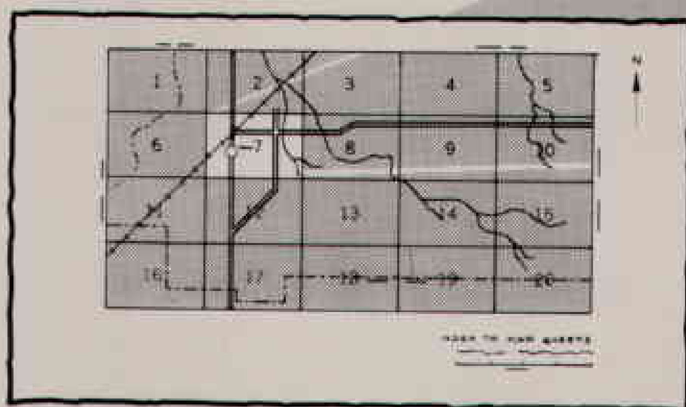
Soil Survey of

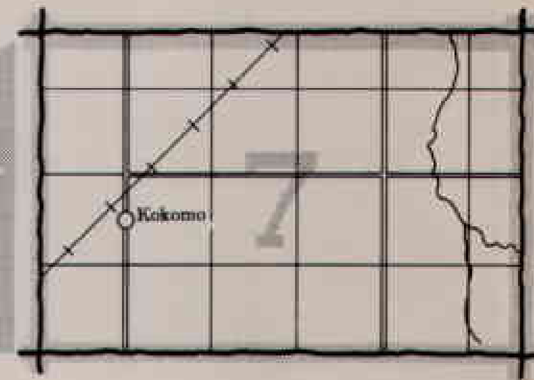
Porter County, Indiana

United States Department of Agriculture, Soil Conservation Service
In cooperation with
Purdue University, Agricultural Experiment Station
Indiana Department of Natural Resources, Soil and Water Conservation Committee

HOW TO USE

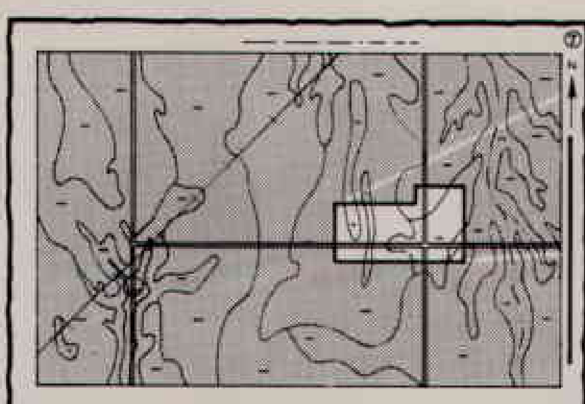
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

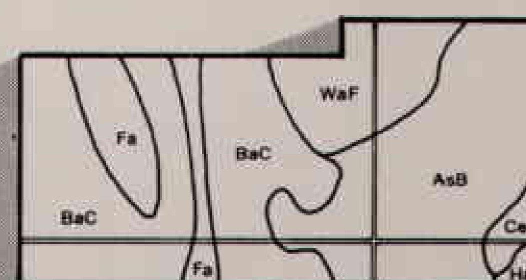




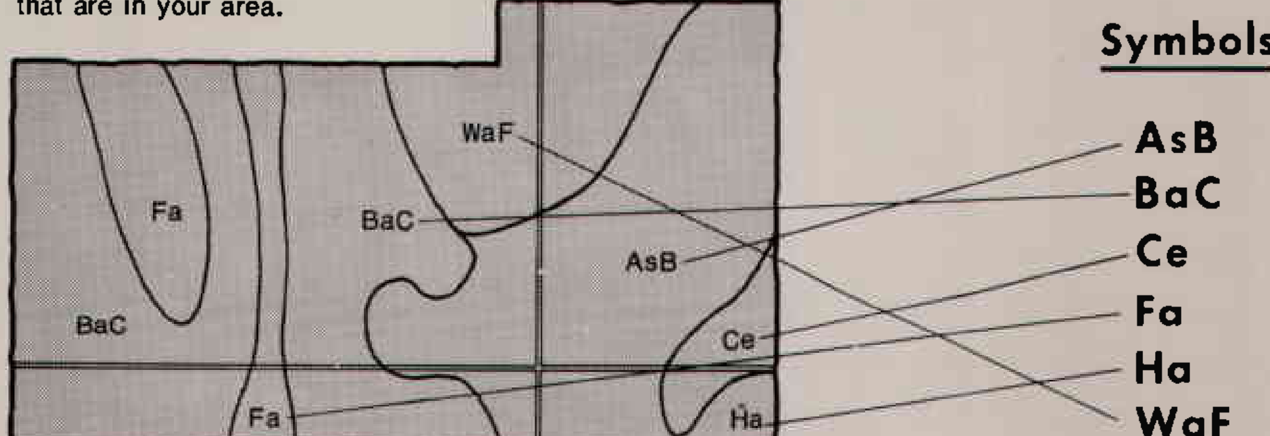
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



