, subangular blocky structure; firm; abundant roots; pH 4.8; smooth boundary.

B21t—8 to 10 inches, brown (7.5YR 4/4) clay; weak, very fine and fine, subangular blocky structure; firm; abundant roots; pH 4.5; gradual, wavy boundary.

B22t—10 to 13 inches, brown (7.5YR 4/4) clay; moderate, fine and very fine, angular blocky structure; very firm; abundant roots; pH 4.4; clear, irregular boundary.

B23t—13 to 20 inches, dark-brown (10YR 4/3) clay with few, fine, distinct, yellowish-brown (10YR 5/8) mottles; strong, medium and coarse, angular blocky structure; very firm; common roots; pH 4.7; gradual, irregular boundary.

B24t—20 to 24 inches, dark grayish-brown (10YR 4/2) clay loam with few, fine, distinct, yellowish-brown (10YR-5/4) mottles; moderate, fine and medium, angular blocky structure; firm; common roots; pH 7.5; clear, irregular boundary.

C1—24 to 28 inches, grayish-brown (10YR 5/2) clay loam till with few, fine, prominent, yellowish-brown (10YR-5/8) mottles; moderate, medium and thick, platy structure; very firm; few small roots; calcareous; gradual, wavy boundary.

C2—28 to 32 inches, dark grayish-brown (10YR 4/2) clay loam till with few, fine, prominent, brownish-yellow (10YR 6/8) mottles; moderate, medium and thick, platy structure; very firm and compact; few roots; calcareous.

C3—32 to 38 inches, dark grayish-brown (10YR 4/2) clay loam till with common, medium, prominent, yellowish-brown (10YR 5/8) mottles; moderate, medium and thick, platy structure; very firm and compact; no roots; calcareous.

C4—38 to 44 inches, dark grayish-brown (10YR 4/2) clay loam till with common, medium, prominent, yellowish-brown (10YR 5/8) mottles; moderate, medium and thick, platy structure; very firm and compact; no roots; calcareous.

RAWSON SERIES

The upper part of the profile of the Rawson soils is similar to that of the Haney soils, but the lower part developed in fine-textured material. These soils are generally in small areas on beach ridges and stream terraces.

The Rawson soils are mainly moderately well drained, but in a few areas, too small to be mapped separately, they are well drained.

The moderately well drained Rawson soils are represented by the profile of a Rawson loam, sample number AL–123. The upper part of the solum developed in somewhat variable, medium-textured material, 18 to 36 inches thick. The lower part of the solum is a fine-textured IIBt horizon, 3 to 12 inches thick, over a calcareous, fine-textured substratum. The texture of these soils varies considerably, as does the content of sand and fine gravel. Varying amounts of fine or medium gravel generally occur throughout the profile.

Profile of a Rawson loam in a meadow where the slope is 4 percent. (AL–123; American Township, SE¼-SW¼ sec. 18):

Ap—0 to 8 inches, dark-brown (10YR 3/3) loam; moderate, fine and medium, granular structure; very friable; abundant roots; pH 6.8; abrupt, smooth boundary.

B1—8 to 12 inches, brown (10YR 5/3) sandy loam; weak, medium, subangular blocky structure; very friable; abundant roots; a few, fine pebbles as much as one-half inch in diameter; pH 5.7; clear, wavy boundary.

B21—12 to 16 inches, brown (10YR 5/3) sandy loam; weak, medium, granular structure; friable; common roots; common fine pebbles; pH 5.5; clear, smooth boundary.

B22—16 to 23 inches, dark-brown (7.5YR 3/2) sandy loam; weak, medium, subangular blocky structure; friable; common roots; large amount of fine gravel with considerable content of shale; pH 5.3; clear, wavy boundary.

B23—23 to 27 inches, dark-brown (10YR 4/3) sandy loam; weak, medium and coarse, subangular blocky structure; friable; common roots; pebbles as much as 2 inches in diameter; pH 6.0; clear, smooth boundary.

B24t—27 to 32 inches, very dark gray (10YR 3/1) sandy clay loam with common, medium, distinct, dark-brown (7.5YR 4/4) and dark reddish-brown (5YR 3/3) mottles; weak, medium, subangular blocky structure; firm; few fine roots; few fine pebbles; pH 6.0; abrupt, smooth boundary.

IIB25t—32 to 38 inches, dark grayish-brown (10YR 4/2) clay glacial till with many, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, angular blocky structure; very firm; few roots; pH 7.3; clear, wavy boundary.

IIC—38 to 44 inches, gray (10YR 5/1) silty clay glacial till with many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very firm and compact; calcareous.

ST. CLAIR SERIES

The St. Clair soils developed in calcareous clay till, the same kind of material in which the Nappanee and Hoytville soils developed. They are on the slopes and breaks along streams that dissect the lake plain. Their surface layer is silt loam, and their subsoil is silty clay or clay over calcareous clay till. These moderately well drained Gray-Brown Podzolic soils were not sampled for laboratory analysis, but field descriptions and observations indicate the depth of leaching in most places to be about 18 inches. In the steeper areas, however, it is less. The B horizon is moderately developed and contains slightly more clay than the underlying material. In most places the minimum pH value is in the upper part of the B horizon, but in some places it is in the plow layer.

Profile of a St. Clair silt loam in a cultivated field where the slope is 2 to 6 percent. (Field description; Marion Township, NE¼NE¼ sec. 33):

Ap—0 to 7 inches, grayish-brown (10YR 5/2) silt loam; weak, fine, granular structure; friable; slightly acid; abrupt, smooth boundary.

B21t—7 to 12 inches, brown (10YR 5/3) silty clay; weak, fine and medium, subangular blocky structure; firm; medium acid; gradual, wavy boundary.

B22t—12 to 16 inches, yellowish-brown (10YR 5/4) clay with few, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium, angular blocky structure; very firm; slightly acid; diffuse, irregular boundary.

B23t—16 to 22 inches, dark-brown (10YR 4/3) clay with common, medium, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, angular blocky structure; very firm; slightly acid; clear, irregular boundary.

C—22 to 28 inches, dark-brown (10YR 4/3) clay with common, medium, distinct, grayish-brown (2.5Y 5/2) mottles; massive; very compact glacial till; calcareous.

SEWARD SERIES

The profile of a Seward fine sandy loam, sample number AL–119, is typical of the soils of this series in Allen County. The Seward soils are mottled with colors that indicate they are moderately well drained.

Profile of a Seward fine sandy loam in a permanent pasture where the slope is 3 percent. (AL–119; Perry Township, SW¼SE¼ sec. 22):

A1—0 to 9 inches, dark grayish-brown (10YR 4/2) fine sandy loam; moderate, medium and coarse, granular structure; very friable; abundant roots; pH 6.5; abrupt, wavy boundary.

B11—9 to 14 inches, yellowish-brown (10YR 5/4) fine sandy loam; weak, fine and medium, subangular blocky structure; very friable; common roots; pH 5.4; diffuse, irregular boundary.

B12—14 to 20 inches, dark yellowish-brown (10YR 4/4) fine sandy loam with common, fine, distinct, yellowish-brown (10YR 5/6 and 5/8) mottles; weak, medium and coarse, subangular blocky structure; very friable; few roots; pH 5.5; gradual, wavy boundary.

B21—20 to 31 inches, pale-brown (10YR 6/3) fine sandy loam with many, fine and medium, distinct, yellowish-brown (10YR 5/6 and 5/8) and strong-brown (7.5YR 5/8) mottles; weak, fine and medium, subangular blocky structure; very friable; few roots; pH 6.5; abrupt, wavy boundary.

IIB22t—31 to 37 inches, dark-brown (10YR 4/3) clay with many, medium, distinct, gray (10YR 5/1) mottles; moderate, medium and coarse, subangular blocky structure; very firm; few roots; some small fragments of black shale; pH 7.2; diffuse, irregular boundary.

IIC1—37 to 43 inches, dark grayish-brown (10YR 4/2) clay loam glacial till with few, fine, distinct, yellowish-brown (10YR 5/8 and 5/4) mottles; moderate, medium and coarse, subangular blocky structure; firm; no roots; calcareous; diffuse, wavy boundary.

IIC2—43 to 52 inches, brown (10YR 5/3) clay loam glacial till with few, fine, faint, gray (10YR 5/1) and distinct, brownish-yellow (10YR 6/8) mottles; massive; very firm and compact; no roots; calcareous.

TUSCOLA SERIES

The Tuscola series consists of moderately well drained soils developed in medium-textured material over calcareous, water-laid, stratified silt, very fine sand, and fine sand. The soils developed in the same kind of material as the Kibbie and Colwood soils. They are mainly in small areas, principally in sandy areas of the lake plain. The profile of a Tuscola loam, sample number AL–4, shows that leaching has taken place to a depth of 46 inches. The maximum content of clay is in the B2 horizon, and the minimum pH value is in the upper part of the B horizon.

Profile of a Tuscola loam, in a cultivated field where the slope is 2 percent. (AL–4; Marion Township, NW¼-NW¼ sec. 24. The area of Tuscola soil is small and is included in an area of Kibbie soils):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; very friable; pH 6.8; abrupt, smooth boundary.

A2—8 to 11 inches, dark-gray (10YR 4/1) loam; weak, thick, platy structure; very friable; pH 7.0; clear, smooth boundary.

B1—11 to 15 inches, yellowish-brown (10YR 5/4) loam with thin, dark grayish-brown (10YR 4/2) coatings on the peds; moderate, medium, subangular blocky structure; friable; pH 6.8; gradual, wavy boundary.

B21—15 to 27 inches, brown (10 YR 5/3), loam with common, medium, distinct, yellowish-brown (10YR 5/8) mottles and grayish-brown (2.5Y 5/2) coatings on the peds; moderate, medium, subangular blocky structure; friable; pH 7.1; clear, wavy boundary.

B22—27 to 36 inches, pale-brown (10YR 6/3) very fine sandy loam with common, medium, faint, light yellowish-brown (10YR 6/4) and yellowish-brown (10YR 5/6) mottles; weak, fine, subangular blocky structure; very friable; pH 7.5; gradual, wavy boundary.

B3—36 to 46 inches, light brownish-gray (2.5YR 6/2) very fine sandy loam with common, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, fine, subangular blocky structure; very friable; pH 7.6; clear, irregular boundary.

IIC—46 to 60 inches; light brownish-gray (10YR 6/2) silt loam; massive; very friable; stratified silt with very fine sand; calcareous.

Gray-Brown Podzolic soils intergrading toward Low-Humic Gley soils.—The soils of the Blount, Digby, Haskins, Kibbie, Nappanee, Randolph, and Rimer series are in the Gray-Brown Podzolic great soil group, but they are intergrading toward the Low-Humic Gley great soil group. These soils are somewhat poorly drained.

BLOUNT SERIES

The Blount soils are the most extensive soils in this county. They are nearly level or gently sloping and are in areas of the till plain. They developed in moderately fine textured till, in the same kind of material as that in which the Morley and Pewamo soils developed.

The profile of a Blount silt loam, sample number AL–S8, is typical of the somewhat poorly drained Gray-Brown Podzolic soils that are intergrading toward the Low-Humic Gley great soil group. The mottling below a depth of 10 inches indicates somewhat poor drainage. The depth to carbonates varies, but it is commonly between 22 and 30 inches. Leaching extends to a depth of 36 inches in places, and it extends to a depth of at least 18 inches in nearly all areas. The underlying material is clay loam or silty clay loam till. The content of clay in the underlying material is generally 31 to 36 percent. As shown in the laboratory data, the B horizon is strongly developed. The maximum content of clay in the B horizon is 50 percent or less in most places. The minimum pH value is in the upper part of the B horizon.

