Series 1947, No. 10 Issued August 1961

SOIL SURVEY

Lenawee County Michigan

This is the last Soil Survey for the year 1947

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
MICHIGAN AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

A PERSON who has lived in a locality for a long time probably knows the major differences among the soils of his community. He may not, however, know how nearly these soils are like the soils on experiment station farms or in other parts of the county where higher yields are reported. He may wonder whether those higher yields were from soils like his own or from soils so different that he could not expect similar yields. If he knows the kinds of soils on his farm and compares them with soils on which new methods have been tried, he can avoid some of the risks in trying either new management practices or new crop varieties.

Farmers and those who work with farmers can use this report most conveniently by following this procedure:

1. Locate the farm on the index map at the back of the report. Numbered rectangles on the index map show the area covered by each soil map.

2. Outline on the soil map the land in which you are interested. This can be done by finding the section number and the part of the section in which your farm is located. The legal description of your farm will help you to do this. This description is in the abstract of your title and is on your annual tax receipt. Landmarks, such as roads, streams, villages, schools, churches, houses, and other features will also be helpful.

3. Know the soils in each field on your farm. Each kind of soil is identified by a symbol on the soil map. Each map symbol has at least two parts. The first capital letter and small letter together stand for the soil series and the texture of the plow layer; the next capital letter shows the range of slope, or lay of the land. In addition, many of the soils have a final number, which designates the degree of erosion. For example, the symbol BbB2 stands for Berrien loamy sand, 3 to 7 percent slopes, moderately eroded. All of the map symbols and the names of the soils are listed in the Guide to Mapping Units at the back of this report.

The soils on your farm or on the land in which you are interested are described in approximately alphabetical order in the section, Descriptions of Soils. With the aid of the soil descriptions and the soil map, you usually will be able to identify the soils in each field.

4. You will find detailed suggestions for managing your soils in the section, Management and Productivity of Soils. In that section soils that are similar and that, therefore, require about the same kind of management are grouped together in soil management groups and are further subdivided into soil management units. Suggestions for managing the soils of each management group are given in the subsection, Soil Management Groups and Units.

Help in farm planning can be obtained from local technicians of the Soil Conservation Service or from the county extension director.

Soil scientists will find information about how the soils are formed and how they are classified in the section, Genesis and Classification of Soils.

Engineers will find information pertaining to their work and references to other information in the section, Engineering Applications.

Students, teachers, and other users will find information about the soils and their management in various parts of the report, depending on their particular interest. Those interested in broad soil areas in Lenawee County should read the section, Soil Associations, and examine the general soil map at the back of this report. The section, Additional Facts About the County, provides general information of interest to many readers. A glossary is provided for those not familiar with the technical terms used or who want to know the special meaning that some common terms have in soil science.

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Fieldwork for this survey was completed in 1947. Unless otherwise indicated, all statements refer to conditions at the time the survey was in progress.

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Issued August 1961

SOIL SURVEY OF LENAWEE COUNTY, MICHIGAN

Soils Surveyed by M. M. STRIKER and A. E. TAYLOR, Soil Survey,[1] and L. J. BARTELLI, L. S. ROBERTSON, C. SHAW, and A. W. McALLISTER, Michigan State University

Report by M. M. STRIKER and L. I. HARMON, United States Department of Agriculture
United States Department of Agriculture in Cooperation with Michigan Agricultural Experiment Station

LENAWEE COUNTY is in the southeastern part of Michigan. The county is rectangular in shape (fig. 1). It is about 30 miles from east to west and about 25 miles

Figure 1.—Location of Lenawee County in Michigan.

from north to south. The total land area is 754 square miles, or 482,560 acres. Adrian is the county seat.

Agriculture is a leading industry in the county, but a large number of people work in processing plants or are engaged in manufacturing. On the farms a large part of the farm income is derived from the sale of livestock and livestock products and field crops. The feeding of livestock is important, and the field crops are used largely for that purpose. Large numbers of livestock are shipped into the county. In addition, many animals are raised locally.

[1] Fieldwork for this survey was done when Soil Survey was part of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Soil Survey was transferred to the Soil Conservation Service on November 15, 1952.

How a Soil Survey Is Made

The scientist who makes a soil survey examines soils in the field, classifies the soils in accordance with facts that he observes, and shows their boundaries on aerial photographs.

FIELD STUDY.—The soil scientist bores or digs many holes to see what the soils are like. The holes are not spaced in a regular pattern but are located according to the lay of the land. In most soils each boring reveals several distinct layers, called horizons, which collectively are known as the soil profile. Each layer is studied to see how it differs from others in the profile and to learn the things about this soil that influence its capacity to support plant growth. The description of a soil profile is called a description of soil morphology.

Color in the surface layer is usually related to the amount of organic matter and natural drainage. The darker the surface soil, as a rule, the more organic matter it contains. Soils with a brown subsoil are generally well drained. Streaks and spots of gray, yellow, and brown in the lower layers generally indicate poorer drainage and poorer aeration.

Texture, or the relative proportions of sand, silt, and clay in the soil, is determined by the way the soil material feels when rubbed between the fingers. Texture determines how well the soil retains moisture, plant nutrients, and fertilizer and whether it is easy or difficult to cultivate.

Structure, which is the way the individual soil particles are arranged in larger aggregates and the amount of pore space between grains or aggregates, gives us clues to the ease or difficulty with which the soil is penetrated by plant roots, by moisture, and by air. Structure is defined in terms of distinctness, size, and shape of the soil aggregates. For example, "moderate, medium, subangular blocky" means moderately distinct, medium-sized aggregates of subangular blocky shape.

Consistence, or the tendency of the soil to crumble or to stick together, indicates whether it is easy or difficult to keep the soil open and porous under cultivation. Consistence is described at three standard moisture contents—dry, moist, and wet. The consistence when the soil is moist is commonly the most significant. The terms friable and firm, when used with statement of moisture content, imply that the soil is moist. The term loose applies to noncoherent materials, such as sand or gravel.

Other characteristics observed in the course of the field study and considered in classifying the soil include the two following groups: (1) Properties of the soil profile, such as the thickness of the various soil layers, the presence of gravel or stones in amounts that will interfere with cultivation, the degree of erosion, and the reaction or the acidity or alkalinity of the soil as measured by chemical

test; and (2) factors associated with the formation of different kinds of soils, such as the steepness and pattern of slopes, the nature of the parent material from which the soil developed, the vegetation and animal life associated with the soil, the climate of the area, and the probable age of the soil.

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

As an example of soil classification, consider the Cadmus series of Lenawee County. This series is made up of two soil types, subdivided into phases, as follows:

Series:
  Cadmus.
Types of the series:
  Cadmus loam.
  Cadmus sandy loam.
Phases of the types:
  Cadmus loam, 3 to 7 percent slopes.
  Cadmus loam, 3 to 7 percent slopes, moderately eroded.
  Cadmus sandy loam, 0 to 3 percent slopes.
  Cadmus sandy loam, 3 to 7 percent slopes.
  Cadmus sandy loam, 3 to 7 percent slopes, moderately eroded.

Soil series.—The soil series is a group of soils that have soil horizons similar in differentiating characteristics and arrangement in the soil profile, except for the texture of the surface soil, and developed from a particular type of parent material.[2] The soils within a series are essentially alike in all soil profile characteristics, except texture of the surface horizon, and in such features as slope, stoniness, degree of erosion, and topographic position that do not modify greatly the kind and arrangement of soil horizons. Soil series normally are named for a place near which they were first recognized.

Soil type.—Soils similar in kind, thickness, and arrangement of horizons and having essentially the same texture in the surface soil are classified as one soil type. In organic soil series, soil types are differentiated as to degree of decomposition of the organic materials in the plow layer and are classified into muck or peat types.

Soil phase.—Soil types are frequently divided into phases because of differences other than those in kind, thickness, and arrangement of horizons. Frequently, these differences are significant in managing the soil. Among the characteristics that suggest dividing a soil type into phases are variation in slope, in degree of erosion, and in thickness of surface soil and subsoil.

Mapping unit.—The soil phase (or the soil type if it has not been divided into phases) is the most common unit shown on the soil map and is referred to as a mapping unit. It is a unit with a small range of characteristics. Use and management, therefore, can be specified for it more definitely than for broader groups of soils that necessarily contain more variation.

Some mapping units are composed of two or more soil types that are so intricately mixed they were not mapped separately at the scale of mapping used; for example, Miami loam and Boyer sandy loam, 12 to 25 percent slopes.

Areas that have little true soil, that are too inaccessible to be surveyed, or that for other reasons cannot feasibly be classified and mapped in detail, for example, Lake borders, are not classified in types, series, or phases; they are identified by descriptive names.

Definitions.—Most of the words scientists use in describing soils are familiar, but some may have special meanings in soil science. Definitions of words used in the report and terms used in the tables are given in the Glossary, p. 58.

Descriptions of Soils

This section is provided for those who want detailed information about the soils of the county. It discusses the general characteristics of the soil series and describes a typical profile for each series. Following each series description are listed the names of the single soils, or mapping units, in the series; that is, the areas on the detailed soil map that are bounded by lines and identified by a letter symbol.

For more generalized information about the soils, the reader can refer to the section, Soil Associations. The approximate acreage and proportionate extent of the soils are given in table 1, and a list of the soils mapped, along with the soil management unit of each, is given in the back part of the report. To make the soil descriptions concise and exact, it was necessary to use many technical terms. Explanations of such terms are given in the Glossary.

Adrian Series

The Adrian series consists of organic soils formed from the moderately well disintegrated remains of plants. The soils are similar to the Palms soils but are underlain by sand or loamy sand instead of by sandy loam or clay loam. They are also similar to the Ogden and Houghton soils, but the Ogden soils are underlain by fine silty clay loam or clay, and the Houghton soils are deeper over the underlying mineral materials. The native vegetation was shrubs, sedges, grasses, and reeds.

Profile description of Adrian muck:

0 to 14 inches, black or very dark brown; well-decomposed muck; fine, granular structure; slightly acid to medium acid.
14 to 17 inches, very dark brown; muck containing few distinguishable plant remains; slightly acid to medium acid.
17 to 32 inches, yellowish brown; partly decomposed, fibrous peat; slightly acid to mildly alkaline.
32 inches +, gray; mottled with yellowish brown or olive brown; sand and loamy sand; loose; calcareous.

In thickness the organic material ranges from 12 to 42 inches, and in degree of decomposition, from muck to moderately disintegrated peat. The reaction is generally medium acid to mildly alkaline.

Adrian muck is used mainly for pasture and is not well suited to cropping. If it is cultivated, the organic layers gradually disappear and only the sand remains.

MAPPING UNIT

(AaA) **Adrian muck, 0 to 3 percent slopes.** Soil management unit M/4c(IVW).

[2] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY MANUAL. U.S. Dept. Agr. Handb. No. 18, 503 pp., illus.

TABLE 1.—*Names, approximate acreage, and proportionate extent of the mapping units*

Soil name	Acres	Percent
Adrian muck, 0 to 3 percent slopes	438	0. 1
Barry sandy loam, overwashed, 0 to 3 percent slopes	999	. 2
Berrien loamy sand, 0 to 3 percent slopes	86	(1)
Berrien loamy sand, 3 to 7 percent slopes	244	. 1
Berrien loamy sand, 3 to 7 percent slopes, moderately eroded	43	(1)
Berrien sandy loam, 0 to 3 percent slopes	1, 515	. 3
Berrien sandy loam, 3 to 7 percent slopes	3, 062	. 6
Berrien sandy loam, 3 to 7 percent slopes, moderately eroded	63	(1)
Berrien sandy loam, 7 to 15 percent slopes	54	(1)
Berville loam, 0 to 3 percent slopes	155	(1)
Berville sandy loam, 0 to 3 percent slopes	157	(1)
Blount loam, 0 to 3 percent slopes	12, 981	2. 7
Blount loam, 0 to 3 percent slopes, moderately eroded	21	(1)
Blount loam, 3 to 7 percent slopes	24, 217	5. 0
Blount loam, 3 to 7 percent slopes, moderately eroded	2, 172	. 5
Blount loam and Pewamo clay loam, 0 to 3 percent slopes	5, 759	1. 2
Brady sandy loam, 0 to 3 percent slopes	2, 861	. 6
Brady and Macomb loams, 0 to 3 percent slopes	23, 645	4. 9
Brady and Macomb sandy loams, 0 to 3 percent slopes	770	. 2
Bronson sandy loam, 0 to 3 percent slopes	2, 785	. 6
Bronson sandy loam, 3 to 7 percent slopes	1, 398	. 3
Brookston loam, 0 to 3 percent slopes	961	. 2
Brookston loam, overwashed, 0 to 3 percent slopes	4, 898	1. 0
Cadmus loam, 3 to 7 percent slopes	5, 675	1. 2
Cadmus loam, 3 to 7 percent slopes, moderately eroded	401	. 1
Cadmus sandy loam, 0 to 3 percent slopes	940	. 2
Cadmus sandy loam, 3 to 7 percent slopes	2, 422	. 5
Cadmus sandy loam, 3 to 7 percent slopes, moderately eroded	101	(1)
Cadmus and Blount loams, 0 to 3 percent slopes	3, 567	. 7
Carlisle muck, 0 to 3 percent slopes	6, 996	1. 4
Colwood very fine sandy loam, 0 to 3 percent slopes	8, 070	1. 7
Colwood and Wauseon fine sandy loams, 0 to 3 percent slopes	3, 441	. 7
Conover loam, 0 to 3 percent slopes	3, 551	. 7
Conover loam, 3 to 7 percent slopes	1, 620	. 3
Conover loam, 3 to 7 percent slopes, moderately eroded	33	(1)
Edwards muck, 0 to 3 percent slopes	2, 282	. 5
Fox cobbly gravelly loam, 0 to 3 percent slopes	1, 572	. 3
Fox cobbly gravelly loam, 3 to 7 percent slopes	101	(1)
Fox cobbly gravelly loam, 7 to 15 percent slopes, moderately eroded	36	(1)
Fox loam, 0 to 3 percent slopes	2, 146	. 4
Fox loam, 3 to 7 percent slopes	1, 728	. 4
Fox loam, 7 to 15 percent slopes	218	(1)
Fox loam, 7 to 15 percent slopes, moderately eroded	256	. 1
Fox sandy loam, 0 to 3 percent slopes	2, 742	. 6
Fox sandy loam, 3 to 7 percent slopes	5, 907	1. 2
Fox sandy loam, 3 to 7 percent slopes, moderately eroded	245	. 1
Fox sandy loam, 7 to 15 percent slopes	3, 168	. 7
Fox sandy loam, 7 to 15 percent slopes, moderately eroded	1, 279	. 3
Fox sandy loam, 12 to 25 percent slopes	2, 687	. 6
Fox sandy loam, 12 to 25 percent slopes, moderately eroded	1, 836	. 4
Fox sandy loam, 25+ percent slopes	221	(1)
Fox soils, 7 to 15 percent slopes, severely eroded	95	(1)
Fox soils, 12 to 25 percent slopes, severely eroded	54	(1)
Fox soils, 25+ percent slopes, moderately or severely eroded	50	(1)
Genesee loam, 0 to 3 percent slopes	1, 016	0. 2
Genesee loam, 3 to 7 percent slopes	44	(1)
Genesee sandy loam, 0 to 3 percent slopes	318	. 1
Genesee sandy loam, 3 to 7 percent slopes	37	(1)
Genesee and Eel loams, 0 to 3 percent slopes	1, 648	. 3
Granby loamy sand, 0 to 3 percent slopes	264	. 1
Granby sandy loam, 0 to 3 percent slopes	567	. 1
Griffin and Genesee loams, 0 to 3 percent slopes	9, 182	1. 9
Griffin and Sloan loams, 0 to 3 percent slopes	790	. 2
Griffin and Sloan sandy loams, 0 to 3 percent slopes	8, 816	1. 8
Hillsdale sandy loam, 3 to 7 percent slopes	50	(1)
Hillsdale sandy loam, 7 to 15 percent slopes, moderately eroded	27	(1)
Houghton muck, 0 to 3 percent slopes	6, 916	1. 4
Hoytville clay loam and silty clay loam, 0 to 3 percent slopes	70, 956	14. 7
Hoytville mucky clay loam, 0 to 3 percent slopes	504	. 1
Hoytville clay loam and Rimer sandy loam, 0 to 3 percent slopes	783	. 2
Hoytville and Wauseon loams, 0 to 3 percent slopes	7, 511	1. 6
Ionia loam, 0 to 3 percent slopes	2, 484	. 5
Ionia loam, 3 to 7 percent slopes	1, 128	. 2
Kendallville loam, 7 to 15 percent slopes	258	. 1
Kendallville loam, 7 to 15 percent slopes, moderately eroded	391	. 1
Kendallville sandy loam, 7 to 15 percent slopes	431	. 1
Kendallville soils, 7 to 15 percent slopes, moderately or severely eroded	74	(1)
Kerston muck and loams, 0 to 3 percent slopes	1, 232	. 3
Kibbie and Colwood fine sandy loams, 0 to 3 percent slopes	795	. 2
Kibbie and Colwood fine sandy loams, 3 to 7 percent slopes	154	(1)
Kokomo and Barry loams, 0 to 3 percent slopes	5, 670	1. 2
Kokomo, Barry, and Wallkill loams, overwashed, 0 to 3 percent slopes	3, 318	. 7
Lake borders	539	. 1
Lenawee silty clay loam, 0 to 3 percent slopes	6, 402	1. 3
Linwood muck, 0 to 3 percent slopes	299	. 1
Macomb fine sandy loam, 0 to 3 percent slopes	2, 165	. 4
Macomb sandy clay loam and Hoytville clay loam, 0 to 3 percent slopes	3, 115	. 6
Maumee loamy sand, 0 to 3 percent slopes	361	. 1
Miami loam, 0 to 3 percent slopes	57	(1)
Miami loam, 3 to 7 percent slopes	6, 163	1. 3
Miami loam, 3 to 7 percent slopes, moderately eroded	2, 984	. 6
Miami loam, 7 to 15 percent slopes	6, 370	1. 3
Miami loam, 7 to 15 percent slopes, moderately eroded	6, 514	1. 3
Miami loam, 12 to 25 percent slopes, moderately eroded	426	. 1
Miami soils, 7 to 15 percent slopes, severely eroded	34	(1)
Miami soils, 15 to 25 percent slopes, severely eroded	88	(1)
Miami loam and Boyer sandy loam, 12 to 25 percent slopes	2, 561	. 5
Miami loam and Boyer sandy loam, 12 to 25 percent slopes, moderately eroded	3, 067	. 6
Miami loam and Boyer sandy loam, 25+ percent slopes	90	(1)
Miami and Boyer soils, 12 to 25 percent slopes, severely eroded	81	(1)
Miami and Boyer soils, 25+ percent slopes, moderately eroded	56	(1)
Morley loam, 0 to 3 percent slopes	696	. 1
Morley loam, 3 to 7 percent slopes	7, 837	1. 6
Morley loam, 3 to 7 percent slopes, moderately eroded	40, 607	8. 4

See footnote at end of table.

TABLE 1.—*Names, approximate acreage, and proportionate extent of the mapping units*—Continued

Soil name	Acres	Percent
Morley loam, 7 to 15 percent slopes	1,314	0.3
Morley loam, 7 to 15 percent slopes, moderately eroded	18,572	3.8
Morley loam, 12 to 25 percent slopes	263	.1
Morley loam, 12 to 25 percent slopes, moderately eroded	3,328	.7
Morley loam, 25+ percent slopes	118	(1)
Morley soils, 3 to 7 percent slopes, severely eroded	34	(1)
Morley soils, 7 to 15 percent slopes, severely eroded	3,312	.7
Morley soils, 12 to 25 percent slopes, severely eroded	1,346	.3
Morley soils, 25+ percent slopes, moderately or severely eroded	99	(1)
Nappanee silt loam, 0 to 3 percent slopes	15,378	3.2
Nappanee silt loam, 3 to 7 percent slopes	251	.1
Nappanee silt loam, 3 to 7 percent slopes, moderately eroded	431	.1
Nappanee loam, 3 to 7 percent slopes	4,186	.9
Nappanee loam, 3 to 7 percent slopes, moderately eroded	6,054	1.3
Ogden muck, 0 to 3 percent slopes	300	.1
Oshtemo loamy sand, 0 to 3 percent slopes	249	.1
Oshtemo loamy sand, 3 to 7 percent slopes	766	.2
Oshtemo loamy sand, 3 to 7 percent slopes, moderately eroded	54	(1)
Oshtemo loamy sand, 7 to 15 percent slopes	40	(1)
Ottawa loamy sand, 7 to 15 percent slopes, slightly or moderately eroded	52	(1)
Palms muck, 0 to 3 percent slopes	386	.1
Pewamo clay loam, 0 to 3 percent slopes	25,086	5.2
Pewamo mucky clay loam, 0 to 3 percent slopes	4,823	1.0
Plainfield and Ottawa loamy sands, 0 to 3 percent slopes	62	(1)
Plainfield and Ottawa loamy sands, 3 to 7 percent slopes	2,102	.4
Plainfield and Ottawa loamy sands, 3 to 7 percent slopes, moderately eroded	131	(1)
Plainfield and Ottawa loamy sands, 7 to 15 percent slopes	1,218	.3
Plainfield and Ottawa loamy sands, 7 to 15 percent slopes, moderately eroded	68	(1)
Plainfield and Berrien loamy sands, 0 to 3 percent slopes	1,472	0.3
Plainfield and Berrien loamy sands, 3 to 7 percent slopes	658	.1
Rifle peat, 0 to 3 percent slopes	178	(1)
Rollin muck, 0 to 3 percent slopes	621	.1
Sebewa loam, 0 to 3 percent slopes	1,245	.3
Sebewa sandy loam, 0 to 3 percent slopes	521	.1
Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes	160	(1)
Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes, moderately eroded	83	(1)
Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes	92	(1)
Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes, moderately eroded	512	.1
Spinks, Boyer, Plainfield, and Hillsdale soils, 12 to 25 percent slopes, moderately eroded	55	(1)
St. Clair loam, 7 to 15 percent slopes	95	(1)
St. Clair loam, 7 to 15 percent slopes, moderately eroded	1,316	.3
St. Clair loam, 12 to 25 percent slopes, moderately eroded	528	.1
St. Clair loam, 25+ percent slopes	39	(1)
St. Clair loam, 25+ percent slopes, moderately eroded	133	(1)
St. Clair soils, 7 to 15 percent slopes, severely eroded	122	(1)
Tawas muck, 0 to 3 percent slopes	92	(1)
Wallkill loam, overwashed, 0 to 3 percent slopes	507	.1
Warners muck and marl, 0 to 3 percent slopes	377	.1
Wauseon loam, 0 to 3 percent slopes	9,725	2.0
Willette muck, 0 to 3 percent slopes	817	.2
Urban and miscellaneous areas	4,589	1.0
Total	482,560	99.8

[1] Less than 0.1 percent; 0.2 percent of soils mapped are less than 0.1 percent.

Barry Series

Soils of the Barry series are poorly to very poorly drained and have formed in calcareous glacial till of sandy loam texture. They are mainly in shallow depressions and receive water from surrounding areas. The native vegetation consisted of elm, ash, hickory, pin oak, aspen, and other hardwoods.

The Barry soils are in the same catena as the well-drained Hillsdale soils. In places they occur in intricate mixtures with the Kokomo soils, and the soils of the two series are mapped as one unit. In other places they are mapped with the Kokomo and Wallkill soils. The Barry soils are similar to the Brookston and Maumee soils but contain more sand than the Brookston soils. They are less sandy than the Maumee soils, which have formed in loose sand.

Profile description of a Barry sandy loam:

A_1 0 to 12 inches, very dark gray to very dark grayish brown; sandy loam; weak, fine, granular structure; friable when moist, and soft when dry; high content of organic matter; neutral.

GB_1 12 to 16 inches, dark grayish brown; mottled with dark yellowish brown; sandy loam or loam; weak, fine to medium, subangular blocky structure; friable when moist, and soft when dry; neutral.

GB_2 16 to 24 inches, dark grayish brown to grayish brown; mottled with light olive brown and dark yellowish brown; sandy loam or sandy clay loam; moderate, medium to coarse, subangular blocky structure; somewhat plastic when wet, slightly firm when moist, and hard when dry; neutral.

GB_3 24 to 35 inches, light brownish gray or light olive brown; mottled with yellowish brown; sandy loam; coarse, subangular blocky structure; friable when moist, and soft when dry; neutral or mildly alkaline.

C 35 inches +, light brownish gray or olive brown; mottled with olive yellow; sandy loam glacial till; friable when moist, and slightly hard when dry; calcareous.

In thickness the surface layer ranges from 8 to about 15 inches. Depth to calcareous material ranges from 30 to 40 inches.

Most areas of Barry sandy loam that have been drained adequately are used to grow corn, beans, wheat, and oats, but some are in grass-legume meadow. Some areas are used for gardens or for growing truck crops. The areas

that have not been drained are generally used for permanent pasture.

MAPPING UNIT

(BaA) **Barry sandy loam, overwashed, 0 to 3 percent slopes.** The profile of this soil differs from the profile of the Barry sandy loam described in that light-colored soil material has washed onto it from the surrounding areas. The layer of overwash material is 8 to 24 inches thick. Soil management unit 3cA(IIW).

Berrien Series

Soils of the Berrien series are sandy and are moderately well drained. They have formed in sand or fine sand that was sorted by water and wind. Beneath the sand is calcareous glacial till or lake-laid sediments of loam to clay texture. The native vegetation was mainly forest, consisting predominantly of oak, hickory, beech, and black walnut.

The Berrien soils are generally on long, narrow beach ridges of old glacial lakes and on the swells of sandbars. They are mainly at elevations of 5 to 20 feet above the lake plain. The soils are in the same catena as the well-drained Ottawa, the poorly to very poorly drained Granby, and the very poorly drained Maumee soils.

Profile description of a Berrien loamy sand:

A_p 0 to 6 inches, brown or grayish brown; loamy sand; very weak, granular structure; very friable; low content of organic matter; medium to strongly acid.

A_2 6 to 24 inches, pale brown or light yellowish brown; loamy sand or fine sand; single grain; loose; medium to strongly acid.

B 24 to 48 inches, brown to pale brown; mottled with yellowish brown; intensity of mottling increases with increasing depth; loamy sand and light sandy loam; weak, coarse, subangular blocky structure; very friable; medium to strongly acid.

C 48 to 60 inches, pale brown; mottled with yellow, brown, and gray; loamy sand and fine sand; single grain; loose; slightly acid to neutral.

D 60 inches +, light brownish gray to light olive brown; mottled with yellowish brown; loam to clay; firm; calcareous.

The thickness of the sandy material over the loam or clay ranges from 42 to 66 inches. Depth to mottling ranges from 18 to about 36 inches. The texture of the surface soil ranges from loamy sand to sandy loam, and that of the lower horizons, from sand to coarse sandy loam. The sandy loams are somewhat finer textured throughout than the loamy sands. They are also somewhat higher in moisture-holding capacity and in natural fertility and are better suited to some crops. Internal drainage in the Berrien soils is rapid in the upper part of the profile and slow to medium in the loamy and clayey materials.

Included with the mapping units of Berrien soils are many small areas of very poorly drained soils in depressions or pockets.

From 35 to 50 percent of the acreage of Berrien soils is cropped; 10 to 20 percent is woodland; and the rest is in permanent pasture or used for other purposes. The principal crops are rye, wheat, buckwheat, legumes and grasses grown together, small fruits, and special truck crops. A smaller acreage is used to grow corn and oats. Some areas are used for orchards consisting of apple, peach, and pear trees.

MAPPING UNITS

(BbA) **Berrien loamy sand, 0 to 3 percent slopes.** Soil management unit 5aA(IVS).

(BbB) **Berrien loamy sand, 3 to 7 percent slopes.** Soil management unit 5aB(IVS).

(BbB2) **Berrien loamy sand, 3 to 7 percent slopes, moderately eroded.** Soil management unit 5aB(IVS).

(BcA) **Berrien sandy loam, 0 to 3 percent slopes.** Soil management unit 5aA(IVS).

(BcB) **Berrien sandy loam, 3 to 7 percent slopes.** Soil management unit 5aB(IVS).

(BcB2) **Berrien sandy loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 5aB(IVS).

(BcC) **Berrien sandy loam, 7 to 15 percent slopes.** Soil management unit 5aC(IVS).

Berville Series

The Berville soils are dark colored and are poorly to very poorly drained. They have formed in loamy, sandy, and gravelly deposits that overlie calcareous silt loam to clay loam. The native vegetation was principally elm, ash, hickory, maple, white oak, and other hardwoods.

The Berville soils are in the same catena as the imperfectly drained Macomb and the well-drained Kendallville soils. In places they are associated with Wauseon and Sebewa soils.

Profile description of a Berville loam:

A_p 0 to 10 inches, very dark grayish brown to very dark brown; loam; weak, fine, granular structure; friable when moist, and hard when dry; moderately high content of organic matter; neutral.

GB_1 10 to 24 inches, grayish brown; mottled with yellowish brown; sandy loam or loam; weak, medium, subangular blocky structure; friable when moist, and somewhat hard when dry; neutral.

GB_2 24 to 36 inches, light brownish gray or grayish brown; mottled with olive brown; loam, gravelly loam, or sandy clay loam; medium, subangular blocky structure; friable when moist, and somewhat hard when dry; neutral or alkaline.

D 36 inches +, grayish brown; mottled with olive brown; silt loam or loam; massive; slightly plastic when wet, somewhat firm when moist, and hard when dry; calcareous.

In thickness the surface layer ranges from 5 to 12 inches, and in texture, from sandy loam to loam. Fine gravel and cobblestones occur in a few places in the plow layer. The amount of gravel varies in the different layers. In places the GB_2 horizon is a gravelly clay loam. Depth to loam or clay loam ranges from 18 to 42 inches.

Surface runoff is very slow. Unless the areas are drained, they are ponded in places during part of the year. Most areas are now sufficiently drained so that they can be cultivated. Under natural conditions water moves through the upper part of the profile at a medium rate, but it moves slowly through the lower part.

From 55 to 65 percent of the acreage of Berville soils is in crops, 20 to 25 percent is in permanent pasture, and 10 to 15 percent is in woods and other uses. The principal crops are corn, wheat, oats, and legumes and grasses grown together. A small acreage is used for soybeans and for tomatoes, potatoes, and other truck crops.

MAPPING UNITS

(BdA) **Berville loam, 0 to 3 percent slopes.** Soil management unit 3/2cA(IIW).

(BeA) **Berville sandy loam, 0 to 3 percent slopes.** Berville sandy loam has a somewhat coarser texture throughout than Berville loam. Soil management unit 3/2cA(IIW).

Blount Series

Soils of the Blount series are moderately dark colored and are imperfectly drained. They have formed in calcareous glacial till consisting of silty clay loam or clay loam. The soils occur on gentle swells, or rises, where the relief is dominantly of the sag and swell type with the depressions 2 to 5 feet below the tops of the swells. The native vegetation was a dense stand of elm, oak, ash, beech, maple, and other hardwoods.

The Blount soils are in the same catena as the well to moderately well drained Morley and the poorly to very poorly drained Pewamo soils. In some places they occur in such intricate mixtures with the Pewamo soils that the soils of the two series are mapped as one unit. In others they occur in intricate mixtures with the Cadmus soils. The Blount soils are similar to the Conover and Nappanee soils but have a finer textured subsoil. The Conover soils have formed in glacial till consisting of loam or silt loam, and the Nappanee soils, in till consisting of clay to silty clay.

Profile description of a Blount loam:

- A_p 0 to 7 inches, dark grayish brown to dark gray; loam; weak, fine to medium, granular structure; friable; moderate content of organic matter; slightly acid.
- A_2 7 to 10 inches, light brownish gray to pale yellow; in places a few yellowish-brown mottles in lower part; silt loam to light silty clay loam; weak, coarse, granular structure to moderate, fine, subangular blocky structure; slightly firm; strongly to medium acid.
- B_{2g} 10 to 26 inches, dark grayish brown to yellowish brown; mottled with gray, yellow, and brown; silty clay loam to light silty clay; moderate, medium, subangular blocky to blocky structure; slightly plastic when wet, and hard when dry; medium acid in the upper part to slightly acid below.
- C 26 inches +, grayish brown; mottled with yellowish brown; clay loam to silty clay loam; weak, coarse, subangular blocky structure; firm; calcareous.

The texture of the surface soil ranges from loam to silty clay loam. The depth to calcareous till ranges from 18 to about 36 inches, and the depth to mottling, from about 8 to 15 inches.

Surface runoff is slow. In most places these soils have been artificially drained so that they can be cultivated.

Included with the Blount loams are areas of Pewamo and Morley soils that were too small to map separately.

In areas where the Blount soils are mapped alone, from 55 to 65 percent of the acreage is in crops, 10 to 20 percent is in permanent pasture, and 20 to 25 percent is in woods and other uses. Corn, grain, hay crops, and legumes or legumes and grasses grown together for rotation pasture are the main crops. Soybeans and sugar beets are grown to some extent.

In the areas where the Blount soils were mapped with Pewamo soils, from 55 to 65 percent of the acreage is cropped, 15 to 25 percent is in pasture, and 15 to 25 percent is in woods and other uses. Corn, small grains, and legumes and grasses grown together are the main crops.

MAPPING UNITS

(BfA) **Blount loam, 0 to 3 percent slopes.** Soil management unit 2bA(I).

(BfA2) **Blount loam, 0 to 3 percent slopes, moderately eroded.** Soil management unit 2bA(I).

(BfB) **Blount loam, 3 to 7 percent slopes.** Soil management unit 2bB(IIW).

(BfB2) **Blount loam, 3 to 7 percent slopes, moderately eroded.** Soil managment unit 2bB(IIW).

(BgA) **Blount loam and Pewamo clay loam, 0 to 3 percent slopes.** In areas where the Blount and Pewamo soils are intricately mixed, they have not been mapped separately. In these areas the Blount soils are on the gentle swells or rises, and the Pewamo soils, in gentle swales or depressions. The Pewamo soils occur in a dendritic, or fingering, pattern. The natural slope of the till plain generally has a drop of 5 to 10 feet per mile. In many places reworking or sorting of the surface material by lake water has increased the amount of sand in the surface and subsurface layers, and the texture of the surface layer is sandy loam. A profile typical of the Pewamo soils is described under the Pewamo series.

If these soils have not been drained, surface runoff is slow to medium and internal drainage is slow to very slow.

Included with these soils are areas of Morley soils that were too small to map separately. Soil management group 2cA(I).

Boyer Series

The Boyer soils are light colored and well drained. They have formed in sandy and loamy materials that overlie calcareous coarse sand and gravel. These soils occur on complex topography where the slopes have a gradient of 12 to 25 percent.

The Boyer soils are in the same catena as the moderately well drained Bronson soils. They are similar to the Oshtemo soils, which have neutral to calcareous sand and gravel at depths of 42 to 66 inches, but are shallower than those soils. Their B horizon is coarser textured than that of the Fox soils.

Profile description of a Boyer sandy loam:

- A_p 0 to 8 inches, dark grayish brown to grayish brown; sandy loam; weak, fine, granular structure; friable when moist; slightly acid to neutral.
- A_2 8 to 12 inches, brown to yellowish brown; sandy loam; weak, medium, granular structure; friable when moist; slightly to medium acid.
- B_1 12 to 18 inches, yellowish brown; sandy loam; weak to moderate, coarse, granular to weak, fine, subangular blocky structure; friable when moist, and soft when dry; medium to strongly acid.
- B_2 18 to 36 inches, brown; heavy sandy loam grading to coarse sandy clay loam; moderate, medium, subangular blocky structure; friable to firm when moist, and hard when dry; medium to slightly acid.
- D 36 inches +, grayish brown; stratified sand and gravel; loose; calcareous.

The texture of the surface soil ranges from sandy loam to loamy sand. As much as 10 inches of coarse sandy clay loam occurs in places in the lower part of the B_2 horizon. Depth to calcareous sand and gravel ranges from 24 to 42 inches.

The Boyer soils are not mapped separately in this county but are mapped with the Miami soils and also as a unit with the Spinks, Plainfield, and Hillsdale soils.

Brady Series

The Brady soils are imperfectly drained and are moderately dark colored. They are nearly level and occur on outwash plains and on terraces and valley trains. The soils have formed in sandy and loamy materials that overlie calcareous gravel and sand. These materials are simi-

lar to the sandy and loamy materials in which the Macomb soils developed, but the Macomb soils are underlain by loam or clay loam. In some places the Brady soils occur in such intricate mixtures with the Macomb soils that the soils of the two series are mapped as one unit. The Brady soils developed under forest consisting mainly of elm, ash, soft maple, hickory, and basswood.

Profile description of a Brady sandy loam:

A_p 0 to 8 inches, brownish gray; sandy loam; weak, fine, granular structure; friable; moderate content of organic matter; medium to slightly acid.

A_{2g} 8 to 12 inches, light grayish brown; mottled with yellow and brown; coarse sandy loam; very weak, coarse, granular structure; very friable; slightly acid to medium acid.

B_{1g} 12 to 26 inches, grayish brown; mottled with yellowish brown; heavy sandy loam; moderate, medium, subangular blocky structure; friable to firm; medium acid.

B_{2g} 26 to 36 inches, grayish brown; mottled with yellowish brown and brown; gravelly sandy clay loam or clay loam; moderate, medium, subangular blocky structure; friable to firm when moist; slightly to medium acid.

D 36 inches +, gray and pale yellow; stratified, coarse to medium sand and gravel; loose; neutral to calcareous.

The plow layer ranges in texture from light sandy loam to heavy sandy loam within short distances. Depth to calcareous sand and gravel ranges from about 24 to 42 inches. The thickness of the B_{2g} horizon ranges from about 5 to 15 inches. If the soil has not been drained, internal drainage is slow to medium.

Areas of Macomb and Sebewa soils, too small to map separately, are included with the Brady soils.

In areas where the Brady soil is mapped alone, from 50 to 60 percent of the acreage is in crops, 5 to 10 percent is in pasture, and 15 to 25 percent is in woods and other uses.

In the areas that are mapped with Macomb soils, approximately 70 percent of the acreage is used for crops and the rest is in permanent pasture or other uses. Corn, small grains, and legumes grown together with grasses are the main crops. A small acreage is used for soybeans and potatoes.

MAPPING UNITS

(BhA) **Brady sandy loam, 0 to 3 percent slopes.** Soil management unit 3bA(IIW).

(BkA) **Brady and Macomb loams, 0 to 3 percent slopes.** In areas where the Brady and Macomb soils occur in close association, they were not mapped separately. Areas where they are mapped together occur on the lake plain in the eastern part of the county; along old glacial drainageways; and, in places, on outwash plains. A profile typical of the Macomb soils is described under the Macomb series.

In most places these soils have been cleared. Most of the areas have been drained sufficiently so that they can be cultivated. In areas that have not been drained, surface runoff is slow and internal drainage is slow to medium. Soil management unit 3bA(IIW).

(BmA) **Brady and Macomb sandy loams, 0 to 3 percent slopes.** Except for the texture of the surface layer, this mapping unit is similar to Brady and Macomb loams, 0 to 3 percent slopes, and it is used in about the same way. Soil management unit 3bA(IIW).

Bronson Series

Soils of the Bronson series are moderately well drained. They have formed in sandy and loamy materials that overlie calcareous, stratified sand and gravel. The native vegetation was mainly forest, consisting predominantly of oak, maple, beech, and hickory.

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These soils are nearly level to gently sloping. They occur on glacial outwash plains and terraces; on old shorelines and beach ridges on the lakebed plain; and on terraces immediately adjacent to stream valleys. The Bronson soils are coarser textured throughout than the Ionia soils. They are in the same catena as the well-drained Boyer soils.

Profile description of a Bronson sandy loam:

A_p 0 to 7 inches, yellowish brown to grayish brown; sandy loam; weak, medium, granular structure; very friable; medium to slightly acid.

A_2 7 to 12 inches, light grayish brown or pale yellow; loamy sand; very weak, subangular blocky structure; very friable to loose; medium acid.

B_1 12 to 18 inches, yellowish brown or dark yellowish brown; heavy loamy sand to light sandy loam; weak, fine, subangular blocky structure; very friable; medium to strongly acid.

B_{21g} 18 to 32 inches, dark brown or dark yellowish brown; slightly mottled with gray and yellow, the mottles becoming more numerous with increasing depth; sandy loam; weak, medium, subangular blocky structure; friable; medium to strongly acid.

B_{22g} 32 to 38 inches, dark brown or dark yellowish brown; mottled with gray; sandy clay loam or gravelly clay loam; weak to moderate, coarse, subangular blocky structure; firm; medium acid to neutral.

D 38 inches +, grayish brown or brown; stratified sand and gravel; loose; calcareous.

The texture of the plow layer ranges from sandy loam to loamy sand. In some areas the plow layer contains a moderate amount of gravel. Depth to mottling ranges from 14 to 28 inches. The B_{22g} horizon ranges from about 3 to 10 inches in thickness, and in places tongues from this horizon extend downward into the D horizon for 6 inches or more. Depth to calcareous sand or gravel ranges from 24 to 42 inches.