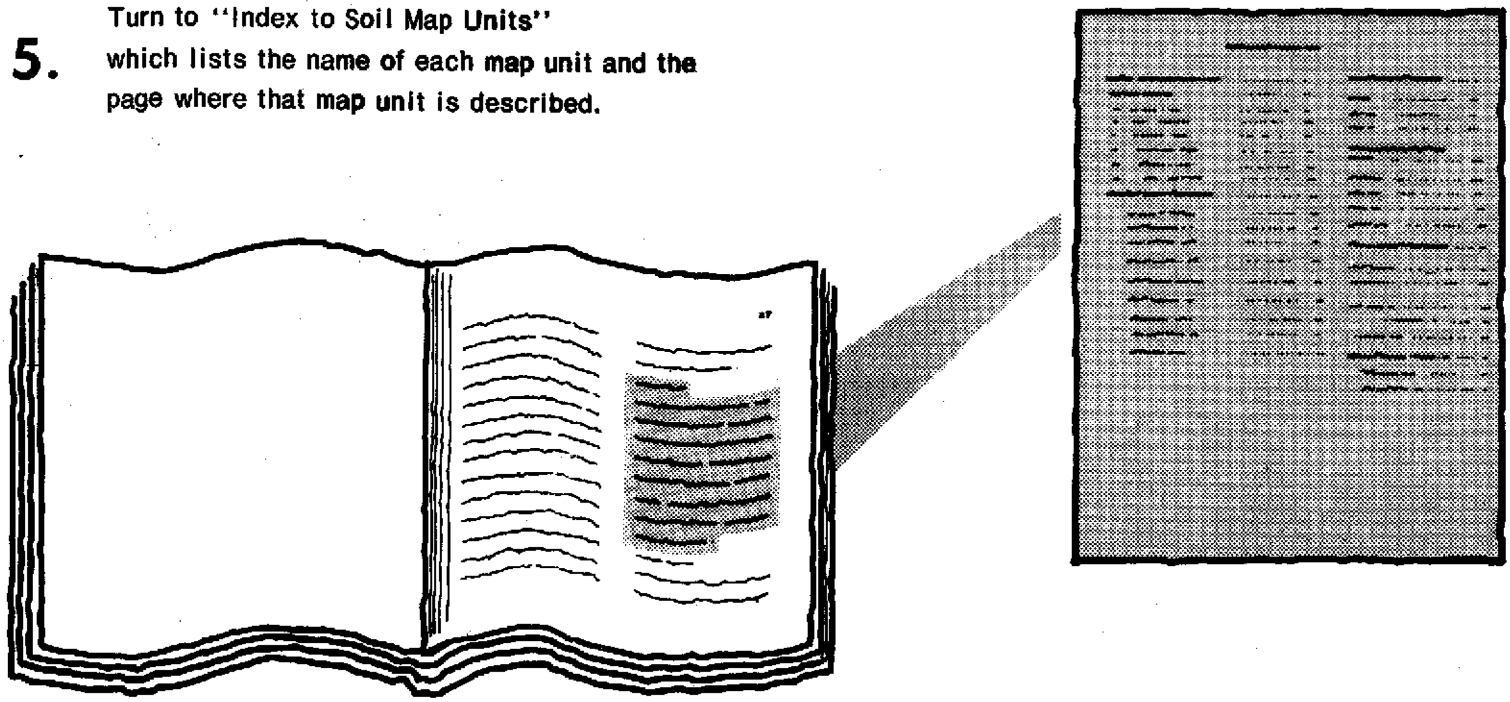


4. List the map unit symbols that are in your area.

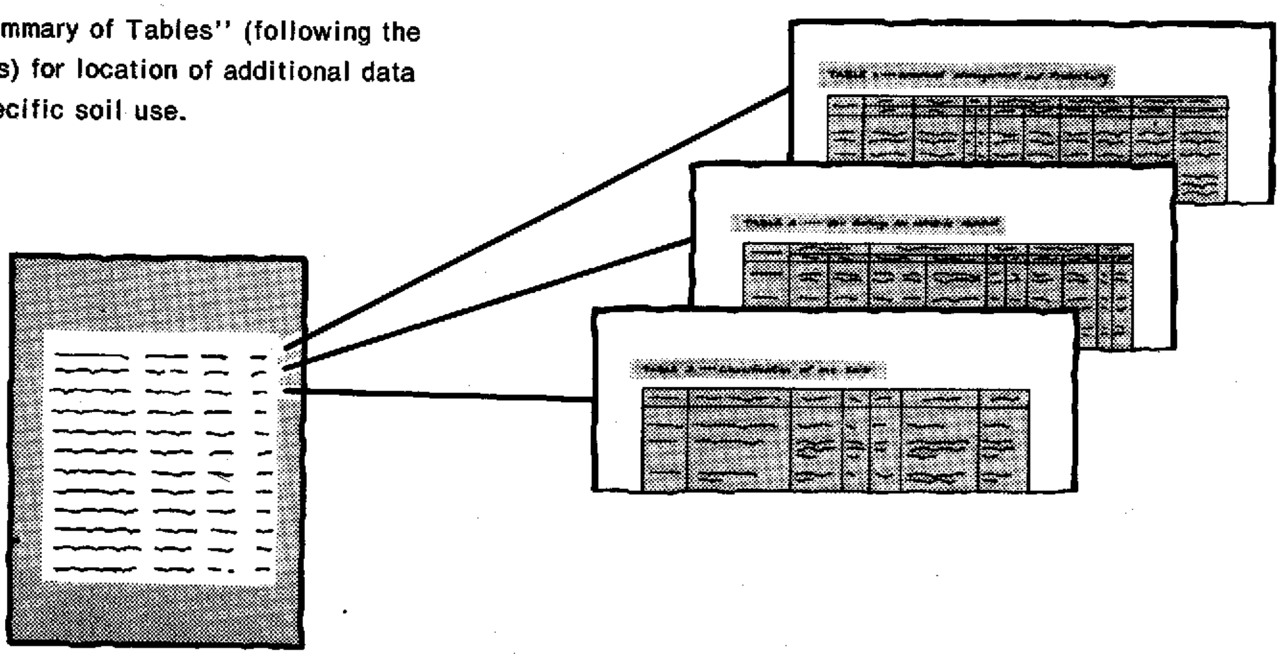


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service, Purdue University, Agricultural Experiment Station, and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Porter County Soil and Water Conservation District. Financial assistance was made available by the Board of County Commissioners of Porter County. Major fieldwork was performed in the period 1971-1977. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1976.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