Profile of a Blount silt loam in a cultivated field where the slope is 2 percent. (AL–S8; Amanda Township, SW¼SW¼ sec. 14):

Ap—0 to 10 inches, dark grayish-brown (10 YR 4/2) silt loam; weak, fine, granular structure; friable; abundant roots; pH 6.6; abrupt, smooth boundary.

A2—10 to 11 inches, light yellowish-brown (10 YR 6/4) clay loam with few, fine, faint, brownish-yellow (10YR 6/6) mottles; weak, fine, granular structure; friable; pH 5.2; abrupt, wavy boundary.

B21t—11 to 17 inches, brown (10YR 5/3) clay loam with common, medium, distinct, yellowish-brown (10YR 5/6 and 5/8) mottles; moderate, medium, angular blocky structure; firm; plentiful roots confined to the faces of peds; pH 4.9; gradual, smooth boundary.

B22t—17 to 25 inches, dark grayish-brown (10YR 4/2) clay with common, medium, distinct, strong-brown (7.5YR 5/6) mottles; moderate, medium, angular blocky structure; very firm; few, small, igneous pebbles and weathered fragments of shale; thin clay films on the surfaces of peds; pH 6.2; clear, wavy boundary.

C1—25 to 38 inches, dark-brown (10YR 4/3) silty clay loam glacial till with common, medium, distinct, olive-gray (5Y 5/2) and light olive-gray (5Y 6/2) mottles; weak, coarse, subangular blocky structure in upper part to massive in lower part; firm; few, small, igneous pebbles and weathered fragments of shale; calcareous; diffuse, irregular boundary.

C2—38 to 48 inches, dark-brown (10YR 4/3) and light olive-gray (5Y 6/2) clay loam with many, medium, distinct mottles; massive; firm; calcareous glacial till.

DIGBY SERIES

The Digby soils developed in the same kind of material as the Belmore, Haney, and Millgrove soils. They developed in medium-textured material that overlies poorly sorted sandy or gravelly outwash on beach ridges. A Digby loam, sample number AL–S10, was sampled for analysis. It has enough clay in the B horizon to give that horizon a texture of sandy clay loam. The C horizon has a texture of gravelly loamy sand. In places calcareous clay loam till is below the solum at a depth of 36 inches or more. The minimum pH value is in the upper part of the B horizon.

Profile of a Digby loam in a cultivated field where the slope is 3 percent. (AL–S10; Monroe Township, SW¼-SE¼ sec. 11):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam; weak, fine, granular structure; friable; common roots; pH 6.1; abrupt, smooth boundary.

B21t—9 to 17 inches, brown (10YR 5/3), clay loam with common, fine, distinct, brownish-yellow (10YR 6/6) mottles; weak, fine and medium, subangular blocky structure; friable; no roots; considerable fine gravel; pH 5.0; gradual, wavy boundary.

B22t—17 to 22 inches, brown (10YR 5/3) sandy clay loam with common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; firm; no roots; considerable fine gravel; pH 5.4; diffuse, wavy boundary.

B23t—22 to 35 inches, dark grayish-brown (10YR 4/2) sandy clay loam with common, medium, prominent, strong-brown (7.5YR 5/6) mottles; weak, fine and medium, subangular blocky structure; firm; no roots; considerable fine gravel; pH 5.9; diffuse, irregular boundary.

IIC—35 to 60 inches, gray (10YR 5/1) gravelly loamy sand; single grain; loose; no roots; pH 7.0.

HASKINS SERIES

The Haskins soils are mainly on beach ridges and outwash plains, but they are also in small areas on the till plain. A Haskins loam, sample number AL–115, was sampled on the till plain in the northern part of the county. The upper part of its solum developed in medium-textured material that is 18 to 36 inches thick. The lower part of the solum consists of a fine-textured IIBt horizon, 3 to 12 inches thick, over a calcareous, fine textured or moderately fine textured substratum. The texture of the profile and the content of gravel vary considerably. Varying amounts of fine or medium gravel generally occur throughout the profile. The maximum content of clay is in the lower part of the B horizon, and the minimum pH value is in the upper part of the B horizon.

Profile of a Haskins loam in a cultivated field where the slope is 1 percent. (AL–115; Monroe Township, NE¼SW¼ sec. 9):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) loam; weak, fine and medium, granular structure; friable; plentiful roots; few small pebbles up to 3 millimeters in diameter; pH 5.1; abrupt, smooth boundary.

B1—8 to 11 inches, brown (10YR 5/3) loam with few, medium, faint, yellowish-brown (10YR 5/4 and 5/6) mottles; weak, fine, subangular blocky structure; friable; plentiful roots; occasional fine pebbles; pH 5.2; gradual, wavy boundary.

B21g—11 to 14 inches, brown (10YR 5/3) loam with many, medium, distinct, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; friable; plentiful roots; pH 5.0; gradual, wavy boundary.

B22gt—14 to 17 inches, yellowish-brown (10YR 5/6) sandy clay loam with common, medium, distinct, brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; very friable plentiful roots; pH 5.1; gradual, irregular boundary.

B23gt—17 to 22 inches, dark grayish-brown (10YR 4/2) sandy clay loam with many, medium, faint, dark yellowish-brown (10YR 4/4) mottles; weak, fine and medium, subangular blocky structure; friable; plentiful roots; small manganese concretions; pH 5.6; gradual, wavy boundary.

B24gt—22 to 27 inches, grayish-brown (10YR 5/2) sandy clay loam with common, fine and medium, distinct brown (10YR 5/3) and yellowish-brown (10YR 5/6) mottles; weak, fine and medium, subangular blocky structure; friable; few roots; pH 6.6; clear, irregular boundary.

IIB25gt—27 to 31 inches, dark yellowish-brown (10YR 4/4) heavy sandy clay loam with common, medium, distinct, yellowish-brown (10YR 5/6), very dark brown (10YR 2/2), and dark brown (10YR 4/3) mottles; weak, medium, subangular blocky structure; very firm; few roots; pH 7.1; abrupt, wavy boundary.

IIIC—31 to 49 inches, dark grayish-brown (10YR 4/2) clay loam with few, fine, faint, yellowish-brown (10YR 5/4) and dark yellowish-brown (10YR 4/4) mottles; massive; no roots; highly compact glacial till with numerous fragments of shale and limestone and an occasional igneous pebble; calcareous.

KIBBIE SERIES

The Kibbie soils developed in the same kind of material as the Tuscola and Colwood soils, that is, in moderately fine textured material over calcareous, water-laid, stratified silt, fine sand, and very fine sand. The Kibbie soils are mainly in small, sandy areas of the lake plain, but they are also associated with soils of the moraines and outwash areas. The profile of a Kibbie silt loam, sample number AL–89, shows that leaching has taken place to a depth of 35 inches. The maximum content of clay is in the lower part of the B horizon, and the minimum pH value is in the upper part of the B horizon.

Profile of a Kibbie silt loam in a cultivated field where the slope is 1 percent. (AL–89; Sugar Creek Township, SE¼SE¼ sec. 29):

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; friable; abundant roots; pH 6.2; abrupt, smooth boundary.

A2—6 to 10 inches, yellowish-brown (10YR 5/4) silt loam with few, fine, faint, light yellowish-brown (10YR 6/4) mottles; weak, fine and very fine, subangular blocky structure; friable; abundant roots; pH 5.8; gradual, wavy boundary.

B21g—10 to 15 inches, grayish-brown (10YR 5/2) clay loam with many, coarse, prominent, strong-brown (7.5YR 5/6) mottles; strong, fine, subangular blocky structure; firm; common roots; pH 5.7; diffuse, wavy boundary.

B22g—15 to 21 inches, dark grayish-brown (10YR 4/2) clay loam with common, medium, prominent, yellowish-brown (10YR 5/6) mottles; strong, fine and medium, subangular blocky structure; firm; common roots; pH 6.2; diffuse, wavy boundary.

B23g—21 to 29 inches, dark grayish-brown (10YR 4/2) clay loam with many, medium, prominent, yellowish-brown (10YR 5/6) mottles; strong, medium and coarse, subangular blocky structure; firm; common roots; pH 6.6; diffuse, wavy boundary.

B24g—29 to 35 inches, grayish-brown (10YR 5/2) silty clay loam with common, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium and coarse, subangular blocky structure; firm; few roots; pH 7.0; clear, irregular boundary.

C1—35 to 41 inches, yellowish-brown (10YR 5/4) silt loam with common, coarse, faint, yellowish-brown (10YR 5/8) mottles; weak, medium, blocky structure; friable; few roots; many laminations of silt and fine sand; calcareous; diffuse, irregular boundary.

C2—41 to 46 inches, yellowish-brown (10YR 5/4) silt loam with many, coarse, faint, yellowish-brown (10YR 5/8) mottles; weak, coarse, blocky structure; friable; many laminations of silt and very fine sand; calcareous.

C3—46 to 52 inches, dark yellowish-brown (10YR 4/4) silt loam with common, medium, distinct, yellowish-brown (10YR 5/8) mottles; weak, medium, platy structure or laminated silt and very fine sand; friable; calcareous.

NAPPANEE SERIES

The Nappanee soils developed in the same kind of material as the Hoytville and St. Clair soils. They developed in fine-textured glacial till that has been somewhat altered by lacustrine sediment. The Nappanee soils are generally on the low knolls of the lake plains. They are calcareous at a depth of about 20 inches. No samples of these soils were analyzed, but field descriptions and observations indicate that these soils are leached to a depth of 18 to 24 inches. Clay or silty clay is immediately below the plow layer. The maximum content of clay appears to be in the lower part of the B horizon. The minimum pH value is in the upper part of the B horizon.

The profile of a Nappanee silt loam in a cultivated field where the slope is 1 percent. (Field description; Marion Township, SW¼NE¼ sec. 30):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; friable; moderate, fine and medium, granular structure; slightly acid; abrupt, smooth boundary.

B21gt—8 to 10 inches, grayish-brown (10YR 5/2) silty clay with common, medium, prominent, yellowish-brown (10YR 5/4 and 5/6) mottles; weak, fine, angular blocky structure; firm; slightly acid; abrupt, smooth boundary.

B22gt—10 to 19 inches, dark grayish-brown (10YR 4/2) clay with many, medium, distinct, dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) mottles; moderate, medium, angular blocky structure; very firm; neutral; abrupt, irregular boundary.

C1—19 to 26 inches, grayish-brown (10YR 5/2) clay with many, medium, distinct, dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) mottles; massive; very firm; compact glacial till; calcareous.

C2—26 to 40 inches, dark-brown (10YR 4/3) clay with many, medium and coarse, prominent, grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/6) mottles; massive; very firm; compact glacial till; calcareous.

RANDOLPH SERIES

The Randolph soils are of limited extent in this county, and they are of little importance for agriculture. They occur on terraces in association with the Millsdale and Sloan soils. The Randolph soils developed in glacial till or old alluvium that is underlain by limestone bedrock at a depth of 20 to 42 inches. No samples of the Randolph soils were analyzed in the laboratory.