Surface runoff is slow to medium. Internal drainage, or movement of moisture through the soil, is medium.

Included with the Bronson soils are areas of Boyer, Oshtemo, Ionia, and other soils that were too small to map separately.

From 55 to 65 percent of the acreage of Bronson sandy loams is used for crops; 15 to 25 percent is in pasture; and 20 percent is in woods and other uses. The principal crops are corn, small grains, and legumes and grasses grown together.

MAPPING UNITS

(BnA) **Bronson sandy loam, 0 to 3 percent slopes.** Soil management unit 4aA(IIIS).

(BnB) **Bronson sandy loam, 3 to 7 percent slopes.** Soil management unit 4aB(IIIS).

Brookston Series

Soils of the Brookston series are dark colored and poorly drained. They have formed in glacial till consisting of loam, silt loam, or light clay loam. The native vegetation was a hardwood forest consisting mainly of soft maple, elm, basswood, sycamore, and other deciduous trees.

These soils occur in depressions or on broad flats. They are in the same catena as the well-drained Miami, the imperfectly drained Conover, and the very poorly drained Kokomo soils. The Brookston soils have a thinner, lighter colored surface soil than the Kokomo, and the upper part of the subsoil is predominantly gray rather than mottled. They are coarser textured than the Pewamo

and Hoytville soils and are finer textured than the Barry soils.

Profile description of a Brookston loam:

A_p 0 to 7 inches, very dark grayish brown; loam; moderate, fine to medium, granular structure; friable; moderate to high content of organic matter; neutral to slightly acid.

GB_1 7 to 18 inches, brownish yellow to grayish brown; slightly mottled with gray and yellow; silt loam to silty clay loam; fine to medium, granular structure; friable when moist; neutral to slightly acid.

GB_2 18 to 23 inches, dark yellowish brown to grayish brown; mottled with gray; loam to clay loam; moderate, medium, subangular blocky structure; firm when moist; neutral.

C 23 inches +, very dark gray to dark brownish gray; silt loam to light clay loam; weak, coarse, subangular blocky structure; firm when moist; neutral to slightly alkaline, but in most places calcareous at depths of less than 34 inches.

Some areas have a light-colored surface soil because soil material from the higher slopes has washed onto them. Slopes have a gradient of as much as 5 percent, but in most places the gradient is less than 2 percent.

All of the crops commonly grown in the county are grown on the Brookston loams, and yields are usually high. About 60 percent of the acreage is in crops, 15 to 20 percent is in pasture, and 15 to 25 percent is in woods and other uses. Corn, small grains, and legumes and grasses grown together as rotation pasture are the main crops.

MAPPING UNITS

(BoA) **Brookston loam, 0 to 3 percent slopes.** Soil management unit 2cA(I).

(BpA) **Brookston loam, overwashed, 0 to 3 percent slopes.** This soil differs from the Brookston loam described in that the surface soil is light-colored loam or sandy loam 7 to 24 inches thick. Soil management unit 2cA(I)

Cadmus Series

The Cadmus soils are moderately well drained. They have formed in sandy and loamy materials that overlie calcareous till that has a texture of loam or silty clay loam. The native cover consisted of oak, hickory, maple, and other deciduous trees.

These soils occur in rather narrow, long strips between the Till Plains and the glacial outwash plains and terraces. They are similar to the Ionia soils, but the texture of their D horizon is loam to silty clay loam. The Cadmus soils are in the same catena as the well-drained Kendallville, the imperfectly drained Macomb, and the poorly to very poorly drained Berville soils. In some places the Cadmus soils occur in such intricate mixtures with the Blount soils that the soils of the two series are mapped as one unit.

Profile description of a Cadmus sandy loam:

A_p 0 to 7 inches, very dark grayish brown; sandy loam; weak, fine, granular structure; friable when moist; moderate content of organic matter; slightly to medium acid.

A_2 7 to 12 inches, pale brown; sandy loam; weak, medium, granular structure; friable when moist; medium acid.

B_1 12 to 14 inches, light brown; sandy loam or heavy sandy loam; weak, medium, subangular blocky structure; friable when moist, and soft when dry; medium acid.

B_{2g} 14 to 34 inches, light brown to dark brown; mottled with light brownish gray; sandy clay loam, sandy loam, or gravelly clay loam; medium, subangular blocky structure; plastic when wet, firm when moist, and hard when dry; slightly to medium acid.

D 34 inches +, light brown and dark yellowish brown; mottled with gray; loam to silty clay loam till; weak, medium, subangular blocky structure; plastic when wet, firm when moist, and hard when dry; calcareous.

In texture the surface layer ranges from loam to sandy loam. The texture of the B_1 and B_{2g} horizons ranges from sandy loam to sandy clay loam, and these horizons contain varying amounts of gravel. Depth to the underlying, finer textured material ranges from 24 to 42 inches. In places a layer of sand and gravel, 2 to 8 inches thick, occurs just above the substratum. Surface runoff is slow, and internal drainage is medium.

In areas where the Cadmus soils are mapped alone, from 55 to 65 percent of the acreage is cropped, 15 to 20 percent is in woods and other uses, and about 20 percent is in bluegrass pasture.

In areas where the Cadmus soils are mapped with Blount soils, from 55 to 65 percent of the acreage is cropped, 15 percent is in permanent pasture, and 20 to 25 percent is in woods and other uses.

Corn, small grains, hay crops, and legumes or legumes and grasses grown together are the principal crops, both on the Cadmus soils mapped alone and on the Cadmus soils mapped with Blount soils.

MAPPING UNITS

(CaB) **Cadmus loam, 3 to 7 percent slopes.** Soil management unit 3/2aB(IIS).

(CaB2) **Cadmus loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 3/2aB(IIS).

(CbA) **Cadmus sandy loam, 0 to 3 percent slopes.** Soil management unit 3/2aA(IIS).

(CbB) **Cadmus sandy loam, 3 to 7 percent slopes.** Soil management unit 3/2aB(IIS).

(CbB2) **Cadmus sandy loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 3/2aB(IIS).

(CcA) **Cadmus and Blount loams, 0 to 3 percent slopes.** In areas where the Cadmus and Blount soils occur in close association, they were not mapped separately. In these places areas of each soil are less than 5 acres in size and the boundary between the areas is indefinite. Each soil comprises 30 to 50 percent of an area. Internal drainage is somewhat slower in the Blount soil than in the Cadmus soil. A profile typical of the Blount soils is described under the Blount series. Soil management unit 3/2aA(IIS).

Carlisle Series

The Carlisle series consists of black to very dark brown, well-decomposed organic soils. The soils have formed in mixed woody and fibrous materials under a swamp-timber type of vegetation. The organic soil materials are generally more than 42 inches thick. Native vegetation was elm, willow, aspen, swamp white oak, and herbaceous species.

The Carlisle soils occur in old lakebeds and in drainageways, but the most extensive areas are in closed depressions in the uplands. A few areas occur on bottom lands and outwash plains and in old glacial valleys. These soils are similar to the Houghton soils, but the Houghton soils have formed from fibrous materials.

Profile description of Carlisle muck:

0 to 14 inches, black to very dark brown; well-decomposed muck that contains many small fragments of partly decayed wood; moderate, fine to medium, granular structure; friable; slightly acid.

14 to 24 inches, very dark gray to very dark brown; well-decomposed muck that contains more woody remains than the layer above; moderate, medium, granular structure; friable; slightly acid to neutral.

24 inches +, brown to dark yellowish-brown; peaty material composed mostly of grasses, sedges, and fragments of wood; neutral to mildly alkaline.

In most places mineral materials are at depths of 4 to 20 feet. In some small areas the muck has been burned. In places silty overwash material covers the surface.

From 10 to 15 percent of Carlisle muck is used for crops, 50 to 60 percent is in second-growth forest, and 25 to 35 percent is in pasture and other uses. Corn is the principal crop. Two moderately large areas in glacial drainage valleys have been drained systematically by ditches and used to grow potatoes, cabbage, onions, celery, and other special truck crops. Some areas in the valley of the River Raisin in Raisin Township and in the Canandaigua Swamp also are used for special crops and corn. Practically all the other areas are used for pasture or woods.

Recently, some of the undrained, cleared, and brushland pastures have been plowed, fertilized heavily, and planted to reed canarygrass for use as permanent pasture. Such pastures are productive, especially in dry years.

A few areas of Houghton muck and Rifle peat have been included with this soil.

MAPPING UNIT

(CdA) **Carlisle muck, 0 to 3 percent slopes.** Soil management unit Mc(IIIW).

Colwood Series

The Colwood soils are dark colored and are poorly to very poorly drained. They have formed in stratified, calcareous silt and fine sand mixed with a small amount of clay. The soils are nearly level or occur in slight depressions. The distance between the level of the swales and the crests of the swells is 100 to 200 feet. The native cover was a swamp forest of elm, maple, swamp white oak, hickory, and other hardwoods.

These soils are in the same catena as the well drained Sisson and moderately well drained Tuscola soils, which are not mapped in this county but occur in adjacent counties. The catena also includes the imperfectly drained Kibbie soils.

In places the Colwood soils occur in such intricate mixtures with the Wauseon soils that the soils of the two series are mapped as one unit. In other places they are mapped with the Kibbie soils.

The Colwood soils are similar in natural drainage to the Pewamo, Hoytville, Brookston, and Gilford soils but differ in parent material. The Pewamo soils formed from glacial till consisting of silty clay loam or clay loam; the Hoytville soils, from till consisting of silty clay or clay; and the Brookston soils, from till consisting of loam, silt loam, or light clay loam. The Gilford soils, which are not mapped in this county, formed from sand and gravel.

Profile description of a Colwood very fine sandy loam:

A_p 0 to 7 inches, very dark brownish gray to dark gray; very fine sandy loam; weak, medium, granular structure; friable; fairly high content of organic matter; neutral.

A_{12} 7 to 14 inches, dark gray; mottled with yellow, brown, and gray; loamy fine sand to fine sandy loam; weak, coarse, granular structure; neutral.

GB 14 to 34 inches, gray or grayish brown; mottled with yellow, brown, and gray; very fine sandy loam to silt loam with layers or lenses of fine sand, silt, and clay; generally free of gravel and stones; moderate, medium, subangular blocky structure; firm to friable; slightly acid to mildly alkaline.

C 34 inches +, grayish brown; mottled with yellowish brown and light olive brown; stratified fine sand, silt, and clay; massive; friable; calcareous.

In thickness the surface layer ranges from 6 to about 14 inches. The content of organic matter, the thickness of the surface layer, and the sequence and thickness of the layers of stratified materials all vary within short distances and between areas. In some places fine-textured till occurs at depths ranging from 4 to 10 feet.

The water table is at or near the surface during a large part of the year. Most areas have been drained, however, so that they can be cultivated.

In areas where the Colwood soils are mapped alone, from 60 to 70 percent of the acreage is used for corn, small grains, and legumes and grasses grown together. Sugar beets, tomatoes, and soybeans are grown to some extent. The rest of the acreage is in woods, pasture, and other uses.

In the areas where the Colwood soils are mapped with Wauseon soils, from 55 to 65 percent of the acreage is cropped, 15 to 20 percent is in permanent pasture, and 15 to 20 percent is in woods and other uses. Corn is the principal crop, but small grains and legumes and grasses grown together are also important.

MAPPING UNITS

(CeA) **Colwood very fine sandy loam, 0 to 3 percent slopes.** Soil management unit 3cA(IIW).

(CfA) **Colwood and Wauseon fine sandy loams, 0 to 3 percent slopes.** Where the Colwood and Wauseon soils occur in close association, they were not mapped separately. These areas occur on the lake plain and in other parts of the county. In these areas the level to gently undulating topography causes considerable variation within short distances in the texture and color of the plow layer and in the amount of organic matter in the plow layer. In thickness the plow layer ranges from 6 to 12 inches. A profile typical of the Wauseon soil is described under the Wauseon series.

The native cover on these soils was a medium to good stand of swamp forest consisting of elm, black ash, maple, basswood, hickory, beech, oak, sycamore, cottonwood, and aspen, with a thick undergrowth of shrubs and vines. Soil management unit 3cA(IIW).

Conover Series

The Conover series consists of imperfectly drained, moderately dark colored soils that are nearly level to very gently sloping. The soils have formed in highly calcareous glacial till of medium texture. The native vegetation was a hardwood forest, consisting mainly of elm, ash, sugar maple, white oak, hickory, and basswood.

These soils are in the same catena as the well-drained Miami, the poorly to very poorly drained Brookston, and the very poorly drained Kokomo soils. They are similar to the Blount soils, which have formed in glacial till consisting of silty clay loam or clay loam. They also resemble the Brady soils, which have formed in loamy and sandy material over sand and gravel.

Profile description of a Conover loam:

A_p 0 to 7 inches, dark gray to dark grayish brown; loam; weak, fine to medium, granular structure; friable; moderate content of organic matter; neutral to slightly acid.

A_2 7 to 12 inches, pale yellow to brownish yellow; loam to silt loam; weak, medium, granular structure; friable; slightly to medium acid.

B_2 12 to 36 inches, light brown; mottled with yellow, brown, and gray; clay loam that contains some pebbles and large stones; moderate, fine to medium, subangular blocky structure; friable to firm when moist, and

slightly hard when dry; slightly to medium acid in upper part, with gradual change to neutral in lower part.

C 36 inches +, light brown; mottled with gray and yellow; loam to coarse clay loam; weak, medium to coarse, subangular blocky structure; firm to friable; calcareous.

The texture of the surface layer ranges from light clay loam to heavy sandy loam. The soil contains some pebbles and cobblestones, but these seldom interfere with cultivation.

From 55 to 65 percent of the acreage of Conover loams is in crops, 15 to 20 percent is in pasture, and 15 to 20 percent is in woods and other uses. Corn, small grains, and legumes and grasses grown together are the main crops.

Areas of Miami and Brookston soils, too small to map separately, are included with the Conover soils.

MAPPING UNITS

(CgA) **Conover loam, 0 to 3 percent slopes.** Soil management unit 2bA(I).

(CgB) **Conover loam, 3 to 7 percent slopes.** Soil management unit 2bB(IIW).

(CgB2) **Conover loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 2bB(IIW).

Edwards Series

The Edwards series consists of organic soils made up of granular, very dark brown to black muck. The muck was formed from woody materials or mixtures of woody and fibrous organic materials and is underlain by marl. The original vegetation was mostly lowland hardwoods.

The soils occur in marshes, swamps, and bogs and adjoin areas of other organic soils. In most of the areas, the soils are transitional between the Carlisle and upland mineral soils. They are similar to the Carlisle soil, but the organic matter from which the Carlisle soil formed is 42 or more inches thick. They are also similar to Rollin muck, but the Rollin soil formed in fibrous materials. Like the Edwards soils, the Rollin soils are underlain by marl. In the Rollin soil marl is at depths of 12 to 42 inches.

Profile description of Edwards muck:

0 to 12 inches, very dark brown to black; muck; fine, granular structure; neutral.

12 to 24 inches, brown to very dark brown; muck that in many places contains a few, small fragments of shells; fine, granular structure; neutral to mildly alkaline.

24 inches +, light gray to dark gray; marl formed from sedimentary lime material from plants or from shells of small animals; massive; soft and smooth.

The thickness of the layer of marl ranges from 5 to 15 feet. Depth to marl ranges from 12 to 42 inches. In deeply plowed areas marl has been mixed with the muck. In some places the marl contains a small proportion of sand, silt, clay, or organic materials.

From 10 to 15 percent of the acreage of Edwards muck is used for corn and other truck crops, 50 to 60 percent is in woods, and the rest is in pasture.

MAPPING UNIT

(EaA) **Edwards muck, 0 to 3 percent slopes.** Soil management unit M/mc(IVW).

Eel Series

Soils of the Eel series are moderately well drained and have formed in alluvium consisting mainly of loam, silt loam, and sandy loam. In most places they occur in slight depressions and swales. The native vegetation was a deciduous forest in which elm and sycamore were prominent.

Profile description of an Eel silt loam:

A_p 0 to 7 inches, grayish brown; silt loam; weak, fine, granular structure; friable; medium content of organic matter in most places; neutral to slightly acid.

C_1 7 to 20 inches, brown or light yellowish brown; fine sandy loam, loam, silt loam, or clay loam with loam the most common texture; weak, coarse, granular structure to fine, subangular blocky structure; friable; neutral to mildly alkaline.

C_{2g} 20 inches +, dark yellowish brown or brown; mottled with yellow; loam, coarse silty clay loam, silt loam, or coarse clay loam with thin lenses or layers of sandy loam, fine sand, and clay; calcareous to neutral.

The content of organic matter in the surface layer varies, and the texture and drainage of the surface layer, subsurface layer, and substratum vary within short distances. In places gravel and sand occur below depths of 4 to 5 feet.

The Eel soils are not mapped separately in this county but are mapped with the Genesee soils.

Fox Series

Soils of the Fox series are well drained. They have formed in loamy material that overlies highly calcareous, stratified gravel and sand. The native vegetation was principally oak and hickory but included some beech and sugar maple.

These soils occur on outwash plains and on terraces and valley trains. They are in the same catena as the moderately well drained Ionia and the poorly to very poorly drained Sebewa soils. They are not so coarse textured as the Oshtemo soils in which calcareous sand and gravel is at depths of 42 to 66 inches.

Profile description of a Fox loam:

A_p 0 to 7 inches, light yellowish brown or grayish brown; loam; weak, fine to medium, granular structure; friable; low in content of organic matter; slightly to medium acid.

A_2 7 to 15 inches, light yellowish brown; sandy loam to loam that contains some gravel; weak, coarse, granular structure to weak, fine, subangular blocky structure; friable; slightly to medium acid.

B_{21} 15 to 28 inches, yellowish brown to reddish brown; gravelly sandy clay loam to clay loam; moderate, coarse, subangular blocky structure; slightly sticky when wet, firm when moist, and hard when dry; medium to slightly acid.

B_{22} 28 to 32 inches, dark reddish brown; gravelly sandy clay loam or clay loam; weak to moderate, coarse and very coarse, angular blocky structure; firm; tongues from this horizon extend downward into the underlying material; neutral to slightly acid.

D 32 inches +, pale brown, gray, and yellow; stratified gravel and sand with a few pockets or layers of cobblestones, boulders, and, in a very few places, sandy clay or silt; calcareous.

The texture of the surface layer ranges from sandy loam to loam or cobbly gravelly loam. In thickness the B_{21} horizon ranges from 10 to 20 inches, and the B_{22} horizon from 2 to 12 inches. The depth to calcareous sand and gravel ranges from 24 to 42 inches.

The Fox sandy loams and the Fox cobbly gravelly loams are somewhat lighter colored and coarser textured throughout than the Fox loam described, and their surface layer contains less organic matter. The Fox cobbly gravelly loams contain more cobblestones and gravel throughout

the surface and subsurface horizons than the Fox loam described.

Runoff is slow in the nearly level areas and rapid in the more sloping areas. Permeability is moderately rapid.

From 20 to 40 percent of the acreage of gently sloping Fox soils is in permanent pasture and woods, and the rest is cropped. The principal crops are corn, small grains, and legumes and grasses grown together. In places some potatoes and small fruits are grown.

The more strongly sloping Fox soils are used mainly for pasture and woods, but from 20 to 30 percent of the acreage is used for crops. Small grains and legumes and grasses grown together are the principal crops, but corn is grown to a minor extent.

Minor areas of Ionia, Boyer, Oshtemo, and other associated soils, too small to map separately, are included with the Fox soils.

MAPPING UNITS

(FaA) **Fox cobbly gravelly loam, 0 to 3 percent slopes.** Soil management unit 3aA(IIS).

(FaB) **Fox cobbly gravelly loam, 3 to 7 percent slopes.** Soil management unit 3aB(IIS).

(FaC2) **Fox cobbly gravelly loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 3aC(IIIS).

(FbA) **Fox loam, 0 to 3 percent slopes.** Soil management unit 3aA(IIS).

(FbB) **Fox loam, 3 to 7 percent slopes.** Soil management unit 3aB(IIS).

(FbC) **Fox loam, 7 to 15 percent slopes.** Soil management unit 3aC(IIIS).

(FbC2) **Fox loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 3aC(IIIS).

(FcA) **Fox sandy loam, 0 to 3 percent slopes.** Soil management unit 3aA(IIS).

(FcB) **Fox sandy loam, 3 to 7 percent slopes.** Soil management unit 3aB(IIS).

(FcB2) **Fox sandy loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 3aB(IIS).

(FcC) **Fox sandy loam, 7 to 15 percent slopes.** Soil management unit 3aC(IIIS).

(FcC2) **Fox sandy loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 3aC(IIIS).

(FcD) **Fox sandy loam, 12 to 25 percent slopes.** Soil management unit 3aD(IVS).

(FcD2) **Fox sandy loam, 12 to 25 percent slopes, moderately eroded.** Soil management unit 3aD(IVS).

(FcE) **Fox sandy loam, 25+ percent slopes.** Soil management unit 3aE(VIIS).

(FdC3) **Fox soils, 7 to 15 percent slopes, severely eroded.** Soil management unit 3aC(IVS).

(FdD3) **Fox soils, 12 to 25 percent slopes, severely eroded.** Soil management unit 3aD(VIS).

(FdE2) **Fox soils, 25+ percent slopes, moderately or severely eroded.** Soil management unit 3aE(VIIS).

Genesee Series

The Genesee soils are well drained. They have formed in alluvium made up of loam, sandy loam, and silt loam. The soils are mainly nearly level to very gently sloping, but on several small, natural levees they have slopes greater than 3 percent. The native vegetation was a deciduous forest consisting of elm, sycamore, and other hardwoods.

These soils are in the same catena as the moderately well drained Eel and the poorly to very poorly drained Sloan soils. In places they occur in such intricate mixtures with the Eel soils that the soils of the two series are mapped as one unit. In other places they are mapped with the Griffin soils.

Profile description of a Genesee loam:

A_p 0 to 7 inches, grayish brown; loam; weak, fine to medium, granular structure; friable; content of organic matter variable but generally low; slightly acid to mildly alkaline.

C_1 7 to 22 inches, yellowish brown; silt loam or loam; weak, medium to coarse, granular structure; friable; neutral to mildly alkaline.

C_2 22 to 36 inches, brown to light yellowish brown; silt loam or loam with thin lenses of fine sand and clay in some places; weak, coarse, granular structure or fine, subangular blocky structure; friable; neutral to mildly alkaline.

C_3 36 inches +, brownish yellow to yellowish brown; stratified silt, silt loam, loam, fine sand, and clay; neutral to calcareous.

The texture of the surface layer ranges from sandy loam to loam. From one place to another, there is marked variation in the texture of the profile.

In areas where the Genesee soils are mapped alone, approximately 50 percent of the acreage is cropped and the rest is in permanent pasture and woods.

In the areas where the Genesee soils are mapped with Eel soils, approximately 50 percent of the acreage is cropped, 40 to 50 percent is in permanent pasture and woods, and 5 to 10 percent is in other uses. Corn and legumes and grasses grown together are the principal crops, both on the Genesee soils mapped alone and on the Genesee soils mapped with Eel soils. Small grains and soybeans are grown to a lesser extent.

MAPPING UNITS

(GaA) **Genesee loam, 0 to 3 percent slopes.** Soil management unit 2a–LA(IIW).

(GaB) **Genesee loam, 3 to 7 percent slopes.** Soil management unit 2a–LA(IIW).

(GbA) **Genesee sandy loam, 0 to 3 percent slopes.** Soil management unit 2a–LA(IIW).

(GbB) **Genesee sandy loam, 3 to 7 percent slopes.** Soil management unit 2a–LA(IIW).

(GcA) **Genesee and Eel loams, 0 to 3 percent slopes.** In areas where the Genesee and Eel soils occur in close association, they were not mapped separately. The soils occupy the higher parts of the flood plains or bottoms. In most places they occur at elevations 5 to 10 feet above areas occupied by Griffin and Sloan soils. The soils are generally nearly level to gently undulating, but in some narrow areas, adjacent to the lower lying bottom lands, they have slopes greater than 3 percent. A profile typical of the Eel soils is described under the Eel series. Soil management unit 2a–LA(IIW).

Granby Series

The soils of the Granby series are dark colored and are poorly to very poorly drained. They have formed in sand. The soils occupy nearly level areas or occur in depressions or in depressed flats on outwash plains and lake plains. The native cover was a swamp-forest type of mixed hardwoods consisting mainly of elm, ash, pin oak, swamp white oak, sycamore, cottonwood, aspen, and red maple. The undergrowth was shrubs and other plants. In many places there were patches of sedges and bluejoint, which grew in marshy areas.

These soils have a thinner, lighter colored surface layer than the Maumee soils, which also were formed in sand. In addition the upper part of the subsoil is mottled rather than predominantly gray.

Profile description of a Granby loamy sand:

A 0 to 8 inches, dark gray to very dark grayish brown; loamy sand; very weak, medium, granular structure; very friable; fairly high content of organic matter; neutral to slightly acid.

GB 8 to 36 inches, gray; mottled with yellow and brown, the mottles becoming more numerous with increasing depth; sand to fine sand; single grain; loose; neutral.

C_g 36 inches +, gray or light gray; mottled with yellow; sand to fine sand; loose; neutral to calcareous.

The surface layer ranges in texture from loamy sand to sandy loam, and, in thickness, from 6 to 14 inches. The depth to calcareous sand ranges from 32 to 48 inches. Thin lenses of sandy loam occur in places in the GB and C_g horizons.

If the soils have not been drained, surface runoff is very slow and many areas are ponded during part of the year. A few areas are drained by open ditches.

The Granby soils are used mainly for pasture and woodlots. From 20 to 30 percent of the acreage is cropped. Corn and cabbage, cucumbers, garden beets, turnips, table beans, melons, asparagus, onions, sweet corn, and other special crops are grown.

MAPPING UNITS

(GdA) **Granby loamy sand, 0 to 3 percent slopes.** Soil management unit 5cA(IVW).

(GeA) **Granby sandy loam, 0 to 3 percent slopes.** The profile of this soil is slightly finer textured throughout than that of Granby loamy sand, 0 to 3 percent slopes. Soil management unit 5cA(IVW).

Griffin Series

Soils of the Griffin series are nearly level and are imperfectly drained. They occur in swales and in old stream channels on alluvial flood plains, or bottom lands. The soils are subject to overflow and receive fresh deposits when they are flooded. Most of the areas are long and narrow and are less than 3 acres in size.

The Griffin soils are not mapped separately in this county. In places they occur in such intricate mixtures with the Genesee soils that the soils of the two series are mapped as one unit. In these units the proportion of each soil varies greatly from one mapping unit to another.

In some places the Griffin soils are mapped with Sloan soils. The native vegetation was chiefly ash, elm, soft maple, and willow.

Profile description of a Griffin loam:

A_p 0 to 9 inches, dark grayish brown; loam; weak, fine, granular structure; friable when moist, and soft when dry; moderately high content of organic matter; neutral to mildly alkaline.

C_{1g} 9 to 26 inches, dark grayish brown; mottled with yellowish brown; loam, light sandy clay loam, silt loam, or sandy loam; weak, medium, subangular blocky structure; plastic when wet, friable when moist, and hard when dry; neutral to mildly alkaline.

C_{2g} 26 inches +, light brown; loam, light silty clay loam, silt loam, or sandy loam; massive; plastic when wet, friable when moist, and hard when dry; calcareous.

The thickness and sequence of the textural layers vary within short horizontal distances.

The danger of flooding limits the use of the soils in the Griffin and Genesee mapping units. From 10 to 20 percent of the acreage is cropped, but the soils are used primarily for pasture or as woodland. The principal crops are corn, soybeans, oats, and legumes and grasses grown together.

The soils in the Griffin and Sloan mapping units are also mainly in pasture and woods. Approximately 10 to 15 percent of the acreage is used for crops, mainly corn, oats, soybeans, and legumes and grasses grown together. Because of variation in the amount of flooding, in the extent of productive soils nearby, in the width and shape of the areas, and in the ease or difficulty of draining the areas, there is wide variation in the use of the soils. For example, little of the acreage of these soils between Tecumseh and Blissfield is used for cultivated crops and the proportion of pasture to woodland is more than 50 percent. On the other hand, areas of these soils west of Adrian, on the bottoms near Wolf Creek, have nearly all been cleared and about 30 percent of the acreage is cropped.

MAPPING UNITS

(GfA) **Griffin and Genesee loams, 0 to 3 percent slopes.** In this mapping unit the Griffin soil occurs in swales and in old stream channels, and the Genesee soil, on gently sloping swells and on low natural levees. Soil management unit 2c–LA(IIW).

(GgA) **Griffin and Sloan loams, 0 to 3 percent slopes.** In this mapping unit the Griffin and Sloan soils occur together on alluvial flood plains, or bottom lands. The Griffin soil is on gently sloping swells, and the Sloan soil, mainly in swales, in old stream channels, or in bayous. Because of the intricate mixture of swells and swales, the variation in overflow and deposition, and the gentle slope of the streambeds, which have a drop of 5 to 10 feet per mile, these soils vary greatly and a number of small areas of other soils are mapped with them. The proportions of Griffin and Sloan soils are about equal and comprise about 60 to 80 percent of the acreage in the mapping unit. The soils are flooded occasionally and receive fresh deposits of material annually. A profile typical of the Sloan soils is described under the Sloan series. Soil management unit 2c–LA(IIW).

(GhA) **Griffin and Sloan sandy loams, 0 to 3 percent slopes.** The soils of this mapping unit are similar to Griffin and Sloan loams, 0 to 3 percent slopes, in location and in the proportions of each soil making up an individual area. Like Griffin and Sloan loams, 0 to 3 percent slopes, these soils are flooded occasionally. Soil management unit 2c–LA(IIW).

Hillsdale Series

Soils of the Hillsdale series are light colored and well drained. They have formed in calcareous glacial till consisting of sandy loam. The native vegetation was a hardwood forest made up mainly of oak, sugar maple, and hickory.

These soils are in the same catena as the Barry soils, which are poorly drained. In places they occur in such intricate mixtures with the Spinks, Boyer, and Plainfield soils that the soils are mapped as one unit. The Hillsdale soils are similar to the Miami and Fox soils. They are coarser textured throughout than the Miami soils, however, and lack the sandy and gravelly substratum typical of the Fox soils.

Profile description of a Hillsdale sandy loam:

A_p 0 to 7 inches, grayish brown; sandy loam; weak, medium, granular structure; very friable; low content of organic matter; slightly to strongly acid.

A_2 7 to 16 inches, yellowish brown to brownish yellow; sandy loam; weak, coarse, granular structure; very friable; medium to strongly acid.

B_2 16 to 48 inches, yellowish brown to brownish yellow; sandy clay loam to heavy loam; in most places cobblestones and fragments of sandstone are abundant; moderate, fine to medium, subangular blocky structure; firm when moist, and slightly hard when dry; medium to strongly acid in upper part, and slightly acid in lower part.

C 48 inches +, brownish yellow; glacial till consisting of sandy loam; fragments of sandstone abundant in most places; calcareous.

In places the plow layer contains a moderate amount of cobblestones. In some areas, especially where these soils

occur near Miami soils, the profile is much shallower over the neutral or calcareous sandy loam parent material than indicated in the profile described. In places the texture of the C horizon is loamy sand.

Surface runoff is medium to rapid, and internal drainage, or movement of water through the soil, is medium.

Approximately half of the acreage of Hillsdale sandy loams is used for corn, small grains, legumes and grasses grown together, and other crops. From 20 to 30 percent of the acreage is used for permanent pasture, and the rest is in woods and other uses.

MAPPING UNITS

(HaB) **Hillsdale sandy loam, 3 to 7 percent slopes.** Soil management unit 3aB(IIS).

(HaC2) **Hillsdale sandy loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 3aC(IIIS).

Houghton Series

The Houghton series consists of organic soils that have formed from fibrous plant remains deposited in wet depressions. In the uppermost few inches of the profile, the sedges and grasses from which these soils formed are partly or entirely decomposed. They are successively less decomposed at increasing depths. The native vegetation was mainly sedges and bluejoint. In places there were a few scattered bushes and trees.

These soils occur mainly in marshy areas, some of which are bordered by lakes. They differ from Carlisle muck, which has formed mainly from woody plants rather than from fibrous materials. They differ from the Adrian, Palms, Ogden, and Rollin mucks in the character of the underlying materials and in being deeper over underlying materials. In contrast to the Houghton soil, Adrian muck is underlain by sand and loamy sand; Palms muck, by sandy loam or loam; Ogden muck, by silty clay loam to clay; and Rollin muck, by marl, which is at depths of less than 42 inches.

Profile description of Houghton muck:

0 to 12 inches, very dark brown to black; muck that contains very little or no woody material; fine, granular structure; slightly acid to neutral.

12 to 36 inches, very dark grayish brown to dark brown; fibrous peat composed chiefly of fibrous rootlets and other plant remains that are partly decomposed; very few logs or stumps; neutral to slightly acid.

36 inches +, variable deposits made up of fibrous peat and sedimentary nonfibrous peat; the firm mineral substratum of sand and gravel is generally at depths of 5 to 20 feet in the areas in outwash plains; in areas bordered by lakes and steep-sided gravelly hills, it is much deeper, or as much as 40 feet in places.

The thickness of the organic deposits ranges from 5 to 20 feet. The degree of decomposition of the plant materials varies. In a few places the surface layer is somewhat woody.

Only about 10 to 15 percent of the acreage of Houghton muck is used to grow crops. From 30 to 40 percent is used for pasture, and the rest is in cutover woods and brush.

MAPPING UNIT

(HbA) **Houghton muck, 0 to 3 percent slopes.** Soil management unit Mc(IIIW).

Hoytville Series

The Hoytville soils are dark colored and are poorly to very poorly drained. They have formed in highly calcareous glacial till consisting of silty clay or clay. The soils occur in nearly level areas or in slight depressions. Many of the areas, especially those in the southeastern part of the county, are large. The native vegetation was mainly elm, red maple, ash, swamp white oak, and other lowland hardwoods.

These soils are in the same catena as the moderately well drained St. Clair and the imperfectly drained Nappanee soils. In some places they are closely associated with the Nappanee soils, but they are darker colored and have formed under more moist conditions than those soils.

In places the Hoytville soils occur in such intricate mixtures with the Rimer soils that the soils of the two series are mapped as a single unit. In other places they are mapped with the Wauseon soils, and in still others, with the Macomb soils. The Hoytville soils are similar to the Pewamo soils, but the Pewamo soils formed in glacial till made up of silty clay loam to clay loam.

Profile description of a Hoytville silty clay loam:

A_p 0 to 7 inches, dark brownish gray to very dark brownish gray; silty clay loam; weak, medium, granular structure; plastic when wet, hard when dry, and firm when moist; fairly high content of organic matter; slightly acid to neutral.

GB_1 7 to 16 inches, gray; highly mottled with brown and yellow; silty clay; strong, medium, angular blocky structure; very firm when moist; neutral.

GB_2 16 to 36 inches, gray; mottled with yellow and brown; silty clay that contains a few stones and cobblestones; moderate, medium to coarse, angular blocky structure; sticky when wet, very firm when moist, and hard when dry; neutral.

C_g 36 inches +, gray; mottled with brownish yellow; silty clay or clay that contains considerable gravel and stones; weak, coarse to very coarse, angular blocky structure; very firm; calcareous.

The surface layer ranges in thickness from about 6 to 12 inches. The content of organic matter in the surface layer is moderately high to high. In some places the surface layer consists of muck that is less than 10 inches thick. In others it is a thin layer of sand, loamy sand, or fine gravel. Cracks from ¼ to 1 inch wide and 6 to 18 inches deep develop in many areas when the soil is dry for extended periods. The depth to calcareous till ranges from 32 to 40 inches.

Surface runoff is very slow, and many areas were under water for a part of each year before artificial drainage was installed. Permeability is slow to very slow.

In areas where the Hoytville soils are mapped alone, about 75 percent of the acreage is cropped, 5 to 10 percent is in bluegrass pasture, 5 to 10 percent is in woods, and 12 to 15 percent is in other uses. Corn, oats, wheat, soybeans, and legumes and grasses grown together are the principal crops.

In areas where the Hoytville soils are mapped with Rimer soils, from 55 to 65 percent of the acreage is cropped, 10 to 20 percent is in permanent pasture, and the rest is in woods and other uses. The principal crops are corn, soybeans, small grains, and hay, but tomatoes, cucumbers, potatoes, and other truck crops are grown to some extent. Because the Rimer soils vary from the Hoytville soils in productivity, crops vary in rate of growth within short distances.

In areas where the Hoytville soils are mapped with Wauseon soils, from 60 to 70 percent of the acreage is used for corn, soybeans, small grains, hay crops, and rotation meadow. About 15 percent is in permanent pasture, and

the rest is in woodland pasture or in forest or other uses. Areas within the lakebed plain in the eastern part of the county are probably used more extensively for crops than other areas of these soils. Here, tomatoes and a few other special crops are grown.

MAPPING UNITS

(HcA) **Hoytville clay loam and silty clay loam, 0 to 3 percent slopes.** Soil management unit 1cA(IIW).

(HdA) **Hoytville mucky clay loam, 0 to 3 percent slopes.** Soil management unit 1cA(IIW).

(HeA) **Hoytville clay loam and Rimer sandy loam, 0 to 3 percent slopes.** In areas where the Hoytville and Rimer soils occur in intricate mixtures, they were not mapped separately. In these areas the relief is gently undulating—the Hoytville soils occur in the depressions and the Rimer, on the crests of the swells and mounds, which are 2 to 5 feet high. In most of the areas, the proportions of Hoytville and Rimer soils are approximately the same. A profile typical of the Rimer soils is described under the Rimer series. Soil management unit 1cA(IIW).

(HfA) **Hoytville and Wauseon loams, 0 to 3 percent slopes.** In areas where the Hoytville and Wauseon soils occur in intricate mixtures, they were not mapped separately. Most of these areas are on the lakebed plain in the eastern part of the county. The areas are small to fairly large.

In some places these soils lie between areas of Hoytville clay loam and silty clay loam, 0 to 3 percent slopes, and Wauseon loam, 0 to 3 percent slopes. In others they occupy low swells within broad areas of Hoytville clay loam and silty clay loam, 0 to 3 percent slopes. Before artificial drainage was installed, the lowest areas were under water, or ponded, for a large part of each year. A profile typical of the Wauseon soils is described under the Wauseon series. Soil management unit 1cA(IIW).

Ionia Series

The Ionia soils are moderately well drained. They have formed in loamy materials that overlie calcareous sand and gravel. These soils are nearly level to gently sloping and occur in broad, glacial drainage valleys or on outwash plains. The native vegetation was mainly sugar maple, oak, beech, and hickory.

The Ionia soils are in the same catena as the well-drained Fox and the poorly to very poorly drained Sebewa soils. They are somewhat similar to the Bronson soils but have a finer textured subsoil.

Profile description of an Ionia loam:

- A_p 0 to 7 inches, yellowish brown to grayish brown; loam; moderate, fine, granular structure; friable; fairly low content of organic matter; medium acid.
- A_2 7 to 12 inches, light brownish yellow; sandy loam that contains some gravel; weak, coarse, granular structure; very friable; medium acid.
- B_1 12 to 18 inches, light yellowish brown or yellowish brown; sandy loam; weak to moderate, medium, subangular blocky structure; friable; medium to slightly acid.
- B_{2g} 18 to 36 inches, yellowish brown to reddish brown; faint gray and yellow mottling in upper part, the mottling increasing with increasing depth; sandy clay loam; weak to moderate medium, subangular blocky structure; firm; medium acid in upper part, grading to slightly acid or neutral below.
- D 36 inches +, gray and yellow; stratified sand and gravel; loose; neutral to calcareous.

In most places, the texture of the surface soil is loam, but in some places it is sandy loam. The content of organic matter varies considerably. The plow layer is gravelly and cobbly in places. Pieces of black, acid shale are common in the lower part of the profile. Depth to mottling ranges from 14 to about 28 inches. Depth to calcareous sand and gravel ranges from 24 to 42 inches. Fine-textured materials, either till or lacustrine, occur below a depth of 5 feet in some areas.

Surface runoff and internal drainage are medium to slow.

About 10 percent of the acreage of Ionia loams is wooded; 55 to 65 percent is used for corn, small grains, legumes and grasses grown together, and other crops; and 30 percent is in permanent pasture and other uses. Vegetables and small fruits are grown to some extent.

Areas of Bronson and other associated soils, too small to map separately, are included with these soils.

MAPPING UNITS

(IaA) **Ionia loam, 0 to 3 percent slopes.** Soil management unit 3aA(IIS).

(IaB) **Ionia loam, 3 to 7 percent slopes.** Soil management unit 3aB(IIS).

Kendallville Series

The Kendallville soils are well drained and light colored. They have formed in loamy and gravelly materials Beneath these materials is calcareous glacial till consisting of loam to clay loam. These soils are widely distributed throughout the till uplands, in glacial drainage valleys, and in areas bordering the lakebed plains. Some areas occur on terraces adjacent to the valleys of the principal streams, and a few areas are on low swells and on beach ridges. Commonly, the soils occur in a transitional zone between soils of the till plains and soils of the glacial valleys and outwash plains. The native vegetation was a deciduous forest made up mainly of oak, hickory, and maple.