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Soil series

Issued February 1981

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foreword

This soil survey contains information that can be used in land-planning programs in Porter County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations inherent in the soil or hazards that adversely affect the soil, improvements needed to overcome the limitations or reduce the hazards, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Buell M. Ferguson

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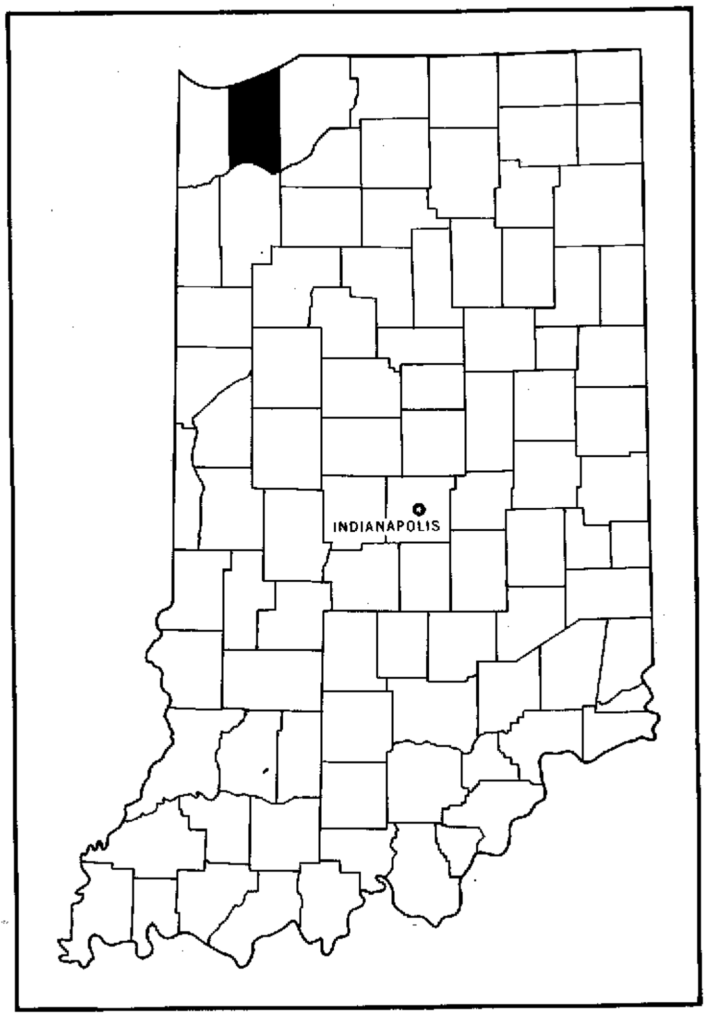
State Conservationist
Soil Conservation Service



Location of Porter County in Indiana.

soil survey of
Porter County, Indiana

By G. Franklin Furr, Jr., Soil Conservation Service

Fieldwork by G. Franklin Furr, Jr., Rex A. Brock, Robert H. Montgomery, Jerry A. Thomas, John D. Crooke, Benjamin F. Smallwood, and Daniel A. Shipman, Soil Conservation Service; and Thomas J. Bauer and Robert C. Dancker, Indiana Department of Natural Resources Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service
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PORTER COUNTY is in the northwestern part of Indiana bordering Lake Michigan. It has an area of 425 square miles, or 272,000 acres. Valparaiso, the county seat, is in the central part of the county. The population of Porter County is about 95,100.

The Valparaiso Moraine extends across the county in a north and northeasterly direction and divides the drainage areas north and south. South and east of the moraine are nearly level to gently sloping soils that drain south into the Kankakee River. The gently sloping to steep soils of the moraine are well dissected by small drainageways. North of the moraine are lacustrine or sandy, nearly level to steep soils that drain north into Lake Michigan. Elevation of the land ranges from about 585 feet on the shore of Lake Michigan to about 888 feet above sea level.

About 60 percent of the county is actively farmed. Most of the area south and east of the moraine is in cultivated crops. Corn, soybeans, and wheat are the principal crops. Truck farms are on some of the muck soils and on the lakebed soils in the northern part of the county. A few orchards are on some of the Riddles and Tracy soils. Urban development is continually decreasing the acreage in farms.

The first soil survey of Porter County was published in 1918 (*4*) but is now out of print. The present survey updates the first survey and provides additional information and larger maps that show the soils in greater detail.

general nature of the county

Settlers moved into the area in the early 1800's. In January 1836 the Indiana Legislature formed Porter County by separating from La Porte County all of the land lying north of the Kankakee River and west of Range 4 West. Porter County was named in honor of Commodore David Porter. The county originally included all the land that is now in Lake County.

The moraine and outwash prairie were the first areas to be settled. The Kankakee marsh was not settled until the river was dredged. The settlers came from other parts of Indiana and the Eastern States. Newcomers arrived in Porter County by following the Indiana Trail southwest of Door Village in La Porte County. The Indians who originally occupied the area moved out as settlers moved into the county.

Portersville was chosen as the county seat in 1836. The name was changed to Valparaiso, meaning "Vale of Paradise," in 1837. In 1850 the population of Valparaiso was 522, in 1960 it was 15,227, and in 1970 it was

20,020. Porter County had a population of 2,162 in 1840. In 1960 the population was 60,279, and in 1970 it was 87,114.

relief and drainage

The highest elevation in Porter County is on a summit in section 30, T. 36 N., R. 5 W., about 3.5 miles north of Valparaiso. It is 888 feet above sea level. The lowest elevation is on the shore of Lake Michigan. It is about 585 feet above sea level. The flatter land in the southern part of the county is more than 652 to 700 feet above sea level. The higher lying part of the Valparaiso Moraine north and northeast of Valparaiso is more than 800 feet above sea level (*4*).