Profile of a Randolph silt loam in permanent pasture where the slope is 2 percent. (Field description; Richland Township, NE¼SE¼ sec. 12):

Ap—0 to 5 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, medium and coarse, granular structure; friable; pH 7.0; abrupt, smooth boundary.
A2—5 to 9 inches, grayish-brown (10YR 5/2) silt loam with few, fine, faint, yellowish-brown (10YR 5/4) mottles; moderate, medium and thick, platy structure that breaks to moderate, medium, subangular blocky; friable; pH 6.5; abrupt, wavy boundary.
B1—9 to 14 inches, dark grayish-brown (10YR 4/2) silty clay loam with many, medium, faint, dark yellowish-brown (10YR 4/4) mottles; moderate, medium, subangular blocky structure; firm; few, thin, patchy clay films on the surfaces of peds; pH 6.2; gradual, wavy boundary.
B21gt—14 to 22 inches, dark-brown (7.5YR 3/2) silty clay with common, medium, prominent, yellowish-brown (10YR 5/6) mottles; strong, medium and coarse, subangular blocky structure; very firm; continuous clay films on the surfaces of peds; pH 6.6; clear, wavy boundary.
B22gt—22 to 28 inches, dark-brown (7.5YR 3/2) clay loam with common, medium, prominent, yellowish-brown (10YR 5/6) mottles; moderate, medium and coarse, subangular blocky structure; firm; discontinuous clay films; pH 6.8; gradual, wavy boundary.
B23gt—28 to 40 inches, dark grayish-brown (10YR 4/2) silty clay with common, medium, distinct, brown (7.5YR 4/4) mottles; moderate, medium and coarse, angular blocky structure; very firm; pH 6.8; abrupt, wavy boundary.
R—40 inches +, weathered limestone bedrock.

RIMER SERIES

The Rimer soils were not sampled for laboratory analysis, but they are similar to the Seward soils. They do have gleyed colors, however, which are lacking in the Seward soils. The gleyed colors indicate that drainage is somewhat poor.

Profile of a Rimer loamy fine sand in a cultivated field where the slope is 2 percent. (Field description; Marion Township, NW¼NW¼ sec. 28):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loamy fine sand; very weak, fine, granular structure; loose; slightly acid; abrupt, smooth boundary.
B11—9 to 20 inches, pale-brown (10YR 6/3) loamy fine sand with common, medium, distinct, yellowish-brown (10YR 5/4) and grayish-brown (10YR 5/2) mottles; single grain; loose; slightly acid; diffuse, wavy boundary.
B12—20 to 30 inches, brown (10YR 5/3) loamy fine sand with many, coarse, prominent, yellowish-brown (10YR 5/8) and dark yellowish-brown (10YR 4/4) mottles; weak, coarse, angular blocky structure; very friable; slightly acid; diffuse, wavy boundary.
IIB2gt—30 to 36 inches, gray (5YR 6/1) sandy clay loam with many, coarse, prominent, yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) mottles; weak, coarse, subangular blocky structure; friable; slightly acid; abrupt, wavy boundary.
IIIC—36 to 42 inches, dark-gray (N 4/0) silty clay; massive; very compact glacial till; calcareous.

Regosols intergrading toward Low-Humic Gley soils.—The Tedrow soils are the only Regosols intergrading toward Low-Humic Gley soils in Allen County. They are moderately coarse textured to coarse textured and lack a textural B horizon. They have a mottled subsoil, which is an indication that the soils are intermittently saturated with water. In these soils the A horizon directly overlies the C horizon.

TEDROW SERIES

The Tedrow soils have a deep, sandy profile. The uppermost 20 inches is loamy sand or loamy fine sand, but below a depth of 20 inches, the proportion of silt and clay is smaller, and the texture is sand or fine sand. The Tedrow soils do not have a textural B horizon and are mottled below a depth of 8 to 16 inches. The Tedrow soils in the county overlie clay at a depth between 36 and 60 inches. These soils are not mapped separately in this county but are mapped as undifferentiated units with the Rimer soils. The representative profile described was taken from Paulding County.

Profile of a Tedrow loamy fine sand in a cultivated field. (SW¼NW¼ sec. 1, T. 2 N., R. 4 E., Paulding County, Ohio):

Ap—0 to 9 inches, dark-brown (10YR 3/3) or dark grayish-brown (2.5Y 4/2) loamy fine sand; very weak, fine, granular structure; very friable; slightly acid to medium acid.
A2—9 to 20 inches, yellowish-brown (10YR 5/6) to strong-brown (7.5YR 5/6) loamy fine sand with few, medium, distinct, pinkish-white (7.5YR 8/2) and yellowish-red (5YR 5/8) mottles; very weak, medium, granular structure; very friable; slightly acid to medium acid.
C1—20 to 60 inches, light brownish-gray (10YR 6/2) to light yellowish-brown (10YR 6/4) fine sand with many, coarse, prominent, light-gray (10YR 7/1 to 7/2) and yellowish-red (5YR 5/8) mottles; single grain; loose; slightly acid.
C2—60 inches +, light brownish-gray (10YR 6/2) or strong-brown (7.5YR 5/6) fine sand; single grain; loose; calcareous.

Gray-Brown Podzolic soils intergrading toward Regosols.—The Spinks soils are in the Gray-Brown Podzolic great soil group, but they have some characteristics of Regosols. They developed in calcareous, neutral loamy sand, sand, or fine sand. The Spinks soils are deep and well drained.

SPINKS SERIES

The profile of a Spinks loamy fine sand, sample number AL–116, is typical of the soils of this series in Allen County. This soil was sampled on a gently sloping knoll in an outwash area in the northeastern part of the county.

The typical Spinks soils have discontinuous, textural B horizons. The thickness, number, and continuity of the Bt horizons vary considerably within short distances. The thickness of the Bt horizons ranges from ⅛ inch to about 5½ inches. As shown in the laboratory data of the soil sampled, the content of clay of the collective Bt horizons increases with increasing depth, but the clay in the collective A2 horizons remains fairly constant. The pH value of the Bt horizons is the same or slightly lower than the pH value of the A2 horizons that immediately overlie them, except for the Bt horizon at a depth of 11 to 12 inches. Below a depth of 33 inches, the Bt horizons show considerable firmness and are very hard when dry.

Profile of a Spinks loamy fine sand in a meadow where the slope is 4 percent. (AL–116; Richland Township, NW¼SW¼ sec. 5):

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loamy fine sand; weak, medium, granular structure; very friable; abundant roots; pH 6.2; abrupt, smooth boundary.

A2—9 to 11 inches, light yellowish-brown (10YR 6/4) loamy fine sand; weak, very thick, platy structure in place, and breaks to weak, medium, subangular blocky when disturbed; loose; plentiful roots; pH 6.6; abrupt, wavy boundary.

Bt—11 to 12 inches, reddish-yellow (7.5YR 6/6) loamy fine sand; weak, medium, subangular blocky structure; very friable; common roots; pH 6.7; clear, irregular boundary.

A2—12 to 15½ inches, light yellowish-brown (10YR 6/4) fine sand; single grain; loose; common roots; pH 6.8; abrupt, wavy boundary.

Bt—15½ to 17½ inches, strong-brown (7.5YR 5/6) loamy fine sand; weak, medium, subangular blocky structure; very friable; few roots; pH 6.8; clear, irregular boundary.

A2—17½ to 22 inches, light yellowish-brown (10YR 6/4) fine sand; single grain; loose; few roots; pH 6.9; abrupt, wavy boundary.

Bt—22 to 24 inches, strong-brown (7.5YR 5/6) loamy fine sand; weak, fine, subangular blocky structure; very friable; few roots; pH 6.9; clear, irregular boundary.

A2—24 to 26½ inches, light yellowish-brown (10YR 6/4) fine sand with few, fine, faint, yellowish-brown (10YR 5/6) mottles; single grain, loose; few roots; pH 7.0; abrupt, wavy boundary.

Bt—26½ to 28 inches, yellowish-brown (10YR 5/6) loamy fine sand; weak, fine, subangular blocky structure; very friable; few roots; pH 6.9; clear, irregular boundary.

A2—28 to 33½ inches, pale-brown (10YR 6/3) fine sand with few, medium, distinct, yellowish-brown (10YR 5/4) mottles; very weak, fine, subangular blocky structure; very friable to loose; few roots; pH 6.8; abrupt, wavy boundary.

Bt—33½ to 38 inches, dark yellowish-brown (10YR 4/4) loamy fine sand; weak, medium and coarse, subangular blocky structure; very friable; few roots; pH 6.4; clear, irregular boundary.

A2—38 to 40 inches, pale-brown (10YR 6/3) fine sand with few, fine, faint, brown (10YR 5/3) mottles; single grain; loose; few roots; pH 6.7; abrupt, wavy boundary.

Bt—40 to 42½ inches, yellowish-red (5YR 4/8) loamy fine sand; weak, medium, subangular blocky structure; friable when moist, hard when dry; few roots; pH 6.6; clear, irregular boundary.

A2—42½ to 47 inches, light yellowish-brown (10YR 6/4) fine sand with few, fine, faint, yellowish-brown (10YR 5/4) mottles; weak, medium, platy structure; very friable to loose; few roots; pH 6.8; abrupt, wavy boundary.

Bt—47 to 51½ inches, yellowish-red (5YR 4/6) fine sandy loam; weak, fine and medium, subangular blocky structure; friable when moist, hard when dry; few roots; few fine pebbles; old root channels filled with material from the A2 horizon immediately above; pH 6.3; clear, irregular boundary.

A2—51½ to 53 inches, light yellowish-brown (10YR 6/4) sand with few, fine, faint, yellowish-brown (10YR 5/4) mottles; single grain; loose; few roots; pH 6.5; abrupt, wavy boundary.

Bt—53 to 56 inches, yellowish-red (5YR 4/6) loamy fine sand; weak, medium, subangular blocky structure; friable when moist, hard when dry; few roots; pH 6.4; clear, wavy boundary.

A2—56 to 59 inches, pale-brown (10YR 6/3) fine sand with few, fine, distinct, yellowish-brown (10YR 5/6) mottles; single grain; loose; no roots; pH 6.4; abrupt, wavy boundary.

Bt—59 to 60 inches, yellowish-red (5YR 4/6) loamy fine sand; very weak, medium, subangular blocky structure; very friable to loose; no roots; pH 6.0; clear, irregular boundary.

A2—60 to 70 inches, pale-brown (10YR 6/3) sand with many, medium, distinct, brownish-yellow (10YR 6/6) mottles; single grain; loose; no roots; pH 6.4; abrupt, wavy boundary.

Bt—70 to 74 inches, yellowish-red (5YR 4/6) fine sandy loam; weak, medium, subangular blocky structure; friable; no roots; pH 5.6; clear, wavy boundary.

IIC1—74 to 78½ inches, pale-brown (10YR 6/3) fine sandy loam with many, medium, distinct, reddish-yellow (7.5YR 6/8) and strong-brown (7.5YR 5/8) mottles; massive; very friable; many fine pebbles; pH 5.7; diffuse, irregular boundary.

IIC2—78½ to 106 inches, dark grayish-brown (10YR 4/2) fine sandy loam with many, medium, distinct, yellowish-brown (10YR 5/6) and 5/8) mottles; massive; very friable; no roots; pH 6.9.

IIC3—106 to 112 inches, dark-brown (10YR 4/3) fine sandy loam with many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very friable; no roots; calcareous outwash.

Humic Gley soils

Humic Gley soils are poorly drained or very poorly drained and occur in nearly level areas or depressions. They have a periodically high water table. The natural vegetation on these soils was predominantly swamp forest.

These soils have a thick, dark surface layer over a drab, mottled subsoil, which is gleyed. The drab colors and mottled patterns are the result of poor drainage. The amount of organic matter in the surface layer is moderately high to high. The A1 horizon is normally thicker than that of the associated Gray-Brown Podzolic soils.