The Kendallville soils are in the same catena as the moderately well drained Cadmus, the imperfectly drained Macomb, and the poorly to very poorly drained Berville soils. They are similar to the Fox soils but differ in that loose gravel and sand underlie the Fox soils instead of calcareous glacial till.

Profile description of a Kendallville loam:

- A_p 0 to 7 inches, grayish brown to yellowish brown; loam; weak, fine, granular structure; friable; content of organic matter variable but generally low; medium to slightly acid.
- A_2 7 to 14 inches, yellowish brown; sandy loam to loam; contains moderate amounts of gravel and cobblestones in places; weak, coarse, granular structure; friable; medium to slightly acid.
- B_{21} 14 to 28 inches, yellowish brown to reddish brown; clay loam to silty clay loam; moderate, medium to coarse, subangular blocky structure; firm; medium to slightly acid.
- B_{22} 28 to 36 inches, brownish yellow or yellowish brown; sand and gravelly material or gravelly clay loam; very weak, coarse, subangular blocky structure; very friable to firm; slightly acid.
- C 36 inches +, brownish yellow; glacial till consisting of loam to clay loam; massive or very weak, coarse, angular blocky structure; neutral to calcareous.

The texture of the surface soil ranges from sandy loam to loam. In some places the plow layer contains a few cobblestones or other stones. The depth to till ranges from 18 to 42 inches. The B_{22} horizon ranges from 0 to 10 inches in thickness and occurs at depths ranging from 24 to 42 inches. The material over the till is generally moderately gravelly and cobbly, and in a few places there is evidence of sorting by water.

Runoff is medium to rapid. Permeability is moderate.

Approximately 40 to 50 percent of the acreage of Kendallville soils is in general crops, 30 percent is in pasture, and 25 percent is in woods and other uses.

MAPPING UNITS

(KaC) **Kendallville loam, 7 to 15 percent slopes.** Soil management unit 3/2aC(IIIS).
(KaC2) **Kendallville loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 3/2aC(IIIS).
(KbC) **Kendallville sandy loam, 7 to 15 percent slopes.** Soil management unit 3/2aC(IIIS).
(KcC2) **Kendallville soils, 7 to 15 percent slopes, moderately or severely eroded.** Soil management unit 3/2aC(IVS).

Kerston Series

The Kerston soils consist of alternate layers of black muck and alluvial sands and silts. The layers of mineral material are generally thinner than the layers of muck. The soils are in poorly drained depressions or on the flats of bottom lands. They have a high water table and are flooded frequently. The native vegetation consisted mainly of a mixed stand of elm, ash, red maple, poplar, alder, and other hardwoods, together with marsh grasses and sedges.

Profile description of Kerston muck:

0 to 8 inches, very dark gray or black; muck; fine, granular structure; neutral.
8 to 42 inches, alternate layers of black or dark-brown muck, gray sand, and gray silt; all layers are slightly acid to calcareous.
42 inches +, gray; alternate layers of alluvial silts, clays, and sands; in places the layers of gravel and sand are less than 6 inches thick.

The thickness and number of alternate layers of muck and mineral materials vary greatly from place to place and within short horizontal distances.

Areas of these soils that have been cleared are used mainly for pasture. The rest is in brush and woodland.

MAPPING UNIT

(KdA) **Kerston muck and loams, 0 to 3 percent slopes.** Soil management unit Mc–LA(IVW).

Kibbie Series

The soils of the Kibbie series are imperfectly drained. They have formed in stratified fine sand, silt, and clay. The topography in the areas where these soils occur is of the sag and swale type with local changes in elevation of 2 to 5 feet.

The Kibbie soils are in the same catena as the well drained Sisson and the moderately well drained Tuscola soils. The Sisson and Tuscola soils are not mapped in this county but are mapped elsewhere in the State. In this county the Kibbie soils occur in such intricate mixtures with the Colwood soils that the soils of the two series are mapped as one unit.

Profile description of a Kibbie fine sandy loam:

A_p 0 to 7 inches, dark gray to very dark grayish brown; fine sandy loam; weak, fine, granular structure; friable when moist, and soft when dry; moderate content of organic matter; slightly acid.
A_2 7 to 11 inches, grayish brown; slightly mottled with yellowish brown; loam; weak, medium, granular structure; friable when moist, and soft when dry; slightly acid or neutral.
B_{21g} 11 to 19 inches, brown; mottled with grayish brown, light brown, and gray; silt loam to silty clay loam; moderate, medium, subangular blocky structure; plastic when wet, firm when moist, and hard when dry; neutral.
B_{22g} 19 to 34 inches, light brown; mottled with yellowish brown and gray; light silty clay loam or sandy clay loam; medium, subangular blocky structure; plastic when wet, firm when moist, and hard when dry; neutral.
C_g 34 inches +, light brown; mottled with yellowish brown and gray; silt and very fine sand; massive; friable when moist, and slightly hard when dry; calcareous.

The thickness and sequence of layers of silt, sand, and clay are variable. In some places thin layers of loam and clay occur in the lower part of the profile.

Each year approximately 65 to 75 percent of the acreage of Kibbie and Colwood fine sandy loams is used to grow corn, small grains, and hay crops, or for legume rotation pasture or special crops. The rest is about equally divided among woods, permanent pastures, and other uses. Tomatoes and soybeans are grown in some areas.

MAPPING UNITS

(KeA) **Kibbie and Colwood fine sandy loams, 0 to 3 percent slopes.** Soil management unit 3cA(IIW).
(KeB) **Kibbie and Colwood fine sandy loams, 3 to 7 percent slopes.** Soil management unit 3cA(IIW).

Kokomo Series

Soils of the Kokomo series are very poorly drained. They have formed in loamy materials. The soils are very gently sloping to nearly level. They occur in a transitional zone between lighter colored, better drained soils and deeper depressions occupied by muck and peat. Most of the areas are 25 to 75 yards wide; in many places they completely occupy depressions.

The Kokomo soils are in the same catena as the well-drained Miami, the imperfectly drained Conover, and the poorly to very poorly drained Brookston soils. The Kokomo soils are not mapped separately in this county. In places they occur in such intricate mixtures with the Barry soils that the soils of the two series are mapped as one unit. In other places they are mapped with the Barry and Wallkill loams.

Profile description of a Kokomo loam:

A_p 0 to 7 inches, very dark gray to very dark brown or black; loam; weak, medium to fine, granular structure; friable when moist, and soft when dry; very high content of organic matter; neutral.
A_1 7 to 15 inches, very dark gray; silty clay loam or clay loam; moderate, coarse, granular structure; plastic when wet, firm when moist, and hard when dry; moderately high content of organic matter; neutral or slightly acid.
GB 15 to 31 inches, gray; mottled with yellowish brown and dark yellowish brown; silty clay loam; moderate, medium to coarse, angular blocky structure; plastic when wet, firm when moist, and hard when dry; neutral to slightly acid.
C_g 31 inches +, grayish brown; mottled with dark yellowish brown and olive brown; glacial till consisting of loam; massive; slightly plastic when wet, firm when moist, and hard when dry; calcareous.

The thickness of the dark-colored surface layer ranges from 12 to about 18 inches. The GB horizon is predominantly light gray in some places.

The areas where the Kokomo soils are mapped with Barry loams are too narrow to farm separately. Generally, they are used in the same way as the surrounding soils. About 40 to 50 percent of the acreage of Kokomo

and Barry loams is used for crops, 20 to 30 percent for pasture, and 20 to 30 percent for woods and other uses. Corn, soybeans, oats, wheat, and legumes and grasses grown together are the common crops.

Because of the poor natural drainage and the difficulty in obtaining outlets for drainage, only a small part of the acreage of Kokomo, Barry, and Wallkill loams mapped together is used for crops. Most of it is in pasture and woods.

MAPPING UNITS

(KfA) **Kokomo and Barry loams, 0 to 3 percent slopes.** Soil management unit 2cA(I).

(KgA) **Kokomo, Barry, and Wallkill loams, overwashed, 0 to 3 percent slopes.** These soils occur together in basins or in sags or swales and in seepage areas. They form a complex pattern, and the areas of individual soils were too small to map separately. The Kokomo soils comprise the major part of the mapping unit.

These soils are covered with a light-colored to moderately dark colored layer of silt loam or sandy loam that is 8 to 30 inches thick. Their natural drainage ranges from very poor to poor. A profile typical of the Barry soils is described under the Barry series, and a profile typical of the Wallkill soils is described under the Wallkill series. Soil management unit 2cA(I).

Lake Borders

Surrounding many of the lakes in Lenawee County are intricate mixtures of organic and mineral soils. The areas of individual soils are usually less than 2 acres in size. No attempt was made to separate them at the time the soil survey was made.

The areas are generally low and wet and have a high water table. They are covered with brush and with marsh sedges and grasses. Small areas of better drained soils also occur throughout the unit. In general, the soils of this mapping unit are poorly suited to agriculture. A few areas are used for pasture, and a small acreage is used for summer cottages and for recreation.

MAPPING UNIT

(LaA) **Lake borders.** Soil management unit Xc(VIIIW).

Lenawee Series

The Lenawee series consists of poorly to very poorly drained, dark-colored soils. These soils have formed in lake-laid deposits of stratified, calcareous silty clay loam and clay loam with thin lenses of fine sand, silt, and clay. The native vegetation was largely sedges and grasses but included some elm, swamp white oak, sycamore, willow, and cottonwood trees.

These soils are similar to the Colwood soils, but the Colwood soils formed in lacustrine deposits of stratified very fine sand and silt containing some clay. They also resemble the Pewamo soils, but the Pewamo soils formed in glacial till.

In the largest area of these soils on the lakebed plain, there is a gradient of less than 2 feet per mile.

Profile description of a Lenawee silty clay loam:

A_p 0 to 7 inches, dark gray to very dark brownish gray; silty clay loam; weak, fine to medium, granular structure; friable to firm; medium to high content of organic matter; neutral to slightly acid.

GB_1 7 to 18 inches, dark grayish brown; mottled with olive brown; silty clay loam; moderate, medium, subangular blocky structure; plastic when wet, firm when moist; slightly acid to neutral.

GB_2 18 to 32 inches, dark grayish brown; mottled with yellow, gray, and brown; silty clay loam that contains thin layers of very fine sand and clay; moderate, medium to coarse, angular structure; firm; neutral.

C_g 32 inches +, grayish brown; mottled with gray, yellow, and brown; stratified silty clay loam and clay loam that contains thin layers of fine sand, silt, and clay; massive; firm; calcareous.

The plow layer ranges from 6 to 10 inches in thickness. Where the Lenawee soils grade to Colwood soils, the proportion of silt and fine sand increases.

Runoff is very slow, and permeability is moderately slow.

About 75 to 85 percent of the acreage of Lenawee silty clay loam is in crops, 10 to 15 percent is in pasture and woods, and 10 percent is in other uses. Corn, small grains, soybeans, and legumes and grasses grown together are the main crops. Squash, tomatoes, potatoes, melons, and other special crops are also grown in some areas.

MAPPING UNIT

(LbA) **Lenawee silty clay loam, 0 to 3 percent slopes.** Soil management unit 2cA(I).

Linwood Series

The Linwood series consists of organic soils in which the remains of plants are well disintegrated. The soils have formed in mixed woody and fibrous materials that overlie loam. They resemble the Tawas, Willette, and Edwards soils, but Tawas muck is underlain by sand; Willette muck, by clay and silty clay; and Edwards muck, by marl. The Linwood mucks also resemble the Carlisle and Ogden soils, but the Carlisle soils formed in more than 42 inches of mixed woody and fibrous materials, and the Ogden soils, in fibrous organic materials.

Profile description of Linwood muck:

0 to 12 inches, very dark gray; well-decomposed muck that contains many fine fragments of partly decayed wood; fine, granular structure; slightly acid.

12 to 22 inches, very dark gray to very dark brown; well-decomposed muck that contains some fragments of partly decayed wood; medium, granular structure; slightly acid.

22 to 31 inches, brown to dark yellowish brown; peat made up of partly decayed grasses and sedges and some woody materials; slightly acid to neutral.

31 inches +, grayish brown; mottled with light olive brown; loam or sandy loam; massive; friable when moist, and soft when dry; calcareous.

Depth to the loam substratum ranges from 12 to 42 inches. In places soft, gelatinous, sedimentary silt and clay occur just above the substratum. There are small amounts of marl in the subsurface layer.

A fairly large portion of Linwood muck has been cleared and is used for pasture. Bluegrass and whiteclover are grown on the drained areas, and reed canarygrass, on the undrained area. Approximately 20 percent of the acreage is used for crops, principally corn.

MAPPING UNIT

(LcA) **Linwood muck, 0 to 3 percent slopes.** Soil management unit M/3c(IIW).

Macomb Series

Soils of the Macomb series are imperfectly drained and are moderately dark colored. They have formed in sandy loam and loamy materials. Beneath these materials is

glacial till consisting of loam or light silty clay loam. The soils are nearly level. They occur along the western edge of the lake plain; along glacial drainageways; as small, shallow areas in outwash plains; or on the borders of lakes or swamps. The native vegetation was elm, red maple, and some beech trees and other hardwoods.

The Macomb soils are in the same catena as the well-drained Kendallville and the poorly to very poorly drained Berville soils. In places they occur in such intricate mixtures with the Hoytville soils that the soils of the two series are mapped as one unit. In other places they are mapped with the Brady soils. The Macomb soils resemble the Brady soils in that they formed in similar materials; the Brady soils, however, overlie coarse sand and gravel.

Profile description of a Macomb fine sandy loam:

A_p 0 to 7 inches, very dark grayish brown; fine sandy loam; weak, fine, granular structure; friable when moist; moderate content of organic matter; medium to slightly acid.

A_{2g} 7 to 11 inches, pale brown or yellowish brown; fine sandy loam; weak, fine, subangular blocky structure to weak, coarse, granular structure; friable when moist; slightly to medium acid.

B_{1g} 11 to 13 inches, yellowish brown; mottled with pale brown; loam to fine sandy loam; moderate, medium, subangular blocky structure; friable when moist; medium acid.

B_{2g} 13 to 32 inches, light brown; mottled with dark ylelowish brown; loam, sandy clay loam, or clay loam; moderate medium, subangular blocky structure; plastic when wet, firm when moist, and hard when dry; medium acid.

D 34 inches +, light brown; mottled with dark yellowish brown; glacial till consisting of loam or light clay loam; medium, subangular blocky structure to massive; firm when moist, and hard when dry; calcareous.

The surface layer ranges in texture from fine sandy loam to loamy sand. The texture of the B horizons ranges from heavy sandy loam to clay loam but includes variable amounts of gravel. Depth to fine-textured calcareous material ranges from about 18 to 42 inches. In some places fine gravel occurs in the surface soil and subsoil; in others the coarser textured overburden thins out, and the loam or silty clay loam is exposed at the surface.

Surface runoff is slow. Permeability is moderate. In some places during wet periods there is a seepage zone, or lateral-moving, suspended ground water. The reddish-brown color of the surface soil in some places is evidence that such seepage areas are present.

In areas where the Macomb soils are mapped alone, the acreage is mainly in crops but a minor part is in pasture, woods, and other uses. Corn, small grains, hay and legume pasture are the principal crops. Because few fields consist entirely of Macomb soils, the use and management of the adjoining soils help to determine the use and management of these soils.

In areas where the Macomb soils are mapped with Hoytville soils, from 70 to 75 percent of the acreage is used for corn, soybeans, small grains, legumes and grasses grown together, and other crops. Approximately 5 to 10 percent of the acreage is in bluegrass pasture, and 10 to 20 percent is in woods and other uses.

MAPPING UNITS

(MaA) **Macomb fine sandy loam, 0 to 3 percent slopes.** Small areas of Berville, Brady, and other associated soils, too small to map separately, are included with this soil in mapping. Soil management unit 3/2bA(IIW).

(MbA) **Macomb sandy clay loam and Hoytville clay loam, 0 to 3 percent slopes.** In areas where the Macomb and Hoytville soils occur in intricate mixtures, they were not mapped separately. In these areas the topography is typically of the sag and swell type. Included with these soils in mapping are areas of Berville, Pewamo, and other adjoining soils too small to map separately. A profile typical of the Hoytville soils is described under the Hoytville series. Soil management unit 3/2bA(IIW).

Maumee Series

The Maumee series consists of dark-colored, very poorly drained soils formed in sand. The native vegetation was primarily marsh grasses, reeds, sedges, and water-tolerant trees.

These soils are in the same catena as the well-drained Plainfield and the poorly to very poorly drained Granby soils. They are similar to the Granby soils, except that the surface soil is thicker and darker colored, the upper part of the subsoil is predominantly grayer, and they are more poorly drained.

Profile description of a Maumee loamy sand:

A_1 0 to 12 inches, very dark gray to black; loamy sand; very weak, fine, granular structure; very friable; very high content of organic matter; neutral to slightly acid.

GB 12 to 36 inches, gray; upper part slightly mottled with yellow and brown, the mottling increasing with increasing depth; loamy sand to fine sand; single grain structure; loose; neutral to mildly alkaline.

C_g 36 inches +, light gray; mottled with yellow and brown; fine sand or sand; single grain structure; loose; calcareous; this material extends to depths of 5 to 20 feet or more.

The surface layer ranges in thickness from 10 to 15 inches or more. Generally, a thin layer of muck covers the surface in undisturbed areas. In some places, at depths between about 12 and 24 inches, the subsoil is light gray with little or no mottling. Small areas have layers of loamy material 1 to 3 inches thick at depths of 12 to 24 inches.

About 20 percent of the acreage of Maumee loamy sand, 0 to 3 percent slopes, is used to grow corn, cabbage, cucumbers, garden beets, turnips, table beans, melons, asparagus, onions, sweet corn, and other special crops. The rest is used mainly for pasture and woodlots. The pastures are made up of sedges and bluejoint as well as bluegrass. The native woods are largely cut over, and the second growth is mostly aspen, alder, oak, and elm. The undergrowth consists of shrubs and other plants.

MAPPING UNIT

(McA) **Maumee loamy sand, 0 to 3 percent slopes.** Soil management unit 5cA(IVW).

Miami Series

The Miami series consists of light-colored, well-drained soils formed in highly calcareous glacial till made up of loam to light clay loam. The native vegetation was mainly oak, hickory, maple, elm, beech, ash, and basswood.

These soils are in the same catena as the imperfectly drained Conover, the poorly to very poorly drained Brookston, and the very poorly drained Kokomo soils. In places they occur in such intricate mixtures with the Boyer soils that the soils of the two series are mapped as one unit. The Miami soils are similar to the Morley and Hillsdale soils. They have a coarser textured subsoil and substratum than the Morley soils and are somewhat

shallower over calcareous till than the Hillsdale soils. In addition, the till from which they formed was finer textured than the sandy loam till that was the parent material of the Hillsdale soils.

Profile description of a Miami loam:

A_p 0 to 7 inches, grayish brown; loam containing some gravel and stones; weak, fine to medium, granular structure; friable; low content of organic matter; medium to slightly acid.

A_2 7 to 12 inches, light yellowish brown; heavy loam containing some partially rounded stones and gravel; moderate, medium to coarse, granular structure or fine, subangular blocky structure; friable; medium to strongly acid.

B 12 to 36 inches, yellowish brown; clay loam that contains some angular and partially rounded stones; moderate, medium, subangular blocky structure in upper part and coarse, subangular blocky structure in lower part; firm when moist, hard when dry; medium to strongly acid in upper part, and slightly acid in lower part.

C 36 inches +, brownish yellow; glacial till consisting of loam to light clay loam; massive to weak, coarse, angular blocky structure; calcareous.

In places the texture of the surface layer is sandy loam. The amount of gravel, cobblestones, and other stones and boulders varies from place to place. Depth to calcareous till ranges from 24 to about 40 inches. In these soils runoff is medium and permeability is moderate.

In areas where the Miami soils are mapped alone, most of the acreage where slopes are less than 15 percent is used for corn, soybeans, small grains, and legumes and grasses grown together. Approximately 20 to 30 percent of the acreage is used for pasture, and 15 to 20 percent is in woods.

Most of the acreage where the Miami soils have slopes of more than 15 percent is used for permanent pasture. About 20 percent of this acreage is in woods, and 20 to 25 percent is used for small grains, legumes and grasses grown together, and other crops. Corn, soybeans, and other row crops are grown to a minor extent.

Included with the Miami loams are areas of Conover, Washtenaw, Hillsdale, and Brookston soils. The Washtenaw soils are not mapped separately in this county.

In the areas where the Miami soils are mapped with Boyer soils, the acreage where slopes are between 12 and 25 percent is used about as follows: 20 to 25 percent of it is in crops; 40 to 50 percent is in pasture, and 30 percent is in woods and other uses. Small grains and legumes and grasses grown together are the principal crops grown on these soils. Corn is grown to a minor extent.

Areas where the Miami and Boyer soils have slopes of more than 25 percent are used primarily for permanent pasture and woods.

Included with the Miami loam and Boyer sandy loam mapping units are minor areas of Fox, Hillsdale, Oshtemo, and Washtenaw soils

MAPPING UNITS

(MdA) **Miami loam, 0 to 3 percent slopes.** Soil management unit 2aA(I).

(MdB) **Miami loam, 3 to 7 percent slopes.** Soil management unit 2aB(IIE).

(MdB2) **Miami loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 2aB(IIE).

(MdC) **Miami loam, 7 to 15 percent slopes.** Soil management unit 2aC(IIIE).

(MdC2) **Miami loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 2aC(IIIE).

(MdD2) **Miami loam, 12 to 25 percent slopes, moderately eroded.** Soil management unit 2aD(IVE).

(MfC3) **Miami soils, 7 to 15 percent slopes, severely eroded.** Soil management unit 2aC(IVE).

(MfD3) **Miami soils, 15 to 25 percent slopes, severely eroded.** Soil management unit 2aD(VIE).

(MeD) **Miami loam and Boyer sandy loam, 12 to 25 percent slopes.** In many places the Miami and Boyer soils occur together as small individual areas on complex topography. A profile typical of the Boyer soils is described under the Boyer series. Soil management unit 2aD(IVE).

(MeD2) **Miami loam and Boyer sandy loam, 12 to 25 percent slopes, moderately eroded.** Soil management unit 2aD(IVE).

(MeE) **Miami loam and Boyer sandy loam, 25+ percent slopes.** Soil management unit 2aE(VIIE).

(MgD3) **Miami and Boyer soils, 12 to 25 percent slopes, severely eroded.** Soil management unit 2aD(VIE).

(MgE2) **Miami and Boyer soils, 25+ percent slopes, moderately eroded.** Soil management unit 2aE(VIIE).

Morley Series

Soils of the Morley series are light colored and are well to moderately well drained. They have formed in glacial till consisting of calcareous silty clay loam or clay loam. The native vegetation was chiefly oak, hickory, maple, ash, beech, and elm.

The Morley soils belong to the same catena as the imperfectly drained Blount and the poorly to very poorly drained Pewamo soils. They resemble the Miami soils, but the Miami soils formed in loam to light clay loam and have a coarser textured B horizon.

Profile description of a Morley loam:

A_p 0 to 7 inches, grayish brown; loam; weak, fine to medium, granular structure; friable; low content of organic matter; medium to slightly acid.

A_2 7 to 11 inches, yellowish brown to pale yellow; loam to light silty clay loam that contains some stones and gravel; weak, coarse, granular structure; friable to slightly firm; medium to strongly acid.

B_2 11 to 24 inches, yellowish brown; material in lower 3 or 4 inches normally darker colored; silty clay loam, clay loam, or light silty clay that contains some gravel and fragments of rock; moderate, medium to coarse, subangular blocky structure; firm when moist, and hard when dry; medium to strongly acid in upper part, slightly acid to neutral below.

C 24 inches +, brownish yellow; glacial till consisting of clay loam or silty clay loam; weak, coarse, angular blocky structure to massive; firm; calcareous.

The texture of the surface soil ranges from a light silty clay loam to loam. The surface soil in woodlots is 1 to 3 inches thick. The plow layer contains a moderate amount of cobblestones and other stones in a few places. Depth to calcareous till ranges from 20 to 30 inches.

Runoff is medium, and movement of water through the soil is moderate.

The Morley soils that have slopes of less than 15 percent are used as follows: 45 to 55 percent of the acreage is in corn, soybeans, small grains, legumes and grasses grown together, and other crops; 20 to 25 percent is in permanent pasture; and 20 percent is in woods and other uses.

The Morley soils that have slopes of more than 15 percent are used primarily for permanent pasture. About 10 to 15 percent of the acreage of these soils is cropped, and 20 to 30 percent is in woods and other uses.

Areas of Blount and Pewamo soils too small to map separately are included with the Morley soils.

MAPPING UNITS

(MhA) **Morley loam, 0 to 3 percent slopes.** Soil management unit 2aA(I).
(MhB) **Morley loam, 3 to 7 percent slopes.** Soil management unit 2aB(IIE).
(MhB2) **Morley loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 2aB(IIE).
(MhC) **Morley loam, 7 to 15 percent slopes.** Soil management unit 2aC(IIIE).
(MhC2) **Morley loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 2aC(IIIE).
(MhD) **Morley loam, 12 to 25 percent slopes.** Soil management unit 2aD(IVE).
(MhD2) **Morley loam, 12 to 25 percent slopes, moderately eroded.** Soil management unit 2aD(IVE).
(MhE) **Morley loam, 25+ percent slopes.** Soil management unit 2aE(VIIE).
(MkB3) **Morley soils, 3 to 7 percent slopes, severely eroded.** Soil management unit 2aB(IIIE).
(MkC3) **Morley soils, 7 to 15 percent slopes, severely eroded.** Soil management unit 2aC(IVE).
(MkD3) **Morley soils, 12 to 25 percent slopes, severely eroded.** Soil management unit 2aD(VIE).
(MkE2) **Morley soils, 25+ percent slopes, moderately or severely eroded.** Soil management unit 2aE(VIIE).

Nappanee Series

The Nappanee soils are light colored and imperfectly drained. They have formed in glacial till consisting of calcareous silty clay to clay. The soils occur chiefly in the lakebed plain in the eastern part of the county. Old glacial lakes covered most of the areas and modified the surface material and the relief. The native vegetation was beech, maple, oak, basswood, elm, and other deciduous trees.

These soils are in the same catena as the moderately well drained St. Clair and the poorly to very poorly drained Hoytville soils. In places the Nappanee soils are transitional to Hoytville silty clay loam. In other places, where the slope has a drop of 5 to 15 feet per mile, the slight development of natural dissection has caused Nappanee soils to form on the very gently sloping swells and Hoytville soils in the swales.

Profile description of a Nappanee silt loam:

A_p 0 to 7 inches, brownish gray to pale brown; silt loam; weak, fine to medium, granular structure; friable; low content of organic matter; slightly to medium acid.
A_2 7 to 10 inches, brownish gray to grayish yellow; faint, pale-yellow mottling in the lower part; silty clay loam; moderate, fine, subangular blocky structure; firm; slightly to medium acid.
B_{2g} 10 to 20 inches, gray; mottled with brown and pale yellow; silty clay or clay; moderate, medium to coarse, angular blocky structure; very firm when moist, and hard when dry; medium to slightly acid.
C_g 20 inches +, gray; mottled with brownish yellow; glacial till consisting of silty clay or clay and containing fragments of black or dark-gray shale; weak, coarse to very coarse, angular blocky structure; very firm when moist, and hard when dry; calcareous.

The texture of the surface soil is generally loam to silt loam, but in some places the surface is covered with 4 or 5 inches of sandy loam. In most places gravel, boulders, cobblestones, and other stones are not abundant, and most fields are rather free of stones. When the soil dries out, cracks develop. These cracks range up to 1 inch in width and 18 inches in depth.

Approximately 55 to 65 percent of the acreage of Nappanee soils is in crops, 20 to 25 percent is in pasture, and 15 percent is in woods and other uses. The major crops are corn, soybeans, small grains, and legume-grass meadow.

Included in the Nappanée mapping units are areas of Pewamo and other associated soils too small to map separately.

MAPPING UNITS

(NaA) **Nappanee silt loam, 0 to 3 percent slopes.** Soil management unit 1bA(IIIW).
(NaB) **Nappanee silt loam, 3 to 7 percent slopes.** Soil management unit 1bA(IIIW).
(NaB2) **Nappanee silt loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 1bA(IIIW).
(NbB) **Nappanee loam, 3 to 7 percent slopes.** Soil management unit 1bA(IIIW).
(NbB2) **Nappanee loam, 3 to 7 percent slopes, moderately eroded.** Soil management unit 1bA(IIIW).

Ogden Series

The Ogden series consists of organic soils that have formed from fibrous reeds and sedges. The underlying materials are made up of fine silty clay loam to clay. The native vegetation was sedges, reeds, and grasses.

These soils resemble the Houghton soil but are shallower over the underlying mineral materials. They are similar to the Willette soils, but the Willette soils have formed largely from woody organic materials. The Ogden soils also resemble the Palms, Adrian, and Rollin soils, except that the texture of the underlying mineral differs. The Palms soils are underlain by sandy loam or clay loam; the Adrian soil, by sand or loamy sand; and the Rollin soil, by marl.

Profile description of Ogden muck:

0 to 13 inches, black; well-decomposed muck; moderate, fine to medium, granular structure; slightly to medium acid.
13 to 15 inches, very dark brown; muck that contains few distinguishable plant remains and roots; slightly to medium acid.
15 to 30 inches, yellowish brown; partly decomposed, fibrous peaty material; slightly acid to mildly alkaline.
30 to 34 inches, gray; fine silty clay loam, silty clay, or clay; massive; very firm; mildly alkaline.
34 inches +, gray; mottled with reddish brown; fine silty clay loam, silty clay, or clay; massive or weak, fine, angular blocky structure; very firm; alkaline to calcareous.

The degree of decomposition varies. Depth to the mineral substratum of fine silty clay loam or silty clay ranges from 12 to 42 inches.

Many of the undrained areas are used for pasture. The areas that have been drained are used largely for growing corn and truck crops.

MAPPING UNIT

(OaA) **Ogden muck, 0 to 3 percent slopes.** Soil management unit M/1c(IIIW).

Oshtemo Series

The Oshtemo soils are light colored and well drained. They have formed in sandy and loamy materials that overlie neutral to calcareous sand and gravel. These soils are on outwash plains and terraces. Areas 40 to 200 acres in size occur in Raisin Township, and areas 10 to 30 acres in size, in other parts of the county. The native vegetation was a hardwood forest, principally oak, hickory, and maple.

The Oshtemo soils are deeper over loose sand and gravel and are coarser textured throughout the profile than the Fox soils. They resemble the Boyer soils, but the Boyer

soils are underlain by calcareous sand and gravel at a depth of 24 to 42 inches.

Profile description of an Oshtemo loamy sand:

A_p 0 to 8 inches, grayish brown to yellowish brown; loamy sand; very weak, medium, granular structure; very friable; low content of organic matter; slightly to strongly acid.

A_2 8 to 14 inches, grayish brown to brown; sand to loamy sand; single grain structure; loose to very friable; medium to strongly acid.

B_1 14 to 38 inches, yellowish brown; loamy sand to sandy loam; very weak, medium, subangular blocky structure; very friable; medium to strongly acid.

B_2 38 to 45 inches, yellowish brown to reddish brown; sandy loam to sandy clay loam; weak, medium, subangular blocky structure; firm; medium acid.

D 45 inches +, pale yellow; sand and fine gravel; loose; neutral to calcareous.

The thickness of the B_2 horizon varies considerably from place to place and ranges from about 3 to 10 inches. Depth to calcareous sand and gravel ranges from 42 to 66 inches. Sand piled up along fence rows and on eastward-facing slopes shows that wind erosion has been active in some fields. A few blowouts occur in some areas.

Runoff is slow to medium, and most of the water passes through the soil at a rapid rate.

Approximately 35 to 45 percent of the acreage of Oshtemo loamy sand is cropped, 30 to 40 percent is pastured, and the rest is in woods or other uses. Small grains and legumes and grasses grown together are the principal crops.

Small areas, usually less than 2 acres in extent, of Fox sandy loam, Boyer sandy loam, and Ottawa loamy fine sand are included in the Oshtemo mapping units.

MAPPING UNITS

(ObA) **Oshtemo loamy sand, 0 to 3 percent slopes.** Soil management unit 4aA(IIIS).

(ObB) **Oshtemo loamy sand, 3 to 7 percent slopes.** Soil management unit 4aB(IIIS).

(ObB2) **Oshtemo loamy sand, 3 to 7 percent slopes, moderately eroded.** Soil management unit 4aB(IIIS).

(ObC) **Oshtemo loamy sand, 7 to 15 percent slopes.** Soil management unit 4aC(IIIS).

Ottawa Series

The Ottawa series consists of well-drained soils that have formed in sand and fine sand. They overlie calcareous glacial till made up of loam to clay or lacustrine materials. Most of these soils occur on glacial lake beach ridges that are long and narrow and on sandbar swells that rise 5 to 20 feet above the lake plain. The native vegetation was a forest consisting of oak, hickory, beech, and other hardwoods.

These soils are in the same catena as the moderately well drained Berrien, the poorly to very poorly drained Wauseon and Granby, and the very poorly drained Maumee soils. In places the Ottawa soils occur in such intricate mixtures with the Plainfield soils that the soils of the two series are mapped as one unit. The Ottawa soils differ from the Plainfield soils in having finer textured materials at a depth of 42 to 66 inches.

Profile description of an Ottawa loamy sand:

A_1 0 to 7 inches, grayish brown to yellowish brown; loamy sand; structureless; loose; low content of organic matter; medium to strongly acid.

A_2 7 to 35 inches, light brownish yellow or pale yellow; loamy sand to fine sand; structureless; loose; medium to strongly acid.

B 35 to 50 inches, brownish yellow or pale yellow; fine sand; structureless; loose; medium to strongly acid in upper part, slightly acid in lower part.

C_g 50 inches +, gray; mottled with yellowish brown; glacial till made up of loam, clay loam, or lake-laid clays; massive; plastic when wet, firm when moist, and hard when dry; calcareous.

The depth to the heavier textured substratum ranges from 42 to 66 inches. In some areas there are a few thin and generally discontinuous lenses or bands of strong-brown, heavy loamy sand or light sandy loam in the B horizon. Permeability is moderately rapid in the sandy material.

The acreage of this mapping unit is small. Its use is similar to that of Plainfield and Ottawa loamy soils described under the Plainfield series.

MAPPING UNIT

(OcC) **Ottawa loamy sand, 7 to 15 percent slopes, slightly or moderately eroded.** Soil management unit 5aC(IVS).

Palms Series

The Palms series consists of organic soils formed from fibrous plant materials, largely reeds and sedges. The soils contain little or no woody materials. They overlie sandy loam or clay loam.

These soils resemble the Ogden and Adrian soils, but the Ogden soils are underlain by clay, and the Adrian, by sand and loamy sand. They also resemble the Linwood and Houghton soils, but the Linwood soils have formed largely from woody organic materials, and the Houghton are deeper over the underlying mineral materials.

Profile description of Palms muck:

0 to 13 inches, black to very dark brown; well-decomposed muck; fine, granular structure; slightly to medium acid.

13 to 15 inches, very dark brown; muck containing few distinguishable plant remains; slightly to medium acid.

15 to 32 inches, yellowish brown; partly decomposed, fibrous peaty materials; slightly acid to mildly alkaline.

32 inches +, gray; mottled with dark yellowish brown or olive brown; sandy loam or loam; massive; friable when moist; calcareous.

The depth to the underlying mineral material ranges from 12 to 42 inches.

Areas of Palms muck that have been drained are used successfully to grow corn and special crops.

MAPPING UNIT

(PaA) **Palms muck, 0 to 3 percent slopes.** Soil management unit M/3c(IIW).

Pewamo Series

Soils of the Pewamo series are very dark colored and are poorly to very poorly drained. They have formed in calcareous glacial till consisting of silty clay loam or clay loam. The native vegetation was elm, ash, swamp white oak, soft maple, and other hardwoods.

The Pewamo soils are in the same catena as the moderately well to well drained Morley and the imperfectly drained Blount soils. The Pewamo soils resemble the Brookston soils, except that the Brookston soils formed from loam, silt loam, and light clay loam. The Pewamo

soils are also similar to the Hoytville soils, but the Hoytville soils formed from silty clay and clay.

Profile description of a Pewamo clay loam:

A_p 0 to 7 inches, very dark gray to very dark brownish gray; clay loam; weak, medium, granular structure; friable to firm; rather high content of organic matter; neutral to slightly acid.

A_{1g} 7 to 16 inches, very dark gray; mottled with yellow and brown; silty clay loam or light silty clay; moderate, medium, angular blocky structure; firm when moist, plastic when wet, and hard when dry; content of organic matter lower than in the A horizon; neutral.

GB 16 to 32 inches, grayish brown; mottled with yellow, brown, and gray; silty clay loam, clay loam, or light silty clay; moderate, coarse, angular blocky structure; firm when moist, plastic when wet, and hard when dry; root channels contain dark-colored silty materials; neutral to mildly alkaline.

C 32 inches +, yellowish brown; mottled with grayish brown and gray; glacial till consisting of silty clay loam or clay loam; calcareous.

In thickness the dark-colored surface layer ranges from 9 to 15 inches, and in texture, from clay loam to mucky clay loam. In some places there are thin deposits of silt loam, loam, or sandy loam where runoff and wash materials from adjacent slopes have collected.

From 60 to 70 percent of the acreage of Pewamo soils is cropped, about 15 percent is in pasture, and 15 to 20 percent is in woods and other uses. The major crops are corn, soybeans, small grains, and legumes and grasses grown together.

Included in the Pewamo mapping units are areas of Blount and other associated soils that were too small to map separately.

MAPPING UNITS

(PbA) **Pewamo clay loam, 0 to 3 percent slopes.** Soil management unit 2cA(I).

(PcA) **Pewamo mucky clay loam, 0 to 3 percent slopes.** Soil management unit 2cA(I).

Plainfield Series

Soils of the Plainfield series are light colored and well drained. They have formed in loose, sandy materials. The topography in the area where these soils occur is nearly level to very gently undulating.

The Plainfield soils are not mapped separately in this county. In some places they occur in such intricate mixtures with the Ottawa soils that the soils of the two series are mapped as one unit, and in others they are mapped with the Berrien soils. In still other places they are mapped with the Boyer, Hillsdale, and Spinks soils.

The Plainfield and Ottawa soils occur together on glacial lake beaches and on outwash plains and terraces that have been reworked by wind. Most areas are rounded in shape and are 30 to 50 acres in size. Unlike the Plainfield soils, the Ottawa soils are underlain by loam to clay instead of by loose sand.

Profile description of a Plainfield loamy sand:

A_p 0 to 7 inches, grayish brown to yellowish brown; loamy sand; very weak, fine, granular structure to single grain; very friable to loose; low content of organic matter; medium to strongly acid.

A_2 7 to 12 inches, yellowish brown or pale brown; loamy sand or fine sand; single grain; loose; strongly acid.

B 12 to 36 inches, light brownish yellow; sand to coarse loamy sand; single grain; loose; medium to strongly acid.

C_1 36 to 60 inches, brownish yellow or pale yellow; medium sand, fine sand, or very fine sand; single grain; loose; medium to strongly acid in upper part, slightly acid in lower part.

C_2 60 inches +, light gray to yellowish gray; sand or very fine sand; slightly acid to mildly alkaline; this layer extends to depths of several feet and normally is underlain by till or by lake-laid clay.

Thin, strong-brown or reddish-brown lenses or pellets and thin, discontinuous layers of loamy sand occur below a depth of 60 inches in some places.

From 20 to 30 percent of the acreage of Plainfield and Ottawa loamy sands mapped together is used for corn, small grains, legumes and grasses grown together, and other crops; 40 to 50 percent is in bluegrass pasture; 10 to 15 percent is in woods; and 15 to 20 percent is in fruit crops and other uses. Apples and peaches are the main fruits, but pears, cherries, and plums are grown to some extent. Berries, melons, and other truck and garden crops are produced commercially on a small scale in some areas.

Approximately 50 to 60 percent of the acreage of Plainfield and Berrien loamy sands mapped together is in corn, small grains, legumes and grasses grown together, and other crops. About 20 percent is used for permanent pasture, and the rest is in woods and other uses. A few areas are used for gardens or for fruit or truck crops.

Included with both the Plainfield and Ottawa loamy sands and the Plainfield and Berrien loamy sands are small areas of Spinks and Coloma soils too small to map separately. The Spinks and Coloma soils have a finer textured B horizon and are somewhat higher in moisture-holding capacity and in fertility than either the Plainfield and Ottawa loamy sands or the Plainfield and Berrien loamy sands. The Coloma soils are not mapped separately in this county but occur in adjacent areas.

In some areas of the Plainfield and Ottawa loamy sands and in the Plainfield and Berrien loamy sands there are small, wet depressions that contain other mineral soils and muck. A few blowouts occur in some places where the wind has removed the sand to a depth of a few feet.

MAPPING UNITS

(PeA) **Plainfield and Ottawa loamy sands, 0 to 3 percent slopes.** Soil management unit 5aA(IVS).

(PeB) **Plainfield and Ottawa loamy sands, 3 to 7 percent slopes.** Soil management unit 5aB(IVS).