The relief of Porter County ranges from nearly level or depressional to steep. In the southern part of the county, the Kankakee Valley is mainly nearly level or depressional to gently sloping. The area, which was a swamp until the river was dredged, is drained by an extensive system of drainage ditches that have made most of the old marsh tillable. Some areas in the Kankakee Valley are gently sloping to moderately sloping windblown sand ridges. This plain to the north of the Kankakee Valley in the southeastern part of the county is nearly level to moderately sloping. The outwash plain is transected by streams that flow into the Kankakee Valley. The prairie outwash plain to the north of the outwash plain southeast of Valparaiso is mainly nearly level to strongly sloping and is pitted. Some of these pitted areas hold water for long periods, and some hold water for only a few days after periods of heavy rainfall. The Valparaiso Moraine in the northern and western part of the county is a dissected ridge that crosses the county in a northeast to southwest direction. The highest elevation in the county is on this ridge. The ridge is mainly gently sloping to moderately steep and has many streams that begin near lakes or muckbeds. The Valparaiso Moraine is the dividing line between water flowing to the Gulf of Mexico and water flowing to the Atlantic Ocean. North of the Valparaiso Moraine is the Lake Chicago Plain that is mainly made up of nearly level lakebed material. Bordering Lake Michigan is a sand plain that consists of numerous sand dunes and areas of low wet flats. This plain has a belt of high dunes that rise as much as 200 feet above the level of the lake and form an almost continuous band around Lake Michigan.

water supply

Ground water is the main source of water in Porter County. Supplies are adequate for drinking, household use, and farmstead use in most areas of the county and are generally adequate for industrial use. Wells are fairly shallow in all areas except the moraine. The wells in the moraine are deeper but are not always reliable for a bountiful water supply, even for household purposes. Artesian wells and springs are fairly common on the moraine.

Plans are being formulated to store water in several reservoirs in the county. These reservoirs could be used to supplement the water supplies of residential areas and cities.

Lake Michigan is used as a source of water for industrial use by some of the industries along the lake shore.

Irrigation water is drawn from wells in the outwash plain.

transportation facilities

There are 172 miles of highways in Porter County. This includes 19 miles of interstate, 16 miles of the Indiana Toll Road, 71 miles of U.S. highway, and 66 miles of state highways. There are approximately 730 miles of county roads in Porter County. Most of these roads are paved. The major highways criss-cross the county and provide good access to all parts of the county.

One airport provides service to small private planes and a small commuter airline in Porter County.

Eight main railroad lines with approximately 197 miles of track cross the county. Passenger service is available in Valparaiso. Commuter rail lines also operate throughout Porter County.

The Port of Indiana, on Lake Michigan, provides access to the Atlantic Ocean for transporting goods and materials by ship.

manufacturing and business service of agriculture

Valparaiso, the county seat of Porter County, has many industries, ranging from small to fairly large. Large steel mills are on the lakeshore near Lake Michigan. These industries provide employment for much of the labor force in Porter County and for some people from surrounding counties.

Grain markets are provided by local elevators and by major grain terminals on the shore of Lake Michigan near Chicago.

The major livestock markets for cattle and hogs are in the Chicago area. Hogs also are marketed locally.

trends in popultion and land use

At present Porter County has a population of about 87,114 people and a population density of 205 people per square mile. Population increased 44.5 percent between 1960 and 1970.

During the period 1958 to 1967, urbanized land increased by 44.6 percent and all categories of agricultural land decreased by the same amount. About 60 percent of the county remained in agricultural use (*3*). This trend is expected to continue as long as urban land in the county is developed at the expense of agricultural land.

climate

This section was prepared by the National Climatic Center, Asheville, North Carolina.

Porter County is cold and snowy in winter and warm in summer. Areas nearest the lake are markedly cooler than the rest of the county in summer. Precipitation is well distributed during the year and is adequate for most crops on most soils. From late fall through winter, snow squalls are frequent and total snowfall is generally heavy. In some years a single prolonged storm can produce more than two feet of snow on the ground, and strong winds can create deep drifts.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Valparaiso, Indiana in the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 19 degrees. The lowest temperature on record, which occurred at Valparaiso on January 28, 1963, is -23 degrees. In summer the average temperature is 71 degrees, and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred on July 20, 1954, is 98 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 39.3 inches. Of this, 24 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 5.13 inches at Valparaiso on October 10, 1954. Thunderstorms occur on about 45 days each year, and most occur in summer.

Average seasonal snowfall is 47 inches. The greatest snow depth at any one time during the period of record was 22 inches. On an average of 20 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 65 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in March.

Crop development early in the growing season is slowed by frequent cool winds off of a cold lake. This slowing is important to fruit crops, which usually do not blossom until after most chance of a spring freeze is past. Fall winds, which blow off of a relatively warm lake, delay the first fall freeze and prolong the growing season for all crops.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Table 4 shows the extent of the map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, hay and pasture, woodland,* and *urban uses*. Cultivated crops are those grown extensively in the survey area. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments.

The names of some map units in Porter County are not like those appearing in the recently published surveys of the adjacent counties. This is due primarily to the differences in percentage of the major soils in the various map units.

Areas dominated by nearly level, somewhat poorly drained and very poorly drained soils on bottom lands and in upland depressions

These areas are on nearly level bottom lands and stream flood plains mostly along the Kankakee River, and in bogs and old lakebeds scattered throughout the county on glacial outwash plains, till plains, and moraines.

These areas make up about 3 percent of the county. Most areas have been cleared and drained and are used for cultivated crops. Some areas are used for woodland or pasture. Most of these areas are generally unsuitable for urban uses because of flooding, ponding, or a high content of organic matter.