Leaching of bases has been restricted in the Humic Gley soils because of poor drainage. The depth to carbonates, however, is generally greater than in the associated soils that are better drained. This condition is reflected in the slightly acid to mildly alkaline reaction of the soils. For the most part the surface layer is slightly acid to neutral, and the deeper horizons are neutral to mildly alkaline. The percentage of base saturation is high, and it increases with increasing depth. Most Humic Gley soils have a base saturation of more than 70 percent in the surface layer; the base saturation is as low as 50 percent in only a few soils. The exchange capacity of the Humic Gley soils is also generally higher than that of the associated Gray-Brown Podzolic soils (*12*).

In this county two groups of Humic Gley soils can be distinguished on the basis of translocation of clay within the profile. One group has an evident accumulation of clay in the B horizon, or a textural B horizon, and the other does not. These two groups are described separately.

Humic Gley soils that have a textural B horizon.—In this county the Humic Gley soils that have an accumulation of clay in the B horizon are those of the Hoytville, Lenawee, Millgrove, Millsdale, Montgomery, Pewamo, and Toledo series.

HOYTVILLE SERIES

The Hoytville soils are the most extensive Humic Gley soils of the lake plains in the northwestern part of the county. These soils developed in calcareous clay till like that in which the Nappanee and St. Clair soils developed. The profile of a Hoytville silty clay, sample number AL–16, represents the Hoytville soils in this county.

In this profile the amount of clay is between 38 and 50 percent. The depth of carbonates ranges from 32 to 65 inches, but in most places it is about 44 inches. The surface layer is very dark gray or very dark grayish brown. The B horizon has weak textural development in terms of clay accumulation, but the angular blocky structure is strongly developed.

Profile of a Hoytville silty clay in a cultivated field where the slope is 0 to 2 percent. (AL-16; Marion Township, SE¼NE¼ sec. 32):

Ap—0 to 7 inches, very dark gray (10YR 3/1) silty clay; moderate, medium and coarse, angular blocky structure; firm; high in organic matter; pH 7.5; abrupt, smooth boundary.

B21g—7 to 12 inches, dark-gray (5Y 4/1) silty clay with many, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; strong, medium, angular blocky structure; very firm; pH 7.5; diffuse, wavy boundary.

B22g—12 to 22 inches, dark-gray (5Y 4/1) silty clay with common, fine, faint, dark grayish-brown (10YR 4/2) mottles; strong, fine and medium, angular blocky structure; very firm; pH 7.2; gradual, wavy boundary.

B23g—22 to 48 inches, gray (5Y 5/1) silty clay with common, medium, prominent, light olive-brown (2.5Y 5/6) mottles; moderate, fine, angular blocky structure; very firm; pH 7.3; abrupt, irregular boundary.

C1—48 to 68 inches, gray (5Y 5/1) clay with many, coarse, prominent, yellowish-brown (10YR 5/4 and 5/6) mottles; massive; compact, weakly calcareous glacial till with many small fragments of shale and limestone.

C2—68 inches +, brown (10YR 5/3) silty clay loam with few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; firm, compact glacial till; calcareous.

LENAWEE SERIES

The Lenawee soils are among the least extensive of the soils in the county. They developed in water-laid, calcareous sediment of silty clay loam or clay loam. A Lenawee silt loam, sample number AL-S1, was sampled for laboratory analysis. This soil is in the north-central part of the county near an area of outwash. The amount of clay in its B horizon is greater than that in the Ap horizon, and as a result, the texture of the B horizon is heavy silty clay loam. The pH value is fairly constant throughout the profile.

Profile of a nearly level Lenawee silt loam in a cultivated field. (AL-S1; Sugar Creek Township, NW¼NE¼ sec. 4):

Ap—0 to 9 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate, fine and medium, granular structure; very friable; abundant roots; pH 7.1; abrupt, smooth boundary.

B21gt—9 to 14 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; plentiful roots; pH 7.2; clear, smooth boundary.

B22gt—14 to 19 inches, very dark gray (N 3/0) clay loam with common, fine, distinct, dark-brown (7.5YR 4/4) mottles; moderate, medium, angular blocky structure; firm; plentiful roots; pH 7.2; gradual, wavy boundary.

B23g—19 to 41 inches, yellowish-brown (10YR 5/6) silty clay loam with common, medium, distinct, gray (10YR 5/1) mottles; weak, medium, subangular blocky structure; firm; common roots; pH 7.2; clear, smooth boundary.

C—41 to 48 inches +, yellowish-brown (10YR 5/6) clay loam with common, medium, distinct, dark-gray (10YR 4/1) mottles; weak, medium and coarse, subangular blocky structure; firm; few roots; stratified fine sand, silt, and some clay; pH 7.3; calcareous below a depth of 50 inches.

MILLGROVE SERIES

The Millgrove soils developed in gravelly and sandy outwash that contains some silt, material similar to that in which the Belmore, Haney, and Digby soils developed. A Millgrove loam, sample number AL-100, is representative of the typical Millgrove soils in this county. The sample was taken from an area of outwash in the northeastern part of the county. The surface layer is dark colored. There is a greater amount of clay in the B horizon than in the A, and therefore the texture of the B horizon is sandy clay loam and clay loam. The texture of the underlying material is gravelly loam. The pH value is neutral in the surface layer, but it increases with increasing depth. The underlying material is calcareous. Some of the Millgrove soils in this county overlie clay at a depth of 24 to 60 inches. A technical profile of a Millgrove silt loam, over clay, is also described.

Profile of a nearly level Millgrove loam in a meadow. (AL-100; Monroe Township, SW¼SE¼ sec. 12):

A1p—0 to 8 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium and coarse, granular structure; plentiful roots; a few fine pebbles; pH 7.0; clear, smooth boundary.

A12—8 to 16 inches, very dark grayish-brown (10YR 3/2) clay loam with common, medium, prominent, yellowish-brown (10YR 5/4) mottles; strong, medium, subangular blocky structure; friable; plentiful roots; numerous fine pebbles; pH 7.2; gradual, wavy boundary.

B21—16 to 22 inches, dark grayish-brown (10YR 4/2) sandy clay loam with many, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine and medium, subangular blocky structure; friable; few roots; few fine pebbles; pH 7.3; gradual, wavy boundary.

B22gt—22 to 29 inches, dark grayish-brown (10YR 4/2) sandy clay loam with few, medium, prominent, yellowish-brown (10YR 5/8) mottles; moderate, fine and medium, subangular blocky structure; friable; few roots; a few fine pebbles; pH 7.4; gradual, wavy boundary.

B23gt—29 to 36 inches, grayish-brown (10YR 5/2) clay loam with common, medium, distinct, brownish-yellow (10YR 6/6) mottles; moderate, fine and medium, subangular blocky structure; friable; few roots; many fragments of limestone as much as 5 inches in diameter; pH 7.4; gradual, wavy boundary.

IIC1—36 to 42 inches, light brownish-gray (2.5Y 6/2) fine gravelly loam with common, medium, distinct, olive-yellow (2.5Y 6/6) mottles; massive; very friable; many fragments of limestone as much as 6 inches in diameter; calcareous; gradual, wavy boundary.

IIC2—42 to 48 inches, brown (10YR 5/3) gravelly loam; massive; loose; calcareous; diffuse, irregular boundary.

IIC3—48 to 54 inches; light-gray (10YR 7/2) fine gravelly loam; single grain; loose; calcareous.

Profile of a nearly level Millgrove silt loam, over clay, in a cultivated field. (Field description; Sugar Creek Township, NE¼SW¼ sec. 29):

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam; moderate, fine and medium, granular structure; friable; neutral; abrupt, smooth boundary.

B21g—9 to 24 inches, dark grayish-brown (2.5Y 4/2) clay loam with common, medium, distinct, dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; firm; a few fine pebbles; neutral to slightly acid; gradual, wavy boundary.

B22gt—24 to 36 inches, grayish-brown (2.5Y 5/2) sandy clay loam with common, medium, prominent, yellowish-brown (10YR 5/6 and 5/8) mottles; weak, moderate, fine and medium, subangular blocky structure; friable; considerable fine gravel; neutral; abrupt, wavy boundary.

IIC—36 to 42 inches +, grayish-brown (10YR 5/2) clay till with many, medium, prominent, yellowish-brown (10YR 5/6 and 5/8) and dark yellowish-brown (10YR 4/4) mottles; massive; very firm; calcareous glacial till.

MILLSDALE SERIES

The Millsdale soils in this county are on first bottoms, where they are associated with the Sloan and Wabash soils. They are underlain by limestone bedrock at a depth of 20 to 42 inches. The Millsdale soils were not sampled for laboratory analysis, but field descriptions and observations indicate that the surface layer is predominantly silty clay loam and that the B horizon is clay or silty clay. The surface layer is generally very dark brown or very dark gray. The structure of the B horizon is generally strong, subangular blocky. The pH value is slightly acid to neutral throughout the profile.

Profile of a nearly level Millsdale silty clay loam in permanent pasture. (Field description; Richland Township, NE¼SE¼ sec. 12):

Ap—0 to 9 inches, very dark brown (10YR 2/2) silty clay loam; strong, fine and medium, subangular blocky structure; friable; slightly acid; abrupt, smooth boundary.

B21gt—9 to 20 inches, very dark gray (10YR 3/1) silty clay with few, fine, faint, dark-brown (10YR 4/3) mottles; strong medium and coarse, subangular blocky structure; very firm; neutral; diffuse, irregular boundary.

B22gt—20 to 32 inches, dark-gray (10YR 4/1) silty clay with common, medium, distinct, dark-brown (10YR 4/3) and yellowish-brown (10YR 5/6) mottles; moderate, medium and coarse, subangular blocky structure; very firm; neutral; abrupt, wavy boundary.

R—32 inches +, limestone bedrock.

MONTGOMERY SERIES

A Montgomery silty clay, sample number AL–118, was sampled in the south-central part of the county in a fairly large depression. It was in an area near outwash along the Auglaize River and the St. Johns end moraine. The increase in the content of clay in the upper part of the B horizon can be attributed to the clay films on the faces of the peds. The frequency and prominence of these clay films decreases with increasing depth. Outwash material or clay loam till commonly occurs below a depth of 60 inches. The structural development is strong or moderate throughout the profile. The pH value is neutral to mildly alkaline.

Profile of a nearly level Montgomery silty clay in a cultivated field. (AL–118; Perry Township, SW¼SE¼ sec. 35):

Ap—0 to 7 inches, very dark grayish-brown (10YR 3/2) silty clay; moderate, medium and coarse, granular structure grading to fine and medium, subangular blocky structure in the lower part of the horizon; friable; abundant roots; pH 7.2; abrupt, smooth boundary.

B21gt—7 to 14 inches, very dark-gray (10YR 3/1) clay with common, fine and medium, distinct, dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) mottles; strong, medium, subangular blocky structure; very firm; many roots; thick clay films on the faces of all peds; pH 7.4; clear, wavy boundary.

B22gt—14 to 20 inches, very dark gray (10YR 3/1) clay with few, fine, distinct dark grayish-brown (10YR 4/2) and dark yellowish-brown (10YR 4/4) mottles; moderate, fine and medium, subangular blocky structure; very firm; common roots; medium clay films on the faces of all peds; pH 7.4; clear, smooth boundary.

B23gt—20 to 27 inches, gray (10YR 5/1) silty clay with few fine, distinct, yellowish-brown (10YR 5/6 and 5/8) mottles; weak, fine and medium, prismatic structure in place and breaks to moderate, medium and coarse, subangular blocky when disturbed; plastic when wet; few roots; variable, medium, thin clay films; pH 7.6; gradual, irregular boundary.

B24gt—27 to 40 inches, gray (10YR 5/1) silty clay with common, medium, distinct, yellowish-brown (10YR 5/4, 5/6, and 5/8) mottles; weak, medium, prismatic structure in place and breaks to moderate, fine and medium, subangular blocky; plastic when wet; few roots; clay films decrease in number with increasing depth and tend to be confined to vertical, prismatic surfaces; pH 7.5; gradual, irregular boundary.