(PeB2) **Plainfield and Ottawa loamy sands, 3 to 7 percent slopes, moderately eroded.** Soil management unit 5aB(IVS).

(PeC) **Plainfield and Ottawa loamy sands, 7 to 15 percent slopes.** Soil management unit 5aC(IVS).

(PeC2) **Plainfield and Ottawa loamy sands, 7 to 15 percent slopes, moderately eroded.** Soil management unit 5aC(IVS).

(PdA) **Plainfield and Berrien loamy sands, 0 to 3 percent slopes.** Soil management unit 5aA(IVS).

(PdB) **Plainfield and Berrien loamy sands, 3 to 7 percent slopes.** Soil management unit 5aB(IVS).

Rifle Series

The Rifle series consists of organic soils formed mainly from slightly decomposed woody plants, such as tamarack, red maple, elm, and white birch, and from a few fibrous plants. The soils are similar to Carlisle and Houghton soils, but the surface layer of the Carlisle soils consists of much more decomposed muck and the Houghton soils have formed mainly from fibrous plant remains.

Profile description of Rifle peat:

0 to 14 inches, nearly black to very dark brown; slightly decomposed peaty materials; open and porous; medium to strongly acid.
14 inches +, brown or yellowish brown; fibrous, coarse-textured peat; medium acid to mildly alkaline.

In thickness the surface layer ranges from 4 to 10 inches. Depth to the underlying mineral substratum is more than 42 inches and is as much as 12 feet or more in some places.

These soils are mainly in second-growth woods and shrubby undergrowth or in marshland pasture. A small part of the acreage is used to grow truck crops, general crops, and pasture.

Small areas of Houghton muck are included with this mapping unit.

MAPPING UNIT

(RaA) **Rifle peat, 0 to 3 percent slopes.** Soil management unit Mc(IIIW).

Rimer Series

Soils of the Rimer series are imperfectly drained. They have formed in loamy sand or sandy loam. Beneath these materials is calcareous clay to silty clay.

The Rimer soils are in the same catena as the poorly to very poorly drained Wauseon soils. They resemble the Macomb soils but have a coarser textured B horizon. In addition, the Macomb soils are underlain by loam or clay loam.

Profile description of a Rimer sandy loam:

A_p 0 to 7 inches, dark brown to light yellowish brown; sandy loam; weak, fine, granular structure; very friable; moderate to low content of organic matter; medium to slightly acid.
A_2 7 to 15 inches, pale yellow to brownish yellow; faintly mottled with gray; fine sand to light sandy loam; very friable to very loose; medium to slightly acid.
B_{1g} 15 to 30 inches, yellow; mottled with brown; fine sand to light sandy loam; very weak, coarse, subangular blocky structure to single grain; loose to very friable; medium to slightly acid.
C_g 30 inches +, mottled yellow and brown; glacial till or lake-laid materials consisting of clay or silty clay; massive or weak, very coarse, angular blocky structure; very firm; calcareous.

The thickness of the sandy material in which these soils formed ranges from 18 to 42 inches. The texture of the surface soil ranges from sandy loam to loamy fine sand. Seepage is common at the base of the swells; in some areas where seepage occurs, the surface soil and the subsoil are both reddish brown.

The Rimer soils are not mapped separately in this county but are mapped with the Hoytville soils.

Rollin Series

The Rollin series consists of organic soils that have formed from the fibrous remains of reeds and sedges. The soils are underlain by marl. They are similar to the Ogden soils, but the Ogden soils are underlain by silty clay loam and clay. These soils occur in association with the Houghton, Ogden, Adrian, and Palms mucks and other organic soils.

Profile description of Rollin muck:

0 to 12 inches, black or very dark gray; well-decomposed muck; weak to moderate, fine, granular structure; slightly acid to mildly alkaline.
12 to 15 inches, very dark brown; muck that contains very few distinguishable plant remains; weak, medium, granular structure; slightly acid to mildly alkaline.
15 to 30 inches, yellowish brown; fibrous peaty materials; massive or thick platy structure; slightly acid to mildly alkaline.
30 inches +, gray; marl; massive; calcareous.

The thickness of the muck horizons and the degree of decomposition vary. Lenses of clay loam or silty clay loam mineral materials occur in the marl horizon in some places.

Rollin muck is used primarily for pasture and woods. It is best suited to pasture crops, such as reed canarygrass and bluegrass, depending upon the depth to the water table. Because the marl is near the surface, the value of the soil for cropping is limited. The marl also makes artificial drainage difficult.

MAPPING UNIT

(RbA) **Rollin muck, 0 to 3 percent slopes.** Soil management unit M/mc(IVW).

Sebewa Series

The Sebewa series consists of dark-colored, poorly to very poorly drained soils formed in loamy materials. The soils overlie calcareous sand and gravel. They occur on naturally wet flats in old glacial drainageways and on outwash or delta plains. The native cover was a dense growth of lowland hardwoods, principally elm, black ash, swamp white oak, silver maple, sycamore, tulip-poplar, beech, shagbark hickory, basswood, cottonwood, walnut, and butternut.

These soils are in the same catena as the well drained Fox and the moderately well drained Ionia soils. The catena also includes imperfectly drained Matherton soils, which are not mapped in this county but occur in adjacent areas. In many places the Sebewa soils occur in association with Berville soils, which have formed in similar materials but are underlain by loam or clay loam.

Profile description of a Sebewa loam:

A_p 0 to 8 inches, very dark gray to nearly black; loam; weak, fine, granular structure; friable; very high content of organic matter and mucky in places; neutral to slightly acid.
BG 8 to 30 inches, predominantly gray; mottled with yellow and brown; sandy clay loam to silty clay loam; moderate, fine to coarse, subangular blocky structure; firm; neutral to mildly alkaline.
D 30 inches +, gray and yellow; sand and fine gravel; generally contains some light-gray lime concretions and numerous fragments of black shale; loose; calcareous.

In places there is a thin layer of muck on the surface. The texture of the plow layer ranges from loam to sandy loam. The texture in the lower part of the BG horizon is heavy sandy loam. Depth to calcareous sand and gravel ranges from 24 to 42 inches.

Approximately 50 to 60 percent of the acreage of Sebewa soils is in crops, 35 to 45 percent is in pasture and woods, and 10 percent is in other uses. The major crops are corn, soybeans, small grains, and legumes and grasses grown together.

Included with the mapping units are small areas of Brady, Berville, and other associated soils.

MAPPING UNITS

(SaA) **Sebewa loam, 0 to 3 percent slopes.** Soil management unit 3cA(IIW).

(SbA) **Sebewa sandy loam, 0 to 3 percent slopes.** Soil management unit 3cA(IIW).

Sloan Series

Soils of the Sloan series are nearly level and are poorly to very poorly drained. They occur on alluvial flood plains, mainly in swales or in old stream channels and bayous. The areas are long and narrow, and most of them are less than 3 acres in size.

Profile description of a Sloan sandy loam:

A_p 0 to 9 inches, dark gray to very dark grayish brown; sandy loam; weak, medium, granular structure; friable when moist, soft when dry; high content of organic matter; neutral to alkaline.

A_1 9 to 15 inches, gray; mottled with brown; sandy clay loam or loam; weak, coarse to medium, granular structure; plastic when wet, friable when moist, and hard when dry; neutral to mildly alkaline.

$C_{21}g$ 15 to 22 inches, gray; mottled with dark yellowish brown; light clay loam; weak, medium to coarse, subangular blocky structure; plastic when wet, firm when moist, and hard when dry; neutral to alkaline.

$C_{22}g$ 22 inches +, dark brown to brown; mottled with brownish yellow; loam to light clay loam; massive; plastic when wet, firm when moist, and hard when dry; calcareous.

The thickness of the dark-colored surface layer ranges from 7 to about 15 inches. Below a depth of 9 inches, the texture varies—loam, silty clay loam, or heavy sandy loam occurs in places.

The Sloan soils are not mapped separately in this county but are included in mapping units with the Griffin soils.

Spinks Series

Soils of the Spinks series are light colored. They have formed in calcareous or neutral loamy sand, sand, and fine sand. The soils resemble the Plainfield soils but are heavier textured throughout and are not so strongly acid.

The Spinks soils are not mapped separately in this county. In places they occur in such intricate mixtures with the Boyer, Plainfield, and Hillsdale soils that the soils of these four series are mapped as one unit.

Profile description of a Spinks loamy sand:

A_p 0 to 7 inches, brown or dark grayish brown; loamy sand; very weak, medium, granular structure; very friable; neutral to medium acid.

A_2 7 to 20 inches, brown or yellowish brown; loamy sand or sand; very weak, medium, granular structure; loose; neutral to medium acid.

A_2 and B_2 20 to 50 inches, alternating yellowish-brown loamy sand and brown, more clayey bands ¼ to ½ inch thick; weak, fine to medium, subangular blocky structure in the bands; friable to very friable; slightly acid to neutral in upper part, mildly alkaline in lower part.

C 50 inches +, pale brown; loamy sand, fine sand, or sand; loose; calcareous.

The texture of the plow layer ranges from fine sand to loamy fine sand. The A_2 and B_2 horizons and the C horizon in many places consist of thin and discontinuous layers of loamy sand and sandy loam, 1/8 inch to 2 inches in thickness, separated by layers of brown sand.

Soils of the Spinks, Boyer, Plainfield, and Hillsdale mapping units that have slopes of less than 15 percent are used about as follows: 30 to 40 percent of the acreage is in corn, small grains, and legumes and grasses grown together; 35 to 40 percent is in pasture; and 25 to 40 percent is in woods, orchards, truck crops, and other uses.

Soils of these mapping units that have slopes of more than 15 percent are used primarily for permanent pasture and woods. A small proportion of the acreage is used for small grains, legumes and grasses grown together, and other crops.

MAPPING UNITS

(ScB) **Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes.** Soil management unit 4aB(IIIS).

(ScB2) **Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes, moderately eroded.** Soil management unit 4aB (IIIS).

(ScC) **Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes.** Soil management unit 4aC(IIIS).

(ScC2) **Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes, moderately eroded.** Soil management unit 4aC-(IIIS).

(ScD2) **Spinks, Boyer, Plainfield, and Hillsdale soils, 12 to 25 percent slopes, moderately eroded.** Soil management unit 4aD-(IVS).

St. Clair Series

Soils of the St. Clair series are light colored and moderately well drained. They have formed in highly calcareous glacial till consisting of silty clay to clay. The areas are rounded and long and range in size from 10 to 40 acres. Native vegetation was a deciduous forest made up mainly of white oak, hickory, maple, elm, beech, and white ash.

The soils are in the same catena as the imperfectly drained Nappanee and the poorly to very poorly drained Hoytville soils. They resemble the Morley soils but have a finer textured subsoil and substratum, are shallower to calcareous till, and contain more fragments of shale in the till.

Profile description of a St. Clair loam:

A_p 0 to 7 inches, grayish brown to light yellowish brown; loam; weak, fine to medium, granular structure; friable; low content of organic matter; medium to slightly acid.

A_2 7 to 11 inches, light yellowish brown; heavy loam to light silty clay loam; moderate, fine, subangular blocky structure; friable to firm when moist; medium to slightly acid.

B_2 11 to 23 inches, yellowish brown; clay to silty clay that contains small, partly weathered pieces of dark-gray shale; moderate, medium to coarse, angular blocky structure; very firm when moist, and hard when dry; strongly to medium acid in upper part, grading with depth to slightly acid or neutral in lower part.

C 23 inches +, light yellowish brown; faintly mottled with gray; silty clay or clay that contains small fragments of dark-gray shale; weak, coarse to very coarse, angular blocky structure; calcareous.

In places the lower part of the B_2 horizon is faintly mottled with gray. Boulders, cobblestones, and other stones are abundant in some areas. Stone symbols are used on the soil map to designate small areas where there are many surface stones that would interfere with cultivation.

Runoff is medium to rapid, and internal drainage, or movement of water through the soil, is medium in the upper part of the profile and slow in the lower part.

The St. Clair soils that have slopes of 7 to 15 percent are used about as follows: 45 to 55 percent of the acreage is in crops, 25 to 30 percent is in pasture, and 15 to 20 percent is in woods and other uses. The principal crops

are corn, small grains, hay, and legumes and grasses grown together.

The St. Clair soils that have slopes of more than 15 percent are used mainly for permanent pasture. From 10 to 15 percent of the acreage is in crops, and about 20 to 25 percent is in woods and other uses. Most areas that are cultivated consist of small strips located in fields where there is a predominance of smoother slopes.

Small areas of Morley, Nappanee, Hoytville, Kokomo, and Wallkill soils, each 1 to 2 acres in size, are included in some mapping units. A thin loamy or sandy and gravelly overburden covers the soil in a number of areas.

MAPPING UNITS

(SdC) **St. Clair loam, 7 to 15 percent slopes.** Soil management unit 1aC(IIIE).

(SdC2) **St. Clair loam, 7 to 15 percent slopes, moderately eroded.** Soil management unit 1aC(IIIE).

(SdD2) **St. Clair loam, 12 to 25 percent slopes, moderately eroded.** Soil management unit 1aD(IVE).

(SdE) **St. Clair loam, 25+ percent slopes.** Soil management unit 1aE(VIIE).

(SdE2) **St. Clair loam, 25+ percent slopes, moderately eroded.** Soil management unit 1aE(VIIE).

(SeC3) **St. Clair soils, 7 to 15 percent slopes, severely eroded.** Soil management unit 1aC(IVE).

Tawas Series

The Tawas series consists of well-decomposed organic soils. The soils have formed principally from woody materials that overlie loose sand. The native vegetation consisted primarily of a mixed stand of hardwoods and conifers, mainly soft maple, white-cedar, balsam fir, and spruce.

The Tawas soils are shallower over the mineral substratum than the Carlisle soils. They resemble the Linwood and Willette soils, but unlike the Tawas soils, the Linwood and Willette soils are underlain by loam, silty clay, and clay.

Profile description of Tawas muck:

0 to 12 inches, black or very dark brown; well-decomposed muck that contains recognizable fragments of wood; weak, fine, granular structure; friable when moist, and soft when dry; medium to slightly acid.

12 to 24 inches, very dark gray to very dark brown; well-decomposed muck that contains some fragments of wood; moderate, medium, granular structure; friable when moist, and soft when dry; medium to slightly acid.

24 to 28 inches, brown to dark brown; peaty materials composed mostly of partly decomposed grasses and sedges; massive; slightly acid to neutral.

28 inches +, grayish brown; mottled with olive brown; sand or loamy sand; single grain; loose; calcareous.

The muck in the surface layer varies in degree of decomposition. In some areas the muck is only slightly to moderately decomposed. Depth to the underlying sand ranges from 12 to 42 inches.

Most of Tawas muck consists of wild areas. A few small areas have been drained and are used to grow truck crops and grasses.

MAPPING UNIT

(TaA) **Tawas muck, 0 to 3 percent slopes.** Soil management unit M/4c(IVW).

Wallkill Series

Soils of the Wallkill series are poorly drained. They have formed in a rather recent deposit of mineral materials that overlie organic materials. The mineral materials range from silt loam to sandy loam; the underlying organic materials are similar to those in the Carlisle, Houghton, Rollin, and other organic soils. The native vegetation was a deciduous forest.

In some places the Wallkill soils occur in such intricate mixtures with the Kokomo and Barry soils that the soils of the three series are not mapped separately.

Profile description of a Wallkill loam:

A_1 0 to 7 inches, grayish brown; loam; weak, fine, granular structure; friable when moist; neutral or slightly acid.

C_1 7 to 20 inches, light yellowish brown; fine sandy loam or loam; friable when moist; neutral or slightly acid.

O_1 20 inches +, black or very dark brown; well-decomposed muck; fine, granular structure; friable when moist; slightly acid to neutral.

The mineral alluvial materials generally range from 8 to 30 inches in thickness, but in some places they are as much as 40 inches thick. In some areas the layer of muck or peat underlying the soil is thin and is underlain by mineral soil materials.

Areas of Wallkill loam that have been drained are used to grow potatoes, corn, and other truck crops. The rest is in permanent pasture or woods.

MAPPING UNIT

(WaA) **Wallkill loam, overwashed, 0 to 3 percent slopes.** Soil management unit 2c–LA(IIW).

Warners Series

The Warners series consists of poorly to very poorly drained soils made up of a thin layer of black muck over marl. They occur along the shores of receding glacial lakes, generally as a narrow rim between the lake and the moderately to steeply sloping uplands. The topography is gently sloping to nearly level. Most areas of these soils are low and wet, have a high water table, and are covered with marsh sedges and grasses.

The Warners soils resemble the Edwards soils but do not have so dark colored nor so thick an organic layer.

Profile description of Warners muck:

0 to 10 inches, black or very dark brown; well-decomposed muck; weak, fine, granular structure; friable when moist; alkaline or calcareous.

10 inches +, gray; marl; massive; very friable when moist; strongly calcareous.

The depth to marl is generally less than 12 inches, and in places the marl outcrops.

Most areas of these soils are used for pasture or woods. The soils are not well suited to crops. Marl is excavated in some places and used for agricultural liming material.

MAPPING UNIT

(WbA) **Warners muck and marl, 0 to 3 percent slopes.** Soil management unit M/mc(IVW).

Wauseon Series

Soils of the Wauseon series are dark colored and are poorly to very poorly drained. They have formed in sandy loam or loam that overlies clay to silty clay. In many places they are associated with the Hoytville soils. The native vegetation consisted of sugar maple, basswood, and beech but included some hickory, white oak, sycamore, and cottonwood.

The Wauseon soils resemble the Berville soils, but the Berville soils have a substratum of silt loam to clay loam and a finer textured subsoil.

Profile description of a Wauseon loam:

A_1 0 to 10 inches, dark gray to very dark brownish gray; loam; weak, fine to medium, granular structure; friable; rather high content of organic matter; slightly acid to neutral.

G 10 to 28 inches, gray or mottled gray and yellow; loam to sandy loam, the lower part finer textured in places; weak, fine to medium, subangular blocky structure; friable; neutral to mildly alkaline.

D 28 inches +, gray; mottled with yellow; silty clay or clay; calcareous.

The thickness of the individual horizons varies. The dark-colored surface layer ranges in thickness from 6 to about 15 inches. Depth to the substratum of clay or silty clay ranges from 18 to 42 inches. Surface runoff is very slow.

Most of the acreage of Wauseon loam is cultivated. The principal crops are corn, oats, wheat, barley, soybeans, alfalfa, and timothy and clover grown together.

Included with the Wauseon loams are small areas of Rimer, Hoytville, and other associated soils.

MAPPING UNIT

(WcA) **Wauseon loam, 0 to 3 percent slopes.** Soil management unit 3/1cA(IIW).

Willette Series

The Willette soils have formed in shallow, well-decomposed organic materials, mostly from wood. These materials overlie clay and silty clay. The individual areas are generally long and narrow.

The Willette soils are similar to the Carlisle soils but are shallower over the mineral substratum. They also resemble the Linwood and Tawas soils, but the Linwood and Tawas soils are underlain by loam and sand.

Profile description of Willette muck:

0 to 14 inches, very dark gray to black; well-decomposed muck that contains many fine fragments of wood; weak, fine, granular structure; slightly acid.

14 to 24 inches, very dark gray to very dark brown; well-decomposed muck that contains some woody remains; weak, medium, granular structure; friable; slightly acid.

24 to 30 inches, brown to dark yellowish brown; undecomposed organic materials—mostly remains of grasses and sedges—and some woody materials; slightly acid to neutral.

30 inches +, light brownish gray; mottled with olive yellow; silty clay or clay; massive; plastic when wet, firm when moist, and hard when dry; calcareous.

In some places, where the timber has been removed and the muck has been cultivated, the mineral substratum is exposed. In other places, the black, granular muck is 12 to 42 inches thick and extends downward to the mineral materials. Sedimentary soft and gelatinous materials occur in some areas just above the mineral substratum, and in other areas small amounts of marl occur.

Much of the Willette muck has been cleared and is used for pasture. Approximately 20 percent of the acreage has been drained and is used to grow corn, potatoes, and other truck crops.

MAPPING UNIT

(WdA) **Willette muck, 0 to 3 percent slopes.** Soil management unit M/1c(IIIW).

Management and Productivity of Soils

This section contains three main parts. The first explains soil management groups, which are groups of soils similar in most characteristics, except in slope and degree of erosion. It also shows how these groups are divided into soil management units according to slope and degree of erosion. The second part explains the system of capability grouping used by the Soil Conservation Service and shows how the soil management units can be grouped into capability classes and subclasses. The third describes each soil management unit, lists the soils in each unit, makes suggestions about use of the soils and practices they need, and gives estimates of yields of the usual crops under two levels of management—prevailing management and improved management.

Soil Management Groups and Units

Each soil shown on the map differs from all other soils in one or more important characteristics. To make the most exact statements about how to use and take care of the soils, we need to consider each of them individually. However, many useful statements can be made about groups of soils that are similar in texture and properties throughout their profiles and have similar natural drainage. These groupings, called soil management groups, are useful for such purposes as making general recommendations regarding applications of fertilizer and lime. They are also useful for making general recommendations for forestry plantings and designs for irrigation or drainage systems.

For the purpose of making more specific statements concerning cropping systems and conservation practices, these soil management groups are further subdivided into soil management units (also referred to as land capability units) according to significant variations in slope and in degree of erosion.

Table 2 shows that each soil management group is designated by a symbol that shows the position of the soil on the landscape, the texture of significant layers in the profile that greatly affects soil management, and the degree of natural internal drainage. In the table the mineral soils are arranged vertically, from the finest textures at the top to the coarsest textures at the bottom, and horizontally from the best drained at the left to the most poorly drained at the right. For example, soils in soil management groups 1a are upland soils. The "1" in the symbol shows that the soils developed in clay and silty clay, and the "a" shows that the soils are well drained.

Where the capital letter L is in the symbol, it represents lowland soils subject to flooding. The letter M stands for organic soils—mucks or peats. Where soils are formed from one kind of soil material on top of another kind of soil material, a fractional type symbol is used. The number or letter M above the line refers to the upper layer, and the number or letter below the line refers to the lower layer. For example, 3/2 stands for sandy loam 18 to 42 inches thick over loam or clay loam; M/1 stands for organic material 12 to 42 inches thick over clay or silty clay; and M/m stands for organic material 12 to 42 inches thick over marl.

Soil management groups are subdivided according to significant ranges of slope and degree of erosion into soil

TABLE 2.—*Descriptive symbols for soil management groups* [1]

Position and texture of soil profile	Natural drainage		
	Well or moderately well drained (a)	Imperfectly drained (b)	Poorly or very poorly drained (c)
Upland soils:			
1—Silty clay or clay	1a	1b	1c.
2—Loam, silt loam, clay loam, or silty clay loam.	2a	2b	2c.
3—Sandy loam	3a	3b	3c.
3/1—Sandy loam over clay or silty clay at depths of 18 to 42 inches.			3/1c.
3/2—Sandy loam over loam or clay loam at depths of 18 to 42 inches.	3, 2a	3, 2b	3/2c.
4—Loamy sand	4a		
5—Sand	5a		5c.
Lowland soils:			
2—Loam	2a–L		2c–L.
M–4—Stratified organic and mineral layers.			Mc–L.
Organic soils:			
M—More than 42 inches deep			Mc.
M/1—Organic material over clay or silty clay at depths of 12 to 42 inches.			M/1c.
M/3—Organic material over sandy loam to silty clay loam at depths of 12 to 42 inches.			M/3c.
M/4—Organic material over sand or loamy sand at depths of 12 to 42 inches.			M/4c.
M/marl—Organic material over marl at depths of 12 to 42 inches.			M/mc.
Miscellaneous land types, X:			
X—Lake borders			Xc.

[1] These soil management groups are further subdivided, on the basis of slope, into soil management units, also called land capability units.

management units, also called land capability units. In general, the capital letter A, B, C, D, or E, placed after the group symbol, designates the range of slope; for example, the A in soil management unit 1cA(IIW) means that the soils are nearly level. Of the other designations for slope, B means the soils are gently sloping; C, that they are moderately sloping; D, that they are strongly sloping to steep; and E, that they are steeply sloping.

Capability Grouping

In capability grouping the soil management units are grouped into subclasses and then into eight broad classes. This is a grouping to emphasize the relative suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the needs and limitations of the soils for use, on the risks of damage when they are used, and on their responses to management. Subclasses within the broad capability classes are designated by capital letters. The letter symbol "E" for a subclass indicates that the main limiting factor is risk of erosion if the plant cover is not maintained; "W" means excess water that retards plant growth or interferes with cultivation; and "S" shows that the soils are shallow, droughty, or unusually low in fertility. In some areas there is another subclass "C" for the soils that are limited chiefly by a climate that is too cold or too dry.

The broadest grouping, the land class, is identified by Roman numerals. All the soils in one class have limitations and management problems of about the same degree, but of different kinds, as shown by the subclass. All the land classes, except class I, may have one or more subclasses.

In classes I, II, and III are soils that are suitable for annual or periodic cultivation of annual or short-lived crops.

Class I soils are those that have the widest range of use and the least risk of damage. They are level or nearly level, productive, and easy to work. They can be cultivated with almost no risk of erosion and will remain productive if managed with normal care.

Class II soils can be cultivated regularly but do not have quite so wide a range of suitability as class I soils. Some class II soils are gently sloping; consequently, they need moderate care to prevent erosion. Other soils in class II may be slightly droughty, or slightly wet, or somewhat limited in depth.

Class III soils can be cropped regularly but have a narrower range of use. These need even more careful management.

In class IV are soils that should be cultivated only occasionally or only under very careful management.

In classes V, VI, and VII are soils that normally should not be cultivated for annual or short-lived crops, but they can be used for pasture or range, for woodland, or for wildlife.

Class V soils (none in Lenawee County) are nearly level or gently sloping but are wet, low in fertility, or otherwise unsuitable for cultivation.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife. Some soils in class VI can, without damage, be cultivated enough so that fruit trees or forest trees can be set out or pasture crops or some other special crops can be seeded.

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

In class VIII are soils that have practically no agricultural use. Some of them have value as watersheds, as wildlife habitats, or for scenery.

In the outline that follows are brief descriptions of the capability classes, subclasses, and soil management units in Lenawee County.

Class I.—Deep, nearly level, productive soils that have few or no permanent limitations that restrict their use.

- 2aA(I): Nearly level, slightly eroded, light-colored, medium-textured, well-drained soils.
- 2bA(I): Nearly level, slightly to moderately eroded, moderately dark colored, medium to moderately fine textured soils formed under imperfect drainage.
- 2cA(I): Nearly level, dark-colored, medium to moderately fine textured soils formed under poor drainage.

Class II.—Soils that have some limitations that reduce the choice of plants or that require some conservation practices.

Subclass IIE.—Soils that are likely to erode if not protected.
- 2aB(IIE): Gently sloping, slightly to moderately eroded, light-colored, medium to moderately fine textured, well-drained soils.

Subclass IIS.—Soils that have moderate limitations because of low moisture-holding capacity and erosion hazard.
- 3aA(IIS): Nearly level, slightly eroded, light-colored, moderately coarse textured, well-drained soils.
- 3aB(IIS): Gently sloping, slightly to moderately eroded, light-colored, moderately coarse textured, well-drained soils.
- 3/2aA(IIS): Nearly level, moderately well drained, light-colored, moderately coarse textured soils underlain by loam or clay loam material at depths of 18 to 42 inches; the moderately coarse textured material is absent in some places, and the soils are formed in clay loam material.
- 3/2aB(IIS): Gently sloping, slightly to moderately eroded, light-colored, moderately well drained, moderately coarse textured soils underlain by loam or clay loam at depths of 18 to 42 inches.

Subclass IIW.—Soils with a wetness problem that cannot be fully corrected by drainage and having other moderate limitations including a hazard of flooding.
- 1cA(IIW): Nearly level, dark-colored, predominantly fine textured soils formed under poor drainage.
- 2a–LA(IIW): Level to gently sloping, well and moderately well drained, moderately dark colored, medium-textured alluvial soils.
- 2c–LA(IIW): Nearly level, predominantly imperfectly and poorly drained, dark-colored, medium-textured alluvial soils.
- 2bB(IIW): Gently sloping, slightly to moderately eroded, moderately dark colored, medium to moderately fine textured soils formed under imperfect drainage.
- 3bA(IIW): Nearly level, moderately dark colored, moderately coarse textured soils formed under imperfect drainage; in some areas loam and clay loam materials occur at depths of 18 to 42 inches.
- 3cA(IIW): Nearly level to gently sloping, dark-colored, moderately coarse textured soils formed under poor drainage.
- 3/1cA(IIW): Nearly level, poorly drained, dark-colored, moderately coarse textured soils underlain by clay or silty clay materials at depths of 18 to 42 inches.
- 3/2bA(IIW): Nearly level, moderately dark colored, imperfectly drained, moderately coarse textured soils underlain by loam or clay loam at depths of 18 to 42 inches.
- 3/2cA(IIW): Nearly level, dark-colored, moderately coarse textured, poorly drained soils underlain by loam or clay loam at depths of 18 to 42 inches.
- M/3c(IIW): Shallow organic soils that overlie sandy loam to silty clay loam mineral materials at depths of 12 to 42 inches.

Class III.—Soils that have severe limitations that require special conservation practices.

Subclass IIIE.—Soils that will erode if not protected.
- 1aC(IIIE): Moderately sloping, slightly to moderately eroded, light-colored, fine-textured, moderately well drained soils.
- 2aB(IIIE): Gently sloping, severely eroded, light-colored, moderately fine textured, well-drained soils.
- 2aC(IIIE): Moderately sloping, slightly to moderately eroded, light-colored, medium to moderately fine textured, well-drained soils.

Subclass IIIS.—Soils that have severe limitations because of low moisture-holding capacity and the hazard of erosion.
- 3aC(IIIS): Moderately sloping, slightly to moderately eroded, light-colored, moderately coarse textured soils.
- 3/2aC(IIIS): Moderately sloping, slightly to moderately eroded, light-colored, well-drained, moderately coarse textured soils underlain by loam or clay loam materials at depths of 18 to 42 inches.
- 4aA(IIIS): Nearly level, light-colored, coarse-textured, well to moderately well drained soils.
- 4aB(IIIS): Gently sloping, slightly to moderately eroded, light-colored, coarse-textured, well and moderately well drained soils.
- 4aC(IIIS): Moderately sloping, slightly to moderately eroded, light-colored, coarse-textured, well-drained soils.

Subclass IIIW.—Soils with a wetness problem that can be only partly corrected by drainage and having additional limitations that severely limit their use.
- 1bA(IIIW): Nearly level to gently sloping, moderately dark colored, fine-textured soils formed under imperfect drainage.
- Mc(IIIW): Organic soils, more than 42 inches deep, formed from woody and fibrous plant materials.
- M/1c(IIIW): Shallow organic soils that overlie clay or silty clay mineral materials at depths of 12 to 42 inches.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, that require very careful management, or both.

Subclass IVE.—Soils that will erode if not protected.
- 1aC(IVE): Moderately sloping, severely eroded, light-colored, fine-textured, moderately well drained soils.
- 1aD(IVE): Strongly sloping to steep, moderately eroded, light-colored, fine-textured, well-drained soils.
- 2aC(IVE): Moderately sloping, severely eroded, light-colored, medium to moderately fine textured, well-drained soils.
- 2aD(IVE): Strongly sloping to steep, slightly to moderately eroded, light-colored, medium to moderately fine textured soils.

Subclass IVS.—Soils that have very severe limitations because of low moisture-holding capacity, low fertility, and the hazard of erosion.

3aC(IVS): Moderately sloping, severely eroded, light-colored, moderately coarse textured soils.

3aD(IVS): Strongly sloping to steep, slightly to moderately eroded, light-colored, moderately coarse textured soils.

3/2aC(IVS): Moderately sloping, moderately to severely eroded, light-colored, well-drained, moderately coarse textured soils underlain by loam or clay loam at depths of 18 to 42 inches.

4aD(IVS): Strongly sloping to steep, moderately eroded, light-colored, coarse-textured, well-drained soils.

5aA(IVS): Nearly level, light-colored, well-drained, coarse-textured soils.

5aB(IVS): Gently sloping, slightly to moderately eroded, light-colored, well-drained, coarse-textured soils.

5aC(IVS): Moderately sloping, slightly to moderately eroded, light-colored, well-drained, coarse-textured soils.

Subclass IVW.—Soils with a wetness problem that can be only partly corrected by drainage but having additional limitations that very severely limit their use.

5cA(IVW): Nearly level, dark-colored, coarse-textured soils formed under poor drainage.

Mc-LA(IVW): Soils formed from alluvial and organic deposits in very poorly drained swales and flats in the bottom lands.

M/4c(IVW): Shallow organic soils that overlie sand or loamy sand mineral materials at depths of 12 to 42 inches.

M/mc(IVW): Shallow organic soils that overlie marl at depths of 12 to 42 inches.

Class VI.—Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture, woodland, or wildlife cover.

Subclass VIE.—Soils that are highly susceptible to erosion.

2aD(VIE): Strongly sloping to steep, severely eroded, light-colored, medium to moderately fine textured soils.

Subclass VIS.—Soils that have severe limitations because of low moisture-holding capacity, low fertility, and extreme hazard of erosion.

3aD(VIS): Strongly sloping to steep, severely eroded, light-colored, moderately coarse textured soils.

Class VII.—Soils that are unsuitable for cultivation and that have very severe limitations that restrict their use largely to pasture, woodland, or wildlife cover.

Subclass VIIE.—Soils that are highly susceptible to erosion.

1aE(VIIE): Steeply sloping, slightly eroded, light-colored, fine-textured soils.

2aE(VIIE): Very steep, slightly to moderately eroded, light-colored, medium to moderately fine textured soils.

Subclass VIIS.—Soils that have very severe limitations because of low moisture-holding capacity, low fertility, and extreme hazard of erosion.

3aE(VIIS): Steep, slightly to severely eroded, light-colored, moderately coarse textured soils.

Class VIII.—Soils that are not suitable for the commercial production of crops, pasture, or woodland.

Subclass VIIIW.—Poorly drained mineral and organic soils that occur in complex association on narrow rims or borders between lakes and adjacent uplands.

Xc(VIIIW): Miscellaneous land types.

Descriptions of Soil Management Groups and Units

In this subsection each soil management group is described. Listed for the management units in each group are suggestions for suitable uses and estimated yields of the common crops under two levels of management—prevailing management and improved management. The management is defined in terms of cropping systems and practices for control of erosion.

In table 3 the relative protectiveness of different cropping systems is given in values that range from 20 for the

TABLE 3.—*Cropping systems and their relative protectiveness*

[M=legume-grass meadow; gm=green-manure crop; O=spring grains; R=row crop; W=winter grain]

Cropping system	Relative protectiveness	Cropping system	Relative protectiveness
R	20	ROM	78
RgmR	28	ROWM	79
Rgm	36	ROgmWM	79
RRO	39	RROMMM	80
RRW	42	RgmRMM	80
RWRRO	44	RgmOgmWM	80
RO	48	RM	80
RgmROgm	50	RWM	81
RgmRWgm	53	ROMMW	81
RW	53	RRMMM	82
ROO	55	ROMMWgm	82
RWgmRgmROgm	55	ROOMM	83
ROgm	57	ROgmOMM	83
RWgm	61	RgmRMMM	84
ROgmOgm	64	ROWMM	85
RRM	65	ROgmWMM	86
ROROM	66	ROMM	86
RROM	67	OOM	87
RORWM	68	RgmOMM	87
RROWM	69	RWMM	87
ROgmROM	69	ROWMMM	88
RgmRM	69	WOM	88
RWRWM	70	RMM	88
RgmROM	70	ROMMM	88
ROgmRWM	71	RgmOgmWMMM	89
RgmROgmWM	72	RWMMM	90
RWgmRWM	72	ROMMMM	91
ROROMM	73	RMMM	91
ROgmROMM	74	RWMMMM	92
RORWMM	75	OM	92
ROgmRWMM	75	WOMM	93
RWgmRWMM	75	OWMM	94
RROMM	77	WOMMM	95
RROWMM	77	WM	95
RRMM	77	OMM	96
ROOM	77	WMM	97
RRWMM	77	OMMM	97
ROgmOM	77	WMMM	98
RgmROMM	78	M	99
RgmRWMM	78		

least protective system to 99 for the most protective. These values are based on the assumption that all crop residues are returned to the soil by disking or plowing down just before planting. If crop residues are removed, destroyed, or plowed down far in advance of planting, then the relative protectiveness value for the cropping system must be reduced as follows: For cropping systems that include meadow, subtract 3.0 for each row crop in the cropping system; if the cropping system does not include meadow, subtract 15.0. If minimum tillage is used, a more intensive cropping system may be used. The values shown in table 3 are based on studies made by the Soil Conservation Service.

Soil management groups 1a, 1b, and 1c.—Soil management group 1a consists of light-colored, fine-textured soils that are moderately well drained. In table 4 cropping systems and supporting practices suitable for the soils of each unit in this group are given. All of the cropping systems and supporting practices suggested are for soils with slopes 200 feet long. If the soils have slopes longer than 200 feet, a cropping system that gives more protection is required. If the soils have slopes less than 200 feet long, a cropping system that gives slightly less protection can be used. The numbers in parentheses refer to the relative protectiveness of the cropping system indicated (see table 3).

The cropping system needs to combine soil-depleting and soil-building crops in such a way that production is kept at a high level. Most row crops are soil depleting; they use a large amount of plant nutrients. Alfalfa, clover, and other close-growing legumes improve the soil. The legumes add nitrogen to the soil, although they use large amounts of minerals that must be replaced by adding commercial fertilizer or manure.[3] To keep production at a high level, a cropping system that protects the soil from erosion should be used.

Specific cropping systems have not been supplied in table 4 for the soils of soil management groups 1b and 1c, but suggested cropping systems and management practices have been given under the descriptions of the individual soil management units. Soil management group 1b consists of upland soils that are imperfectly drained, and soil management group 1c, of upland soils that are poorly or very poorly drained.

[3] MICHIGAN STATE UNIVERSITY. FERTILIZER RECOMMENDATIONS FOR MICHIGAN CROPS. Mich. State Univ. Ext. Bul. E–159 (rev.). Prepared by Depts. of Soil Sci. and Hort. 48 pp., illus. 1959.

SOIL MANAGEMENT UNIT 1aC(IIIE)

Moderately sloping, slightly to moderately eroded, light-colored, fine-textured, moderately well drained soils

(SdC) St. Clair loam, 7 to 15 percent slopes.
(SdC2) St. Clair loam, 7 to 15 percent slopes, moderately eroded.

These soils are suitable for most of the crops commonly grown in the area. Because of the hazard of erosion, however, they are not well suited to row crops. They are naturally high in fertility, but internal drainage and the rate of infiltration are slow. The development of roots is somewhat restricted.

These soils tend to develop poor tilth if they are cultivated. They should not be tilled too wet or too dry. They need large amounts of organic matter, which can be supplied by planting deep-rooted legumes and turning under cover crops. Row crops should not be grown unless contouring, stripcropping, terracing, or other practices are used to protect the soils from erosion.

If practices are not used to conserve the soils, a cropping system consisting of 1 year of a small grain followed by 2 to 3 years of legumes and grasses grown together is satisfactory. All crop residues should be returned to the soil. Also, lime and fertilizer should be applied in the amounts indicated by soil tests. The waterways need to be maintained in grass. Cropping systems and supporting practices that will reduce water erosion and maintain fertility are given in table 4.

Pastures yield well on these soils. They should be seeded to alfalfa and bromegrass or to other productive legumes and grasses.

These soils are suitable for growing trees for wood products, but yields will be somewhat lower than on the medium-textured soils. Trees that grow well on these soils are white pine, Austrian pine, Norway spruce, black walnut, and tulip-poplar.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	28	65
Soybeans	bushels	15	20
Wheat	bushels	18	33
Oats	bushels	28	60
Barley	bushels	20	40
Alfalfa	tons	1. 7	3. 2
Mixed hay	tons	1. 3	2. 2

TABLE 4.—*Cropping systems* [1] *suitable for the soils of soil management units in group 1a under named practices of water erosion control*

Soil management unit	Slope	Practices to control water erosion			
		None	Contour tillage	Stripcropping	Terracing
	Percent				
1aC(IIIE)	7–15	WMMM(98)	WMMM(98)	RWMMMM(92)	ROWMMM(88).
1aC(IVE)	7–15	WMMM(98)	WMMM(98)	RWMMMM(92)	ROMMM(88).
1aD(IVE)	12–18	M(99)	WMMM(98)	OWMM(94)	[2].
	18–25	[3]	[3]	[3]	[2].
1aE(VIIE)	25+	[3]	[3]	[3]	[2].

[1] Symbols indicating cropping systems: M=legume-grass meadow; O=spring grains; R=row crops; W=winter grains.
[2] Not recommended.
[3] Soils should be kept under grass, trees, or other permanent vegetation.

SOIL MANAGEMENT UNIT IaC(IVE)

Moderately sloping, severely eroded, light-colored, fine-textured, moderately well drained soils

(SeC3) St. Clair soils, 7 to 15 percent slopes, severely eroded.