1. Suman-Fluvaquents

Nearly level, very poorly drained and somewhat poorly drained silty and loamy soils; on flood plains

This map unit consists of nearly level soils on bottom lands that are characterized by barely discernible swales and swells. The areas are narrow and are along the Kankakee River. Slope ranges from 0 to 2 percent.

This map unit makes up about 2 percent of the county. It is about 50 percent Suman soils and similar soils and 35 percent Fluvaquents. The rest is soils of minor extent.

The very poorly drained Suman soils are in the depressional areas, in swales, and along poorly defined drainageways. They have a surface layer of black silt loam and a subsoil of dark gray, mottled clay loam and sandy clay loam overlying sand.

Fluvaquents soils are on the slightly higher lying, flat areas and slight rises. They are dominantly somewhat poorly drained and have a surface layer that is dark gray or dark grayish brown, mottled loam or silt loam and a subsoil that varies in texture.

The minor soils are the very poorly drained Gilford and Maumee soils in larger depressional areas on the outer edges of the map unit.

Most of the acreage of this unit has been cleared and drained and is used for cultivated crops. A few swampy areas are used for woodland or pasture.

If these soils are adequately drained, they are suited to cultivated crops. Wetness and the hazard of flooding are the main limitations to use. Ponding or flooding is common in winter and spring (fig. 1).

The soils in this unit are poorly suited to trees. Only water-tolerant trees grow on these soils. Because of wetness and flooding, harvesting is restricted to very dry seasons or to periods when the ground is frozen.

This unit is unsuitable for sanitary facilities and building site developments. Flooding and wetness are the main limitations. Pollution of ground water by effluent from

Figure 1.—Suman silt loam and Fluvaquents along the Kankakee River. These soils are frequently flooded by heavy rainfall in spring.

waste disposal facilities is possible because of the sandy underlying material.

2. Houghton-Adrian-Palms

Nearly level, very poorly drained organic soils in bogs and old lakebeds; on till plains, lake plains, outwash plains, and moraines

This map unit consists of nearly level deposits of muck in large depressional areas.

This map unit makes up about 1 percent of the county. It is about 50 percent Houghton soils, 25 percent Adrian soils, and 15 percent Palms soils. The rest is soils of minor extent.

The very poorly drained Houghton soils are in the deepest depressions or in the deepest part of a depressional area. The organic layers are more than 51 inches thick. The surface layer is black muck, and the underlying layers are dark brown and very dark grayish brown muck. Houghton soils cannot be differentiated from the other muck soils by visual means.

The very poorly drained Adrian soils are in somewhat shallower depressional areas than Houghton soils, or they may be near the edges of units of deeper muck. The organic layers are 16 to 51 inches thick. The surface layer is black muck and the underlying layers are very dark gray muck overlying sand. Adrian soils cannot be differentiated from the other muck soils by visual means.

The very poorly drained Palms soils also are in somewhat shallower depressional areas, or they may be near the edges of units of deeper muck. The organic layers are 16 to 51 inches thick. The surface layer is black muck and the underlying layers are black and dark gray muck overlying loamy mineral material. Palms soils cannot be differentiated from the other muck soils by visual means.

Of minor extent are the very poorly drained Edwards soils that are underlain with marl and the very poorly drained Maumee and Sebewa soils near the edges of the depressional areas.

Some of the acreage of this unit has been cleared and is used for cultivated crops. Most of these cleared areas have been drained. Water-tolerant trees and shrubs grow in some swampy areas, and cattails and other water-tolerant herbaceous plants grow in other swampy areas.

If these soils are adequately drained, they are suited to cultivated crops. Ponding and wetness are the main limitations, and wind erosion is the main hazard in the use of these soils for farming.

The soils in this unit are poorly suited to trees. Only water-tolerant trees grow on these soils. Because of wetness and ponding, harvesting is restricted to very dry seasons or to periods when the ground is frozen.

This unit is generally not suitable for sanitary facilities and building site developments. Ponding is the main limitation. Pollution of ground water by effluent from waste disposal facilities is possible in areas that have sandy underlying material.

Areas dominated by nearly level to very steep, well drained, very poorly drained, and moderately well drained soils on uplands and in upland depressions

These areas are on nearly level to very steep outwash plains, old beach ridges, and lake plains in the northern part of the county.

These areas make up about 8 percent of the county. They are used primarily for woodland. A large area is used for building site development.

3. Oakville-Maumee-Brems

Nearly level to very steep, well drained, very poorly drained, and moderately well drained sandy soils; on outwash plains, lake plains, beach ridges, and sand dunes

This map unit consists of nearly level to very steep soils on alternating high ridges and flats. The ridges are old windblown dunes that have been stabilized by trees, and the flats are low lying areas between the sand ridges. These areas are large and are near Lake Michigan. Slope ranges from 0 to 40 percent.

This map unit makes up about 8 percent of the county. It is about 32 percent Oakville soils, 22 percent Maumee soils, and 18 percent Brems soils. The rest is soils of minor extent.

The well drained Oakville soils are on ridges, old dunes, and higher swells. They have a surface layer of very dark grayish brown fine sand and a subsoil of yellowish brown and light yellowish brown fine sand.

The very poorly drained Maumee soils are in depressional areas. They have a surface layer of black loamy sand, a subsurface layer of very dark gray loamy sand, and a substratum of grayish brown and very dark grayish brown, mottled loamy sand and sand.

The moderately well drained Brems soils are on lower lying swales and higher lying flats. They have a surface layer of very dark brown sand and a subsoil of yellowish brown sand overlying light yellowish brown, strong brown, and dark brown, mottled sand and loamy sand.