B25gt—40 to 60 inches, gray (10YR 5/1) silty clay with many, medium, distinct, yellowish-brown (10YR 5/6 and 5/8) and brownish-yellow (10YR 6/6) mottles; moderate and strong, fine, medium and coarse, subangular blocky structure; plastic when wet; pH 7.5; abrupt, wavy boundary.

IIC—60 to 66 inches +, calcareous fine sandy loam with fine gravel and considerable silt and clay; saturated at time of sampling; sufficient head of water to fill pit within 2 feet of ground surface.

PEWAMO SERIES

The Pewamo soils are fairly extensive in this county. They developed in moderately fine textured till, the same kind of material in which the Morley and Blount soils developed. The Pewamo soils are on the depressed flats of the till plain and in the drainageways of morainic areas in the uplands. They overlie calcareous clay loam or silty loam till. The profiles described for two Pewamo silty clay loams, sample numbers AL–22 and AL–26, are representative of the Pewamo soils in this county. Depth to carbonates is generally about 50 inches, but it ranges from 30 to 60 inches. The maximum content of clay in the B horizons is generally less than 50 percent. The content of clay in the underlying material is normally 31 to 36 percent. Strong and moderate, subangular and angular blocky structure is evident in the B horizons. The pH value is in the neutral or mildly alkaline range throughout the profile.

Profile of a nearly level Pewamo silty clay loam in a meadow. (AL–22; Spencer Township, NE¼SE¼ sec. 34):

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine and medium, subangular blocky structure; firm; high content of organic matter; pH 7.2; abrupt, smooth boundary.

B21gt—8 to 12 inches, dark-gray (10YR 4/1) silty clay with many, fine, distinct, brown (10YR 4/3) and yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; very firm; pH 7.1; diffuse, wavy boundary.

B22gt—12 to 28 inches, dark-gray (5Y 4/1) silty clay with many, fine, prominent, reddish-brown (5YR 4/3) and yellowish-brown (10YR 5/6) mottles; strong, fine and medium, subangular blocky structure; very firm; pH 7.1; gradual, wavy boundary.

B23gt—28 to 54 inches, gray (5Y 5/1) silty clay with many, fine and medium, prominent, grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/8) mottles; moderate, fine, medium, and coarse, subangular blocky structure; very firm; pH 7.4; clear, irregular boundary.

C1—54 to 66 inches, light-gray (5Y 6/1) silty clay loam glacial till with many, medium, prominent, dark yellowish-brown (10YR 4/4) and brown (10YR 5/3) mottles; weak, medium, subangular blocky structure; very firm; numerous small fragments of black shale; calcareous; diffuse, irregular boundary.

C2—66 to 80 inches, brown (10YR 4/3) silty clay loam glacial till; very firm and compact; massive; numerous small fragments of shale and limestone with an occasional granite pebble; calcareous.

Profile of a nearly level Pewamo silty clay loam in a cultivated field. (AL–26; Spencer Township, SW¼ NW¼ sec. 10):

Ap—0 to 8 inches, black (10YR 2/1) silty clay loam; moderate, fine and medium, subangular blocky structure; friable; pH 7.3; abrupt, smooth boundary.

A12—8 to 10 inches, black (10YR 2/1) silty clay loam; strong, medium, subangular blocky structure; firm; pH 7.2; clear, smooth boundary.

B21gt—10 to 16 inches, dark-gray (5Y 4/1) silty clay with common, fine and medium, prominent, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; moderate, coarse, prismatic structure in place, and breaks to strong, fine, subangular blocky when disturbed; very firm; pH 7.3; gradual, wavy boundary.

B22gt—16 to 32 inches, gray (5Y 5/1) silty clay with common, medium, distinct, yellowish-brown (10YR 5/6) mottles; strong, fine and medium, angular blocky structure; very firm; pH 7.3; gradual, wavy boundary.

B23gt—32 to 50 inches, grayish-brown (10YR 5/2) silty clay with common, medium, prominent, yellowish-brown (10YR 5/8) mottles; moderate, fine and medium, angular blocky structure; very firm; pH 7.3; clear, wavy boundary.

C1—50 to 70 inches, gray (10YR 5/1) silty clay loam with many, medium, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4 and 5/6) mottles; massive; calcareous glacial till; very firm and compact; diffuse, smooth boundary.

C2—70 to 75 inches, compact silty clay loam glacial till; massive; calcareous.

TOLEDO SERIES

The Toledo soils are not extensive in this county. Field observations show that these soils are typical Humic Gley soils that have a weak, textural B horizon. There is some question as to whether or not the amount of clay in the B horizon should be considered great enough for a textural B horizon. In most profiles some very thin, patchy clay films seem to indicate a slight translocation of clay. In some profiles the increase in clay could be attributed to stratification. The clay films on the surfaces of peds are not so evident as those in the B horizon of the Montgomery soils. The pH value in all the horizons above the C horizon is slightly acid to mildly alkaline. The soil structure in the B horizon of the Toledo soils is commonly weak or moderate.

Profile of a Toledo silty clay loam in a cultivated field where the slope is 0 to 2 percent. (Field description; Sugar Creek Township, SE¼NW¼ sec. 21):

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay loam; weak, medium, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

B21g—8 to 14 inches, very dark gray (10YR 3/1) silty clay with common, medium, prominent, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; very firm; plentiful roots; neutral; gradual, smooth boundary.

B22g—14 to 22 inches, gray (10YR 5/1) silty clay with many medium, prominent, yellowish-brown (10YR 5/8) mottles; moderate, medium, subangular blocky structure; very firm; abundant roots; neutral; gradual, wavy boundary.

B23g—22 to 42 inches, gray (10YR 6/1) silty clay with common, medium, prominent, reddish-brown (5YR 4/4) and yellowish-brown (10YR 5/6 and 5/8) mottles; moderate, medium and coarse, prismatic structure that breaks to moderate, medium, subangular blocky structure; very firm; neutral; clear, irregular boundary.

C—42 to 50 inches, light brownish-gray (10YR 6/2) silty clay with common, medium, prominent, brownish-yellow (10YR 6/6) and yellowish-brown (10YR 5/6) mottles; massive; very firm; stratified lacustrine clay and silt; calcareous.

Humic Gley soils that lack a textural B horizon.—In this county the Humic Gley soils that do not have an accumulation of clay in the B horizon are the Colwood, Sloan, and Wabash. None of these soils was sampled for laboratory analysis in Allen County, but a representative technical field description is given for a profile of each series.

COLWOOD SERIES

The Colwood soils are among the least extensive soils in the county. They are very poorly drained Humic Gley soils that overlie calcareous, waterlaid, stratified silt, very fine sand, and fine sand. These soils developed in the same kind of material as the Tuscola and the Kibbie soils. Field descriptions and observations indicate that carbonates normally occur at a depth of about 40 inches, but in some places the depth is as great as 60 inches. The surface layer is loam or silt loam, and the B horizon is loam, very fine sandy loam, and, in some places, sandy clay loam. The Colwood soils have weak structural development in the B horizon. The soil profile and underlying material show evidence of varying degrees of stratification. The pH value is neutral throughout the solum.

Profile of a Colwood silt loam in a cultivated field where the slope is 0 to 2 percent. (Field description; Sugar Creek Township, NW¼NE¼ sec. 33):

Ap—0 to 9 inches, very dark gray (10YR 3/1) silt loam; moderate, medium, granular structure; friable; abundant roots; slightly acid; abrupt, smooth boundary.

B21g—9 to 20 inches, dark grayish-brown (10YR 4/2) loam with common, medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine and medium, subangular blocky structure; friable; abundant roots; neutral; clear, wavy boundary.

B22g—20 to 40 inches, light brownish-gray (10YR 6/2) sandy clay loam with few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; friable; plentiful roots; neutral; gradual, irregular boundary.

IIC—40 to 50 inches +, gray (10YR 5/1) stratified fine sand and very fine sand and silt with thin lenses of clay; few, fine, distinct, brownish-yellow (10YR 6/6) and light yellowish-brown (10YR 6/4) mottles; friable; calcareous.

SLOAN SERIES

In the past the Sloan soils were considered to be Alluvial soils with a dark-colored surface layer and a deep, gleyed profile. They are now classified as Humic Gley soils because the surface layer is dark and is high in content of organic matter. Field observations show considerable variation in the texture of the profile, which is probably a result of stratification. These soils have weak to moderate development of structure. The pH value in all horizons is neutral to mildly alkaline.

Profile of a Sloan silty clay loam in a cultivated field where the slope is 0 to 2 percent. (Field description; Shawnee Township, SW¼SW¼ sec. 3):

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay loam; moderate, fine, granular structure; friable; neutral; abrupt, smooth boundary.

C1g—9 to 20 inches, dark-gray (5Y 4/1) silty clay loam with many, fine, distinct, dark grayish-brown (10YR 4/2) mottles; weak, medium, blocky structure; firm; neutral; diffuse, wavy boundary.

C2g—20 to 40 inches, dark-gray (5Y 4/1) silty clay loam with common, medium, prominent, light olive-brown (2.5Y 5/6) mottles; weak, fine, subangular blocky structure; firm; neutral.

WABASH SERIES

Like the Sloan soils, the Wabash soils were previously considered to be Alluvial soils with a dark-colored surface layer and a deep, gleyed profile. The Wabash soils formed in fine-textured alluvium of the first bottoms. They are generally in abandoned stream channels, in old oxbows, and along the lowest parts of the flood plains, where the floodwaters have been most sluggish. The surface layer is mainly silty clay, and little change in texture is evident throughout the profile. The pH value is neutral to mildly alkaline. The structural development in all horizons is weak.

Profile of a nearly level Wabash silty clay in an idle area. (Field description; Marion Township, SW¼ NE¼ sec. 21):

Ap—0 to 9 inches, very dark gray (10YR 3/1) silty clay; moderate, fine, subangular blocky structure; firm; neutral; abrupt, smooth boundary.

C1g—9 to 16 inches, dark-gray (10YR 4/1) silty clay with many, fine, faint, brown (10YR 4/3) mottles; weak, medium, subangular blocky structure; very firm; neutral; diffuse, wavy boundary.

C2g—16 to 28 inches, dark-gray (5Y 4/1) silty clay with many, fine, prominent, reddish-brown (5YR 4/3) and yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; very firm; neutral; diffuse, wavy boundary.

C3g—28 to 45 inches, gray (5Y 5/1) silty clay with many, fine and medium, prominent, grayish-brown (2.5Y 5/2) and yellowish-brown (10YR 5/8) mottles; weak, medium, subangular blocky structure; very firm; neutral.

Alluvial soils

Alluvial soils developed in recently deposited alluvium, and most of them receive additional deposits when the streams overflow. Little or no modification of the alluvium has taken place through the processes of soil formation. These soils generally lack discernible horizons, although some have a weakly developed A1 or Ap horizon, caused by a slight accumulation of organic matter. Some Alluvial soils are mottled in the lower part of their profile, which shows that they are moderately well drained or somewhat poorly drained. Otherwise, they have been changed but little. Although there is a fairly large acreage of Alluvial soils along many of the small tributaries, the principal acreage is along the Auglaize and Ottawa Rivers and along Sugar and Riley Creeks. The well drained and moderately well drained Alluvial soils are mainly along the Auglaize and Ottawa Rivers. The Alluvial soils in this county are those of the Eel, Genesee, and Shoals series.

EEL SERIES

The Eel soils are well drained and moderately well drained Alluvial soils that are mottled below a depth of 18 to 24 inches. No sample was taken for laboratory analysis, but a technical description of a representative profile is given.