These soils are suited to most of the crops commonly grown in the area, but yields are below average. Because of previous erosion, the soils are low in organic matter and in fertility. Their fine texture causes internal drainage to be slow and root development to be somewhat restricted.

Soil structure and fertility need to be maintained and erosion controlled for satisfactory yields. The supply of organic matter can be maintained by planting deep-rooted legumes and turning under cover crops. Row crops should not be grown unless contouring, terracing, stripcropping, or other practices are used. Cover crops ought to be seeded in all row crops. Lime and fertilizer should be applied in the amounts indicated by soil tests. All waterways need to be maintained in grass.

If practices are not used to conserve the soils, a suitable cropping system is 1 year of a small grain followed by 3 years of grass-legume meadow. Cropping systems and supporting practices that will reduce water erosion are given in table 4.

Pastures make good yields on these soils. They should be seeded to alfalfa and bromegrass or other productive legumes and grasses. Because of past erosion, the soils are low in organic matter and in fertility. Consequently, they need adequate lime and fertilizer for good yields.

If the woodlands are well stocked and otherwise well managed, the soils are suitable for growing trees for wood products. Yields are somewhat lower than on the medium-textured and less eroded soils. Trees suitable for planting are white pine, Austrian pine, Norway spruce, black walnut, and tulip-poplar.

Probable yields per acre of crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	22	50
Soybeans	bushels	14	18
Wheat	bushels	16	25
Oats	bushels	25	50
Barley	bushels	18	35
Alfalfa	tons	1. 7	3. 0
Mixed hay	tons	1. 3	2. 0

SOIL MANAGEMENT UNIT IaD(IVE)

Strongly sloping to steep, moderately eroded, light-colored, fine-textured, well-drained soils

(SdD2) St. Clair loam, 12 to 25 percent slopes, moderately eroded.

Different areas of this soil vary somewhat in suitability for use and in limitations. Water erosion is the principal problem.

In the areas where slopes are between 12 and 18 percent, the soil is suited to small grains and legumes and grasses grown together, provided contouring, stripcropping, or other erosion-control practices are used. The areas are too steep for terraces to be effective. If practices are not used to control erosion, a cover of legumes or grasses should be kept on the soil as much of the time as practical. Lime and fertilizer ought to be applied in the amounts indicated by soil tests. All waterways need to be maintained in grass. Cropping systems and supporting practices that will reduce erosion are given in table 4.

Areas of this soil that have slopes of 18 to 25 percent ought to be kept in grass, trees, or other permanent vegetation. With good management, yields of pasture will be moderately high. Adequate lime and fertilizer need to be applied according to soil tests, and grazing should be regulated.

The soil is suited to growing trees. Yields are somewhat lower than on the medium-textured soils. Trees suitable for planting are white pine, Norway spruce, white spruce, tulip-poplar, Douglas-fir, and black walnut.

Probable yields per acre of small grains and hay crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Wheat	bushels	17	25
Oats	bushels	26	40
Barley	bushels	20	30
Alfalfa	tons	1. 7	3. 0
Mixed hay	tons	1. 3	2. 0

SOIL MANAGEMENT UNIT IaE(VIIE)

Steeply sloping, slightly eroded, light-colored, fine-textured soils

(SdE) St. Clair loam, 25+ percent slopes.
(SdE2) St. Clair loam, 25+ percent slopes, moderately eroded.

Because of their susceptibility to severe erosion, these soils are best suited to permanent vegetation. They have good moisture-holding capacity. Fair to good yields of pasture are obtained if suitable legumes and grasses are seeded. Lime and fertilizer need to be applied in amounts indicated by soil tests.

Trees suitable for planting on these soils are Norway spruce, white spruce, white pine, Douglas-fir, and black walnut.

SOIL MANAGEMENT UNIT IbA(IIIW)

Nearly level to gently sloping, moderately dark colored, fine-textured soils formed under imperfect drainage

(NaA) Nappanee silt loam, 0 to 3 percent slopes.
(NaB) Nappanee silt loam, 3 to 7 percent slopes.
(NaB2) Nappanee silt loam, 3 to 7 percent slopes, moderately eroded.
(NbB) Nappanee loam, 3 to 7 percent slopes.
(NbB2) Nappanee loam, 3 to 7 percent slopes, moderately eroded.

If adequately drained, these soils are suitable for most of the crops commonly grown in the county. They are naturally high in fertility and have good moisture-holding capacity.

Slow internal drainage and difficulty in maintaining good tilth are the principal management problems. Erosion is also a problem where the soils have slopes of more than 3 percent. In spring these soils warm up slowly and tend to remain wet. Because of their fine texture, root development is somewhat restricted.

Providing artificial drainage and maintaining good soil tilth are essential for good yields on these soils. Open ditches or tile can be used to provide drainage. Because permeability is slow, artificial drainage is not so effective as that provided for the more permeable soils of the area. The tile lines need to be spaced 2 to 4 rods apart and at depths of 3 to 4 feet. The tile should be blinded, or covered with a layer of straw or similar material 6 to 12 inches thick.

These soils should not be cultivated when too wet or too dry, and plowing and fitting must be kept to a mini-

mum. The soils need large amounts of organic matter, which can be supplied by planting deep-rooted legumes and by turning under winter cover crops and crops grown as green manure. All crop residues should be returned to the soil and lime and fertilizer applied in amounts indicated by soil tests.

In areas of these soils that have slopes of 0 to 3 percent, a suitable cropping system is 1 year each of a row crop, a small grain, and grass-legume meadow. In areas where the slopes exceed 3 percent, contouring ought to be used as a supporting practice.

If well managed, pastures on these soils produce moderately high to high yields. Fertilizer and lime should be applied in the amounts indicated by soil tests. Grazing needs to be regulated; when the ground is soft, pastures should not be grazed. Legumes and grasses suitable for pasture are alfalfa, ladino clover, alsike clover, and bromegrass.

Normally, these soils are not planted to trees; however, Norway spruce, white spruce, white pine, Austrian pine, and cottonwood may be grown.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	45	70
Soybeans	bushels	20	30
Sugar beets	tons	8	12
Wheat	bushels	22	40
Oats	bushels	35	70
Barley	bushels	25	45
Alfalfa	tons	2. 5	3. 7
Mixed hay	tons	2. 0	2. 7

SOIL MANAGEMENT UNIT IcA(IIW)

Nearly level, dark-colored, predominantly fine textured soils formed under poor drainage

(HcA) Hoytville clay loam and silty clay loam, 0 to 3 percent slopes.
(HdA) Hoytville mucky clay loam, 0 to 3 percent slopes.
(HeA) Hoytville clay loam and Rimer sandy loam, 0 to 3 percent slopes.
(HfA) Hoytville and Wauseon loams, 0 to 3 percent slopes.

If these soils are well managed, good yields are obtained from most of the crops commonly grown in the area. Except for the Rimer and Wauseon soils, the soils are fine textured.

Internal drainage is slow in these soils, and root development is restricted. In addition, good tilth is difficult to maintain. The soils are slow to warm up in spring; they tend to remain wet for a longer period of time than other poorly drained soils in the county.

For good yields, the soils must be drained and good tilth maintained. Open ditches or tile may be used. The tile should be placed at depths of 3 to 4 feet in lines that are 2 to 4 rods apart, and they should be blinded with straw or similar material. Because permeability is slow, artificial drainage is not so effective in these soils as it is in the more permeable soils of the area.

These soils should not be cultivated when too wet or too dry. They need large amounts of organic matter, which can be supplied by planting deep-rooted legumes and turning under winter cover crops and green-manure crops. Plowing and fitting should be kept to a minimum. All crop residues ought to be returned to the soil, and fertilizer should be applied in amounts indicated by soil tests.

If the soils are drained adequately, a cropping system consisting of 1 year each of a row crop, a small grain, and legume-grass meadow may be used.

If well managed, pastures on these soils make moderately high yields. Fertilizer needs to be applied in amounts indicated by soil tests, and grazing should be regulated. The pastures should not be grazed when the ground is soft. Legumes and grasses suitable for pasture are alfalfa, ladino clover, alsike clover, and bromegrass.

Normally, these soils are not planted to trees. Nevertheless, if drainage is adequate, Norway spruce, white spruce, white pine, and Austrian pine can be grown.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	50	85
Soybeans	bushels	20	30
Sugar beets	tons	10	14
Wheat	bushels	25	40
Oats	bushels	40	70
Barley	bushels	30	45
Alfalfa	tons	2. 7	3. 7
Mixed hay	tons	2. 2	2. 7

Soil management groups 2a, 2b, 2c, 2a–L, and 2c–L.—Soil management group 2a consists of light-colored, medium to moderately fine textured soils that are well drained. Table 5 gives cropping systems and supporting practices suitable for the soils of each unit in this soil management group. All of the cropping systems and supporting practices suggested are for soils with slopes 200 feet long. If the soils have slopes longer than 200 feet, a cropping system that gives more protection is required unless terraces are used. If the soils have slopes less than 200 feet long, a cropping system that gives slightly less protection can be used. The numbers in parentheses following the cropping system refer to the relative protectiveness of the cropping system (see table 3).

Specific cropping systems have not been supplied in table 5 for the soils of soil management groups 2b, 2c, 2a–L, and 2c–L, but suggested cropping systems and management practices have been given under the descriptions of the individual soil management units. Soil management group 2b consists of imperfectly drained upland soils; 2c, of poorly or very poorly drained upland soils; 2a–L, of well drained and moderately well drained lowland soils; and 2c–L, of poorly or very poorly drained lowland soils.

SOIL MANAGEMENT UNIT 2aA(I)

Nearly level, slightly eroded, light-colored, medium-textured, well-drained soils

(MdA) Miami loam, 0 to 3 percent slopes.
(MhA) Morley loam, 0 to 3 percent slopes.

These soils are suited to all of the crops commonly grown in the area. They can be kept in row crops and small grains most of the time, and, under good management, moderately high to high yields are obtained. The soils are fertile and have high moisture-holding capacity. They are fairly easy to maintain in good tilth. Normally, artificial drainage is not needed, but in some places tile is required to intercept seepage along slopes or to drain small depressions.

A good supply of plant nutrients must be kept in these soils and good tilth must be maintained for crops to make high yields. The soils should not be cultivated when too wet or too dry. They need large amounts of organic

TABLE 5.—*Cropping systems* [1] *suitable for the soils of soil management units in group 2a under named practices of water erosion control*

Soil management unit	Slope	Practices to control water erosion			
		None	Contour tillage	Stripcropping	Terracing
	Percent				
2aA(I)	0–3	RROM(67)	[2]	[2]	[2].
2aB(IIE)	3–7	ROMM(86)	ROM(78)	RORWMM(75)	ROgm(57).
2aB(IIIE)	3–7	RWMMM(90)	ROWMM(85)	RORWMM(75)	RROWM(69).
2aC(IIIE)	7–15	WMM(97)	WMM(97)	ROWMMM(88)	ROM(78).
2aC(IVE)	7–15	WMMM(98)	WMM(97)	ROWMMM(88)	ROWM(79).
2aD(IVE)	12–18	WMMM(98)	WMM(97	OWMM(94)	[3].
	18–25	[4]	[4]	[4]	[4].
2aD(VIE)	12–25	[4]	[4]	[4]	[4].
2aE(VIIE)	25+	[4]	[4]	[4]	[4].

[1] Symbols indicating cropping systems: gm=green-manure crop; M=legume-grass meadow; O=spring grains; R=row crops; W=winter grains.
[2] Not used.
[3] Not recommended.
[4] Soils should be kept under grass, trees, or other permanent vegetation.

matter, which can be supplied by planting green-manure crops or adding barnyard manure. Crop residues should be returned to the soil and lime and fertilizer added in the amounts indicated by soil tests.

A suitable cropping system consists of 2 years of a row crop and 1 year each of a small grain and legume-grass meadow. Cropping systems and supporting practices that will reduce water erosion are given in table 5.

If well managed, pastures make high yields on these soils. They need to have adequate lime and fertilizer added and grazing regulated. Suitable legumes and grasses are alfalfa, red clover, ladino clover, and bromegrass.

These soils are suited to trees, and yields of woodland products are good. White pine, red pine, Scotch pine, white spruce, Norway spruce, and white-cedar are suitable for new plantings.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	45	85
Soybeans	bushels	20	30
Sugar beets	tons	8	13
Potatoes	bushels	150	350
Wheat	bushels	24	40
Oats	bushels	35	75
Barley	bushels	28	51
Alfalfa	tons	2. 3	3. 4
Mixed hay	tons	1. 6	2. 4

SOIL MANAGEMENT UNIT 2aB(IIE)

Gently sloping, slightly to moderately eroded, light-colored, medium to moderately fine textured, well-drained soils

(MdB) Miami loam, 3 to 7 percent slopes.
(MdB2) Miami loam, 3 to 7 percent slopes, moderately eroded.
(MhB) Morley loam, 3 to 7 percent slopes.
(MhB2) Morley loam, 3 to 7 percent slopes, moderately eroded.

These soils are well suited to most of the crops commonly grown in the area; under good management yields are moderately high to high. The soils have good natural fertility and high moisture-holding capacity. Unless properly managed, however, they are subject to moderate erosion. Contouring, stripcropping, terracing, or other practices that will reduce erosion are needed. All waterways need to be maintained in grass.

The natural supply of organic matter is moderately low in these soils. Therefore, it is important to include grass-legume meadow and cover crops in the cropping system and to return all crop residues to the soil.

If no practices are used to control erosion, a cropping system that consists of 1 year each of a row crop and a small grain and then 2 to 3 years of grass-legume meadow is satisfactory. Cropping systems and supporting practices that will reduce water erosion are given in table 5.

If these soils are cultivated, they tend to develop poor tilth. Therefore, tillage needs to be kept to a minimum. Lime and fertilizer should be applied in amounts indicated by soil tests.

Normally, artificial drainage is not needed on these soils; in some places, however, tile may be required to intercept the seepage along slopes or to drain shallow depressions.

If well managed, pastures on these soils produce moderately high to high yields. They need to have adequate lime and fertilizer applied in amounts indicated by soil tests, and grazing should be regulated. Legumes and grasses suitable for pasture are alfalfa, red clover, ladino clover, and bromegrass.

These soils are suited to trees, and good yields of woodland products are obtained. White pine, red pine, Scotch pine, white spruce, Norway spruce, and white-cedar may be grown.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	40	80
Soybeans	bushels	20	30
Sugar beets	tons	8	13
Potatoes	bushels	150	350
Wheat	bushels	24	40
Oats	bushels	35	75
Barley	bushels	28	51
Alfalfa	tons	2. 3	3. 4
Mixed hay	tons	1. 6	2. 4

SOIL MANAGEMENT UNIT 2aB(IIIE)

Gently sloping, severely eroded, light-colored, moderately fine textured, well-drained soils

(MkB3) Morley soils, 3 to 7 percent slopes, severely eroded.

If these soils are managed properly, yields are good of all the crops commonly grown in the area. The soils are high in moisture-holding capacity, but, because of severe erosion in the past, they are moderately low to low in organic matter.

Soil structure must be maintained and erosion controlled if good crop yields are to be obtained. Also, the soils will need an adequate supply of plant nutrients. They need large amounts of organic matter, which can be supplied by planting meadow and green-manure crops. They should not be cultivated when too wet or too dry.

A cropping system consisting of 1 year each of a row crop and a small grain and then 3 to 4 years of grass-legume meadow will maintain fertility and control erosion. All crop residues should be returned to the soil. Lime and fertilizer should be added in amounts indicated by soil tests. Cover crops ought to be seeded in all row crops. Waterways that show evidence of active erosion need to be maintained in grass. On the longer slopes, where tilling on the contour, stripcropping, and terracing can be used effectively, the cropping system may include a higher proportion of row crops. Cropping systems and supporting practices that will reduce water erosion are given in table 5.

If pastures are well managed, they make fair to high yields on these soils. They should be limed and fertilized adequately and grazing regulated. Alfalfa, bromegrass, and other suitable legumes and grasses should be grown.

Fair to good yields of timber are obtained on these soils. If new plantings are made, white pine, red pine, Scotch pine, white spruce, Norway spruce, white-cedar, and black walnut can be used.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	35	65
Soybeans	bushels	17	24
Sugar beets	tons	6	10
Potatoes	bushels	135	275
Wheat	bushels	18	35
Oats	bushels	30	60
Barley	bushels	22	40
Alfalfa	tons	2.0	3.2
Mixed hay	tons	1.5	2.2

SOIL MANAGEMENT UNIT 2aC(IIIE)

Moderately sloping, slightly to moderately eroded, light-colored, medium to moderately fine textured, well-drained soils

(MdC) Miami loam, 7 to 15 percent slopes.
(MdC2) Miami loam, 7 to 15 percent slopes, moderately eroded.
(MhC) Morley loam, 7 to 15 percent slopes.
(MhC2) Morley loam, 7 to 15 percent slopes, moderately eroded.

Because of the hazard of erosion, these soils are not well suited to row crops, but most crops commonly grown in the area can be grown. Under good management, medium to high yields are obtained. The soils are naturally fertile, and they have high moisture-holding capacity.

These soils need practices to control erosion. Their supplies of organic matter and plant nutrients need to be maintained. Row crops should not be grown unless terracing, stripcropping, contour tillage, or other practices are used to protect against erosion. The soils need large amounts of organic matter, which can be supplied by planting grass-legume meadow crops and turning under cover crops. All tillage needs to be on the contour, and the soils should not be cultivated when too wet or too dry. Lime and fertilizer should be applied in amounts indicated by soil tests, and all crop residues ought to be returned to the soil. The waterways should be kept in grass.

If practices are not used to conserve these soils, a cropping system consisting of 1 year of a small grain followed by 2 years of legume-grass meadow will maintain fertility and control erosion. Cropping systems and supporting practices that will reduce water erosion are given in table 5.

If well managed, pastures make moderately high yields on the soils of this unit. They should be limed and fertilized adequately, and grazing controlled. Alfalfa, red clover, bromegrass, and other suitable legumes and grasses should be seeded.

Timber makes good yields on these soils. For new plantings, white pine, red pine, Scotch pine, white spruce, Norway spruce, and white-cedar may be used.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	30	65
Soybeans	bushels	17	25
Wheat	bushels	20	38
Oats	bushels	30	70
Barley	bushels	23	45
Alfalfa	tons	1.7	3.2
Mixed hay	tons	1.3	2.2

SOIL MANAGEMENT UNIT 2aC(IVE)

Moderately sloping, severely eroded, light-colored, medium to moderately fine textured, well-drained soils

(MfC3) Miami soils, 7 to 15 percent slopes, severely eroded.
(MkC3) Morley soils, 7 to 15 percent slopes, severely eroded.

These soils are susceptible to severe erosion and need intensive management if they are used for crops. They are high in moisture-holding capacity, but, because of past erosion, they are low in organic matter and in fertility. If satisfactory yields are to be obtained, the organic matter and fertility must be restored and erosion controlled. Row crops should not be included in the cropping system unless contouring, stripcropping, terracing, or other practices are used to control erosion.

These soils should be kept in grass-legume meadow from one-half to two-thirds of the time. If practices are not used to conserve the soils, a cropping system consisting of 1 year of a small grain followed by 3 years of grass-legume meadow is suitable. Lime and fertilizer should be applied in amounts indicated by soil tests. All waterways need to be kept in grass. Cropping systems and supporting practices that will reduce water erosion are given in table 5.

If well managed, pastures make good yields on these soils. They should be limed and fertilized, and grazing ought to be regulated. Legumes and grasses suitable for seeding pastures are alfalfa, birdsfoot trefoil, and bromegrass.

Fair to good yields of timber are obtained on these soils. In making new plantings, white pine, red pine, Scotch pine, white spruce, Norway spruce, white-cedar, and black walnut can be used.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	25	55
Soybeans	bushels	16	20
Wheat	bushels	16	30
Oats	bushels	25	60
Barley	bushels	20	40
Alfalfa	tons	1. 7	2. 0
Mixed hay	tons	1. 3	2. 0

SOIL MANAGEMENT UNIT 2aD(IVE)

Strongly sloping to steep, slightly to moderately eroded, light-colored, medium to moderately fine textured soils

(MdD2) Miami loam, 12 to 25 percent slopes, moderately eroded.
(MeD) Miami loam and Boyer sandy loam, 12 to 25 percent slopes.
(MeD2) Miami loam and Boyer sandy loam, 12 to 25 percent slopes, moderately eroded.
(MhD) Morley loam, 12 to 25 percent slopes.
(MhD2) Morley loam, 12 to 25 percent slopes, moderately eroded.

Because of their strong slopes, these soils are not suited to row crops. Except for the Boyer soils, most of the soils of this group have high moisture-holding capacity and good natural fertility. The Boyer soils formed in coarse-textured materials and are somewhat droughty.

In areas where the soils have slopes of 12 to 18 percent, small grains and forage crops can be grown, if stripcropping, contouring, or other practices are used to prevent erosion. If contouring is practiced, a cropping system consisting of 1 year of a small grain followed by 2 years of legume-grass meadow is satisfactory. If no supporting practices are used, there should be 3 years of the legume-grass meadow.

Good yields of pasture are obtained on these soils. Adequate lime and fertilizer should be added and grazing regulated. Legumes and grasses suitable for seeding are alfalfa, birdsfoot trefoil, and bromegrass.

Timber makes good yields on these soils. In making new plantings white pine, red pine, Scotch pine, white spruce, and Norway spruce may be used.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Wheat	bushels	17	28
Oats	bushels	27	50
Barley	bushels	19	38
Alfalfa	tons	1. 6	3. 0
Mixed hay	tous	1. 3	2. 0

SOIL MANAGEMENT UNIT 2aD(VIE)

Strongly sloping to steep, severely eroded, light-colored, medium to moderately fine textured soils

(MfD3) Miami soils, 15 to 25 percent slopes, severely eroded.
(MgD3) Miami and Boyer soils, 12 to 25 percent slopes, severely eroded.
(MkD3) Morley soils, 12 to 25 percent slopes, severely eroded.

Except for the Boyer soil, most of the soils in this group have good moisture-holding capacity. The Boyer soil is droughty and formed in coarse-textured materials. It is not extensive, but in some areas it is mapped with the Miami soils.

Because of severe erosion, soils in this management unit are best suited to forage crops, permanent pasture, and woodland.

In areas where the slopes are between 12 and 18 percent, these soils can be used for small grains and legume-grass meadow. However, contour tillage, stripcropping, or other practices to conserve the soil are necessary. A cropping system consisting of 1 year of a small grain followed by 3 to 4 years of legume-grass meadow can be used. For satisfactory yields, commercial fertilizer and manure must be added.

In areas where slopes are between 18 and 25 percent, the soils should be kept in grass, trees, or other permanent vegetation.

Pastures on these soils make fair to good yields. They should be adequately limed and fertilized and grazing regulated. Alfalfa, bromegrass, or other suitable legumes and grasses can be seeded.

Fair to good yields of timber are obtained on these soils. If new plantings are made, white pine, red pine, white spruce, and Norway spruce are suitable.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Wheat	bushels	15	22
Oats	bushels	25	40
Barley	bushels	17	32
Alfalfa	tons	1. 5	2. 0
Mixed hay	tons	1. 2	2. 0

SOIL MANAGEMENT UNIT 2aE(VIIE)

Very steep, slightly to moderately eroded, light-colored, medium to moderately fine textured soils

(MeE) Miami loam and Boyer sandy loam, 25+ percent slopes.
(MgE2) Miami and Boyer soils, 25+ percent slopes, moderately eroded.
(MhE) Morley loam, 25+ percent slopes.
(MkE2) Morley soils, 25+ percent slopes, moderately or severely eroded.

Because of steep slopes, these soils are best suited to grass, trees, or other permanent vegetation.

Except for Boyer sandy loam, the soils have good moisture-holding capacity and fertility. Boyer sandy loam, which is mapped with Miami loam in some places, formed in coarse-textured materials and is somewhat droughty. All the soils in this group warm up early in spring. As a result pastures produce forage early in the season.

If well managed, pastures make fair yields on these soils. For maximum yields, the soils should be limed and fertilized adequately and grazing should be regulated.

Fair yields of timber are obtained. Suitable trees for new plantings are white pine, red pine, Scotch pine, white spruce, Norway spruce, white-cedar, and black walnut.

SOIL MANAGEMENT UNIT 2bA(I)

Nearly level, slightly to moderately eroded, moderately dark colored, medium to moderately fine textured soils formed under imperfect drainage

(BfA) Blount loam, 0 to 3 percent slopes.
(BfA2) Blount loam, 0 to 3 percent slopes, moderately eroded.
(CgA) Conover loam, 0 to 3 percent slopes.

Under good management, crops commonly grown in the area make high yields on these soils. The soils are high in moisture-holding capacity and are naturally fertile. They are seldom affected by water or wind erosion. After the soils are drained, air and water move through them readily.

Generally, artificial drainage is needed. The soils can be drained by installing tile lines, spaced 3 to 5 rods apart and 3 to 4 feet deep. Surface drainage should be used wherever necessary to prevent water from ponding.

These soils tend to develop poor tilth. They should not be cultivated when too wet or too dry, and tillage should be kept to a minimum. A cropping system that includes legume-grass meadow and green-manure crops will help to maintain good soil structure and fertility. Fertilizer should be applied in amounts indicated by soil tests, and all crop residues should be returned to the soil.

If drainage is adequate, a cropping system consisting of 1 year of a row crop followed by 1 year of a small grain seeded to a green-manure crop is satisfactory. Another suitable cropping system consists of 2 years of row crops and 1 year each of a small grain and grass-legume meadow.

If the soils are adequately drained and otherwise well managed, moderately high to high yields of pasture are obtained. Lime and fertilizer should be added in amounts indicated by soil tests, and grazing should be regulated. Legumes and grasses suitable for seeding are alfalfa, red clover, ladino clover, alsike clover, and bromegrass.

Normally, these soils are not planted to trees, but they are suited to Norway spruce, white spruce, white pine, Austrian pine, and cottonwood. Tulip-poplar, Douglas-fir, and black walnut can also be grown.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	50	90
Soybeans	bushels	23	30
Sugar beets	tons	11	16
Wheat	bushels	28	45
Oats	bushels	42	80
Barley	bushels	32	55
Alfalfa	tons	2. 5	3. 7
Mixed hay	tons	2. 0	2. 7

SOIL MANAGEMENT UNIT 2bB(IIW)

Gently sloping, slightly to moderately eroded, moderately dark colored, medium to moderately fine textured soils formed under imperfect drainage

(BfB) Blount loam, 3 to 7 percent slopes.
(BfB2) Blount loam, 3 to 7 percent slopes, moderately eroded.
(CgB) Conover loam, 3 to 7 percent slopes.
(CgB2) Conover loam, 3 to 7 percent slopes, moderately eroded.

Under good management, crops commonly grown in the area make high yields on these soils. The soils are high in moisture-holding capacity and are naturally fertile. They generally need artificial drainage. Drainage can be provided by installing tile lines spaced 3 to 5 rods apart and 3 to 4 feet deep. In some places supplemental drainage can be obtained by using random tile or surface ditches.

The soils should not be cultivated when too wet or too dry, and tillage should be kept to a minimum. Using a cropping system that includes sod crops will help to maintain good soil structure and to control erosion. Fertilizer should be applied in amounts indicated by soil tests, and all crop residues should be returned to the soil.

On uniform slopes, contouring or other practices are needed to control erosion. If no supporting practices are used to conserve the soil, a cropping system consisting of 1 year each of a row crop and a small grain and then 1 or 2 years of legume-grass meadow is suitable. If contour tillage is practiced, a suitable cropping system consists of 2 years of a row crop, 1 year of a small grain, and then 2 years of legume-grass meadow.

Under good management, including adequate drainage, moderately high to high yields of pasture are obtained on these soils. Adequate fertilizer should be applied in amounts indicated by soil tests, and grazing should be regulated. Legumes and grasses suitable for seeding are alfalfa, red clover, alsike clover, ladino clover, and bromegrass.

Normally, these soils are not planted to trees, but Norway spruce, white spruce, white pine, Austrian pine, and cottonwood are suitable for planting. Tulip-poplar, Douglas-fir, and black walnut also can be used.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	50	85
Soybeans	bushels	20	30
Sugar beets	tons	10	14
Wheat	bushels	26	40
Oats	bushels	40	75
Barley	bushels	30	50
Alfalfa	tons	2. 5	3. 4
Mixed hay	tons	2. 0	2. 4

SOIL MANAGEMENT UNIT 2cA(I)

Nearly level, dark-colored, medium to moderately fine textured soils formed under poor drainage

(BgA) Blount loam and Pewamo clay loam, 0 to 3 percent slopes.
(BoA) Brookston loam, 0 to 3 percent slopes.
(BpA) Brookston loam, overwashed, 0 to 3 percent slopes.
(KfA) Kokomo and Barry loams, 0 to 3 percent slopes.
(KgA) Kokomo, Barry, and Wallkill loams, overwashed, 0 to 3 percent slopes.
(LbA) Lenawee silty clay loam, 0 to 3 percent slopes.
(PbA) Pewamo clay loam, 0 to 3 percent slopes.
(PcA) Pewamo mucky clay loam, 0 to 3 percent slopes.

If adequately drained, these soils are among the most productive in Lenawee County for field crops common to the area. They are naturally fertile and are high in moisture-holding capacity. If they are drained and properly managed otherwise, air and water move through them readily.

Care is needed in managing the soils to maintain good soil structure and to prevent packing and puddling. The soils should not be cultivated when too wet or too dry. A cropping system is needed in which a grass-legume sod crop is grown every third or fourth year. A cropping system consisting of 1 year each of a row crop and a small grain seeded to a green-manure crop, or one consisting of 2 years of a row crop and 1 year each of a small grain and legume-grass meadow will maintain the productivity of the soils. All crop residues ought to be returned to the soil and lime and fertilizer applied in amounts indicated by soil tests.

The soils can be drained by placing tile lines 3 to 5 rods

apart and 3 to 4 feet deep. The tile should be blinded with straw or topsoil.

If the soils are drained and otherwise well managed, moderately high to high yields of pasture are obtained. Adequate lime and fertilizer should be added and grazing regulated. Legumes and grasses suitable for seeding the pastures are alfalfa or ladino clover and bromegrass.

Normally, these soils are not planted to trees. Where drainage is adequate, however, suitable trees for planting are Norway spruce, white spruce, white pine, Austrian pine, and cottonwood.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	55	95
Soybeans	bushels	22	34
Sugar beets	tons	13	17
Wheat	bushels	30	45
Oats	bushels	45	80
Barley	bushels	35	60
Alfalfa	tons	2.7	3.7
Mixed hay	tons	2.2	2.7

SOIL MANAGEMENT UNIT 2a-LA(IIW)

Level to gently sloping, well and moderately well drained, moderately dark colored, medium-textured alluvial soils

(GaA) Genesee loam, 0 to 3 percent slopes.
(GaB) Genesee loam, 3 to 7 percent slopes.
(GbA) Genesee sandy loam, 0 to 3 percent slopes.
(GbB) Genesee sandy loam, 3 to 7 percent slopes.
(GcA) Genesee and Eel loams, 0 to 3 percent slopes.

In general, these soils are fairly fertile, contain moderate amounts of organic matter, and are easy to till. In some of the areas, however, swales make tillage difficult. In places the swales overflow about once in 3 to 5 years. Flooding normally occurs when heavy rains fall during spring thaws. In summer, except on the lower parts of the fields, heavy damage from overflow is rare.

Because of differences in the degree of flooding and in the wetness hazard that exists in individual areas, specific management and estimates of crop yields are not given for the soils of this unit. On those areas where the hazards of flooding and wetness are not serious, a high proportion of grain and row crops can be included in the cropping system and yields will be medium to high. Lime and fertilizer should be applied in amounts indicated by soil tests, and crop residues should be returned to the soil. Where the soils are gently rolling, yields can be increased by planting row crops on the contour.

Under good management, pastures on these soils make medium to high yields. Adequate amounts of lime and fertilizer should be added and grazing regulated. White clover, ladino clover, alsike clover, and other moisture-tolerant legumes are suitable for seeding.

Stands of timber are good if woodlands are managed properly. Suitable trees are red maple and cottonwood.

SOIL MANAGEMENT UNIT 2c-LA(IIW)

Nearly level, predominantly imperfectly and poorly drained, dark-colored, medium-textured alluvial soils

(GfA) Griffin and Genesee loams, 0 to 3 percent slopes.
(GgA) Griffin and Sloan loams, 0 to 3 percent slopes.
(GhA) Griffin and Sloan sandy loams, 0 to 3 percent slopes.
(WaA) Wallkill loam, overwashed, 0 to 3 percent slopes.

These soils are generally fairly fertile and are easy to till. Although they are predominantly imperfectly or poorly drained, some areas are well drained.

Because of differences in the condition and in the size and shape of the areas that are subject to overflow and because some of the areas can be more easily drained than others, the soils vary considerably in suitability for use and in crop yields. Normally, the bottoms are flooded once in 2 to 3 years. Flooding occurs most often in spring. If floods occur in summer, the soils are covered by water for only a short period of time.

Areas that are subject to only minor damage from flooding can be used for corn, soybeans, oats, and other cultivated crops. Adequate lime and fertilizer should be applied in amounts indicated by soil tests, and all crop residues should be returned to the soil.

The soils generally need artificial drainage. Drainage can be provided by tile or by open ditches. If tile is used, the lines should be spaced 100 to 132 feet apart and at depths of 3 to 4 feet. Shallow random ditches can also be used to provide surface drainage.

TABLE 6.—*Cropping systems* [1] *suitable for the soils of soil management units in groups 3a and 3/2a under named practices of water erosion control*

Soil management unit	Slope	Practices to control water erosion			
		None	Contour tillage	Stripcropping	Terracing
	Percent				
3aA(IIS)	0–3	RORWMM(75)	(2)	(2)	(2).
3aB(IIS)	3–7	ROWMMM(88)	RWM(81)	RORWMM(75)	RWgmRWM(72).
3aC(IIIS)	7–15	WMM(97)	WMM(97)	ROWMMM(88)	ROWM(79).
3aC(IVS)	7–15	WMMM(98)	WMMM(98)	ROWMMM(88)	ROgmWM(79).
3aD(IVS)	12–18	M(99)	WMMM(98)	OWMM(94)	(3).
	18–25	(2)	(2)	(2)	(2).
3aD(VIS)	12–25	(2)	(2)	(2)	(2).
3aE(VIIS)	25+	(2)	(2)	(2)	(2).
3/2aA(IIS)	0–3	RORWMM(75)	RWgmRWM(72)	RORWMM(75)	RWgmRWM(72).
3/2aB(IIS)	3–7	ROWMMM(88)	RWM(81)	RORWMM(75)	RWgmRWM(72).
3/2aC(IIIS)	7–15	WMM(97)	WMM(97)	ROWMMM(88)	ROWM(79).
3/2aC(IVS)	7–15	WMMM(98)	WMMM(98)	ROWMMM(88)	ROgmWM(79).

[1] Symbols indicating cropping systems: gm=green-manure crop; M=legume-grass meadow; O=spring grains; R=row crops; W=winter grains.

[2] Soils should be kept under grass, trees, or other permanent vegetation.

[3] Not recommended.

Because of differences in the degree of flooding and in the wetness hazard that exists in individual areas, specific suggestions for management and estimated crop yields are not given for these soils.

Pastures on these soils are excellent if properly managed. They need adequate lime and fertilizer, and grazing should be regulated. Smooth bromegrass with white clover, ladino clover, alsike clover, or other moisture-tolerant legumes are suitable for seeding the imperfectly drained areas. Reed canarygrass is suitable for the poorly drained areas.

These soils provide only poor sites for woodland, but red maple and cottonwood are suitable for planting.

Soil management groups 3a, 3b, 3c, 3/1c, 3/2a, 3/2b, and 3/2c.—Soil management group 3a consists of light-colored, moderately coarse textured soils that are well drained. Soil management group 3/2a consists of moderately well drained and well drained, light-colored soils that are moderately coarse textured. The soils of group 3/2a have loam or clay loam at depths of 18 to 42 inches. In table 6 are given cropping systems and supporting practices suitable for the soils of each unit in each of these two groups.

All of the cropping systems and supporting practices suggested are for soils with slopes of 200 feet. If the soils have slopes longer than 200 feet, a cropping system that gives more protection should be used unless the soils are terraced. If the soils have slopes less than 200 feet long, a cropping system that gives slightly less protection can be used. The numbers in parentheses refer to the relative protectiveness of the cropping system (see table 3).

Specific cropping systems have not been supplied in table 6 for the soils of soil management groups 3b, 3c, 3/1c, 3/2b, and 3/2c, but suggested cropping systems and management practices have been given under the descriptions of the individual soil management units. Soil management groups 3b and 3/2b consist of imperfectly drained upland soils, and 3c, 3/1c, and 3/2c, of poorly or very poorly drained upland soils.

SOIL MANAGEMENT UNIT 3aA(IIS)

Nearly level, slightly eroded, light-colored, moderately coarse textured, well-drained soils

(FaA) Fox cobbly gravelly loam, 0 to 3 percent slopes.
(FbA) Fox loam, 0 to 3 percent slopes.
(FcA) Fox sandy loam, 0 to 3 percent slopes.
(IaA) Ionia loam, 0 to 3 percent slopes.

These soils are suited to most of the crops commonly grown in the area, and, under good management, yields are moderately high. The soils are especially well suited to potatoes. Their principal limitations are their moderately low moisture-holding capacity and moderately low fertility.

The soils need large amounts of organic matter to improve the moisture-holding capacity and to make them more resistant to erosion. The organic matter decomposes rapidly. It should be replenished by planting legumes and grasses, by returning all crop residues to the soil, and by applying manure. Tillage ought to be kept to a minimum, and lime and fertilizer should be added in amounts indicated by soil tests. A suitable cropping system consists of 2 years each of a row crop and a small grain and 2 years of legume-grass meadow.

Pastures make good yields on these soils if there is enough moisture and adequate lime and fertilizer are added. Yields may be low during the dry summer months. Alfalfa and bromegrass are suitable for seeding.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, or Scotch pine. Tulip-poplar and black walnut can also be used.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	35	75
Soybeans	bushels	18	26
Sugar beets	tons	8	11
Potatoes	bushels	195	450
Wheat	bushels	23	39
Oats	bushels	34	68
Barley	bushels	28	46
Alfalfa	tons	1. 9	3. 1
Mixed hay	tons	1. 3	2. 3

SOIL MANAGEMENT UNIT 3aB(IIS)

Gently sloping, slightly to moderately eroded, light-colored, moderately coarse textured, well-drained soils

(FaB) Fox cobbly gravelly loam, 3 to 7 percent slopes.
(FbB) Fox loam, 3 to 7 percent slopes.
(FcB) Fox sandy loam, 3 to 7 percent slopes.
(FcB2) Fox sandy loam, 3 to 7 percent slopes, moderately eroded.
(HaB) Hillsdale sandy loam, 3 to 7 percent slopes.
(IaB) Ionia loam, 3 to 7 percent slopes.

These soils are suited to most of the crops commonly grown in the area. Under good management, moderately high yields are obtained. The soils are especially well suited to potatoes. The principal management problems are their susceptibility to moderate erosion, their moderately low moisture-holding capacity, and their low fertility.

The soils need large amounts of organic matter. The organic matter decomposes rapidly, but it can be replenished by planting legumes and grasses, by plowing under all crop residues, and by using available manure. Lime and commercial fertilizer should be applied in amounts indicated by soil tests. Contouring, stripcropping, terracing, or other practices should be used to control erosion.

If no supporting practices are used, a suitable cropping system consists of 1 year of a row crop and 2 years of a small grain followed by 3 years of legume-grass meadow. Cropping systems and supporting practices that will reduce water erosion are given in table 6.

Pastures make good yields on these soils if there is enough moisture and if adequate lime and fertilizer are added. Yields may be low during the dry summer months. Alfalfa and bromegrass are suitable for seeding.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, Scotch pine, white spruce, Norway spruce, and native hardwoods.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	32	65
Soybeans	bushels	17	24
Sugar beets	tons	7. 6	9
Potatoes	bushels	190	400
Wheat	bushels	20	37
Oats	bushels	32	64
Barley	bushels	26	44
Alfalfa	tons	1. 9	3. 1
Mixed hay	tons	1. 3	2. 3

SOIL MANAGEMENT UNIT 3aC(IIIS)

Moderately sloping, slightly to moderately eroded, light-colored, moderately coarse textured soils

(FaC2) Fox cobbly gravelly loam, 7 to 15 percent slopes, moderately eroded.
(FbC) Fox loam, 7 to 15 percent slopes.
(FbC2) Fox loam, 7 to 15 percent slopes, moderately eroded.
(FcC) Fox sandy loam, 7 to 15 percent slopes.
(FcC2) Fox sandy loam, 7 to 15 percent slopes, moderately eroded.
(HaC2) Hillsdale sandy loam, 7 to 15 percent slopes, moderately eroded.

These soils are not suited to sugar beets but are suited to most of the other crops commonly grown in the county. Under proper management, moderate to moderately high yields of most crops are obtained. The principal management problems are susceptibility to severe erosion and moderately low moisture-holding capacity and fertility.

The soils need large amounts of organic matter to improve their moisture-holding capacity and to make them less erodible. They are naturally well drained; consequently, organic matter decomposes rather rapidly and needs to be replenished often.