Of minor extent are the well drained Urban land-Psamments in areas that have been disturbed by excavation and construction; the very poorly drained Adrian and Houghton soils in depressional areas; the somewhat poorly drained Morocco soils on higher lying, flat areas; and the excessively drained Dune land on bare sand dunes near the shore of Lake Michigan.

Most of the acreage of this unit is used for woodland. Trees are generally mixed hardwoods. A few small areas have been cleared and are used for urban or industrial purposes.

The steeper soils have poor potential for cultivated crops because of slope and droughtiness. If these areas are cleared, the sands are subject to moving and shifting by winds. The soils on the lower lying areas are wetter than other areas and require drainage to be suitable for cultivated crops.

The soils in this unit are suited to trees. However, the steep, sandy slopes hinder the use of logging equipment, and the wet, low areas restrict the use of logging equipment to dry seasons or to periods when the ground is frozen. Erosion is a hazard along logging roads and skid trails.

This unit is poorly suited to sanitary facilities and building site developments. Slope is the main limitation. Pollution of ground water by effluent from waste disposal facilities is possible because the sandy soil has poor filtering qualities.

Areas dominated by nearly level, somewhat poorly drained to very poorly drained soils on uplands and in upland depressions

These areas are on nearly level outwash plains, lake plains, and valley trains mostly in the southern and eastern part of the county.

These areas make up about 25 percent of the county. Most areas are drained and are used for cultivated crops. Most of the areas have poor potential for urban uses because of wetness and ponding.

4. Gilford-Maumee-Morocco

Nearly level, very poorly drained and somewhat poorly drained loamy and sandy soils; on outwash plains and lake plains

This map unit consists of nearly level soils on very gradual swales and swells. Most areas are drained by open ditches. Slope ranges from 0 to 2 percent.

This map unit makes up about 5 percent of the county. It is about 30 percent Gilford soils, 25 percent Maumee soils, and 15 percent Morocco soils. The rest is soils of minor extent.

The very poorly drained Gilford soils are in broad depressional areas. They have a surface layer of very dark brown loam, a subsurface layer of very dark gray sandy loam, and a subsoil of dark gray and dark grayish brown, mottled sandy loam and loamy sand.

The very poorly drained Maumee soils also are in broad depressional areas. They have a surface layer of black loamy sand, a subsurface layer of dark gray loamy sand, and a substratum of grayish brown and very dark grayish brown, mottled loamy sand and sand.

The somewhat poorly drained Morocco soils are on slightly higher lying, broad flats and slight rises. They have a surface layer of very dark brown loamy sand and a subsoil of yellowish brown and brownish yellow, mottled sand.

Of minor extent are the somewhat poorly drained Bourbon soils on slightly higher lying, broad flats and slight rises and the moderately well drained Brems soils on higher lying, broad flats and slight rises near sandhills. Also included are the very poorly drained Newton soils in depressional areas near sandhills or ridges and the excessively drained Plainfield soils on the higher lying and more sloping positions.

Most of the acreage of this unit has been cleared and is used for cultivated crops. Most of these cleared areas have been drained (fig. 2). Most of the swampy areas and sandy ridges are used for woodland or pasture.

If these soils are adequately drained, they are suited to cultivated crops. Wetness and ponding are the main limitations to use. Ponding is common in winter and spring.

The soils in this unit are poorly suited to trees. Only water-tolerant trees grow on these soils. Because of ponding, harvesting is restricted to extremely dry seasons or to periods when the ground is frozen.

This unit is poorly suited to sanitary facilities and building site developments. Ponding is the main limitation. Pollution of ground water by effluent from waste disposal facilities is possible because the sandy soil has poor filtering qualities.

5. Bourbon-Gilford-Pinhook

Nearly level, somewhat poorly drained to very poorly drained loamy soils; on outwash plains, valley trains, and lake plains

Figure 2.—A well maintained drainage ditch in the Gilford-Maumee-Morocco map unit. This ditch removes excess water from the soils.

This map unit consists of nearly level soils on very gradual swales and swells. Most areas are drained by open ditches. Slope ranges from 0 to 2 percent.

This map unit makes up about 12 percent of the county. It is about 40 percent Bourbon soils, 25 percent Gilford soils, and 13 percent Pinhook soils. The rest is soils of minor extent.

The somewhat poorly drained Bourbon soils are on higher lying broad flats and slight rises. They have a surface layer of very dark brown sandy loam; a subsurface layer of brown, mottled sandy loam; and a subsoil of brown, yellowish brown, and pale brown, mottled loam, loamy sand, and sand and shaly sand.

The very poorly drained Gilford soils are in broad depressional areas. They have a surface layer of very dark brown loam; a subsurface layer of very dark gray sand; and a subsoil of dark gray and dark grayish brown, mottled sandy loam and loamy sand.

The poorly drained Pinhook soils are on slightly higher lying positions in the depressional areas. They have a surface layer of very dark grayish brown loam; a subsurface layer of light brownish gray, mottled sandy loam; and a subsoil of light brownish gray, gray, and grayish brown, mottled loam, sandy loam, and loamy sand.

Of minor extent are the very poorly drained Adrian and Sebewa soils in lower lying, large depressional areas and the moderately well drained Hanna soils on slightly higher, nearly level areas. Also included are the somewhat poorly drained Alida soils on higher lying, broad flats and slight rises; and the well drained Tracy soils on higher lying, nearly level to gently sloping areas.

Most of the acreage of this unit has been cleared and drained and is used for cultivated crops.

If these soils are adequately drained, they are suited to cultivated crops. Wetness and ponding are the main limitations. Ponding is common in winter and spring.

The soils in this unit are suited to trees. Water-tolerant trees should be grown. Because of wetness, harvesting is restricted to drier seasons or to periods when the ground is frozen.