Profile of a nearly level Eel silt loam in a cultivated field. (Field description; Shawnee Township, NE¼ SW¼ sec. 4):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine and medium, subangular blocky structure; friable; pH 7.0; abrupt, smooth boundary.

C1—8 to 19 inches, dark-brown (10YR 3/3) silt loam; strong, medium and fine, subangular blocky structure; friable; pH 7.0; gradual, wavy boundary.

C2—19 to 24 inches, dark-brown (10YR 3/3) silt loam; moderate, medium and fine, subangular blocky structure; friable; pH 6.1; diffuse, wavy boundary.

C3—24 to 30 inches, dark-brown (10YR 3/3) silt loam with few, fine, faint, dark-gray (10YR 4/1) mottles: moderate, medium, subangular blocky structure; friable; pH 6.2; gradual, irregular boundary.

C4g—30 to 46 inches +, dark-brown (10YR 4/3) silt loam with few, medium, faint, gray (10YR 5/1) mottles; weak, fine and very fine, subangular blocky structure; friable; pH 6.1.

GENESEE SERIES

The Genesee soils are well drained and moderately well drained Alluvial soils that lack horizon differentiation. The Genesee series is represented by a profile of a Genesee silty clay loam, sample number AL–113, an inclusion in the mapping unit of Genesee silt loam. The silty clay loam texture of the surface layer is probably a result of recent deposition.

Profile of a nearly level Genesee silty clay loam on the first bottom in a cultivated field. (AL–113; Amanda Township, NE¼NW¼ sec. 32):

Ap—0 to 8 inches, dark-brown (10YR 4/3) silty clay loam; moderate, medium and fine, granular structure; friable; pH 6.8; abrupt, smooth boundary.

C1—8 to 14 inches, dark-brown (10YR 4/3) clay loam; moderate, fine and very fine, subangular blocky structure; friable; pH 6.7; gradual, wavy boundary.

C2—14 to 20 inches, dark-brown (10YR 4/3) loam; weak, fine and very fine, subangular blocky structure; friable; pH 6.7; gradual, wavy boundary.

C3—20 to 28 inches, dark-brown (10YR 4/3) loam; very weak, very fine, subangular blocky structure; friable; pH 6.6; diffuse, wavy boundary.

C4—28 to 36 inches, dark-brown (10YR 4/3) loam; massive; friable; pH 6.6; gradual, wavy boundary.

C5—36 to 46 inches, dark-brown (10YR 4/3) loam with few, fine, faint, gray (10YR 5/1) mottles; massive; friable; pH 6.7; diffuse, wavy boundary.

C6—46 to 54 inches +, dark-brown (10YR 4/3) clay loam with common, fine, faint, gray (10YR 5/1) mottles; massive; firm; pH 6.7.

SHOALS SERIES

The Shoals soils are somewhat poorly drained Alluvial soils. Variations in texture within the profile reflect the stratification of the alluvial material. Mottling begins just below the surface layer. No sample was taken for laboratory analysis, but a technical description of a representative profile is given.

Profile of a Shoals silt loam in a cultivated field where the slope is 0 to 2 percent. (Field description; Shawnee Township, NE¼NW¼ sec. 4):

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable, neutral; abrupt, smooth boundary.

C1—8 to 14 inches, dark grayish-brown (10YR 4/2) silt loam with common, medium, faint, dark-gray (10YR 4/1) mottles; moderate, fine, subangular blocky structure; friable; neutral; gradual, wavy boundary.

C2g—14 to 24 inches, dark-gray (10YR 4/1) silt loam with common, fine, distinct, yellowish-brown (10YR 5/4) mottles; moderate, medium, subangular blocky structure; friable; neutral; clear, wavy boundary.

C3g—24 to 40 inches +, gray (10YR 5/1) silty clay loam with many, medium, distinct, dark-brown (10YR 4/3) mottles; weak, fine, subangular blocky structure; firm; neutral.

Bog soils

The Bog soils developed in a humid or subhumid climate, under swamp or marsh vegetation. They occur in depressions and were ponded or covered with water during their development. The very poor drainage favors the accumulation of organic material.

LINWOOD SERIES

The Linwood soils are the only Bog soils in Allen County. They developed in organic material, 12 to 42 inches thick, over mineral material having fine sandy loam to light silty clay loam texture. The sample of Linwood muck, sample number AL–99, was taken from an area of outwash near the Auglaize River and the St. Johns moraine.

Profile of a nearly level Linwood muck that is idle. (AL–99; Auglaize Township, SE¼NW¼ sec. 20):

O1—0 to 8 inches, black (5YR 2/1) muck, moderate, fine and medium, granular structure; very friable; roots abundant; pH 7.4; diffuse, irregular bundary.

TABLE 7.—*Laboratory data*

[Absence of figure indicates

Soil, sample number, and location	Horizon	Depth	Particle-size distribution: Very coarse sand (2.0–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*
Belmore sandy loam; AL–97: Monroe Township; NW¼SE¼ sec. 12.	Ap	0–11	7. 1	11. 1	14. 2	22. 6
	B1	11–18	7. 6	11. 1	15. 0	21. 0
	B21	18–26	10. 4	12. 4	16. 6	15. 3
	B22t	26–30	14. 7	12. 4	6. 8	8. 5
	B23t	30–36	14. 4	24. 1	5. 9	6. 9
	B24t	36–41	22. 1	17. 1	2. 9	3. 5
	IIC1	41–47	38. 1	23. 0	3. 1	3. 1
	IIC2	47–53	47. 2	24. 6	3. 1	1. 5
Blount silt loam; AL–S8: Amanda Township; SW¼SW¼ sec. 14.	Ap	0–10	1. 2	3. 6	4. 2	7. 3
	A2	10–11	1. 8	3. 5	3. 7	7. 1
	B21t	11–17	2. 1	3. 9	4. 7	8. 4
	B22t	17–25	1. 3	2. 3	2. 9	5. 2
	C1	25–38	2. 0	3. 0	2. 8	4. 9
	C2	38–48	4. 2	4. 9	3. 8	6. 3
Casco silt loam; AL–96: Auglaize Township; SE¼SE¼ sec. 17.	Ap	0–5	2. 8	5. 0	4. 7	6. 8
	B21t	5–12	2. 4	3. 7	3. 4	5. 2
	B22t	12–18	3. 9	4. 4	2. 9	4. 0
	B23t	18–23	10. 4	8. 0	2. 5	4. 8
	IIC	23–29	43. 0	19. 3	2. 4	2. 3
Digby loam; AL–S10: Monroe Township; SW¼SE¼ sec. 11.	Ap	0–9	5. 2	9. 6	9. 9	9. 6
	B21t	9–17	6. 0	8. 7	6. 6	6. 5
	B22t	17–22	12. 9	20. 1	8. 4	5. 4
	B23t	22–35	15. 5	18. 1	8. 1	3. 8
	IIC	35–60	4. 8	19. 3	48. 8	9. 7
Fox fine sandy loam; AL–98: Auglaize Township; NW¼NW¼ sec. 21.	Ap	0–8	1. 1	7. 0	15. 3	21. 2
	B1	8–11	. 8	7. 2	15. 2	19. 9
	B21t	11–17	. 7	7. 8	16. 1	12. 1
	B22t	17–22	1. 2	6. 8	15. 5	21. 8
	B23t	22–27	1. 8	7. 6	14. 5	20. 3
	B24t	27–35	7. 5	12. 0	9. 1	6. 9
	IIC1	35–40	25. 7	30. 9	11. 2	3. 2
	IIC2	40–46	32. 0	35. 3	9. 1	3. 2
Genesee silty clay loam; AL–113: Amanda Township; NE¼NW¼ sec. 32.	Ap	0–8	. 4	. 2	. 7	6. 6
	C1	8–14		. 1	1. 1	15. 2
	C2	14–20		. 1	1. 7	18. 6
	C3	20–28		. 2	3. 0	20. 6
	C4	28–36	. 1	. 3	4. 4	24. 3
	C5	36–46		. 2	1. 4	19. 7
	C6	46–54	. 1	. 1	1. 0	14. 6

O2—8 to 16 inches, black (5YR 2/1) muck; moderate, medium and coarse, granular structure; very friable; roots abundant; pH 6.9; abrupt, smooth boundary.

IIC1—16 to 20 inches, light-gray (N 6/0) silty clay loam with many, fine, prominent, light olive-brown (2.5Y 5/6) mottles; massive; firm; roots plentiful; few small pebbles; numerous fresh-water shells; tongues extend as far as 1 foot into the underlying horizon; pH 7.4; abrupt, irregular boundary.

IIC2—20 to 26 inches, dark-gray (10YR 4/1) fine sandy loam with many, fine, distinct, light olive-brown (2.5Y 5/4) mottles; massive; loose; roots plentiful; few pebbles as much as one-half inch in diameter; old crayfish holes filled with very dark brown (10YR 2/2) organic material from above; calcareous; clear, wavy boundary.

IIC3—26 to 30 inches, gray (N 5/0) fine sandy loam with many, medium, distinct, very dark gray (N 3/0) mottles; olive-brown (2.5Y 4/4) stains along old root channels; weak, medium and coarse, subangular blocky structure; friable; roots plentiful; few small pebbles; calcareous; gradual, wavy boundary.

Laboratory Determinations

Table 7 gives the results of laboratory tests for several soil types in Allen County. The profiles represent 19 major series in the county.

for several soil profiles

that data were not available]