The following management practices should be used: Maintain organic matter by planting suitable legumes and grasses; apply lime and fertilizer in amounts indicated by soil tests; return all crop residues to the soil; seed and maintain all waterways in grass; and use contouring, stripcropping, terracing, or other practices to control erosion. Cover crops should be seeded in all row crops. Cropping systems and supporting practices that will reduce water erosion and maintain productivity in these soils are given in table 6.

Pastures generally make good yields on these soils if there is enough moisture and if adequate lime and fertilizer are added. Yields may be low in summer because of the limited supply of moisture in the soil. Alfalfa and bromegrass are suitable for planting.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, and Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	30	58
Soybeans	bushels	15	20
Wheat	bushels	20	32
Oats	bushels	30	62
Barley	bushels	25	42
Alfalfa	tons	1. 6	3. 1
Mixed hay	tons	1. 2	2. 3

SOIL MANAGEMENT UNIT 3aC(IVS)

Moderately sloping, severely eroded, light-colored, moderately coarse textured soils

(FdC3) Fox soils, 7 to 15 percent slopes, severely eroded.

These soils are suited to most of the crops commonly grown in the area, and, under intensive management, fair yields are obtained. The soils are best suited to small grains and legume-grass meadow.

The principal management problems are moderately low moisture-holding capacity, moderately low fertility, and susceptibility to severe erosion. The soils have lost much of their original surface layer, and the subsoil is exposed in many places. Organic matter is needed to increase their moisture-holding capacity, to improve fertility, and to reduce the hazard of erosion by wind and water.

The supply of organic matter should be maintained by growing legumes and grasses, by returning all crop residues to the soil, by adding barnyard manure, and by seeding all row crops to cover crops. Lime and fertilizer should be applied in the amounts indicated by soil tests.

If row crops are grown, contouring, stripcropping, terracing, and other practices should be used to control erosion. Waterways should be kept in grass. If no supporting practices are used to control erosion, a suitable cropping system consists of 1 year of a small grain followed by 3 years of grass-legume meadow. Cropping systems and supporting practices that will reduce water erosion are given in table 6.

Pastures on these soils make fair yields if there is enough moisture and if adequate lime and fertilizer are added. In summer yields may be lowered, however, because of the limited supply of moisture in the soil. Alfalfa and bromegrass are suitable for planting.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, and Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	23	42
Wheat	bushels	17	26
Oats	bushels	26	45
Barley	bushels	20	32
Alfalfa	tons	1. 5	2. 8
Mixed hay	tons	1. 1	2. 0

SOIL MANAGEMENT UNIT 3aD(IVS)

Strongly sloping to steep, slightly to moderately eroded, light-colored, moderately coarse textured soils

(FcD) Fox sandy loam, 12 to 25 percent slopes.
(FcD2) Fox sandy loam, 12 to 25 percent slopes, moderately eroded.

These soils are moderately low in moisture-holding capacity and in fertility. Yields are below average for the county. The soils vary greatly in range of slopes; consequently, they vary in capability for use and in management requirements. In areas where the slopes are between 12 and 18 percent, a cropping system consisting of 1 year of a small grain, followed by 3 years of legume-grass meadow, is suitable, providing contouring is used as a supporting practice. Because of the severe hazard of erosion, row crops should not be grown.

The following management practices should be used in areas where slopes are between 12 and 18 percent: Maintain the supply of organic matter by including legumes and grasses in the cropping system; apply lime and fertilizer in amounts indicated by soil tests; return all crop residues to the soil; maintain all waterways in grass; and use stripcropping, contour tillage, and similar practices to control erosion. If practices are not used to control erosion, a suitable cropping system consists of 4 to 5 years of legumes and grasses grown together and 1 year of a small grain.

In areas where the soils have slopes of 18 to 25 percent, row crops and small grains should not be grown and the soils should be kept in permanent vegetation. Suggestions for cropping systems and supporting practices that will

reduce water erosion and keep the soils productive are given in table 6.

Pastures on these soils make fair yields, if there is enough moisture and if adequate lime and fertilizer are added. Yields may be lower in summer, however, because of the limited supply of moisture. Alfalfa and bromegrass are suitable for seeding.

Woodland products make moderately high yields on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, and Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Wheat	bushels	17	25
Oats	bushels	28	45
Barley	bushels	22	30
Alfalfa	tons	1. 6	2. 8
Mixed hay	tons	1. 2	2. 0

SOIL MANAGEMENT UNIT 3aD(VIS)

Strongly sloping to steep, severely eroded, light-colored, moderately coarse textured soils

(FdD3) Fox soils, 12 to 25 percent slopes, severely eroded.

Because of the strong slopes and past erosion, these soils are best suited to pasture and woodland. Both sheet and gully erosion have occurred on many of the areas, and natural fertility is low. The soils are moderately coarse textured and are moderately low in moisture-holding capacity.

In areas where slopes are between 12 and 18 percent, small grains and legume-grass meadow crops may be grown, provided stripcropping or other practices are used to control erosion. A satisfactory cropping system consists of 1 year of a small grain, followed by 4 or 5 years of legume-grass meadow. Yields will be lower than on the less eroded soils. Lime and fertilizer should be applied in amounts indicated by soil tests. All waterways ought to be maintained in grass.

In areas where slopes are between 18 and 25 percent, the soils should be used for grass, trees, or other permanent vegetation.

Pastures make fair yields on these soils if moisture is adequate and if adequate lime and fertilizer are added. Yields may be lowered, however, because of the limited supply of moisture in the soil. Alfalfa and bromegrass are suitable for seeding.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, or Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Wheat	bushels	15	23
Oats	bushels	26	36
Barley	bushels	20	28
Alfalfa	tons	1. 3	2. 5
Mixed hay	tons	1. 0	2. 0

SOIL MANAGEMENT UNIT 3aE(VIIS)

Steep, slightly to severely eroded, light-colored, moderately coarse textured soils

(FcE) Fox sandy loam, 25+ percent slopes.
(FdE2) Fox soils, 25+ percent slopes, moderately or severely eroded.

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Because of the steep slopes, these soils are best suited to pasture, timber, or other permanent vegetation. Pastures make fair yields if moisture is adequate and if adequate lime and fertilizer are added. The soils are moderately low in moisture-holding capacity. Therefore, pastures may make low yields during the summer months.

Woodland products make moderately high yields on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, and Scotch pine.

SOIL MANAGEMENT UNIT 3bA(IIW)

Nearly level, moderately dark colored, moderately coarse textured soils formed under imperfect drainage; in some areas loam and clay loam materials occur at depths of 18 to 42 inches

(BhA) Brady sandy loam, 0 to 3 percent slopes.
(BkA) Brady and Macomb loams, 0 to 3 percent slopes.
(BmA) Brady and Macomb sandy loams, 0 to 3 percent slopes.

The soils in this management unit are somewhat lower in moisture-holding capacity and fertility than soils in management unit 2bA(I), and crop yields are generally not so high. The soils are medium to moderately high in moisture-holding capacity and fertility. Good tilth is fairly easy to maintain. The soils are suited to all the crops commonly grown in the county, and, under proper management, good yields are obtained.

If used for crops, these soils require artificial drainage. Tile lines need to be spaced 4 to 7 rods apart and at depths of 3 to 4 feet. They should be covered with soil from the surface layer, straw, or other suitable material. Extreme care is necessary to maintain the proper gradient.

Organic matter should be maintained in these soils by using a cropping system that includes legume-grass meadow and green-manure crops. All crop residues should be returned to the soil, and lime and fertilizer ought to be added in amounts indicated by soil tests.

A 5-year cropping system, consisting of 1 year each of legume-grass meadow, corn with a cover crop, corn or other row crop grown alone, a small grain, and a green-manure crop and wheat, will help to keep the soils productive.

If adequate drainage is provided, pastures make good yields on these soils. Alfalfa, ladino clover, alsike clover, bromegrass, or other suitable legumes and grasses may be seeded.

These soils are not well suited to timber. White pine, red pine, Scotch pine, or Norway spruce may be planted on the better drained areas; however, yields of woodland products are low.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	45	80
Soybeans	bushels	19	26
Sugar beets	tons	9	13
Potatoes	bushels	200	400
Wheat	bushels	25	40
Oats	bushels	30	75
Barley	bushels	30	50
Alfalfa	tons	2. 0	3. 2
Mixed hay	tons	1. 5	2. 4

SOIL MANAGEMENT UNIT 3cA(IIW)

Nearly level to gently sloping, dark-colored, moderately coarse textured soils formed under poor drainage.

(BaA) Barry sandy loam, overwashed, 0 to 3 percent slopes.
(CeA) Colwood very fine sandy loam, 0 to 3 percent slopes.
(CfA) Colwood and Wauseon fine sandy loams, 0 to 3 percent slopes.
(KeA) Kibbie and Colwood fine sandy loams, 0 to 3 percent slopes.
(KeB) Kibbie and Colwood fine sandy loams, 3 to 7 percent slopes.
(SaA) Sebewa loam, 0 to 3 percent slopes.
(SbA) Sebewa sandy loam, 0 to 3 percent slopes.

The soils in this management unit are somewhat lower in moisture-holding capacity and fertility than the soils in management unit 2cA(I), and crop yields are generally lower. They are suited to all the crops commonly grown in the area but must be artificially drained for crops to be grown successfully. If good management is used, moderately high to high yields are obtained.

If tile are used to drain the soils, the lines should be spaced 4 to 7 rods apart and at depths of 3 to 4 feet. They should be covered with soil from the surface layer, straw, or other suitable material. Extreme care is necessary to maintain the proper gradient.

The supply of organic matter should be maintained in the soils by using a cropping system that includes legume-grass meadow and cover crops. A 5-year cropping system, consisting of 1 year of a row crop, 1 year of a small grain seeded to a green-manure crop, and then 1 year each of a row crop, a small grain, and legume-grass meadow, will help to keep the soils productive. The soils should be tilled only enough to control weeds, to provide an adequate seedbed, and to keep the surface soil in good condition. All crop residues ought to be returned to the soil and lime and fertilizer applied in amounts indicated by soil tests.

Pastures are good on these soils if drainage is adequate. The kinds of legumes and grasses planted will depend upon the degree of wetness in the particular site. If the soils are drained adequately, alfalfa, ladino clover, and bromegrass can be grown.

Because of the high water table, trees ordinarily do not grow well on these soils. The yield of wood products is generally low, and the kinds of trees that can be grown are less desirable than on other sites. Where the water table is at a great enough depth, however, white pine or Norway spruce can be planted.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	50	85
Soybeans	bushels	20	27
Sugar beets	tons	10	15
Wheat	bushels	27	45
Oats	bushels	40	80
Barley	bushels	33	55
Alfalfa	tons	2. 2	3. 4
Mixed hay	tons	1. 7	2. 4

SOIL MANAGEMENT UNIT 3/1cA(IIW)

Nearly level, poorly drained, dark-colored, moderately coarse textured soil underlain by clay or silty clay materials at depths of 18 to 42 inches

(WcA) Wauseon loam, 0 to 3 percent slopes.

If this soil is artificially drained and well managed otherwise, moderately high to high yields are obtained of all the crops commonly grown in the area. The clay or silty clay in the lower part of the profile causes permeability to be slow and makes the soil somewhat difficult to drain. Drainage can be provided by tile or by open ditches. Because of the danger of sloughing, the tile should be laid or ditches dug during the dry part of the year. The tile lines should be spaced from 2 to 4 rods apart and at depths of 3 to 4 feet. They should be covered with straw or other suitable material.

In addition to artificial drainage, the following management practices should be used: Maintain a supply of organic matter in the soil by growing legumes and grasses and returning all crop residues to the soil, and apply lime and fertilizer in amounts indicated by soil tests. A cropping system consisting of 1 year each of a row crop, a small grain seeded to a green-manure crop, another row crop and another small grain, and then 1 year of legume-grass meadow will help to keep the soil productive.

Pastures make good yields on this soil if drainage is adequate. Ladino clover, alsike clover, and bromegrass are suitable for seeding.

Ordinarily, because of the high water table and restricted drainage, this soil is poor for growing trees. The yield is generally low, and the kinds of trees that can be grown are less desirable than on better drained soils. If the soil is artificially drained, white pine, red pine, Scotch pine, white spruce, Norway spruce, and white-cedar can be grown.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	48	80
Soybeans	bushels	20	27
Sugar beets	tons	10	14
Wheat	bushels	25	42
Oats	bushels	40	75
Barley	bushels	30	50
Alfalfa	tons	2. 0	3. 2
Mixed hay	tons	1. 6	2. 2

SOIL MANAGEMENT UNIT 3/2aA(IIS)

Nearly level, moderately well drained, light-colored, moderately coarse textured soils underlain by loam or clay loam material at depths of 18 to 42 inches; the moderately coarse textured material is absent in some places, and the soils are formed in clay loam materials

(CbA) Cadmus sandy loam, 0 to 3 percent slopes.
(CcA) Cadmus and Blount loams, 0 to 3 percent slopes.

If these soils are well managed, moderately high to high yields are obtained of most crops commonly grown in the area. The soils have loam to clay loam at depths of 18 to 42 inches. They are, therefore, somewhat higher in moisture-holding capacity and fertility than the soils in soil management unit 3aA(IIS).

The following management practices should be used: Maintain organic matter by including legumes and grasses in the cropping system and returning all crop residues to the soil. Apply lime and fertilizer in amounts indicated by solid tests.

A 5-year cropping system, consisting of 1 year each of a legume-grass crop, a row crop seeded to a green-manure crop, another row crop, a small grain seeded to a green manure crop, and then winter grain seeded to a legume-grass crop, will help to maintain the fertility of these soils. Other suitable cropping systems and supporting practices that will reduce water erosion are given in table 6.

Pastures on these soils make good yields if moisture is adequate and lime and fertilizer are added. The yields may be lower when the supply of moisture is limited. Alfalfa and bromegrass are suitable for seeding.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, and Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	37	75
Soybeans	bushels	20	28
Sugar beets	tons	8	11
Potatoes	bushels	195	425
Wheat	bushels	24	40
Oats	bushels	37	70
Barley	bushels	29	47
Alfalfa	tons	1. 9	3. 1
Mixed hay	tons	1. 3	2. 5

SOIL MANAGEMENT UNIT 3/2aB(IIS)

Gently sloping, slightly to moderately eroded, light-colored, moderately well drained, moderately coarse textured soils underlain by loam or clay loam at depths of 18 to 42 inches

(CaB) Cadmus loam, 3 to 7 percent slopes.
(CaB2) Cadmus loam, 3 to 7 percent slopes, moderately eroded.
(CbB) Cadmus sandy loam, 3 to 7 percent slopes.
(CbB2) Cadmus sandy loam, 3 to 7 percent slopes, moderately eroded.

These soils are suited to most of the crops commonly grown in the area, and, under good management, moderately high to high yields are obtained. The soils are not well suited to sugar beets or beans. The upper part of the profile is coarser textured than that of the soils in management unit 2aB(IIE), and crop yields are somewhat lower. The principal management problems are susceptibility to moderate erosion and maintenance of organic matter and fertility.

These soils need large amounts of organic matter. It can be supplied by including legumes and grasses in the cropping system, by returning all crop residues to the soil, and by applying barnyard manure. Lime and fertilizer should be added in amounts indicated by soil tests. Contouring, stripcropping, terracing, and similar practices should be used to control erosion, and all waterways ought to be kept in grass.

If practices are not used to conserve the soils, a suitable cropping system is one in which legumes and grasses are grown at least 2 years out of 4. Cropping systems and supporting practices that will reduce water erosion and help to keep the soils productive are given in table 6.

Pastures on these soils make good yields if moisture is adequate and lime and fertilizer are added. Yields may be somewhat lower when the supply of moisture is limited. Alfalfa and bromegrass are suitable for seeding.

Yields of woodland products are moderately high on these soils. Suitable trees for planting are white pine, Austrian pine, red pine, and Scotch pine.

Probable yields per acre of crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	34	70
Soybeans	bushels	18	27
Sugar beets	tons	7. 6	10
Potatoes	bushels	190	400
Wheat	bushels	21	38
Oats	bushels	34	66
Barley	bushels	27	45
Alfalfa	tons	1. 9	3. 1
Mixed hay	tons	1. 3	2. 5

SOIL MANAGEMENT UNIT 3/2aC(IIIS)

Moderately sloping, slightly to moderately eroded, light-colored, well-drained, moderately coarse textured soils underlain by loam or clay loam materials at depths of 18 to 42 inches

(KaC) Kendallville loam, 7 to 15 percent slopes.
(KaC2) Kendallville loam, 7 to 15 percent slopes, moderately eroded.
(KbC) Kendallville sandy loam, 7 to 15 percent slopes.

Moderately high yields of most crops grown in the area are obtained on these soils, but the soils are not well suited to sugar beets or beans. The upper part of the profile is coarser textured than that of the soils in management unit 2aC(IIIE), and crop yields are generally lower. The principal management needs are control of erosion and maintenance of organic matter and fertility.

The following management practices should be used: Maintain organic matter by including legumes and grasses in the cropping system and returning all crop residues to the soil. Seed all row crops to cover crops, and apply lime and fertilizer in amounts indicated by soil tests. Do not plant row crops unless contouring, stripcropping, terracing, or other practices are used to prevent erosion. Keep all waterways in grass.

If practices are not used to control erosion, a cropping system consisting of 1 year of a small grain followed by 2 years of grass-legume meadow is suitable. Cropping systems and supporting practices that will reduce water erosion are given in table 6.

Pastures on these soils make good yields if moisture is adequate and adequate lime and fertilizer are added. The yields may be lower, however, when the supply of moisture is limited. Alfalfa and bromegrass are suitable for seeding.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, and Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	30	60
Soybeans	bushels	17	22
Wheat	bushels	19	36
Oats	bushels	31	64
Barley	bushels	25	44
Alfalfa	tons	1. 6	3. 1
Mixed hay	tons	1. 2	2. 3

SOIL MANAGEMENT UNIT 3/2aC(IVS)

Moderately sloping, moderately to severely eroded, light-colored, well-drained, moderately coarse textured soils underlain by loam or clay loam at depths of 18 to 42 inches

(KcC2) Kendallville soils, 7 to 15 percent slopes, moderately or severely eroded.

If used for crops, these soils require intensive management. They are subject to severe erosion and are low in organic matter and fertility. The upper part of the profile is coarser textured than that of soils in management unit 2aC(IVE), and the moisture-holding capacity is somewhat lower.

These soils are best suited to small grains and legume-grass meadow. Row crops should not be grown unless stripcropping, contour tillage, or other practices are used to prevent erosion.

If practices are not used to control erosion, a suitable

cropping system consists of 1 year of a small grain followed by 3 years of grass-legume meadow. Lime and fertilizer should be applied in amounts indicated by soil tests. All waterways should be kept in grass. Cropping systems and supporting practices that will maintain productivity and reduce water erosion are given in table 6.

Pastures make good yields on these soils if moisture is adequate and adequate lime and fertilizer are added. Yields may be lowered because of limited moisture in the soil and severe erosion. Alfalfa and bromegrass are suitable for seeding.

Yields of woodland products are moderately high on these soils. Trees suitable for planting are white pine, Austrian pine, red pine, and Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	25	50
Wheat	bushels	17	29
Oats	bushels	27	49
Barley	bushels	20	33
Alfalfa	tons	1. 5	2. 9
Mixed hay	tons	1. 0	2. 1

SOIL MANAGEMENT UNIT 3/2bA(IIW)

Nearly level, moderately dark colored, imperfectly drained, moderately coarse textured soils underlain by loam or clay loam at depths of 18 to 42 inches

(MaA) Macomb fine sandy loam, 0 to 3 percent slopes.
(MbA) Macomb sandy clay loam and Hoytville clay loam, 0 to 3 percent slopes.

If these soils are artificially drained and otherwise well managed, moderately high to high yields are obtained of all the crops commonly grown in the area. Good tilth and fertility are fairly easy to maintain. The principal management problem is providing artificial drainage.

Except for areas of Hoytville clay loam, 0 to 3 percent slopes, the upper part of the profile in most areas of these soils is coarser textured than that in the soils of management unit 2bA(I) and yields are somewhat lower. Drainage can be provided by means of tile or open ditches. If tile is used, the lines should be spaced 3 to 5 rods apart and at depths of 3 to 4 feet. They should be covered with soil from the surface layer, straw, or other suitable material.

In addition to artificial drainage, the following management practices are needed: Maintain the supply of organic matter by including legumes and grasses in the cropping system and by returning all crop residues to the soil. Apply lime and fertilizer in amounts indicated by soil tests.

A 5-year cropping system, consisting of 1 year each of legume-grass meadow, corn with a cover crop, corn or another row crop grown alone, a small grain seeded to a green-manure crop, and a small grain, is suitable.

Pastures on these soils make good yields if drainage is adequate. Legumes and grasses suitable for seeding are alfalfa, ladino clover, alsike clover, and bromegrass.

Because of the high water table, these soils ordinarily are not well suited to trees. Yields of wood products are generally low, and the kinds of trees that can be grown are less desirable than those grown on better drained soils. Where the water table is at sufficient depth, however, white pine or Norway spruce may be planted.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	45	80
Soybeans	bushels	20	28
Sugar beets	tons	9	14
Potatoes	bushels	200	450
Wheat	bushels	25	42
Oats	bushels	35	80
Barley	bushels	30	50
Alfalfa	tons	2. 0	3. 3
Mixed hay	tons	1. 5	2. 6

SOIL MANAGEMENT UNIT 3/2cA(IIW)

Nearly level, dark-colored, moderately coarse textured, poorly drained soils underlain by loam or clay loam at depths of 18 to 42 inches

(BdA) Berville loam, 0 to 3 percent slopes.
(BeA) Berville sandy loam, 0 to 3 percent slopes.

If these soils are artificially drained and otherwise well managed, moderately high to high yields are obtained of all the crops commonly grown in the county. They are naturally high in organic matter and fertility, and good tilth is fairly easy to maintain. The principal management problem is providing artificial drainage.

The upper part of the profile in these soils is coarser textured than that of the soils in management unit 2cA(I), and crop yields are generally slightly lower. If tile are used to provide drainage, the tile lines should be spaced 3 to 5 rods apart and at depths of 3 to 4 feet. Because the soil is normally sandy at these depths, the tile ought to be blinded with straw or other suitable material. They should be laid during the dry part of the year to reduce sloughing.

In addition to draining the soils, the following management practices are needed: Maintain the supply of organic matter by including legumes and grasses in the cropping system and by returning all crop residues to the soil. Apply lime and fertilizer in the amounts indicated by soil tests.

A 5-year cropping system consisting of 1 year each of a row crop, a small grain seeded to a green-manure crop, another row crop, a small grain and then legume-grass meadow is suitable for these soils and will help maintain their productivity.

Pastures make good yields on these soils if drainage is adequate. Legumes and grasses suitable for seeding are alfalfa, ladino clover, and bromegrass.

Because of the high water table, these soils ordinarily are not well suited to trees. Yields are generally low, and the kinds of trees that can be grown are less desirable than those grown on better drained soils. In areas where the water table is at sufficient depth, however, white pine or Norway spruce may be planted.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	50	85
Soybeans	bushels	22	28
Sugar beets	tons	10	15
Wheat	bushels	27	45
Oats	bushels	40	80
Barley	bushels	33	55
Alfalfa	tons	2. 2	3. 4
Mixed hay	tons	1. 7	2. 4

TABLE 7.—*Cropping systems*[1] *suitable for the soils of soil management units in group 4a under named practices of water erosion control*

Soil management unit	Slope	Practices to control water erosion			
		None	Contour tillage	Stripcropping	Terracing
	Percent				
4aA(IIIS)	0–3	ROWMM(85)			
4aB(IIIS)	3–7	ROWMM(85)	ROWMM(85)	RWMM(87)	ROWMM(85).
4aC(IIIS)	7–15	WM(95)	RWMMM(90)	RWMM(87)	ROWMM(85).
4aD(IVS)	12–18	WMM(97)	WMM(97)	OWMM(94)	[2].
	18–25	[3]	[3]	[3]	[2].

[1] Symbols indicating cropping systems: gm=green-manure crop; M=legume-grass meadow; O=spring grains; R=row crops; W=winter grains.

[2] Not recommended.

[3] Soils should be kept under grass, trees, or other permanent vegetation.

Soil management group 4a.—Soil management group 4a consists of light-colored, coarse-textured soils that are well to moderately well drained. In table 7 cropping systems and supporting practices suitable for the soils of this group are given. All of the cropping systems and supporting practices suggested are for soils with slopes 200 feet long. Unless terraces are used, a cropping system that gives more protection is required on soils with slopes longer than 200 feet. If the soils have slopes less than 200 feet long, a cropping system that gives slightly less protection can be used. The numbers in parentheses refer to the relative protectiveness of the cropping system (see table 3).

SOIL MANAGEMENT UNIT 4aA(IIIS)

Nearly level, light-colored, coarse-textured, well to moderately well drained soils

(BnA) Bronson sandy loam, 0 to 3 percent slopes.
(ObA) Oshtemo loamy sand, 0 to 3 percent slopes.

If well managed, these soils are suited to most of the crops commonly grown in the area, but they are not suited to sugar beets and beans. Because of their low moisture-holding capacity, crop yields are generally moderately low. The soils are best suited to small grains, crops that require only a short growing season, and legume-grass meadow.

To improve the moisture-holding capacity and fertility of these soils, the supply of organic matter should be kept at a high level. The organic matter decomposes rapidly and must be replaced. Organic matter can be added to the soils by including legumes and grasses in the cropping system, seeding cover crops in all row crops, and returning all crop residues to the soil. Stripcropping should be used to control wind erosion, and adequate fertilizer should be added. Tillage should be kept to a minimum.

A satisfactory cropping system consists of 2 years of legume-grass meadow, 1 year of a row crop, and 2 years of a small grain. Another suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 2 years of legume-grass meadow. Other cropping systems and supporting practices that will help maintain productivity and reduce water erosion are given in table 7.

Because the soils are low in moisture-holding capacity, pastures make only fair yields, especially in summer. They should be seeded to alfalfa, bromegrass, or other deep-rooted legumes and grasses.

Yields of woodland products are fair to good on these soils. White pine, red pine, jack pine, and Scotch pine are suitable for planting.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	28	55
Soybeans	bushels	15	20
Potatoes	bushels	150	400
Wheat	bushels	20	32
Oats	bushels	30	55
Barley	bushels	24	35
Alfalfa	tons	1. 5	2. 8
Mixed hay	tons	1. 0	1. 8

SOIL MANAGEMENT UNIT 4aB(IIIS)

Gently sloping, slightly to moderately eroded, light-colored, coarse-textured, well and moderately well drained soils

(BnB) Bronson sandy loam, 3 to 7 percent slopes.
(ObB) Oshtemo loamy sand, 3 to 7 percent slopes.
(ObB2) Oshtemo loamy sand, 3 to 7 percent slopes, moderately eroded.
(ScB) Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes.
(ScB2) Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes, moderately eroded.

If well managed, these soils are suited to most of the crops commonly grown in the area, but they are not well suited to sugar beets and beans. They are best suited to small grains, short-season crops, and legume-grass meadow. Because they are low in plant nutrients and in moisture-holding capacity, however, crop yields are medium to low.

Organic matter must be maintained at a high level in these soils, but it decomposes rapidly. If satisfactory yields are to be obtained, adequate fertilizer must be applied and practices used to control erosion by wind and water.

The following management practices are needed: Plant windbreaks or combine stripcropping and use of close-growing crops in the cropping system to control wind erosion. Maintain the supply of organic matter by turning under green-manure crops, adding barnyard manure, and returning all crop residues to the soil. Apply lime and fertilizer in amounts indicated by soil tests. To control water erosion, maintain waterways in grass.

A 5-year cropping system, consisting of 2 years of legumes and grasses grown together, 1 year of a row crop, and 2 years of a small grain, is needed to reduce erosion

and maintain soil productivity. Other cropping systems and supporting practices that will maintain productivity and reduce water erosion are given in table 7.

Pastures on these soils are only fair, especially during the summer months. Because of the low moisture-supplying capacity of the soil, alfalfa, bromegrass, or other deep-rooted legumes and grasses should be grown.

Yields of woodland products are fair to moderately good. White pine, red pine, jack pine, and Scotch pine are suitable for planting.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	26	52
Soybeans	bushels	14	18
Potatoes	bushels	125	350
Wheat	bushels	18	28
Oats	bushels	28	50
Barley	bushels	20	32
Alfalfa	tons	1. 5	2. 7
Mixed hay	tons	1. 0	1. 7

SOIL MANAGEMENT UNIT 4aC(IIIS)

Moderately sloping, slightly to moderately eroded, light-colored, coarse-textured, well-drained soils

(ObC) Oshtemo loamy sand, 7 to 15 percent slopes.
(ScC) Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes.
(ScC2) Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes, moderately eroded.

These soils are low in moisture-holding capacity and fertility and are subject to both wind and water erosion. If used for crops, they are best suited to small grains, short-season crops, and legume-grass meadow. The supplies of organic matter and plant nutrients must be maintained and erosion controlled if satisfactory yields are to be obtained.

Organic matter decomposes rapidly in these soils and must be replaced. Stripcropping, contour tillage, terracing, and other practices should be used to help control erosion and increase moisture intake. All crop residues should be returned to the soil and adequate lime and fertilizer applied. Unless practices are used to protect the soil, row crops should seldom be grown. A suitable cropping system consists of 1 year of a small grain and 1 year of legume-grass meadow. Other cropping systems and supporting practices that will maintain productivity and reduce water erosion are shown in table 7.

Pastures make only fair yields on these soils, especially during the dry summer months. Because of the low moisture-supplying capacity, alfalfa, birdsfoot trefoil, bromegrass, or other deep-rooted legumes and grasses should be grown.

Yields of woodland products are fair to moderately good. White pine, red pine, jack pine, and Scotch pine are suitable for new plantings.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Corn	bushels	22	45
Wheat	bushels	18	25
Oats	bushels	27	43
Barley	bushels	18	32
Alfalfa	tons	1. 4	2. 6
Mixed hay	tons	0. 9	1. 6

SOIL MANAGEMENT UNIT 4aD(IVS)

Strongly sloping to steep, moderately eroded, light-colored, coarse-textured, well-drained soils

(ScD2) Spinks, Boyer, Plainfield, and Hillsdale soils, 12 to 25 percent slopes, moderately eroded.

If used for crops, these soils require intensive management. They are low in moisture-holding capacity and fertility and are subject to severe or very severe erosion.

In the areas where the slopes are steep (18 to 25 percent), the soils should be used only for grass, trees, or other permanent vegetation. In areas where slopes are between 12 and 18 percent, the soils may be used for small grains and meadow. Row crops should seldom be grown. If yields are to be satisfactory, the supply of organic matter must be kept high and adequate fertilizer applied. Stripcropping, contouring, and similar practices should be used to control erosion, and all waterways should be kept in sod.

If practices are not used to control erosion, a suitable cropping system consists of 1 year of a small grain followed by 2 to 3 years of meadow. Other cropping systems and supporting practices that will help to maintain productivity and reduce water erosion are given in table 7.

Because the soils are low in moisture-holding capacity, pastures make only fair yields during the dry summer months. Alfalfa, bromegrass, or other deep-rooted legumes and grasses are suitable for seeding.

Yields of woodland products are fair to moderately good on these soils. White pine, red pine, jack pine, and Scotch pine are suitable for new plantings.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		Prevailing management	Improved management
Wheat	bushels	14	22
Oats	bushels	22	38
Barley	bushels	14	27
Alfalfa	tons	1. 4	2. 5
Mixed hay	tons	0. 9	1. 5

Soil management groups 5a and 5c.—Soil management group 5a consists of light-colored, well-drained soils that are coarse textured. In table 8 cropping systems and supporting practices suitable for the soils of this group are given. All of the cropping systems and supporting practices suggested are for soils with slopes 200 feet long. Unless terraces are used, a cropping system that gives more protection is required on soils with slopes longer than 200 feet. If the soils have slopes less than 200 feet long, a cropping system that gives slightly less protection can be used. The numbers in parentheses refer to the relative protectiveness of the cropping system (see table 3).

Specific cropping systems have not been supplied in table 8 for the soils in management group 5c, but suggested cropping systems and management practices have been given under the description of the individual soil management unit. Soil management group 5c consists of poorly or very poorly drained upland soils.

SOIL MANAGEMENT UNIT 5aA(IVS)

Nearly level, light-colored, well-drained, coarse-textured soils

(BbA) Berrien loamy sand, 0 to 3 percent slopes.
(BcA) Berrien sandy loam, 0 to 3 percent slopes.
(PdA) Plainfield and Berrien loamy sands, 0 to 3 percent slopes.
(PeA) Plainfield and Ottawa loamy sands, 0 to 3 percent slopes.

TABLE 8.—*Cropping systems* [1] *suitable for the soils of soil management units in group 5a under named practices of water erosion control*

Soil management unit	Slope	Practices to control water erosion			
		None	Contour tillage	Stripcropping	Terracing
	Percent				
5aA(IVS)	0–3	RWMM(87)			
5aB(IVS)	3–7	ROMMM(88)	RWMM(87)	RWMM(87)	RWMM(87).
5aC(IVS)	7–15	WOMM(93)	WOMM(93)	RWMM(87)	RWMM(87).

[1] Symbols indicating cropping systems: M=legume-grass meadow; O=spring grains; R=row crops; W=winter grains.

If used for crops, these soils require intensive management. They are low to very low in moisture-holding capacity and fertility, and crop yields are generally low. Sod crops, deep-rooted crops, winter grains, and short-season crops are the best to grow. If the soils are irrigated, special crops can be grown successfully.

Organic matter decomposes rapidly when these soils are cultivated. Including legume-grass meadow, green-manure crops, and cover crops in the cropping system and returning all crop residues to the soil will help to replenish the organic matter. If satisfactory crop yields are to be obtained, adequate lime and fertilizer must be applied.

These soils are susceptible to wind erosion. Consequently, to reduce erosion in cultivated fields, windbreaks should be used or the crops planted in alternate strips of sod and a small grain or row crop.

If practices are not used to control erosion, a cropping system consisting of 2 years of legume-grass meadow, 1 year of a row crop, and 1 year of winter grain will maintain the productivity of the soils. Other cropping systems and supporting practices that will maintain productivity and reduce water erosion are given in table 8.

Because the soils are low in moisture-holding capacity and fertility, yields of pastures are low during the dry summer months. If alfalfa and bromegrass or other deep-rooted legumes and grasses are seeded and proper kinds and amounts of fertilizer are added, pastures will make good yields during the early and late part of the growing season.

If established woodlands are well managed, yields of wood products are fair. Trees suitable for new plantings are red pine, jack pine, and Scotch pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	15	40
Potatoes	bushels	125	300
Wheat	bushels	11	22
Oats	bushels	17	33
Alfalfa	tons	0. 9	2. 3
Mixed hay	tons	0. 6	1. 4

SOIL MANAGEMENT UNIT 5aB(IVS)

Gently sloping, slightly to moderately eroded, light-colored, well-drained, coarse-textured soils

(BbB) Berrien loamy sand, 3 to 7 percent slopes.
(BbB2) Berrien loamy sand, 3 to 7 percent slopes, moderately eroded.
(BcB) Berrien sandy loam, 3 to 7 percent slopes.
(BcB2) Berrien sandy loam, 3 to 7 percent slopes, moderately eroded.
(PdB) Plainfield and Berrien loamy sands, 3 to 7 percent slopes.
(PeB) Plainfield and Ottawa loamy sands, 3 to 7 percent slopes.
(PeB2) Plainfield and Ottawa loamy sands, 3 to 7 percent slopes, moderately eroded.

If used for crops, these soils require intensive management. They are low to very low in moisture-holding capacity and fertility, and crop yields are generally low. The soils are better suited to legume-grass meadow, small grains, and short-season crops than to other crops. If the soils are irrigated, however, special crops can be grown successfully. The soils are susceptible to severe erosion by wind and water. If yields are to be satisfactory, erosion must be controlled, adequate lime and fertilizer added, and the supply of organic matter kept at a high level.

The following management practices are needed: Use stripcropping, contouring, and other practices to control erosion by wind and water, and establish windbreaks. Grow legume-grass meadow crops, green-manure crops, and cover crops to keep organic matter at a high level, and return all crop residues to the soil. Apply lime and fertilizer in amounts indicated by soil tests. To prevent organic matter from decomposing rapidly, keep tillage to a minimum. Keep all waterways in grass.

If the practices named are not used to control erosion, a suitable cropping system consists of 2 years of a small grain followed by 1 year of meadow. If practices are used to control erosion, a suitable cropping system is 1 year of a row crop, 1 year of a small grain, and 2 years of grass-legume meadow crops. Other cropping systems and supporting practices that will help to control water erosion are given in table 8.

Because the soils are low in moisture-holding capacity and fertility, yields of pasture are low in summer. The pastures should have adequate lime and fertilizer added and should be seeded to alfalfa, bromegrass, or other deep-rooted legumes and grasses.

If established woodlands are well managed, yields of wood products are fair. Trees suitable for planting are red pine, jack pine, Scotch pine, and white pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	14	36
Potatoes	bushels	125	285
Wheat	bushels	10	22
Oats	bushels	17	33
Alfalfa	tons	0. 9	2. 3
Mixed hay	tons	. 6	1. 4

SOIL MANAGEMENT UNIT 5aC(IVS)

Moderately sloping, slightly to moderately eroded, light-colored, well-drained, coarse-textured soils

(BcC) Berrien sandy loam, 7 to 15 percent slopes.
(OcC) Ottawa loamy sand, 7 to 15 percent slopes, slightly or moderately eroded.
(PeC) Plainfield and Ottawa loamy sands, 7 to 15 percent slopes.
(PeC2) Plainfield and Ottawa loamy sands, 7 to 15 percent slopes, moderately eroded.

These soils require intensive management if they are used for crops. They are low to very low in moisture-holding capacity and fertility, and crop yields are generally low. The soils are better suited to sod crops, deep-rooted legumes, winter grains, and short-season crops than to other crops and are not well suited to intertilled crops. They are low in organic matter and are susceptible to severe erosion by wind and water. For yields to be satisfactory, enough organic matter must be added to keep the supply high, erosion must be controlled, and adequate lime and fertilizer added.

The following management practices are needed: Use stripcropping, contouring, terracing, and other practices to control erosion by water and wind, and establish windbreaks to protect the soils. Maintain a good supply of organic matter by using a cropping system that includes green-manure cover crops and legume-grass meadow.

If practices are not used to control erosion, a suitable cropping system consists of 2 years of a small grain and 2 years of grass-legume meadow. If stripcropping or terracing is used, a cropping system consisting of 1 year each of a row crop and a small grain and then 2 years of grass-legume meadow may be used. Lime and fertilizer should be applied in amounts indicated by soil tests. All crop residues should be returned to the soil. All waterways ought to be kept in grass.

Because of the low moisture-holding capacity and fertility of the soils, yields of pasture are low in summer. Adequate lime and fertilizer should be applied and deep-rooted legumes and grasses seeded.

If established woodlands are well managed, yields are fair. Trees suitable for new plantings are red pine, jack pine, Scotch pine, and white pine.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	10	32
Wheat	bushels	10	20
Oats	bushels	15	30
Alfalfa	tons	0. 9	2. 3
Mixed hay	tons	0. 6	1. 4

SOIL MANAGEMENT UNIT 5cA(IVW)

Nearly level, dark-colored, coarse-textured soils formed under poor drainage

(GdA) Granby loamy sand, 0 to 3 percent slopes.
(GeA) Granby sandy loam, 0 to 3 percent slopes.
(McA) Maumee loamy sand, 0 to 3 percent slopes.

These soils require intensive management if they are used for crops. They are low in natural fertility and in moisture-holding capacity. As a result, crop yields are generally low.

The soils need artificial drainage, which can be supplied by open ditches. Tile are difficult to install because of the continual sloughing or caving in of the sides of the trenches. If tile are used, they should be blinded with straw or other suitable material to prevent sand from filtering into the lines.

A good supply of organic matter should be kept in the soils to improve the moisture-holding capacity and general fertility. Windbreaks and wind stripcropping are needed to control wind erosion. Adequate fertilizer should be added and tillage kept to a minimum.

Because of the high water table and the good supply of moisture in areas that have not been drained, pastures on these soils are productive during July and August when other upland pastures are poor. The pastures can be made more productive by applying fertilizer and by seeding to ladino clover, alsike clover, bromegrass, bluegrass, or other suitable legumes and grasses.

Because of the high water table and poor site, the soils are poorly suited to trees. Neverthless, red maple and cottonwood can be grown.

Probable yields per acre of common crops under both prevailing management and improved management are:

Crop		*Prevailing management*	*Improved management*
Corn	bushels	20	45
Wheat	bushels	13	26
Oats	bushels	20	40
Alfalfa	tons	1. 2	2. 7
Mixed hay	tons	0. 8	1. 7

Soil management groups Mc-L, Mc, M/1c, M/3c, M/4c, and M/mc.—Soil management group Mc-L is made up of lowland soils that consist of stratified organic and mineral layers. Soil management groups Mc, M/1c, M/3c, M/4c, and M/mc are made up of organic soils. The organic soils are generally called mucks or peats. The mucks have decomposed to the extent that the original plant materials cannot be recognized. The peats consist largely of undecomposed or only slightly decomposed organic materials. The organic soils have been separated into management groups according to (1) the thickness of the organic materials and (2) the texture of the underlying mineral materials.