This unit is poorly suited to sanitary facilities and building site developments. Wetness is the main limitation. Pollution of ground water by effluent from waste disposal facilities is possible because the sandy soil has poor filtering qualities.

6. Sebewa-Alida-Pinhook

Nearly level, very poorly drained to somewhat poorly drained loamy soils; on outwash plains and terraces

This map unit consists of nearly level soils on very gradual swales and swells. Most areas are drained by open ditches. Slope ranges from 0 to 2 percent.

This map unit makes up about 8 percent of the county. It is about 55 percent Sebewa soils, 18 percent Alida soils, and 12 percent Pinhook soils. The rest is soils of minor extent.

The very poorly drained Sebewa soils are in depressional areas and in swales. They have a surface layer of black loam and a subsoil of dark gray and grayish brown, mottled sandy clay loam, clay loam, and sandy loam.

The somewhat poorly drained Alida soils are on the higher lying, broad flats and slight rises. They have a surface layer of very dark brown loam and a subsoil of brown, yellowish brown, pale brown and gray, mottled loam, clay loam, sandy clay loam, and shaly clay loam.

The poorly drained Pinhook soils are on slightly higher lying positions in depressional areas. They have a surface layer of very dark grayish brown loam; a subsurface layer of light brownish gray, mottled sandy loam; and a subsoil of light brownish gray, gray, and grayish brown, mottled loam, sandy loam, and loamy sand.

Of minor extent are the somewhat poorly drained Bourbon soils on higher lying, broad flats and slight rises; the very poorly drained Adrian, Gilford, and Palms soils in depressional areas; and the well drained Lydick soils on higher lying flats and gentle slopes.

Most of the acreage of this unit has been cleared and is used for cultivated crops. Most cleared areas have been drained.

If these soils are adequately drained, they are suited to cultivated crops. Wetness and ponding are the main limitations. Ponding is common in winter and spring.

The soils in this unit are suited to trees. Water-tolerant trees should be grown. Because of wetness, harvesting is restricted to drier seasons or to periods when the ground is frozen.

This unit is poorly suited to sanitary facilities and building site developments. Ponding is the main limitation. Pollution of ground water by effluent from waste disposal facilities is possible because the sandy underlying material has poor filtering qualities.

Areas dominated by nearly level and gently sloping, well drained soils on uplands

These areas are on nearly level, gently sloping outwash plains.

These areas make up about 4 percent of the county. They are used mainly for cultivated crops. These areas have good potential for most urban uses.

7. Door-Lydick

Nearly level and gently sloping, well drained loamy soils; on outwash plains

This map unit consists of nearly level and gently sloping soils. The areas are elongated and are along the southeastern edge of the moraine. Slope ranges from 0 to 6 percent.

This map unit makes up about 4 percent of the county. It is about 43 percent Door soils and 35 percent Lydick soils. The rest is soils of minor extent.

The nearly level Door soils are on broad flats in the central part of the unit. They have a surface layer of black and very dark brown loam; a subsurface layer of very dark grayish brown loam; and a subsoil of brown, yellowish brown, grayish brown, strong brown, and dark brown loam, sandy clay loam, shaly sandy clay loam, and shaly loam.

The gently sloping Lydick soils are on broad flat areas near small drainageways. They have a surface layer of very dark grayish brown loam and a subsoil of dark brown, dark yellowish brown, and yellowish brown loam and clay loam.

Of minor extent are the somewhat poorly drained Alida soils on slightly lower lying positions and the well drained Elston soils on broad flats. Also included are the very poorly drained Sebewa soils in small depressional areas and the well drained Tracy soils near the edge of the unit and in gently sloping areas.

Most of the acreage of this unit is used for cultivated crops. Some areas are used for homesites and other urban developments.

These soils are well suited to cultivated crops. There are few limitations for raising crops on these soils.

Trees are not native to these soils, but the soils in this unit are suited to trees. There are few limitations to restrict logging operations.

This unit is suited to sanitary facilities and to building site developments.

Areas dominated by nearly level to strongly sloping, well drained and moderately well drained soils on uplands

These areas are on nearly level to strongly sloping outwash plains, till plains, and moraines in the eastern and central parts of the county.

These areas make up about 16 percent of the county. Most areas are used for cultivated crops. Some areas are used for woodland and pasture. Other areas have been used for subdivisions and urban development. The soils have fair potential for urban uses.

8. Tracy-Hanna

Nearly level to moderately sloping, well drained and moderately well drained loamy soils; on outwash plains

This map unit consists of nearly level to moderately sloping soils. In many areas the plains are almost flat. The more sloping areas are along some of the drainageways. Slope ranges from 0 to 12 percent.

This map unit makes up about 3 percent of the county. It is about 45 percent Tracy soils and 35 percent Hanna soils. The rest is soils of minor extent.

The nearly level to moderately sloping, well drained Tracy soils are in the higher lying positions. They have a surface layer of very dark brown sandy loam, a subsurface layer of brown sandy loam, and a subsoil of dark brown and brown sandy loam and shaly sandy clay loam and shaly loamy sand.

The nearly level to gently sloping, moderately well drained Hanna soils are on slightly lower lying, flat areas. They have a surface layer of dark grayish brown sandy loam; a subsurface layer of yellowish brown loam; and a subsoil of yellowish brown, mottled sandy clay loam, sandy loam, and loamy sand.

Of minor extent are the somewhat poorly drained Bourbon soils on lower lying, flat areas and the well drained Tyner soils on higher lying, flat areas.

Most of the acreage of this unit has been cleared and is used for cultivated crops. A few areas are used for residential developments.

These soils are well suited to cultivated crops. Slope and the hazard of erosion are the main limitations.

These soils are suited to trees. There are few limitations for use of equipment or harvesting.