Particle-size distribution—Continued					Textural class	Calcium carbonate ($CaCO_3$) equivalent	pH value	Organic matter
Very fine sand (0.1–0.05 mm.)	Total sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	Fine clay (<0.0002 mm.)				
Percent	*Percent*	*Percent*	*Percent*	*Percent*		*Percent*		*Percent*
8. 6	63. 6	27. 3	9. 1	1. 5	Sandy loam	----------	5. 3	2. 1
7. 3	62. 0	27. 4	10. 6	3. 0	Sandy loam	----------	5. 8	. 6
4. 8	59. 5	21. 0	19. 5	7. 8	Sandy loam	----------	6. 0	. 6
4. 0	46. 4	22. 8	30. 8	13. 5	Sandy clay loam	----------	6. 2	----------
2. 8	54. 1	14. 6	31. 3	15. 7	Sandy clay loam	----------	6. 3	----------
2. 2	47. 8	14. 6	37. 6	19. 6	Sandy clay	----------	6. 6	----------
3. 3	70. 6	22. 2	7. 2	1. 2	Coarse sandy loam	33. 7	7. 7	----------
2. 0	78. 4	16. 3	5. 3	1. 1	Coarse loamy sand	32. 9	7. 7	----------
7. 5	23. 8	56. 7	19. 5	6. 0	Silt loam	----------	6. 6	2. 9
7. 9	24. 0	48. 9	27. 1	7. 4	Clay loam	----------	5. 2	1. 0
8. 3	27. 4	35. 1	37. 5	17. 5	Clay loam	----------	4. 9	. 7
5. 7	17. 4	35. 8	46. 8	17. 8	Clay	----------	6. 2	1. 1
5. 4	18. 1	43. 1	38. 8	10. 3	Silty clay loam	19. 9	7. 9	----------
6. 2	25. 4	40. 9	33. 7	9. 2	Clay loam	23. 7	7. 9	----------
4. 9	24. 2	52. 3	23. 5	7. 2	Silt loam	----------	6. 2	2. 9
4. 4	19. 1	52. 0	28. 9	10. 2	Silty clay loam	----------	5. 8	1. 5
3. 2	18. 4	35. 6	46. 0	26. 3	Clay	----------	6. 3	1. 2
8. 5	34. 2	37. 9	27. 9	13. 8	Clay loam	30. 9	7. 4	----------
2. 8	69. 8	17. 5	12. 7	5. 4	Coarse sandy loam	46. 4	7. 7	----------
6. 6	40. 9	43. 8	15. 3	4. 9	Loam	----------	6. 1	3. 2
4. 1	31. 9	36. 2	31. 9	14. 2	Clay loam	----------	5. 0	1. 1
3. 7	50. 5	15. 2	34. 3	19. 9	Sandy clay loam	----------	5. 4	1. 0
3. 1	48. 6	19. 8	31. 6	17. 3	Sandy clay loam	----------	5. 9	1. 1
2. 5	85. 1	8. 0	6. 9	2. 5	Loamy sand	----------	7. 0	----------
8. 0	52. 6	34. 1	13. 3	2. 3	Fine sandy loam	----------	6. 2	1. 9
5. 6	48. 7	31. 0	20. 3	7. 4	Loam	----------	6. 1	. 7
14. 6	51. 3	22. 5	26. 2	12. 8	Sandy clay loam	----------	5. 8	. 6
7. 4	52. 7	14. 7	32. 6	20. 4	Sandy clay loam	----------	6. 0	. 6
7. 2	51. 4	13. 6	35. 0	24. 8	Sandy clay loam	----------	5. 8	. 6
3. 1	38. 6	15. 4	46. 0	27. 5	Clay	----------	6. 1	----------
2. 3	73. 3	18. 6	8. 1	2. 7	Coarse sandy loam	44. 3	7. 7	----------
1. 8	81. 4	12. 0	6. 6	1. 8	Coarse loamy sand	61. 0	7. 8	----------
8. 2	16. 1	50. 1	33. 8	7. 9	Silty clay loam	----------	6. 8	2. 9
17. 8	33. 2	37. 2	29. 6	9. 8	Clay loam	----------	6. 7	. 8
17. 2	37. 6	35. 7	26. 7	10. 2	Loam	----------	6. 7	1. 2
15. 2	39. 0	35. 0	26. 0	9. 8	Loam	----------	6. 6	1. 0
13. 6	42. 7	32. 0	25. 3	9. 0	Loam	----------	6. 6	----------
16. 5	37. 8	35. 2	27. 0	8. 8	Loam	----------	6. 7	----------
12. 9	28. 7	39. 5	31. 8	10. 3	Clay loam	----------	6. 7	----------

TABLE 7.—*Laboratory data*

Soil, sample number, and location	Horizon	Depth	Particle-size distribution: Very coarse sand (2.0–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*
Haskins loam; AL–115: Monroe Township; NE¼SW¼ sec. 9.	Ap	0–8	3. 3	9. 0	11. 0	17. 0
	B1	8–11	2. 8	9. 6	11. 6	12. 4
	B21g	11–14	2. 3	9. 4	10. 4	11. 5
	B22gt	14–17	11. 9	18. 2	12. 8	7. 2
	B23gt	17–22	12. 7	19. 7	12. 6	13. 5
	B24gt	22–27	1. 3	4. 4	9. 8	29. 7
	IIB25gt	27–31	1. 7	12. 4	27. 4	16. 5
	IIIC	31–49	1. 5	4. 1	4. 3	6. 6
Hoytville silty clay; AL–16: Marion Township; SE¼NE¼ sec. 32.	Ap	0–7	. 5	1. 0	2. 3	5. 0
	B21g	7–12	. 3	1. 0	1. 9	4. 3
	B22g	12–22	. 2	. 8	1. 7	3. 7
	B23g	22–48	. 6	1. 0	1. 8	3. 8
	C1	48–68	. 9	1. 9	2. 8	4. 9
	C2	68–74+	1. 6	2. 5	3. 2	5. 2
Kibbie silt loam; AL–89: Sugar Creek Township; SE¼SE¼ sec. 29.	Ap	0–6	----	----	----	----
	A2	6–10	----	----	----	----
	B21g	10–15	----	----	----	----
	B22g	15–21	----	----	----	----
	B23g	21–29	----	----	----	----
	B24g	29–35	----	----	----	----
	C1	35–41	----	----	----	----
	C2	41–46	----	----	----	----
	C3	46–52	----	----	----	----
Lenawee silt loam; AL–S1: Sugar Creek Township; NW¼NE¼ sec. 4.	Ap	0–9	----	----	----	----
	B21gt	9–14	----	----	----	----
	B22gt	14–19	----	----	----	----
	B23g	19–41	----	----	----	----
	C	41–48	----	----	----	----
Linwood muck; AL–99: Auglaize Township; SE¼NW¼ sec. 20.	O1	0–8	6. 9	17. 1	9. 2	6. 8
	O2	8–16	32. 4	12. 4	3. 8	2. 9
	IIC1	16–20	2. 5	1. 5	1. 3	3. 0
	IIC2	20–26	5. 8	7. 9	9. 4	26. 6
	IIC3	26–30	3. 5	5. 6	6. 8	20. 7
Millgrove loam; AL–50: Shawnee Township; SE¼SE¼ sec. 17.	Ap	0–8	----	----	----	----
	A12	8–13	----	----	----	----
	B21g	13–25	----	----	----	----
	B22g	25–36	----	----	----	----
	B23g	36–54	----	----	----	----
	C	54–84	----	----	----	----
Montgomery silty clay; AL–118: Perry Township; SW¼SE¼ sec. 35.	Ap	0–7	3. 9	1. 4	1. 6	3. 5
	B21gt	7–14	1. 0	2. 3	2. 2	4. 8
	B22gt	14–20	. 9	2. 3	2. 8	6. 5
	B23gt	20–27	. 5	1. 4	1. 9	4. 0
	B24gt	27–40	. 3	1. 1	1. 3	4. 5
	B25gt	40–60	. 4	. 7	. 8	2. 3
	IIC	60–66	2. 7	5. 8	6. 9	24. 0
Morley silt loam; AL–93: Jackson Township; NE¼NE¼ sec. 13.	Ap	0–6	1. 1	2. 6	6. 8	7. 4
	B21t	6–11	1. 3	2. 3	1. 3	6. 2
	B22t	11–16	1. 3	2. 3	1. 3	6. 2
	B23t	16–21	1. 4	2. 6	1. 3	7. 0
	C	21–27	2. 1	3. 4	3. 6	6. 9
Morley loam; AL–121: Auglaize Township; SW¼NW¼ sec. 8.	Ap	0–6	3. 0	4. 2	4. 3	10. 8
	B1	6–8	2. 1	2. 8	2. 7	7. 0
	B21t	8–10	1. 5	2. 9	2. 7	7. 0
	B22t	10–13	1. 4	2. 7	2. 3	6. 3
	B23t	13–20	1. 9	3. 9	3. 0	7. 3
	B24t	20–24	2. 2	4. 0	3. 2	8. 2
	C1	24–28	2. 4	4. 5	3. 6	9. 0
	C2	28–32	2. 6	5. 1	3. 7	8. 7
	C3	32–38	4. 2	4. 3	3. 0	7. 9
	C4	38–44	3. 2	4. 4	3. 3	8. 1

for several soil profiles—Continued

Particle-size distribution—Continued					Textural class	Calcium carbonate ($CaCO_3$) equivalent	pH value	Organic matter
Very fine sand (0.1–0.05 mm.)	Total sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	Fine clay (<0.0002 mm.)				
Percent	*Percent*	*Percent*	*Percent*	*Percent*		*Percent*		*Percent*
10.7	51.0	35.8	13.2	2.2	Loam		5.1	2.1
8.5	44.9	37.9	17.2	3.3	Loam		5.2	.6
7.6	41.2	35.8	23.0	7.6	Loam		5.0	.3
3.6	53.7	22.6	23.7	6.6	Sandy clay loam		5.1	
4.7	63.2	13.2	23.6	8.4	Sandy clay loam		5.6	
13.7	58.9	12.3	25.8	11.0	Sandy clay loam		6.6	
4.0	62.0	9.0	29.0	17.5	Sandy clay loam		7.1	
7.9	24.4	39.4	36.2	8.9	Clay loam	10.5	7.7	
3.7	12.5	47.1	40.4	17.1	Silty clay		7.5	6.8
4.3	11.9	42.5	45.6	18.0	Silty clay		7.5	
3.7	10.3	40.5	49.2	22.7	Silty clay		7.2	
3.8	11.1	42.6	46.3	21.4	Silty clay		7.3	
4.8	15.5	39.9	44.6	16.0	Clay		7.2	
4.7	17.4	44.3	38.2	8.3	Silty clay loam	18.4	7.9	
	29.3	57.2	13.5		Silt loam		6.2	3.0
	27.9	56.8	15.3		Silt loam		5.8	1.1
	25.3	45.1	29.6		Clay loam		5.7	.7
	27.9	38.7	33.4		Clay loam		6.2	.6
	32.0	39.2	28.8		Clay loam		6.6	.7
	5.3	55.7	39.0		Silty clay loam		7.0	1.0
	9.2	71.0	19.8		Silt loam	2.8	7.4	
	24.3	67.9	7.8		Silt loam	6.9	7.7	
	24.3	63.7	12.0		Silt loam	12.2	7.7	
	21.4	58.8	19.8		Silt loam		7.1	9.0
	20.0	52.5	27.5		Silty clay loam		7.2	
	20.1	48.9	31.0		Clay loam		7.2	
	13.4	51.2	35.4		Silty clay loam		7.2	
	20.6	52.3	27.1		Clay loam		7.3	
3.8	43.8	41.7	14.5	2.8	Muck		7.4	28.4
1.4	52.9	27.0	20.1	5.3	Muck		6.9	29.2
2.4	10.7	52.5	36.8	15.1	Silty clay loam	19.1	7.6	
20.7	70.4	22.1	7.5	2.9	Fine sandy loam	28.1	7.6	
22.9	59.5	32.2	8.3	3.1	Fine sandy loam	20.9	7.3	
	33.8	41.2	25.0		Loam		6.2	
	34.1	38.9	27.0		Loam		6.1	
	32.2	36.9	30.9		Clay loam		6.0	
	30.7	35.5	33.8		Clay loam		6.0	
	29.4	36.1	34.5		Clay loam		6.1	
	19.1	41.4	39.5		Silty clay loam		6.4	
2.5	12.9	45.0	42.1	10.9	Silty clay	1.8	7.2	6.8
2.3	12.6	34.0	53.4	24.9	Clay	.8	7.4	2.7
3.1	15.6	37.2	47.2	20.7	Clay	1.6	7.4	
2.3	10.1	41.7	48.2	23.6	Silty clay	2.1	7.6	
4.0	11.2	44.4	44.4	21.7	Silty clay	1.6	7.5	
2.2	6.4	47.2	46.4	22.7	Silty clay	3.9	7.5	
14.9	54.3	28.7	17.0	7.7	Fine sandy loam	43.5	7.8	
3.0	20.9	54.7	24.4	6.3	Silt loam		6.4	3.1
4.9	16.0	42.4	41.6	14.6	Silty clay		5.6	1.2
4.7	15.8	36.7	47.5	20.5	Clay		5.3	1.0
5.3	17.6	40.5	41.9	16.4	Silty clay		6.8	1.1
6.7	22.7	42.9	34.4	10.4	Clay loam	16.6	7.7	
10.1	32.4	49.0	18.6	3.4	Loam		6.4	2.3
6.3	20.9	42.3	36.8	12.2	Clay loam		4.8	.8
6.6	20.7	37.2	42.1	15.4	Clay		4.5	.7
6.2	18.9	35.0	46.1	19.6	Clay		4.4	
6.8	22.9	33.3	43.8	19.0	Clay		4.7	
7.6	25.2	37.2	37.6	13.8	Clay loam	1.4	7.5	
8.7	28.2	41.3	30.5	9.8	Clay loam	11.0	7.9	
8.0	28.1	41.1	30.8	9.6	Clay loam	17.5	8.0	
7.4	26.8	42.1	31.1	9.4	Clay loam	22.6	8.1	
7.2	26.2	42.0	31.8	8.9	Clay loam	22.4	8.1	