These soils require at least moderately intensive management if they are used for crops. Shelterbelts will help to control wind erosion, and stripcropping will also be valuable for that use. Artificial drainage is necessary and can generally be provided by tile or open ditches. If drainage is difficult, the soils are best kept in pasture or meadow. The soils need phosphate, potash, and certain minor elements. The kinds and amounts of fertilizer to use will depend on the crop to be grown, on the reaction of the soil, and on drainage. Trees normally are not planted on these soils except for windbreaks and shelterbelts.

SOIL MANAGEMENT UNIT Mc-LA(IVW)

Soils formed from alluvial and organic deposits in very poorly drained swales and flats in the bottom lands

(KdA) Kerston muck and loams, 0 to 3 percent slopes.

These soils are very poorly drained and are seldom used for crops. They are difficult to drain and to protect from floods. The soils commonly occur on the lowest alluvial flats and swales in the bottom lands. As a result, some areas are flooded two to three times each year.

Permanent pasture is generally the best use for these soils. The pastures should be seeded to grasses and

legumes that will tolerate wetness. Trees do not grow well on these soils and normally are not planted.

SOIL MANAGEMENT UNIT Mc(IIIW)

Organic soils, more than 42 inches deep, formed from woody and fibrous plant materials

(CdA) Carlisle muck, 0 to 3 percent slopes.
(HbA) Houghton muck, 0 to 3 percent slopes.
(RaA) Rifle peat, 0 to 3 percent slopes.

These soils require moderately intensive management if they are used for crops. Artificial drainage is necessary and can be provided by tile or open ditches. If tile are used, the lines should be spaced 66 to 132 feet apart and at depths of 4 to 5 feet. Because the organic material is unstable, long tile ought to be used. The tile should be placed carefully and blinded with grass hay. For most crops, the water table needs to be kept at a depth of about 30 inches.

These soils are highly susceptible to wind erosion. Shelterbelts should be planted and stripcropping practiced. To reduce soil blowing in fall and winter, seed cover crops in fields that have been used for cultivated crops.

The soils need phosphate, potash, and certain minor elements. The kinds and amounts of fertilizer to use will depend on the crop to be grown, on the reaction of the soil as determined by soil tests, and on drainage.

Crops that mature in fall are likely to be damaged by frost if they are grown on these soils. If the soils become dried out, fire is a hazard.

These soils vary in degree of wetness, and, therefore, management practices needed for the different areas vary. Consequently, suggestions have not been made for managing the soils, nor have figures been given to show probable yields per acre.

Pasture or meadow is a good use for these soils. In the poorly drained areas, reed canarygrass is suitable for seeding. In the better drained areas, bromegrass, timothy, alsike clover, and ladino clover are suitable.

Trees do not grow well on these soils and are normally not planted. Nevertheless, white pine, Austrian pine, and green willow can be planted for shelterbelts and windbreaks.

SOIL MANAGEMENT UNIT M/1c(IIIW)

Shallow organic soils that overlie clay or silty clay mineral materials at depths of 12 to 42 inches

(OaA) Ogden muck, 0 to 3 percent slopes.
(WdA) Willette muck, 0 to 3 percent slopes.

These soils require moderately intensive management if they are used for crops. They are difficult to drain because of the underlying slowly permeable clayey material. Tile or open ditches can be used. The tile lines need to be spaced from 33 to 132 feet apart and at depths of 3½ to 4½ feet. The tile should be blinded with straw or other organic material. If open ditches are used, they should be spaced 200 to 300 feet apart and need to be 30 inches deep.

Shelterbelts should be planted and stripcropping used on these soils to control wind erosion. To reduce soil blowing in fall and winter, plant cover crops in fields that have been used for cultivated crops.

These soils need phosphate, potash, and certain minor elements. The kinds and amounts of fertilizer to use will depend on the crop to be grown, on the reaction of the soil as determined by soil tests, and on drainage.

Crops that mature in fall are likely to be damaged by frost if they are grown on these soils. If the soils become dried out, fire is a hazard.

These soils vary in degree of wetness, and, therefore, management practices needed for the different areas vary. Consequently, suggestions have not been made for managing the soils, nor have figures been given to show probable yields per acre.

If drainage is not adequate for other crops, pasture and meadow are suitable uses for these soils. In the poorly drained areas, reed canarygrass is suitable for seeding. In the better drained areas, bromegrass, timothy, alsike clover, and ladino clover are suitable.

These soils are fair to poor for trees, and, normally, trees are not planted. Nevertheless, for shelterbelts and windbreaks, white pine, Austrian pine, and willow can be planted.

SOIL MANAGEMENT UNIT M/3c(IIW)

Shallow organic soils that overlie sandy loam to silty clay loam mineral materials at depths of 12 to 42 inches

(LcA) Linwood muck, 0 to 3 percent slopes.
(PaA) Palms muck, 0 to 3 percent slopes.

If these soils are well managed, moderately high yields of most farm crops are obtained. Artificial drainage is required. It can be provided by using tile or open ditches. The underlying sandy loam or silty clay loam is moderately permeable and makes a good foundation for tile. The tile lines need to be placed from 38 to 132 feet apart and at depths of 3½ to 4½ feet. The tile should be blinded with straw, hay, or other suitable material. If open ditches are used, they should be spaced 200 to 300 feet apart and need to be 30 inches deep.

Shelterbelts should be planted and stripcropping used on these soils to control wind erosion. To reduce soil blowing in fall and winter, plant cover crops in fields that have been used for cultivated crops.

These soils need phosphate and potash. In addition, certain minor elements are commonly needed. The kinds and amounts of fertilizer to use will depend on the crop to be grown, on the reaction of the soil as determined by soil tests, and on drainage.

Crops that mature in fall are likely to be damaged by frost if they are grown on these soils. If the soils become dried out, fire is a hazard.

These soils vary in degree of wetness, and, therefore, management practices needed for the different areas vary. Consequently, suggestions have not been made for managing these soils, nor have figures been given to show probable yields per acre.

If drainage is not adequate for other crops, pasture and meadow are suitable uses for these soils. In the poorly drained areas, reed canarygrass is suitable for seeding. In the better drained areas, bromegrass, timothy, alsike clover, and ladino clover are suitable.

These soils are fair to poor for trees, and, normally, trees are not planted. Nevertheless, for shelterbelts and windbreaks, white pine, Austrian pine, and willow are suitable.

SOIL MANAGEMENT UNIT M/4c(IVW)

Shallow organic soils that overlie sand or loamy sand mineral materials at depths of 12 to 42 inches

(AaA) Adrian muck, 0 to 3 percent slopes.
(TaA) Tawas muck, 0 to 3 percent slopes.

These soils require intensive management if they are used for crops. Before they are cultivated, drainage is necessary. The water level should be kept at a depth of about 30 inches. Lowering the water table to depths greater than 30 inches, or into the sand, may cause the soils to be droughty. Drainage can be provided by placing ditches 200 to 300 feet apart. The ditches need to be 3 feet deep.

Shelterbelts should be planted and stripcropping used on these soils to control wind erosion. To reduce soil blowing in fall and winter, plant cover crops in fields that have been used for cultivated crops.

These soils need phosphate and potash. In addition, they commonly need certain minor elements. The kinds and amounts of fertilizer to use will depend on the crop to be grown, on the reaction of the soil as determined by soil tests, and on drainage.

Crops that mature in fall are likely to be damaged by frost if they are grown on these soils. Fire is a hazard if the soils become dried out.

These soils vary in degree of wetness, and, therefore, management practices needed for the different areas vary. Consequently, suggestions have not been made for managing the soils, nor have figures been given to show probable yields.

If drainage is not adequate for other crops, pasture and meadow are suitable uses for these soils. In the poorly drained areas, reed canarygrass is suitable for seeding. In the better drained areas, bromegrass, timothy, alsike clover, and ladino clover are suitable.

These soils are fair to poor for trees, and, normally, trees are not planted; nevertheless, for shelterbelts and windbreaks, white pine, Austrian pine, and willow can be planted.

SOIL MANAGEMENT UNIT M/mc(IVW)

Shallow organic soils that overlie marl at depths of 12 to 42 inches

(EaA) Edwards muck, 0 to 3 percent slopes.
(RbA) Rollin muck, 0 to 3 percent slopes.
(WbA) Warners muck and marl, 0 to 3 percent slopes.

These soils require intensive management if they are used for crops. Their suitability for crops depends upon the depth of the organic soil material over marl. If the organic materials are less than 20 inches thick, the use of the soils for crops is questionable. The soils need surface drainage, which can be provided by open ditches. Tile drainage is not advisable. The water level should be kept at a depth of about 30 inches.

Windbreaks should be planted and stripcropping used on these soils to control wind erosion. To reduce soil blowing in fall and winter, plant cover crops in fields that have been used for cultivated crops.

These soils need phosphate, potash, and certain minor elements. The kinds and amounts of fertilizer to use will depend on the crop to be grown, on the reaction of the soil as determined by soil tests, and on drainage.

Crops that mature in fall are likely to be damaged by frost if they are grown on these soils.

These soils vary in degree of wetness and in fertility. As a result, management practices needed for the different areas vary. Consequently, suggestions have not been made for managing the soils, nor have figures been given to show probable yields.

Pasture and meadow are good uses for these soils. In the poorly drained areas, reed canarygrass is suitable for seeding. In the better drained areas, bromegrass, timothy, alsike clover, and ladino clover are suitable.

These soils are poor for growing trees, and trees normally are not planted. However, white pine, Austrian pine, and green willow can be used for planting windbreaks.

Soil management group Xc.—Only one miscellaneous land type—Lake borders—is in this soil management group. This land type is neither suited to crops nor to forestry, but a few areas can be used for pasture.

SOIL MANAGEMENT UNIT Xc(VIIIW)

Poorly drained mineral and organic soils that occur in complex association on narrow rims or borders between lakes and adjacent uplands

(LaA) Lake borders.

Soils of this unit occupy only a small acreage in Lenawee County. Most of the areas are difficult to drain. They are poorly suited to agriculture, but a few areas are used for pasture. Cottages are built on many of the drier areas.

Engineering Applications

This soil survey report contains information that can be used by engineers. The most detailed information useful for engineering is in the section, Descriptions of Soils. The subsection, Soil Management Groups and Units, points out some of the needs of the soils for drainage systems, terraces, and other engineering structures.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words, for example, soil, clay, silt, sand, and granular, have special meanings in soil science. These terms and others that have special meaning to the soil scientist are defined in the Glossary in the back part of the report.

The term soil may be particularly confusing. Soil scientists think of a soil as a natural body made up of different horizons that differ in certain characteristics. Engineers are more likely to single out each horizon as a different kind of soil or refer to the unconsolidated material on the earth's surface, including such unconsolidated material as glacial drift, as soil.

The information in this report is useful to—

1. Make reconnaissance surveys of soils for the purpose of planning the locations of highways and airports and for planning more detailed soil surveys at these locations.
2. Relate soil features, by use of the soil map, to other land features and to cultural features.
3. Locate sand, gravel, and clay for construction purposes.
4. Correlate pavement performance with the kinds of soil so that an economical and effective design for foundations and pavements can be made.
5. Determine the suitability of soils for cross-country movement of vehicles and construction equipment under various conditions of soil and climate.
6. Supplement information from other published maps and reports so that engineering soil maps and reports can be made.

7. Select and develop industrial, business, residential, and recreational sites.
8. Estimate runoff and erosion so that effective structures for soil and water conservation can be made.
9. Design drainage systems.
10. Design irrigation systems.
11. Establish plants to stabilize or beautify an area.

The Field Manual of Soil Engineering, published by the Michigan State Highway Department,[4] gives further information about soils that is useful to engineers.

Soil Associations

In mapping a county or other large tract, definite differences are fairly easy to see as one travels from place to place. There are many obvious differences in shape, gradient, and length of slope; in the course, depth, and speed of streams; in the width of natural flood plains; in the kinds of native plants; and even in the kinds of agriculture. With these more obvious differences, there are less easily noticed differences in the patterns of the soils. The soils differ along with the other parts of the environment.

By drawing lines around the different patterns of soils on a small map, one may obtain a map of the general soil areas, or, as they are called in this report, soil associations. Such a generalized map is useful to those who want only a general idea of the soils, who wish to compare different parts of the county, or who want to locate large areas suitable for some particular kind of agriculture or other broad land use. The generalized map will be of particular interest to geographers, zoning officials, and those who plan for the use of county land.

The eight soil associations, or kinds of soil patterns, in Lenawee County are shown in colors on the general soil map at the back of this report. A brief description of each of these associations follows.

Association 1

Rolling to hilly, well-drained loamy sands and sandy loams. Hillsdale, Spinks, Fox, Oshtemo, Boyer.—In this soil association the topography is complex. The soils occur on knobs and ridges; in shallow to deep basins; in swales; in short, dry draws; and in lakes and valley swamps. Minor soils in the association are the Miami, Bronson, Brady, Wallkill, and various organic soils.

The soils in this association are mainly moderately coarse to coarse textured. In most places they consist of light-colored sandy loams or loamy sands to depths of 18 to 42 inches. The substratum ranges from sandy loam in the Hillsdale soils to open, loose, porous sand and gravel in the Fox, Oshtemo, and Boyer soils.

The soils are moderately low to low in moisture-holding capacity and in fertility. They require special management practices to control erosion.

Association 2

Gently rolling to rolling, well-drained and imperfectly drained loams: Miami, Conover.—This soil association is characterized by short slopes, numerous shallow depressions, and irregular, gently rolling to rolling topography. Minor soils in the association are the Hillsdale, Brookston, and Wallkill soils.

The glacial material is calcareous till that has a texture of loam. The soils are deep. They are rather high in fertility and have good moisture-holding capacity. Most of the soils are well drained. Imperfectly and poorly drained soils occur in drainageways and depressions.

The principal management problems are control of erosion and maintenance of organic matter and fertility.

Association 3

Undulating and rolling, well-drained to imperfectly drained soils developed from limy clay loams, silty clay loams, and clays: Morley, Blount, St. Clair, Nappanee.—In this association the soils range in natural drainage from well drained to imperfectly drained. A small acreage of poorly drained soils occurs in the depressions and in the natural drainageways. Minor soils in the association are the Hoytville, Pewamo, Miami, and Conover soils. In a few places thin deposits of sandy loam or loamy sand cover the soils. These areas occur locally throughout the association.

The soils are deep and are medium to high in natural fertility. The chief management problems are the need for erosion control on the sloping areas and the need for artificial drainage on the wetter sites.

Association 4

Nearly level, imperfectly and poorly drained soils developed from clay loams, silty clay loams, and clays: Blount, Pewamo, Nappanee.—This soil association has a sag and swell type of topography. Numerous shallow, wet depressions occur throughout the areas; many of the depressions contain organic deposits. Minor soils in the association are the Morley, St. Clair, and Hoytville.

The soils are medium to high in natural fertility. The need for artificial drainage and for maintaining good soil tilth are the chief management problems.

Association 5

Level to gently rolling, well-drained soils developed from sandy loam and loamy sand overlying sand and gravel: Fox, Bronson, Oshtemo.—In this association differences in local relief are generally less than 10 feet. A few dry depressions occur throughout the area. Deposits of sand and gravel, which occur at depths of 18 to 42 inches, range in thickness from 30 to 60 feet. Minor soils in the association are soils of the Brady series and various organic and alluvial soils.

Moderately low moisture-holding capacity and fertility are the principal limitations in the agricultural use of these soils.

Association 6

Level to nearly level, poorly drained soils developed from loam, sandy loam, and loamy sand overlying limy sand and gravel: Brady, Sebewa.—In the soils of this association, differences in local relief are generally less than 5 feet. Limy sand and gravel are at depths of 18 to 42 inches.

[4] MICHIGAN STATE HIGHWAY DEPARTMENT. FIELD MANUAL OF SOIL ENGINEERING. Ed. 3, 368 pp., illus. 1952.

A medium-textured to fine-textured substratum occurs in many places at depths of 6 to 20 feet. Principal soils in the association are the Brady and Sebewa and include smaller acreages of Bronson, Fox, and various organic soils. Small areas of alluvial soils also occur throughout the association.

Most of the soils in this association need artificial drainage if crops are to be grown successfully.

Association 7

Level, poorly drained soils developed from clay loams, silty clays, and clays: Nappanee, Hoytville, Pewamo.—Most of the soils in this association have a rather high content of organic matter, nitrogen, and lime. They retain moisture well and have good natural fertility. Minor soils in the association are the Brookston, Blount, Rimer, and Wauseon soils. In a few places thin deposits of sandy loam or loamy sand cover the soil. These areas occur locally throughout the association.

Artificial drainage is the principal requirement for agricultural use of these soils. Good tilth should be maintained and the supply of organic matter kept high for best crop production.

Association 8

Level and undulating, imperfectly and poorly drained soils developed in deltaic and lacustrine deposits: Macomb, Berville, Rimer, Wauseon, Colwood.—These soils overlie glacial till, which is at depths of 18 to 66 inches. The texture of the till is clay loam or silty clay. Minor soils in this association are soils of the Berrien, Brady, and Sebewa series. Included are minor acreages of well-drained soils developed in deeper sands.

Because of variations in texture and in the thickness of the coarser textured overburden, soils of this association vary in their management requirements. Artificial drainage is needed throughout much of the area for crops to grow successfully.

Genesis and Classification of Soils

This section has three main parts. In the first part, the factors that have affected the development of soils in Lenawee County are discussed. In the second part, the soil series in the county are listed in their respective great soil groups and the great soil groups are described. The third part discusses the genetics of soils.

Genesis of Soils

Each soil is the product of the forces of weathering and development acting on the parent material deposited or accumulated by geologic agencies. The characteristics of the soil at any given point depend on (1) the physical and the chemical or mineralogical composition of the parent material; (2) the climate under which the material has 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 processes of development have acted on the material.

Parent materials

The soils of Lenawee County have developed entirely from drift of the Late Wisconsin (Cary) glaciation and from recent alluvial deposits and organic materials. The unweathered glacial material is limy, unconsolidated silt, clay, sand, gravel, and fragments of rock deposited as moraines, till plains, glaciofluvial outwash plains and terraces, and lacustrine plains. Both assorted and unassorted materials are represented.

The mineralogical and chemical composition of the drift varies, depending on the proportion of each constituent; thus, the soils developed on this mixture vary with differences in the proportions of the various sizes and kinds of material. Organic materials from which the organic soils formed consisted of remains of sedges, grasses, and deciduous forest vegetation.

The alluvial sediments represent parent materials recently deposited on the bottom lands of major streams in the county.

Climate

Because climate varies little within the county, there are few local differences in soils that result from differences in climate. Nevertheless, climate has been partly responsible for the morphology and genesis of soils. The cool, humid climate has caused the easily soluble constituents to be leached out of the upper layers of most of the soils. Therefore, the soils have a slightly acid to strongly acid surface soil. Other constituents have been washed out of the surface horizon and deposited in the subsoil. The better drained soils have a subsoil that is enriched by clay washed down from the overlying horizons. These B horizons [5] are finer textured than either the overlying or underlying horizons of the profile.

The climatic and biological conditions permitted only a rather thin layer of organic litter to accumulate on the surface horizon of the well-drained soils.

Vegetation

Differences in natural vegetation within the county are correlated largely with differences in parent materials and natural drainage, and are not conspicuous among the soil-forming factors. The original vegetation, however, has influenced formation of soils in some degree. The physical and chemical characteristics of the organic surface layers are directly related to the original vegetative cover. Most of the soils have developed under a heavy growth of deciduous trees. The forests were predominantly mixed hardwoods.

Red oak, white oak, black oak, sugar maple, and beech were the principal kinds of trees growing on the well-drained rolling and undulating soils. Oak and hickory were dominant on areas of well to excessively drained, sandy and gravelly soils. The imperfectly drained soils had a growth of sugar maple, beech, and elm, with some walnut, hickory, and oak.

Wet areas, especially those bordering lakes in the northwestern part of the county, had a cover of wiregrass, sedges, and bluejoint. The vegetation on the larger wet areas in the northeastern part of the county included grasses, sedges, and reeds. The soils formed under vege-

[5] Horizon with greatest content of clay or greatest structural development.

tation made up of grasses and sedges are much darker in color and higher in content of organic matter than are the better drained soils formed under deciduous trees.

Relief and drainage

Relief and drainage have greatly influenced the development of soils in Lenawee County. Organic soils (mucks and peats) have formed in marshes and swamps. Their properties largely depend on the kinds of plants from which they formed and on the level of the water table and the mineral content of the water.

Poorly drained mineral soils formed in low areas where water did not cover the soil completely or continuously enough to make formation of an organic soil possible. Because of poor aeration, organic matter was better preserved in these soils and was mixed with the mineral soil to greater depths than in the well-drained associates. Beneath the organic-mineral layer, these soils are gray in color.

Well-drained soils were formed where natural drainage was good and where air could enter the soil. The surface layer of these soils is dark grayish brown and is moderately low in organic matter. The subsoil is brown to yellowish brown.

Intermediate between the poorly drained and well-drained soils are the imperfectly drained soils. Because of the fluctuating, but high, water table, these soils have a moderately dark colored surface layer and a mottled subsoil.

Time, or age

The different characteristics of the soil profile that are produced by soil-forming processes require time for their development. Soils formed in recent alluvial sediments along streams or at the base of eroding slopes are the youngest soils in the county. The characteristics of these soils are largely those of the deposited materials, because the deposited materials have not been in place long enough for distinct horizons to develop, other than those in which organic matter accumulates or gleying is produced.

In contrast to the alluvial sediments, glacial deposits have been exposed to soil-forming factors for a long enough time to allow distinct horizons to develop within the soil profile. The last great ice sheet disappeared from the county about 12,000 to 13,000 years ago.

Classification of Soils

Soil scientists have arranged the different soil series in great soil groups. The soils in any one group have similar kinds of horizons in the same sequence in their profiles, but they may differ greatly in some characteristics, such as relief, texture, and thickness of the profile. Some of the soils have characteristics of one great soil group but also have characteristics of another group. In this county such soils are the Gray-Brown Podzolic soils intergrading to the Regosol great soil group, the Gray-Brown Podzolic soils intergrading to the Low-Humic Gley great soil group, and the Alluvial soils intergrading to the Low-Humic Gley great soil group.

Table 9 classifies the soils of the county by great soil groups. It also shows the relationship of parent material and drainage for the mineral soils and the relationship of parent material and thickness for the organic soils.

Gray-Brown Podzolic soils

The Gray-Brown Podzolic great soil group is made up of well, moderately well, and imperfectly drained mineral soils with a distinct B_t horizon. In undisturbed areas these soils are covered by a leaf litter from deciduous trees. In addition, they have a dark, thin, mild (slightly or moderately acid) layer of humus, somewhat mixed with mineral soil; a grayish-brown A_1 horizon with a granular structure; a light grayish-brown or grayish-yellow A_2 horizon; and a finer textured, yellowish-brown, brown, or brownish-yellow B horizon that becomes lighter colored with increasing depth.

The B horizon is enriched with silicate clay that washed down from the overlying horizons or formed in place, in addition to that inherited from the parent material. Consequently, this subsoil layer is finer textured than either the overlying or underlying horizons in the soil profile.

The total thickness of the solum varies considerably, depending on the texture of the parent material in which the soil developed. The profile of these soils formed in loamy or clayey parent material is seldom more than 3 feet thick; the profile of soils formed in coarse-textured materials frequently extends below this depth. The soils in this great soil group belong to the Boyer, Bronson, Cadmus, Fox, Hillsdale, Ionia, Kendallville, Miami, Morley, Oshtemo, Spinks, and St. Clair series.

Gray-Brown Podzolic soils intergrading to the Regosol great soil group

Gray-Brown Podzolic soils intergrading to the Regosol great soil group have a weakly developed profile. The surface soil (A horizon) and the subsoil (B horizon) differ from one another principally in color, in thickness, and in content of organic matter. The accumulation of clay within the solum ranges from none to very slight.

These soils range in natural drainage from imperfectly drained to well drained. The Berrien, Ottawa, Plainfield, and Rimer soils are intergrades between the Gray-Brown Podzolic and Regosol great soil groups.

These soils are much older than the Alluvial soils. They apparently did not develop a B_t horizon because of the low content of clay in the parent material, and because little clay was formed during soil development.

Gray-Brown Podzolic soils intergrading to the Low-Humic Gley great soil group

Gray-Brown Podzolic soils intergrading to the Low-Humic Gley great soil group are represented in Lenawee County by the Blount, Brady, Conover, Kibbie, Macomb, and Nappanee series. These soils have the general characteristics of Gray-Brown Podzolic soils, but they have some characteristics of Low-Humic Gley soils.

Humic Gley soils

The Humic Gley great soil group consists of poorly to very poorly drained mineral soils formed in low-lying areas. The soils have a high water table and are more or less waterlogged. They formed under a swamp-forest type of vegetation. The organic matter has been preserved and has been mixed with the mineral soils to a greater depth than in well-drained soils under forest.

TABLE 9.—*Soil series arranged to show the relationship of parent material and drainage for mineral soils and relationship of parent material and thickness for organic soils*

Parent material	Great soil group				
	Gray-Brown Podzolic			Humic Gley	
	Well drained	Moderately well drained	Imperfectly drained	Poorly to very poorly drained	Very poorly drained
Nonstratified clay and silty clay		St. Clair		Hoytville	
Clay loam and silty clay loam:					
Nonstratified	Morley	Morley		Pewamo	
Stratified				Lenawee	
Loam and silt loam:					
Nonstratified	Miami			Sloan	
				Brookston	Kokomo.
Stratified				Colwood	
Nonstratified sandy loam	Hillsdale			Barry	
Nonstratified loamy sand	Spinks				
Sand				Granby	Maumee.
Loamy fine sand to fine sandy loam overlying limy clay to silty clay at depths of 18 to 42 inches.				Wauseon	
Sandy loam to loam overlying limy loam to silty clay loam at depths of 24 to 42 inches; gritty clay loam textural B horizon.	Kendallville	Cadmus		Berville	
Sandy loam to silt loam overlying gravel and sand at depths of 24 to 42 inches; gritty clay loam textural B horizon more than 10 inches thick.	Fox	Ionia		Sebewa	
Loamy sand to sandy loam overlying sand and gravel at depths of 24 to 42 inches; sandy clay loam textural B horizon less than 10 inches thick:					
Limy at depths of 24 to 42 inches	Boyer	Bronson			
Limy below depths of 42 inches	Oshtemo				

Parent material	Gray-Brown Podzolic soils intergrading to the Regosol great soil group		
	Well drained	Moderately well drained	Imperfectly drained
Sand	Plainfield		
Sand to loamy sand overlying limy loam to clay at depths of 42 to 66 inches	Ottawa [1]	Berrien [1]	
Loamy fine sand to fine sandy loam overlying limy clay to silty clay at depths of 18 to 42 inches.			Rimer.
Gray-Brown Podzolic soils intergrading to the Low-Humic Gley great soil group			
Nonstratified clay and silty clay			Nappanee.
Clay loam and silty clay loam			Blount.
Loam and silt loam:			
Nonstratified			Conover.
Stratified			Kibbie.
Sandy loam to loam overlying limy gravel and sand at depths of 24 to 42 inches; textural B horizon of gritty clay loam.			Macomb.
Sandy loam to silt loam overlying limy gravel and sand at depths of 24 to 42 inches; textural B horizon of gritty clay loam more than 10 inches thick.			Brady.

Alluvial soils					
Loams and silt loams	Genesee	Eel		Wallkill [2]	
Alluvial soils intergrading to Low-Humic Gley great soil group					
Loams and silt loams				Griffin	

[1] Classification will remain in question until more information is available.

TABLE 9.—*Soil series arranged to show the relationship of parent material and drainage for mineral soils and relationship of parent material and thickness for organic soils*—Continued

Bog (organic) soils

Character or organic material	Thickness of organic material				
	Deep—more than 42 inches	Shallow—12 to 42 inches deep			
		Over sands	Over loams	Over clays	Over marl
Partly decomposed muck and peat derived from mixed woody and sedgy materials.	Carlisle	Tawas	Linwood	Willette	Edwards. Warners.[3]
Undecomposed peat from mixed woody and sedgy materials.	Rifle				
Partly decomposed mucky and peaty material from reeds and sedges.	Houghton	Adrian	Palms	Ogden	Rollin.
Alternate layers of black muck and sand or silt.	Kerston				

[2] Depth to marl less than 12 inches.

[3] Depth to organic material ranges from 8 to 30 inches.

In many places, under the organic-mineral horizon, these soils are gray in color or have an olive-gray layer mottled with orange, brown, or yellow splotches or streaks. The formation of these dull gray, solid gray, or olive-colored horizons is associated with the presence of organic matter under poor drainage and poor aeration. The poorly drained soils are generally less acid and contain more nitrogen than their well-drained associates. The Barry, Berville, Brookston, Colwood, Granby, Hoytville, Kokomo, Lenawee, Maumee, Pewamo, Sebewa, Sloan, and Wauseon series are in this great soil group.

Alluvial soils

Soils of the Alluvial great soil group occur on flood plains and first bottoms and along streams. They consist of recently deposited materials that have undergone only slight alteration. Variations in natural drainage have caused some differences in the organic content and color of horizons within this group of soils. Other environmental effects on soil formation are in slight evidence.

The characteristics of Alluvial soils are determined largely by the nature of the materials from which these soils formed and the manner in which the materials were sorted and deposited. The materials have been deposited too recently for a textural B horizon to be developed.

This great soil group is represented in Lenawee County by the Eel, Genesee, and Wallkill series.

Alluvial soils intergrading to the Low-Humic Gley great soil group

Alluvial soils intergrading to the Low-Humic Gley great soil group are represented in this county by the Griffin soils. These soils have the general characteristics of Alluvial soils, but they have some characteristics of Low-Humic Gley soils.

Bog (organic) soils

The Bog, or organic, soils are very poorly drained soils that consist of an accumulation of woody and fibrous organic materials, 12 or more inches thick, over mineral materials. These soils occur in marshy areas or near lakes.

The varying depth of the organic accumulation, its chemical composition, and its degree of decomposition are related to the nature of the plant remains and the height of the water table. Peat is an organic material consisting of an accumulation of slightly decomposed plant remains in which the plant structure can still be identified. Muck is the product of decomposition of peat and is made up of plant remains in which few or no plant structures can be identified. It consists of very dark brown or black granular material. A peat soil is an organic soil that has a surface layer of peat. A muck soil is an organic soil that has a surface layer of muck. The surface layer of a cultivated peat is rapidly converted to muck.

Genetics of Soils

Importance of the soil-forming factors to soil genesis, soil classification, soil mapping, and land use can be readily perceived in Lenawee County. The foregoing discussion has shown how each of five soil-forming factors played a part in the genesis of the soil profiles of the soils in this area. The interrelationships of the soils with one another can also be correlated with these factors. Three kinds of relationships are outstanding in the great soil groups just described:

1. The Gray-Brown Podzolic soils differ from the Gray-Brown Podzolic-Regosol intergrade soils because of differences in the kind of parent materials from which they formed.
2. The Humic Gley and Bog (organic) soils differ from the Gray-Brown Podzolic soils and from each other because of differences in the natural drainage under which they formed. The Humic Gley soils were formed under more poorly drained conditions than the Gray-Brown Podzolic soils, and the Bog (organic) soils were formed under more poorly drained conditions than the Humic Gley soils. It has commonly been said that Bog (organic) soils differ from mineral soils because of differences in their parent materials, but it is more logical to say that they are soils with thick A_0 horizons, which were preserved because of the high water table where they were formed.

3. Alluvial soils differ from the great soil groups just mentioned because their parent materials were so recently exposed to soil formation in their present locations that their profiles have not yet been so clearly differentiated. We might refer to these interrelationships of soils as their genetics or their genetic relationships. Since these relationships help us to understand and remember the characteristics of soils, they are basic to soil classification.

Table 9 shows the genetic relationships of the mineral great soil groups and the various soil series in Lenawee County to each other, and similar relationships of the organic soils. The soil-formation factors and these genetic relationships are useful in relating the soils to the landscapes in soil mapping. Alluvial soils are on the bottom lands along streams or at the foot of eroding slopes. The well-drained soils are on the higher lands with convex surfaces and low water tables; the poorly drained mineral and organic soils are in swales or depressions where there is a high water table; and the imperfectly drained soils are in intermediate topographic positions.

The soil-formation factors are important to land use, not only through their effect on the properties of the soils but because they too may affect land use directly. Climate, rainfall, and temperature, for example, limit the choice of crops and the need for supplemental irrigation. Topography influences the operation of farm machinery and the need for erosion control on steeper slopes when they are cultivated. Parent materials affect the moisture-holding capacity of the soil and the stoniness, which, in turn, may affect tillage operations or choice of crops. Many other illustrations can be cited, but these should suffice to show the importance of soil-formation factors to soil genesis, soil classification, soil mapping, and land use.

Many of these fundamental relationships are still unknown, and additional study will no doubt reveal many more useful scientific and practical relationships.

Additional Facts About the County

In this section the settlement of the county is discussed. Information is also given about the geology, relief, drainage, vegetation, climate, water supplies, transportation, marketing facilities, and industries.

Geology, Relief, and Drainage

Lenawee County lies within the broad, diversified Eastern lake section of the Central Lowland of the east-central United States.[6] The bedrock formations underlying the county consist of flat-lying sedimentary rocks. Sandstone of the Marshall formation underlies the glaciodrift in the extreme northwestern part of the county; shale, limestone, and sandstone underlie the drift in the rest of the county.[7]

The area has been covered more than once by thick sheets of glacial ice. The ice wore away or ground up the bedrock and left thick deposits of drift. The surface features of the county, for the most part, result from the action of the glacial ice. Figure 2 shows the six main physiographic areas, or subdivisions, in the county.

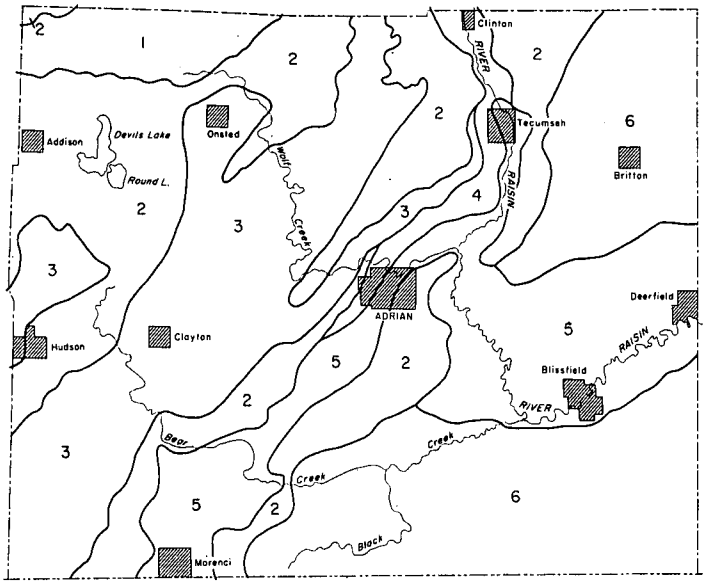

Figure 2.—**Physiographic subdivisions of Lenawee County:**

1. **Kames, outwash plains, and moraines.**
2. **Moraines.**
3. **Ground moraine (till plains).**
4. **Outwash plains and terraces.**
5. **Delta and spillway.**
6. **Lake Bed Plain.**

The last ice sheet, the Cary substage of the Late Wisconsin, melted some thousands of years ago. The ice came from two different directions—the Huron-Erie lobe moved in or expanded from the east and southeast and pressed against the Marshall sandstone in the northwestern part of the county, and the Saginaw lobe advanced from the north. As the glacier moved forward, it ground up the bedrock over which it moved. It mixed the materials and either pushed them along or carried them within or on top of the ice. When the ice sheet melted and receded, it left unconsolidated deposits of silt, sand, clay, gravel, boulders, and fragments of rock, called glacial drift. The glacial drift ranged in thickness from 50 to 250 feet. It was deposited as moraines, till plains, kames, outwash plains, and terraces (see fig. 2).

The glacial drift in kames, outwash plains, and terraces is made up of materials picked up or ground off the bedrock by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of the ice. Gravel and sand, which were sorted and in most places cross-bedded, were deposited by the interglacial streams in crevices on the sides of the glaciers. Some of the sand and gravel plains, ridges, and knolls in the northwestern part of the county, particularly in area 1 (fig. 2), are examples of this kind of deposit.

Stratified and assorted materials, consisting of gravel, sand, silt, and clay, also occur north of Adrian in area 4. This material was deposited by the streams flowing from the glacier front and comprises the glaciofluvial outwash plains and terraces of the county.

Moraines include that part of the glacial drift, called till, deposited directly by the ice with little or no transportation by water. The till is generally an unstratified,

[6] FENNEMAN, N. M. PHYSIOGRAPHY OF EASTERN UNITED STATES. 714 pp., illus. New York and London. 1938.

[7] LEVERETT, FRANK. SURFACE GEOLOGY AND AGRICULTURAL CONDITIONS OF MICHIGAN. Mich. Geol. and Biol. Survey Pub. 25, Geol. Sec. 21, 223 pp., illus. 1917.

unconsolidated, heterogeneous mixture of clay, silt, sand, and gravel, with a few boulders. Moraines are present chiefly in areas 2 and 3.

Gently rolling, rolling, and hilly moraines, deposited near the ice front at a time when the ice front was nearly stationary, make up area 2. Texture of the material ranges from moderately fine to coarse.

A large part of area 3 consists of morainic material deposited during a uniform retreat, or wasting, of the ice front. Here, much of the drift deposit occupies a nearly level to gently rolling till plain and is composed largely of medium- to fine-textured materials.

The eastern and southeastern parts of the county, area 6 in figure 2, were covered by the glacial ice sheet and, subsequently, by glacial lakes, which are extensions or enlargements of present Lake Erie. This part of the county is known as the Lake Bed Plain. Throughout the Lake Bed Plain, or area 6, are a few entrenched drainageways with steep sides. Narrow, low beaches, bars, and gentle swells occur locally. A conspicuous and almost unbroken, narrow glacial lakeshore ridge or beach occurs in the western part of the area, marking the edge of Glacial Lake Whittlesey. Lower and less conspicuous lakeshores mark the boundaries of Glacial Lake Arcona and Glacial Lake Warren. The northern and southern parts of the Lake Bed Plain, area 6, are composed of moderately fine to fine textured till materials and contain a rather small amount of gravel, cobblestones, and boulders.

In area 5, in the central part of the Lake Bed Plain through which the River Raisin now flows, the moderately fine to fine textured materials are covered by a layer of deltaic and lacustrine deposits, 2 to 20 feet thick. Many of the deltaic deposits are similar to the outwash and terrace deposits of area 4. Lacustrine sediments of sand, silt, and clay, 2 to 20 feet thick, are common northeast of Blissfield and north of Deerfield. Thin, water-laid deposits, 1 to 5 feet thick, occur along Black Creek and in the vicinity of Britton. The texture of these deposits ranges from loam to loamy sand.

Elevations in the county range from 600 feet to 1,228 feet above sea level. Local relief is commonly less than 40 feet. The highest elevation is at Prospect Hill in the northwestern part of the county, and the lowest is in the Lake Bed Plain in the eastern part. There is a general rise in elevation from east to west. The elevation in the Lake Bed Plain in the eastern part of the county ranges from 600 to 730 feet; in the till plain, from 810 to 1,050 feet; and in the morainic uplands in the northwestern part, from 1,000 to 1,200 feet.

The River Raisin and its tributaries drain the greater part of the county. A slightly developed trellislike system drains the central and western parts of the county, but natural drainage or stream dissection is poorly developed in the other parts.

Organization and Population

The first permanent white settlement in the area that is now Lenawee County was made at Tecumseh in 1824. The county was organized on December 31, 1836. Tecumseh was the county seat, but Adrian became the county seat 2 years later. By 1850, the county was only sparsely settled. By 1890, however, most of the county had been cleared and settlement was nearly completed.

Settlers came chiefly from the States to the east and south of Lenawee County, but a few came from other countries. The population of the county in 1950 was 64,629 of which 39,443, or about 61 percent, was classified as rural. Adrian, the largest city and principal trading center, had a population of 18,393 in 1950. Other cities or villages that had a population of more than 2,000 in 1950 were Tecumseh, with a population of 4,020; Hudson, with a population of 2,773; and Blissfield, with a population of 2,365. Many other towns and villages serve as local trading centers throughout the county.

Vegetation

When white men first came to the area that is now Lenawee County, they found dense forests. The trees were predominantly hardwoods of various kinds. Red, white, and black oaks, sugar maple, and beech were the principal species on the well-drained, rolling, and undulating soils. Oak and hickory were dominant on the well to excessively drained, sandy and gravelly soils. The imperfectly drained soils had a growth of sugar maple, beech, and elm, and some walnut, hickory, and oak. Marshy areas, especially those bordering lakes in the northwestern part of the county, had a cover of wiregrass, sedge (*Carex filiformis*), and bluejoint, together with many kinds of sedges (*Carex* sp.), flatsedges (*Cyperus* sp.), rushes (*Juncus* sp.), and bulrushes (*Scirpus* sp.). *Hypnum* mosses, leatherleaf, and blueberry were abundant in a few places.