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TABLE 7.—*Laboratory data*

Soil, sample number, and location	Horizon	Depth	Particle-size distribution: Very coarse sand (2.0–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)
		Inches	*Percent*	*Percent*	*Percent*	*Percent*
Pewamo silty clay loam; AL–22: Spencer Township; NE¼SE¼ sec. 34.						
	Ap	0–8				
	B21gt	8–12				
	B22gt	12–28				
	B23gt	28–54				
	C1	54–66				
	C2	66–80				
Pewamo silty clay loam; AL–26: Spencer Township; SW¼NW¼ sec. 10.						
	Ap	0–8				
	A12	8–10				
	B21gt	10–16				
	B22gt	16–32				
	B23gt	32–50				
	C1	50–70				
	C2	70–75				
Rawson loam; AL–123: American Township; SE¼SW¼ sec. 18.						
	Ap	0–8	3.5	11.3	13.6	16.7
	B1	8–12	3.0	11.4	16.2	21.8
	B21	12–16	3.9	12.2	17.0	31.3
	B22	16–23	14.6	25.0	15.9	13.1
	B23	23–27	14.4	27.3	13.9	15.1
	B24t	27–32	3.1	21.8	13.8	20.4
	IIB25t	32–38	1.2	2.9	2.2	5.6
	IIC	38–44	1.9	2.6	2.0	4.9
Seward fine sandy loam; AL–119: Perry Township; SW¼SE¼ sec. 22.						
	A1	0–9	1.8	7.5	13.4	33.4
	B11	9–14	1.0	9.1	15.4	34.8
	B12	14–20	1.9	11.3	16.0	38.1
	B21	20–31	1.6	11.3	14.7	28.4
	IIB22t	31–37	1.1	2.7	2.6	7.0
	IIC1	37–43	1.7	3.3	3.0	7.3
	IIC2	43–52	2.4	3.6	3.0	7.3
Spinks loamy fine sand; AL–116: Richland Township; NW¼SW¼ sec. 5.						
	Ap	0–9	1.1	3.2	12.8	47.9
	A2	9–11	.3	4.0	17.4	46.2
	Bt	11–12	.2	3.1	14.0	48.3
	A2	12–15½	.3	4.6	18.3	47.1
	Bt	15½–17½	.3	4.0	15.4	48.1
	A2	17½–22	.2	5.2	18.5	49.3
	Bt	22–24	.2	4.6	15.2	48.7
	A2	24–26½	.9	6.7	20.0	50.0
	Bt	26½–28	1.2	6.1	16.0	46.9
	A2	28–33½	.6	5.8	20.7	53.9
	Bt	33½–38	.2	5.0	15.5	48.0
	A2	38–40	.4	3.4	18.9	55.9
	Bt	40–42½	.4	3.0	16.9	51.3
	A2	42½–47	.4	3.2	15.9	58.6
	Bt	47–51½	3.4	11.3	15.4	39.4
	A2	51½–53	2.4	13.8	23.3	39.4
	Bt	53–56	.3	6.5	17.3	45.2
	A2	56–59	.3	4.1	17.3	57.6
	Bt	59–60		.9	7.8	57.8
	A2	60–70	.7	7.5	23.3	49.9
	Bt	70–74	1.1	4.6	13.1	36.4
	IIC1	74–78½	1.3	5.3	10.1	29.6
	IIC2	78½–106	2.1	7.5	12.0	33.0
	IIC3	106–112	4.2	10.1	11.3	28.1
Tuscola loam; AL–4: Marion Township; NW¼NW¼ sec. 24.						
	Ap	0–8	.4	.9	.8	19.7
	A2	8–11	.4	.7	.7	20.6
	B1	11–15	.4	.7	.1	20.1
	B21	15–27	.2	.5	.8	14.5
	B22	27–36		.1	.2	13.4
	B3	36–46			.1	6.1
	IIC	46–60	.1	.4	.7	2.2

or several soil profiles—Continued

Particle-size distribution—Continued					Textural class	Calcium carbonate ($CaCO_3$) equivalent	pH value	Organic matter
Very fine sand (0.1–0.05 mm.)	Total sand (2.0–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	Fine clay (<0.0002 mm.)				
Percent	*Percent*	*Percent*	*Percent*	*Percent*		*Percent*		*Percent*
	13.3	49.9	36.8		Silty clay loam		7.2	5.9
	13.0	43.0	44.0		Silty clay		7.1	
	12.4	40.4	47.2		Silty clay		7.1	
	12.1	42.2	45.7		Silty clay		7.4	
	17.5	39.6	42.9		Silty clay	10.6	7.8	
	17.2	47.6	35.8		Silty clay loam	16.6	7.9	
	10.9	49.4	39.7		Silty clay loam		7.3	6.5
	10.7	49.4	39.9		Silty clay loam		7.2	6.4
	11.6	42.7	45.7		Silty clay		7.3	
	11.6	41.5	46.9		Silty clay		7.3	
	12.4	43.0	44.6		Silty clay		7.3	
	17.2	47.1	35.7		Silty clay loam	11.8	7.8	
	19.0	48.0	33.0		Silty clay loam	16.0	7.8	
5.7	50.8	35.3	13.9	1.7	Loam		6.8	1.7
4.9	57.3	31.2	11.5	2.2	Sandy loam		5.7	.6
4.0	68.4	20.2	11.4	2.7	Sandy loam		5.5	
3.7	72.3	14.5	13.2	4.8	Sandy loam		5.3	
4.0	74.7	14.4	10.9	3.7	Sandy loam		6.0	
5.0	64.1	12.0	23.9	11.0	Sandy clay loam		6.0	
5.7	17.6	35.6	46.8	13.8	Clay	0.9	7.3	
5.2	16.6	43.3	41.1	9.0	Silty clay	19.3	7.8	
9.2	65.3	23.1	11.6	2.2	Fine sandy loam		6.5	2.1
8.2	68.5	20.1	11.4	3.8	Fine sandy loam		5.4	.6
9.7	77.0	11.5	11.5	3.1	Fine sandy loam		5.5	
11.7	67.7	17.2	15.1	5.9	Fine sandy loam		6.5	
6.4	19.8	37.9	42.3	15.1	Clay	0.9	7.2	
7.5	22.8	42.9	34.3	9.6	Clay loam	18.6	8.1	
7.0	23.3	43.9	32.8	8.5	Clay loam	22.8	8.2	
17.1	82.1	12.2	5.7	1.3	Loamy fine sand		6.2	.4
17.5	85.4	11.1	3.5	.9	Loamy fine sand		6.6	.1
17.0	82.6	10.2	7.2	1.9	Loamy fine sand		6.7	.1
16.9	87.2	10.3	2.5	.2	Fine sand		6.8	.1
15.7	83.5	9.6	6.9	2.3	Loamy fine sand		6.8	.1
15.8	89.0	7.7	3.3	.1	Fine sand		6.9	.1
16.4	85.1	7.1	7.8	1.8	Loamy fine sand		6.9	.1
14.5	92.1	5.1	2.8	.9	Fine sand		7.0	.1
14.4	84.6	4.6	10.8	2.9	Loamy fine sand		6.9	
13.0	94.0	3.5	2.5	.8	Fine sand		6.8	
14.8	83.5	2.7	13.8	5.3	Fine sandy loam		6.4	
14.7	93.3	3.2	3.5	.8	Fine sand		6.7	
13.9	85.5	.6	13.9	5.9	Loamy fine sand		6.6	
15.9	94.0	2.8	3.2		Fine sand		6.8	
13.6	83.1	3.6	13.3	5.9	Fine sandy loam		6.3	
14.0	92.9	3.8	3.3	1.3	Sand		6.5	
14.4	83.7	2.6	13.7	5.2	Loamy fine sand		6.4	
15.8	95.1	3.3	1.6		Fine sand		6.4	
18.5	85.0	2.2	12.8	4.1	Loamy fine sand		6.0	
12.6	94.0	3.6	2.4		Sand		6.4	
17.9	73.1	11.3	15.6	5.6	Fine sandy loam		5.6	
16.2	62.4	23.8	13.8	5.0	Fine sandy loam		5.7	
16.2	70.8	15.0	14.2	5.4	Fine sandy loam		6.9	
15.8	69.5	15.1	15.4	4.4	Fine sandy loam	15.7	7.5	
28.7	50.5	36.5	13.0	4.4	Loam		6.8	3.6
28.5	50.9	37.2	16.4	5.4	Loam		7.0	2.0
24.8	46.9	29.5	23.6	11.3	Loam		6.8	
27.9	44.1	29.1	26.8	15.9	Loam		7.1	
46.7	60.6	25.0	14.4	5.9	Very fine sandy loam	4.1	7.5	
52.8	59.1	28.9	12.0	3.9	Very fine sandy loam	3.9	7.6	
27.4	30.9	56.9	12.2	3.9	Silt loam	23.5	8.0	

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; that in a poorly aerated soil is considerably higher in carbon dioxide and low in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Calcareous soil. A soil that contains enough lime or calcium carbonate (often with magnesium carbonate) to effervesce (fizz) when treated with dilute hydrochloric acid. It is alkaline in in reaction because calcium carbonate is present.

Catena. A sequence, or "chain," of soils on a landscape, developed from one kind of parent material but having different characteristics because of differences in relief and drainage.

Chroma. The relative purity or strength of the spectral color; increases with decreasing grayness.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt. See also Texture, soil.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; will not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

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 referred to as illuvial. See also Illuviation.

Glacial drift (geology). Rock material transported by glacial ice and then deposited; also includes the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash. Cross-bedded gravel, sand, and silt deposited by melt-water as it flowed from the ice.

Glacial till. Unassorted, nonstratified glacial drift that consists of clay, silt, sand, gravel, and boulders transported and deposited by glaciers.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice; the deposits are stratified and occur in the form of kames, eskers, deltas, and outwash plains.

Gleization. The reduction, translocation, and segregation of soil compounds, notably of iron, generally in the subsoil or substratum, as a result of poor aeration and drainage; expressed in the soil by mottled colors dominated by gray. The soil-forming processes leading to the development of a gley soil.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. See also Surface soil; Subsoil; Substratum.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon. See also Eluviation.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposits. Materials deposited in 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 soluble materials from soils or other material by percolating water.

Loess. Geological deposit of fairly uniform, fine material, mostly silt, presumably transported by the wind.

Moraine (geology). An accumulation of earth, stones, and other unsorted material deposited by a glacier. An end moraine is a ridgelike accumulation of glacial drift built along the outer margin of a glacier or ice sheet.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

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 either pH values or in words as follows:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6–7.3
Very strongly acid	4.5–5.0	Mildly alkaline	7.4–7.8
Strongly acid	5.1–5.5	Moderately alkaline	7.9–8.4
Medium acid	5.6–6.0	Strongly alkaline	8.5–9.0
Slightly acid	6.1–6.5	Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay. See also Texture, soil.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay. See also Texture, soil.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axes of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth. See also Horizon, soil.

Substratum. Any layer lying beneath the solum or true soil; the C or D horizon. See also Horizon, soil.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer. See also Horizon, soil.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine." See also Clay; Sand; Silt.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

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