Few virgin stands of timber remain. The trees on the forested areas are, for the most part, reproductions of the original species. The small woodlots that remain have been cut over and are now largely pastured.

Climate

Lenawee County has a humid-temperate climate. It is in a latitude of 42° north. The county is close enough to Lake Erie so that the waters of the lake have a slight tempering effect on the temperature in summer. To a lesser extent, the waters of the other Great Lakes also affect the temperature. Temperatures are fairly uniform, and precipitation is distributed uniformly throughout the county. Annual temperature and precipitation, compiled from records of the U.S. Weather Bureau at Adrian, are given in table 10.

The average temperature in winter is 25.8°F., but winter temperatures range from a high of 69° to a low of 26° below zero. Periods in which temperatures are continually below freezing normally last less than 2 weeks. As a rule, the soil is frozen to a depth of several inches to 1 foot for 1 to 3 months each year with some surface thawing on a few days. The variations in temperature and the occasional sudden changes, accompanied by alternate freezing and thawing, cause considerable damage to fall-sown small grains, clover, and alfalfa. This is especially true when there is severe cold without a protective cover of snow. The imperfectly and poorly drained, heavy-textured soils are the most affected.

Temperatures in summer range from a maximum of 108° to a minimum of 33°. This wide variation normally does not injure general farm crops seriously, except when high temperatures occur during prolonged periods of drought.

TABLE 10.—*Temperature and precipitation at Adrian, Lenawee County, Mich.*

[Elevation, 774 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1934)	Wettest year (1881)	Average snowfall
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	27.9	65	−17	2.28	2.25	6.57	7.5
January	24.3	68	−26	1.99	1.24	1.79	7.7
February	25.1	69	−24	2.02	.24	5.74	6.9
Winter	25.8	69	−26	6.29	3.73	14.10	22.1
March	35.0	85	−8	2.51	2.18	3.53	4.5
April	47.3	90	10	2.91	3.67	2.43	.5
May	58.7	99	22	3.94	1.04	1.95	.1
Spring	47.0	99	−8	9.36	6.89	7.91	5.1
June	68.8	106	33	3.75	.63	8.91	0
July	73.1	108	41	2.98	.81	4.97	0
August	70.8	107	36	2.95	1.97	2.39	0
Summer	70.9	108	33	9.68	3.41	16.27	0
September	64.0	104	26	3.31	3.51	6.09	0
October	51.8	91	15	2.58	1.14	10.71	(3)
November	38.8	80	−5	2.71	1.64	8.93	2.1
Fall	51.5	104	−5	8.60	6.29	25.73	2.1
Year	48.8	108	−26	33.93	20.32	64.01	29.3

[1] Average temperature based on a 78-year record, through 1955; highest and lowest temperatures on a 62-year record, through 1952.
[2] Average precipitation based on a 78-year record, through 1955; wettest and driest years based on a 77-year record, in the period 1878–1955; snowfall based on a 62-year record, through 1952.
[3] Trace.

The average frost-free season is 158 days, or from May 5 to October 10. Generally, in the northwestern and central parts of the county, the growing season is 2 to 7 days shorter than in the southeastern and southern parts. Frosts that occur late in spring occasionally injure corn, small fruits, and vegetable crops severely, especially crops grown on soils, such as peats and mucks, in low-lying areas. Corn, soybeans, and tomatoes are sometimes injured by early frosts in fall. Peach, apple, and cherry orchards are benefited by planting the trees on the middle and upper parts of slopes, where air drainage is better than on the lower parts of the slopes. At the higher locations, frost damage is not so great as on the lower parts of the slopes and in depressions.

Average annual precipitation is 33.93 inches, and about half of this falls during the growing season, or from May through September. Rainfall is fairly well distributed throughout the year. About half of it falls during the day, and the rest, at night. During winter and early in spring, rains are normally gentle, but thunderstorms are more common in summer. There is an average of 110 days each year with 0.01 to 0.25 inch of rain, and 30 days with 0.26 to 1 inch. Active plant growth and greater evaporation from the soil contribute to more rapid use of moisture in summer than in other seasons. Excessive rainfall in spring delays planting, and severe soil erosion results on the more sloping areas, expecially if the land is being prepared for crops. Hail falls only rarely and causes little widespread injury to crops.

Water Supplies

In Lenawee County water supplies for livestock and for homes and industrial use are obtained largely from wells driven into the unconsolidated drift. The wells are driven to depths ranging from 25 to 150 feet. Water is fairly plentiful in the areas of sandy and gravelly drift in the northwestern part of the county and in the outwash plains in the central part (see area 4, fig. 2). Artesian wells and springs are sources of water in the vicinity of Tipton and Holloway. Water is difficult to obtain in some places in the eastern part of the county, where the substratum is heavy-textured till or lake-laid clay.

Approximately 35 lakes are concentrated in the northwestern quarter of the county. These and the surrounding areas provide recreation for thousands of people in this part of Michigan.

Transportation and Markets

The county is well situated with respect to markets and transportation facilities. Toledo, Ohio, on Lake Erie, is about 30 miles to the southeast. Railroads and highways between Detroit and Chicago pass through the county. More than 2,000 miles of hard-surfaced Federal, State, and county roads have been built. Most of the farms are on or close to all-weather gravel or hard-surfaced roads. The Erie and Kalamazoo Railroad, the first built west of Schenectady, N.Y., was completed from Toledo, Ohio, to Adrian in 1836. Three railroads, the Wabash Railroad Company, the New York Central System, and the Detroit, Toledo, and Ironton Railroad, now serve the county. Passenger service is maintained by both the Wabash and the New York Central. Nine motortruck companies operate through Adrian. They provide 24-hour delivery to or from Detroit, Toledo, Fort Wayne, Columbus, Indianapolis, Cincinnati, and many other points.

Livestock and livestock products are sold locally at adjacent markets. Wheat, soybeans, and other cash grain crops are sold to operators of local grain elevators. The fruit and truck crops are sold largely to local buyers or locally by the grower. Sugar beets and tomatoes are grown under contract for processors in this and adjacent counties.

Industries

Adrian is an industrial and agricultural trading center. There are more than 50 manufacturing and processing industries, which employ 7,000 persons and do an annual business in excess of 125 million dollars. Those industries in the county employing the most persons are engaged in the manufacture of aluminum products, magnesium, steel wire and cable, precision instruments, power sprayers, refrigeration equipment, and automobile parts and accessories. It is estimated that about 20 percent of the rural male population works more or less regularly in these and in other factories. Five milk-processing plants, two vegetable-canning factories, and a sugar-beet refinery are

located in the county. A cement plant is located at Cement City.

A thriving summer and recreational area is in the lake region in the northwestern part of the county. About 12,000 cottages and summer homes are located throughout this area.

Agriculture

This section discusses the general pattern of agriculture and rural living in Lenawee County. The statistics used are from reports published by the U.S. Bureau of the Census.

Agricultural history

The first white settlers lived largely by trapping and fur trading, but they also cleared tracts of land and planted corn, vegetables, and other crops for food. Although considerable timber was used locally for buildings and firewood, much of it was cut and burned to make way for the planting of farm crops. During the period between 1870 and 1890, there was a great demand for timber for building ships and for staves, railroad ties, and hoop poles. Consequently, a large part of the timber was sold for those purposes. As the population increased, agriculture expanded. The areas with well-drained soils were cleared first, but, as settlement increased, the areas with poorly drained soils were drained artificially and used for crops.

The county is now largely agricultural. It lies within the type of farming area known as the general livestock and corn area of Michigan. A large part of the farm income is derived from the sale of livestock and livestock products, mainly dairy products, beef cattle, hogs, and sheep. Another major source of farm income is the sale of corn, wheat, oats, and soybeans.

Types and sizes of farms

Of the 3,463 farms in the county in 1954, an estimated 17.2 percent were miscellaneous and unclassified. The rest are listed according to the major source of income as follows:

	Number
Field crop	1,233
Dairy	566
Livestock farms other than dairy or poultry	497
Poultry	110
Fruit and nut	25
General	436

Farms in the county averaged 123 acres in size in 1954. The 1954 census groups the farms by size as follows:

Acres	*Number*
Less than 10	175
10 to 69	894
70 to 139	1,211
140 to 259	889
260 to 499	265
500 to 999	27
1,000 acres and over	2

Livestock and livestock products

Livestock and livestock products have furnished a large part of the farm income since early days, and they are the medium through which a large part of the crops is marketed. The value of livestock and livestock products sold in 1954 amounted to approximately 51 percent of the total farm income for that year.

Normally, a large number of western feeder cattle are brought into the county each year, fattened on pasture and grain, and marketed in Chicago, Detroit, and other nearby markets. There were 46,206 cattle and calves in the county in 1954. Of this total, 16,070 head were milk cows. The principal dairy breeds are Holstein, Guernsey, and Jersey, and a few miscellaneous breeds. In 1954, more than 107 million pounds of whole milk and 78,883 pounds of butterfat were sold.

There were 40,431 hogs and pigs on farms in 1954. The total value of swine sold in that year amounted to approximately 8 percent of the total farm income.

Farmers in the county had 22,959 sheep and lambs on hand in 1954. A large number of these sheep and lambs are purchased outside the county, fattened on corn and other grains, and on hay, and sold at nearby markets. Only about 1 percent of the total farm income was derived from the sale of sheep and lambs in 1954.

This county is an important poultry-producing area. Most farms have from a few dozen to more than 100 laying hens, and some farms specializing in poultry have several hundred hens. There was a total of 316,993 chickens and 2,378,046 dozen eggs sold in 1954. In addition, 24,788 turkeys and 4,687 ducks were raised. The total value of poultry products sold in 1954 amounted to slightly less than 6 percent of the total farm income.

The number of horses and mules has declined in the last 20 years. This has resulted from the increased use of farm machinery.

Crops

About 77 percent, or 327,419 acres, of the total farmland in the county is used for crops. There are important differences, however, in the proportion of land used for crops in the different parts of the county. In general, the eastern part of the county has the highest proportion of farmland used for crops, and the northwestern part, the smallest. Table 11 shows the acreage of principal crops grown in Lenawee County in stated years.

The acreage in corn has fluctuated since 1879, but in 1954 the acreage was the largest ever reported in the county. Yields vary as the result of differences in seasons; they also vary because of differences in soils and because of differences in management practices. The widespread use of hybrid varieties of corn and increased use of commercial fertilizers have been largely responsible for the increased total production. Corn is grown more extensively in the eastern part of the county, where the dark-colored soils predominate, than in the rest of the county.

Land used for corn normally is plowed in spring, and barnyard manure generally is applied before plowing. Corn is planted in the middle part of May. Drilling is more common than check-planting. Fertilizer of varying amounts and analysis is used under corn.

Methods of harvesting depend upon the use to be made of the crop. The corn may be field chopped for silage or harvested by mechanical pickers.

The acreage of oats has remained fairly constant since 1899. Oats normally follow corn in the cropping system, but they sometimes follow wheat. Ordinarily, the land is plowed for oats in spring. Mechanical combines are used for harvesting the crop. The oats are used mostly to feed livestock; however, a small part of the crop is sold to operators of grain elevators.

TABLE 11.—*Acreage of principal crops and number of fruit trees and grapevines of bearing age in stated years.*

Crop	1929	1939	1949	1954
	Acres	*Acres*	*Acres*	*Acres*
Corn harvested for grain	36, 258	68, 937	87, 370	106, 605
Corn cut for silage	7, 356	5, 550	6, 793	6, 379
Small grains threshed or combined:				
Oats	48, 623	43, 072	51, 818	40, 323
Winter wheat	26, 736	31, 394	50, 656	42, 634
Barley	10, 395	3, 845	377	1, 178
Rye	635	592	280	1, 097
Buckwheat	644	428	256	16
Soybeans for all purposes	588	28, 568	12, 827	30, 024
Sugar beets harvested for sugar	4, 043	4, 142	2, 758	69
Tomatoes for home use or for sale	493	1, 150	2, 645	1, 176
Hay crops:				
Alfalfa cut for hay	32, 314	32, 662	30, 212	36, 431
Clover cut for hay	10, 963	(1)	(1)	(1)
Clover, timothy, and mixtures of grasses cut for hay	23, 571	16, 367	12, 964	12, 688
	Number [2]	*Number* [2]	*Number* [2]	*Number* [2]
Apple trees	56, 815	40, 713	24, 599	19, 650
Peach trees	18, 752	17, 766	13, 466	12, 635
Grapevines	24, 885	22, 944	9, 863	6, 724

[1] Not reported separately.
[2] 1 year later than year at head of column.

Winter wheat was grown on a large acreage in 1954. Wheat normally follows corn in the cropping system, but it sometimes follows oats or other crops. It is seeded in September as soon as feasible after the hessian fly ceases to be a danger. For fertilizing wheat, a general practice is to use 200 to 300 pounds or more fertilizer per acre. Methods of harvesting are similar to those used in harvesting oats. Most of the wheat harvested is sold to operators of local grain elevators as a cash crop; only a small part is used for seed and for livestock feed.

Grain crops grown to a limited extent are barley, rye, and buckwheat. These crops generally do not have a definite place in the cropping system but are often grown as an emergency crop when other crops have failed.

The acreage in soybeans has increased greatly since 1929. Most of the increased acreage consists of land formerly used for other hay and grain crops. Soybeans are grown largely as a cash crop, rather than as a green-manure crop. They are drilled in rows in May or early in June on land that has been prepared by plowing, disking, or both. Harvesting of the seed is accomplished largely by using combines.

In 1954, the acreage in hay crops was 16,175 acres less than in 1929. Because of the rapid increase in the acreage of alfalfa and the reduction in clover and timothy grown alone, there have been radical changes in the kinds of hay grown.

The acreage in alfalfa increased from 1,045 acres in 1909 to 36,431 acres in 1954. This increase was caused largely by a more general knowledge and appreciation of the feeding qualities of alfalfa and also because of the ability of alfalfa to store nitrogen and improve the physical properties of the soil. Some alfalfa seed is drilled on well-prepared seedbeds in the late part of the summer or early in fall, but most of it is sown with oats in spring. Alfalfa is grown both for hay and pasture, depending largely on the type and quantity of livestock on the farm.

Because of the practice of seeding a mixture of clove, timothy, alfalfa, and other legumes and grasses, the acreages used to grow clover and timothy alone have decreased greatly.

The total acreage in vegetables in the county is not large. Potatoes and tomatoes are the principal vegetable crops. Tomatoes are grown under contract for the local canneries. The potatoes are largely sold under contract for processing into potato chips. The total acreage of other vegetables is small.

Sugar beets were an important cash crop from 1910 to 1949. In recent years, only a small acreage has been planted to sugar beets. Sugar beets are grown under contract for the sugar refinery.

Apples and peaches are important sources of income on a few farms. Plums, cherries, pears, and grapes are grown on some farms, but diseases and indifferent management have destroyed most of the small farm orchards and vineyards that were a part of nearly every farm before 1910. Most of the fruit is sold locally; the demand is usually greater than the supply.

Permanent pasture

The proportion of farmland used for permanent pasture varies in different parts of the county; it ranges from about 5 percent of the total farmland in Riga Township to about 30 percent in Clinton Township. A total of 22,905 acres was in pasture in 1954. Relatively little attention has been given to pasture improvement, although the need for management practices is great. Some pastures have only fair to poor stands of bluegrass and a small amount of whiteclover.

Glossary

Acidity. (See Reaction, soil.)
Aggregate (of soil). Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism. Many properties of the aggregate differ from those of an equal mass of unaggregated soil.
Alkalinity. (See Reaction, soil.)
Alluvial soils. Soils on transported and relatively recently deposited alluvial materials (alluvium) with little or no modification of the original deposited materials by soil-forming processes.
Alluvium. Mineral and organic sediments of different sizes deposited on flood plains by streams.
Available water in soils. The part of the water in the soil that can be taken up by plants at rates significant to their growth.
Blinding. Placing loose topsoil, gravel, coarse cinders, or vegetative material, such as marsh hay or straw, around and over the drainage tile to a depth of 6 to 12 inches. This covering in sandy or tight soils prevents the joints from sealing and facilitates drainage.
Blowout. An area of soil from which most, or all, of the fine soil material has been removed by wind. Such an area appears as a shallow depression with a flat or irregular floor consisting of a resistant layer or accumulation of pebbles, or the water table may be at the surface. The soil is usually barren. Blowouts are common near dunes.
Calcareous. Containing enough calcium carbonate to effervesce (fizz) when treated with dilute hydrochloric acid.
Catena, soil. A group of soils within a specific soil zone, formed from similar parent materials but with unlike profile characteristics because of differences in relief or drainage. Sometimes called a toposequence of soils.

Clay. A mineral soil separate in which the soil particles are less than 0.002 millimeter (0.000079 inch) in diameter; a soil textural class; or soil material that contains 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay loam. Soil material that contains 27 to 40 percent clay and 20 to 45 percent sand.

Coarse-textured soils. (See Sandy soils.)

Colluvium (colluvial deposits). Mixed deposits of rock fragments and coarse soil materials near the bases of steep slopes. The deposits have accumulated as the result of soil creep, slides, or local wash.

Consistence, soil. The degree and kind of cohesion and adhesion or the resistance to deformation or rupture of the soil aggregates; the relative mutual attraction of the particles in the whole mass, or their resistance to separation. Terms commonly used to describe consistence include *compact, firm, friable, very friable, loose, plastic, slightly plastic, soft,* and *sticky.*

Compact. Consistence of moist soil. Term denotes a combination of firm consistence and close packing or arrangement of soil particles.

Firm. Consistence of moist soil. Soil material crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Friable. Consistence of moist soil. Soil material crushes easily under gentle to moderate pressure between thumb and forefinger and coheres when pressed together.

Hard. Consistence of dry soil. Soil material is moderately resistant to pressure; can be broken in hands without difficulty but is barely breakable between thumb and forefinger.

Loose. Consistence of moist or dry soil. Noncoherent.

Plastic. Consistence of wet soil. Soil material deforms under moderate pressure; wire formable.

Slightly plastic. Consistence of wet soil. Wire formable, but soil material deforms easily.

Soft. Consistence of dry soil. Soil material is very weakly coherent and fragile; breaks to powder or individual grains under very slight pressure.

Very friable. Consistence of moist soil. Soil material crushes under very gentle pressure but coheres when pressed together.

Delta. An alluvial deposit formed where a stream or river drops its load of sediment when it enters a body of quieter water, formed largely beneath the water's surface, and often resembling the shape of the Greek letter Delta.

Depressional area. A low-lying area that does not have surface outlets for the water or has only poorly developed ones.

Drainage (a practice). The removal of excess water on or within the soil by means of surface or tile drains.

Drainage, natural. Natural drainage condition under which the soil developed.

Drainage, soil. (1) The rapidity and extent of the removal of water from the soil by runoff and by flow through the soil to underground spaces. (2) As a condition of the soil, soil drainage refers to the frequency and duration of periods when the soil is free of saturation. For example, in well-drained soils the water is removed readily, but not rapidly; in poorly drained soils, the root zone is waterlogged for long periods and the roots of ordinary crop plants cannot obtain enough oxygen.

Esker. A narrow ridge or mound of gravelly and sandy drift deposited by a subglacial stream.

Fine texture. (See Clay; Silty clay.)

Genesis, soil. The mode of origin of soil. In describing soil genesis, special reference is given to the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift. Rock and earth materials picked up, carried, and deposited by glacial ice or by water that flows when the glacial ice melts. This material is deposited as stratified, sorted material or as unstratified till.

Glacial outwash. Sandy and gravelly materials deposited in layers on plains or in old glacial drainageways by water from melting glaciers.

Glacial till. Unstratified glacial deposits.

Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams of melt water flowing from the melting ice. These deposits are stratified and may be in the form of outwash plains, deltas, kames, eskers, and kame terraces.

Great soil group. Any one of several broad groups of soils that have the same kind and sequence of horizons in the soil profile. Examples are the Gray-Brown Podzolic and Humic Gley great soil groups.

Green-manure crop. Any crop grown and plowed under while green for the purpose of improving the soil.

Horizon, soil. A layer in the soil profile, approximately parallel to the land surface, that has more or less well-defined characteristics.

Horizon A. The upper horizon of the soil profile from which material has been removed by percolating waters, the surface and subsurface layers; may include the cultivated part of the solum, or plow layer. The A horizon is generally subdivided in two or more subhorizons. The A_0 and A_{00} horizons are not a part of the mineral soil but are the accumulation of organic debris on the surface. The A_1 horizon is a part of the mineral soil that contains organic matter throughout. Other subhorizons are designated as A_1, A_2, and A_3, depending on their properties.

Horizon B. The horizon of deposition, to which materials have been added by percolating waters; the illuviated part of the solum; the subsoil. This horizon may also be divided into several subdivisions, depending on the color, structure, consistence, or character of the material deposited. These layers are designated as B_1, B_2, and B_3, depending on their properties.

Horizon C. The horizon of unweathered material underlying the B horizon, like that and from which at least a part of the solum was formed.

Horizon D. Any stratum, such as layers of clay or sand, that is not similar to the material from which the overlying soil was formed but that may have significance to the genesis and use of the overlying soil.

Humus. The dark-colored, finely divided, well-decomposed, more or less stable part of the organic matter in mineral soils.

Kame. A short, irregular ridge or hill of stratified glacial drift.

Leaching. Removal of materials in solution or suspension by water passing through the soil.

Loam. The soil textural class name for soil having 7 to 27 percent of clay, 28 to 50 percent of silt, and less than 52 percent of sand.

Medium textured. (See also Loam; Silt loam.) A texture intermediate between moderately fine texture and moderately coarse texture.

Micro-organisms. Forms of life too small to be seen with the unaided eye, or barely discernible.

Mineral soil. A general term for a soil composed chiefly of mineral matter, such as sand, silt, and clay, in contrast to an organic soil, which is composed largely of organic material.

Moderately coarse textured. (See Sandy loam.)

Moderately fine textured. (See Clay loam; Sandy clay loam; Silty clay loam.)

Morphology, soil. The physical, chemical, and biological constitution of the soil. This constitution is expressed in the arrangement of the horizons in the soil profile and by the texture, structure, reaction, content of organic matter, and other characteristics of these horizons.

Mottles. Spots, streaks, or blotches of different colors.

Muck. (See also Peat.) Well-decomposed, dark-colored, organic materials that occur in naturally poorly drained areas. If the plant material in a layer, or horizon, of an organic soil is so completely decomposed that the plant structure can no longer be identified, the material is called muck. If the plant structure can still be identified, the material is called peat.

Parent material. (See also Horizon C; Profile, soil; and Substratum.) The relatively unaltered geological deposits similar to those from which at least a part of the soil has developed.

Peat. Soil material consisting primarily of raw, undecayed or slightly decomposed organic material accumulated under conditions of excessive moisture.

Percolation. The downward movement of water through the soil.

Permeable. Easily penetrated, as by water or air.

pH. (See also Acidity.) Term used to designate the acidity or alkalinity of soils; reaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material or substratum.

Reaction, soil. The degree of acidity or alkalinity of the soil mass, expressed in words or in pH values, as follows:

	pH
Extremely acid	Below 4. 5
Very strongly acid	4. 5 to 5. 0
Strongly acid	5. 1 to 5. 5
Medium acid	5. 6 to 6. 0
Slightly acid	6. 1 to 6. 5
Neutral	6. 6 to 7. 3
Mildly alkaline	7. 4 to 7. 8
Moderately alkaline	7. 9 to 8. 4
Strongly alkaline	8. 5 to 9. 0
Very strongly alkaline	9. 1 and higher.

Root zone. That part of the soil profile that is invaded by plant roots.

Runoff. The surface flow of water from an area; or the total volume of surface flow during a specified time.

Sand. As a size group, individual mineral fragments that have diameters ranging from 0.05 millimeter (0.002 inch) to 2 millimeters (0.079 inch). As a textural class, soil material that contains 85 percent or more of sand and not more than 10 percent of clay.

Sandy clay loam. A soil textural class that generally contains 20 to 35 percent clay, less than 28 percent silt, and more than 45 percent sand.

Sandy loam. A soil textural class that generally has more than 50 percent sand and less than 20 percent clay.

Sandy soils. A broad term for sand and loamy sand textural classes; soils with more than 70 percent sand and less than 15 percent clay.

Silt. As a size group, mineral particles ranging from 0.05 millimeter (0.002 inch) to 0.002 millimeter (0.000079 inch) in diameter; as a textural class, soil material that contains 80 percent or more silt and less than 12 percent clay.

Silt loam. Soil material having 50 percent or more silt and 12 to 27 percent clay or 50 to 80 percent silt and less than 12 percent clay.

Silty clay. Soil of this textural class has 40 percent or more of clay and 40 percent or more of silt.

Silty clay loam. Soil of this textural class has 27 to 40 percent of clay and less than 20 percent of sand.

Slope. The incline of the surface of a soil. Usually expressed in percentage of slope, which equals the number of feet of fall per 100 feet of horizontal distance.

Soil. The natural medium for the growth of land plants. The soil is the upper part of the earth's crust, which has layers, or horizons, that are the result of the integrated effect of climate and living matter, especially vegetation, on geological deposits, conditioned by relief, over periods of time.

Soil association. A group of soils that occur together in a characteristic pattern; a general soil area.

Solum. The upper part of the soil profile above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons. Usually, the characteristics of the material in these horizons are quite unlike those of the underlying parent material. Roots and animal life are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into lumps, granules, or other aggregates. Structure is described by grade (*weak, moderate,* or *strong*), that is, the distinctness and durability of the aggregates; by the size of the aggregates (*very fine, fine, medium, coarse,* or *very coarse*); and by their shape (*platy, prismatic, columnar, blocky, granular,* or *crumb*). A soil is described as structureless if there are no observable aggregates. Structureless soils may be massive (coherent) or single grain (noncoherent).

Blocky, angular. Aggregates are block shaped; they may have flat or rounded surfaces that join at sharp angles.

Blocky, subangular. Aggregates have some rounded and some plane surfaces; vertices are rounded.

Columnar. Aggregates are prismatic and are rounded at the upper ends.

Crumb. Generally, soft, small, porous aggregates, irregular, but tending toward a spherical shape, as in the A_1 horizons of many soils. Crumb structure is closely related to granular structure.

Granular. Roughly spherical, firm, small aggregates that may be either hard or soft but that are generally firmer than crumb and without the distinct faces of blocky structure.

Platy. Soil particles are arranged around a plane that normally is horizontal.

Prismatic. Soil particles are arranged around a vertical line; aggregates have flat vertical surfaces.

Subsoil. Technically, the B horizon; commonly, that part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil.

Surface soil. Technically, the A horizon; commonly, the plow layer.

Texture. The relative proportions of sand, silt, and clay in a mass of soil. A coarse-textured soil is one high in sand; a fine textured soil has a large proportion of clay.

Weathering. The physical and chemical disintegration and decomposition of rocks and minerals. Soil is the result of weathering and other chemical, physical, and biological forces that have changed the upper part of the earth's crust through various periods of time.

GUIDE TO MAPPING UNITS[1]

Map symbol	Mapping unit	Page	Soil management unit	Page
CcA	Cadmus and Blount loams, 0 to 3 percent slopes	8	3/2aA(IIS)	40
CdA	Carlisle muck, 0 to 3 percent slopes	9	Mc(IIIW)	47
CeA	Colwood very fine sandy loam, 0 to 3 percent slopes	9	3cA(IIW)	39
CfA	Colwood and Wauseon fine sandy loams, 0 to 3 percent slopes	9	3cA(IIW)	39
CgA	Conover loam, 0 to 3 percent slopes	10	2bA(I)	34
CgB	Conover loam, 3 to 7 percent slopes	10	2bB(IIW)	35
CgB2	Conover loam, 3 to 7 percent slopes, moderately eroded	10	2bB(IIW)	35
EaA	Edwards muck, 0 to 3 percent slopes	10	M/mc(IVW)	48
FaA	Fox cobbly gravelly loam, 0 to 3 percent slopes	11	3aA(IIS)	37
FaB	Fox cobbly gravelly loam, 3 to 7 percent slopes	11	3aB(IIS)	37
FaC2	Fox cobbly gravelly loam, 7 to 15 percent slopes, moderately eroded	11	3aC(IIIS)	38
FbA	Fox loam, 0 to 3 percent slopes	11	3aA(IIS)	37
FbB	Fox loam, 3 to 7 percent slopes	11	3aB(IIS)	37
FbC	Fox loam, 7 to 15 percent slopes	11	3aC(IIIS)	38
FbC2	Fox loam, 7 to 15 percent slopes, moderately eroded	11	3aC(IIIS)	38
FcA	Fox sandy loam, 0 to 3 percent slopes	11	3aA(IIS)	37
FcB	Fox sandy loam, 3 to 7 percent slopes	11	3aB(IIS)	37
FcB2	Fox sandy loam, 3 to 7 percent slopes, moderately eroded	11	3aB(IIS)	37
FcC	Fox sandy loam, 7 to 15 percent slopes	11	3aC(IIIS)	38
FcC2	Fox sandy loam, 7 to 15 percent slopes, moderately eroded	11	3aC(IIIS)	38
FcD	Fox sandy loam, 12 to 25 percent slopes	11	3aD(IVS)	38
FcD2	Fox sandy loam, 12 to 25 percent slopes, moderately eroded	11	3aD(IVS)	38
FcE	Fox sandy loam, 25+ percent slopes	11	3aE(VIIS)	39
FdC3	Fox soils, 7 to 15 percent slopes, severely eroded	11	3aC(IVS)	38
FdD3	Fox soils, 12 to 25 percent slopes, severely eroded	11	3aD(VIS)	39
FdE2	Fox soils, 25+ percent slopes, moderately or severely eroded	11	3aE(VIIS)	39
GaA	Genesee loam, 0 to 3 percent slopes	11	2a–LA(IIW)	36
GaB	Genesee loam, 3 to 7 percent slopes	11	2a–LA(IIW)	36
GbA	Genesee sandy loam, 0 to 3 percent slopes	11	2a–LA(IIW)	36
GbB	Genesee sandy loam, 3 to 7 percent slopes	11	2a–LA(IIW)	36
GcA	Genesee and Eel loams, 0 to 3 percent slopes	11	2a–LA(IIW)	36
GdA	Granby loamy sand, 0 to 3 percent slopes	12	5cA(IVW)	46
GeA	Granby sandy loam, 0 to 3 percent slopes	12	5cA(IVW)	46
GfA	Griffin and Genesee loams, 0 to 3 percent slopes	12	2c–LA(IIW)	36
GgA	Griffin and Sloan loams, 0 to 3 percent slopes	12	2c–LA(IIW)	36
GhA	Griffin and Sloan sandy loams, 0 to 3 percent slopes	12	2c–LA(IIW)	36
HaB	Hillsdale sandy loam, 3 to 7 percent slopes	13	3aB(IIS)	37
HaC2	Hillsdale sandy loam, 7 to 15 percent slopes, moderately eroded	13	3aC(IIIS)	38
HbA	Houghton muck, 0 to 3 percent slopes	13	Mc(IIIW)	47
HcA	Hoytville clay loam and silty clay loam, 0 to 3 percent slopes	14	1cA(IIW)	31
HdA	Hoytville mucky clay loam, 0 to 3 percent slopes	14	1cA(IIW)	31
HeA	Hoytville clay loam and Rimer sandy loam, 0 to 3 percent slopes	14	1cA(IIW)	31
HfA	Hoytville and Wauseon loams, 0 to 3 percent slopes	14	1cA(IIW)	31
IaA	Ionia loam, 0 to 3 percent slopes	14	3aA(IIS)	37
IaB	Ionia loam, 3 to 7 percent slopes	14	3aB(IIS)	37
KaC	Kendallville loam, 7 to 15 percent slopes	15	3/2aC(IIIS)	41
KaC2	Kendallville loam, 7 to 15 percent slopes, moderately eroded	15	3/2aC(IIIS)	41
KbC	Kendallville sandy loam, 7 to 15 percent slopes	15	3/2aC(IIIS)	41
KcC2	Kendallville soils, 7 to 15 percent slopes, moderately or severely eroded.	15	3/2aC(IVS)	41
KdA	Kerston muck and loams, 0 to 3 percent slopes	15	Mc–LA(IVW)	46
KeA	Kibbie and Colwood fine sandy loams, 0 to 3 percent slopes	15	3cA(IIW)	39
KeB	Kibbie and Colwood fine sandy loams, 3 to 7 percent slopes	15	3cA(IIW)	39
KfA	Kokomo and Barry loams, 0 to 3 percent slopes	16	2cA(I)	35
KgA	Kokomo, Barry, and Wallkill loams, overwashed, 0 to 3 percent slopes.	16	2cA(I)	35
LaA	Lake borders	16	Xc(VIIIW)	48
LbA	Lenawee silty clay loam, 0 to 3 percent slopes	16	2cA(I)	35
LcA	Linwood muck, 0 to 3 percent slopes	16	M/3c(IIW)	47
MaA	Macomb fine sandy loam, 0 to 3 percent slopes	17	3/2bA(IIW)	42
MbA	Macomb sandy clay loam and Hoytville clay loam, 0 to 3 percent slopes.	17	3/2bA(IIW)	42
McA	Maumee loamy sand, 0 to 3 percent slopes	17	5cA(IVW)	46
MdA	Miami loam, 0 to 3 percent slopes	18	2aA(I)	31
MdB	Miami loam, 3 to 7 percent slopes	18	2aB(IIE)	32
MdB2	Miami loam, 3 to 7 percent slopes, moderately eroded	18	2aB(IIE)	32
MdC	Miami loam, 7 to 15 percent slopes	18	2aC(IIIE)	33
MdC2	Miami loam, 7 to 15 percent slopes, moderately eroded	18	2aC(IIIE)	33
MdD2	Miami loam, 12 to 25 percent slopes, moderately eroded	18	2aD(IVE)	34
MeD	Miami loam and Boyer sandy loam, 12 to 25 percent slopes	18	2aD(IVE)	34
MeD2	Miami loam and Boyer sandy loam, 12 to 25 percent slopes, moderately eroded.	18	2aD(IVE)	34
MeE	Miami loam and Boyer sandy loam, 25+ percent slopes	18	2aE(VIIE)	34
MfC3	Miami soils, 7 to 15 percent slopes, severely eroded	18	2aC(IVE)	33

Map symbol	Mapping unit	Page	Soil management unit	Page
MfD3	Miami soils, 15 to 25 percent slopes, severely eroded	18	2aD(VIE)	34
MgD3	Miami and Boyer soils, 12 to 25 percent slopes, severely eroded	18	2aD(VIE)	34
MgE2	Miami and Boyer soils, 25+ percent slopes, moderately eroded	18	2aE(VIIE)	34
MhA	Morley loam, 0 to 3 percent slopes	19	2aA(I)	31
MhB	Morley loam, 3 to 7 percent slopes	19	2aB(IIE)	32
MhB2	Morley loam, 3 to 7 percent slopes, moderately eroded	19	2aB(IIE)	32
MhC	Morley loam, 7 to 15 percent slopes	19	2aC(IIIE)	33
MhC2	Morley loam, 7 to 15 percent slopes, moderately eroded	19	2aC(IIIE)	33
MhD	Morley loam, 12 to 25 percent slopes	19	2aD(IVE)	34
MhD2	Morley loam, 12 to 25 percent slopes, moderately eroded	19	2aD(IVE)	34
MhE	Morley loam, 25+ percent slopes	19	2aE(VIIE)	34
MkB3	Morley soils, 3 to 7 percent slopes, severely eroded	19	2aB(IIIE)	33
MkC3	Morley soils, 7 to 15 percent slopes, severely eroded	19	2aC(IVE)	33
MkD3	Morley soils, 12 to 25 percent slopes, severely eroded	19	2aD(VIE)	34
MkE2	Morley soils, 25+ percent slopes, moderately or severely eroded	19	2aE(VIIE)	34
NaA	Nappanee silt loam, 0 to 3 percent slopes	19	1bA(IIIW)	30
NaB	Nappanee silt loam, 3 to 7 percent slopes	19	1bA(IIIW)	30
NaB2	Nappanee silt loam, 3 to 7 percent slopes, moderately eroded	19	1bA(IIIW)	30
NbB	Nappanee loam, 3 to 7 percent slopes	19	1bA(IIIW)	30
NbB2	Nappanee loam, 3 to 7 percent slopes, moderately eroded	19	1bA(IIIW)	30
OaA	Ogden muck, 0 to 3 percent slopes	19	M/1c(IIIW)	47
ObA	Oshtemo loamy sand, 0 to 3 percent slopes	20	4aA(IIIS)	43
ObB	Oshtemo loamy sand, 3 to 7 percent slopes	20	4aB(IIIS)	43
ObB2	Oshtemo loamy sand, 3 to 7 percent slopes, moderately eroded	20	4aB(IIIS)	43
ObC	Oshtemo loamy sand, 7 to 15 percent slopes	20	4aC(IIIS)	44
OcC	Ottawa loamy sand, 7 to 15 percent slopes, slightly or moderately eroded.	20	5aC(IVS)	46
PaA	Palms muck, 0 to 3 percent slopes	20	M/3c(IIW)	47
PbA	Pewamo clay loam, 0 to 3 percent slopes	21	2cA(I)	35
PcA	Pewamo mucky clay loam, 0 to 3 percent slopes	21	2cA(I)	35
PdA	Plainfield and Berrien loamy sands, 0 to 3 percent slopes	21	5aA(IVS)	44
PdB	Plainfield and Berrien loamy sands, 3 to 7 percent slopes	21	5aB(IVS)	45
PeA	Plainfield and Ottawa loamy sands, 0 to 3 percent slopes	21	5aA(IVS)	44
PeB	Plainfield and Ottawa loamy sands, 3 to 7 percent slopes	21	5aB(IVS)	45
PeB2	Plainfield and Ottawa loamy sands, 3 to 7 percent slopes, moderately eroded.	21	5aB(IVS)	45
PeC	Plainfield and Ottawa loamy sands, 7 to 15 percent slopes	21	5aC(IVS)	46
PeC2	Plainfield and Ottawa loamy sands, 7 to 15 percent slopes, moderately eroded.	21	5aC(IVS)	46
RaA	Rifle peat, 0 to 3 percent slopes	22	Mc(IIIW)	47
RbA	Rollin muck, 0 to 3 percent slopes	22	M/mc(IVW)	48
SaA	Sebewa loam, 0 to 3 percent slopes	22	3cA(IIW)	39
SbA	Sebewa sandy loam, 0 to 3 percent slopes	23	3cA(IIW)	39
ScB	Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes	23	4aB(IIIS)	43
ScB2	Spinks, Boyer, Plainfield, and Hillsdale soils, 3 to 7 percent slopes, moderately eroded.	23	4aB(IIIS)	43
ScC	Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes	23	4aC(IIIS)	44
ScC2	Spinks, Boyer, Plainfield, and Hillsdale soils, 7 to 15 percent slopes, moderately eroded.	23	4aC(IIIS)	44
ScD2	Spinks, Boyer, Plainfield, and Hillsdale soils, 12 to 25 percent slopes, moderately eroded.	23	4aD(IVS)	44
SdC	St. Clair loam, 7 to 15 percent slopes	24	1aC(IIIE)	29
SdC2	St. Clair loam, 7 to 15 percent slopes, moderately eroded	24	1aC(IIIE)	29
SdD2	St. Clair loam, 12 to 25 percent slopes, moderately eroded	24	1aD(IVE)	30
SdE	St. Clair loam, 25+ percent slopes	24	1aE(VIIE)	30
SdE2	St. Clair loam, 25+ percent slopes, moderately eroded	24	1aE(VIIE)	30
SeC3	St. Clair soils, 7 to 15 percent slopes, severely eroded	24	1aC(IVE)	30
TaA	Tawas muck, 0 to 3 percent slopes	24	M/4c(IVW)	47
WaA	Wallkill loam, overwashed, 0 to 3 percent slopes	24	2c–LA(IIW)	36
WbA	Warners muck and marl, 0 to 3 percent slopes	24	M/mc(IVW)	48
WcA	Wauseon loam, 0 to 3 percent slopes	25	3/1cA(IIW)	40
WdA	Willette muck, 0 to 3 percent slopes	25	M/1c(IIIW)	47

[1] Table 1, p. 3, gives the acreage and proportionate extent of the soils.

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If you are deaf, are hard of hearing, or have speech disabilities and you wish to file either an EEO or program complaint, please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

If you have other disabilities and wish to file a program complaint, please see the contact information above. If you require alternative means of communication for

program information (e.g., Braille, large print, audiotape, etc.), please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Supplemental Nutrition Assistance Program

For additional information dealing with Supplemental Nutrition Assistance Program (SNAP) issues, call either the USDA SNAP Hotline Number at (800) 221-5689, which is also in Spanish, or the State Information/Hotline Numbers (http://directives.sc.egov.usda.gov/33085.wba).

All Other Inquiries

For information not pertaining to civil rights, please refer to the listing of the USDA Agencies and Offices (http://directives.sc.egov.usda.gov/33086.wba).