This unit is poorly suited to sanitary facilities and building site developments. Wetness and the possibility of pollution of ground water by effluent from waste disposal facilities are the main limitations.

9. Riddles-Tracy

Nearly level to strongly sloping, well drained silty and loamy soils; on outwash plains, till plains, and moraines

This map unit consists of high knolls or ridges that are nearly level or gently sloping on the top and moderately sloping or strongly sloping on the side slopes. Most areas of this unit are drained by small streams. Slope ranges from 0 to 18 percent.

This map unit makes up about 13 percent of the county. It is about 46 percent Riddles soils and 28 percent Tracy soils. The rest is soils of minor extent.

Riddles soils are on high lying positions and on side slopes. They have a surface layer of dark grayish brown or brown loam or silt loam and a subsoil of dark yellowish brown, yellowish brown, or brown loam, clay loam, sandy clay loam, or gravelly sandy clay loam.

Tracy soils are on similar high lying positions and on side slopes. They have a surface layer of very dark brown sandy loam, a subsurface layer of brown sandy loam, and a subsoil of brown sandy loam and shaly sandy clay loam and shaly loamy sand.

Of minor extent are the well drained and moderately well drained Morley and Rawson soils on positions that are similar to the Riddles and Tracy soils and the somewhat poorly drained Blount and Haskins soils in slightly lower lying, nearly level or slightly convex positions.

Most of the acreage of this unit has been cleared and is used for cultivated crops. Most of the cleared areas are on nearly level to moderately sloping positions. A few moderately sloping and strongly sloping areas have been cleared and are used for orchards, permanent pasture, or dwellings. The uncleared acreage consists of rough, steeper areas and are generally in mixed hardwoods.

These soils are suited to cultivated crops on the nearly level to moderately sloping areas. Slope and the hazard of erosion are the main limitations. The steeper slopes are suited to orchards and to permanent pasture.

These soils are suited to trees. However, the steepness of the slopes restricts the use of logging equipment, and erosion is a hazard along logging roads and skid trails.

This unit is suited to sanitary facilities and building site developments. Slope is the main limitation. Erosion needs to be controlled during and after construction.

Areas dominated by nearly level to steep, well drained to very poorly drained soils on uplands and in upland depressions

These areas are on nearly level to steep till plains and moraines.

These areas make up about 33 percent of the county. Some areas are used for cultivated crops, and other areas are used for woodland. These areas have poor potential for urban uses.

10. Morley-Blount-Pewamo

Nearly level to steep, well drained to very poorly drained silty soils; on till plains and moraines

This map unit is on till plains and moraines that are characterized by swells and swales in some areas and by knolls and side slopes along streams in other areas. Slope ranges from 0 to 35 percent.

This map unit makes up about 26 percent of the county. It is about 36 percent Morley soils, 18 percent Blount soils, and 10 percent Pewamo soils. The rest is soils of minor extent.

The well drained and moderately well drained Morley soils are on the higher swells, the knolls, and the side slopes along streams. They have a surface layer of dark grayish brown silt loam and a subsoil of yellowish brown silty clay loam.

The somewhat poorly drained Blount soils are on the convex, broad flats. They have a surface layer of dark grayish brown silt loam and a subsoil of grayish brown and yellowish brown, mottled silty clay loam.

The very poorly drained Pewamo soils are in the depressional areas in swales and along poorly defined drainageways. They have a surface layer of very dark brown silty clay loam and a subsoil of dark gray, olive gray, and gray, mottled silty clay loam.

Of minor extent are the somewhat poorly drained Elliott and Haskins soils on broad flats and slightly higher rises and the well drained and moderately well drained Rawson soils and the well drained Riddles soils on knolls and side slopes. Also included are the moderately well drained and well drained Markham soils on small knolls and the somewhat poorly drained Fluvaquents soils in narrow areas along small streams.

About 60 percent of the acreage of this unit has been cleared. Most of the cleared areas on the higher swells and knolls are used for residential subdivisions. Corn and soybeans are grown on the lower swells and knolls and convex, broad flats and in the depressional areas. Most of the lower areas have been drained. The uncleared acreage consists of strongly sloping to steep areas and are generally in mixed hardwoods.

The nearly level to moderately sloping soils are mostly cleared and drained. They are suited to cultivated crops. Slope, the hazard of erosion, and wetness are the main limitations.

The soils in this unit are suited to trees. However, the steeper slopes restrict the use of logging equipment, and erosion is a hazard along logging roads.

This unit is poorly suited to sanitary facilities and building site developments. Slow or moderately slow permeability is the main limitation. Other limitations are slope, and wetness and ponding in the flatter areas.

11. Elliott-Markham-Pewamo

Nearly level and gently sloping, well drained to very poorly drained silty soils; on till plains and moraines

This map unit consists of nearly level to gently sloping till plains and moraines that are characterized by swales and swells in some places and gently sloping areas near drainageways in other places. Slope ranges from 0 to 6 percent.

This map unit makes up about 7 percent of the county. It is about 40 percent Elliott soils, 16 percent Markham soils, and 12 percent Pewamo soils. The rest is soils of minor extent.

The somewhat poorly drained Elliott soils are on higher lying, slightly convex, broad flats. They have a surface layer of black silt loam, a subsurface layer of very dark grayish brown silt loam, and a subsoil of yellowish brown and light brownish gray, mottled silty clay loam.

The well drained and moderately well drained Markham soils are on knolls and side slopes along streams. They have a surface layer of black silt loam, a subsurface layer of dark grayish brown silt loam, and a subsoil of yellowish brown and brown, mottled silty clay loam.

The very poorly drained Pewamo soils are in the depressional areas in swales and along poorly defined drainageways. They have a surface layer of very dark brown silty clay loam and a subsoil of dark gray, olive gray, and gray, mottled silty clay loam.

Of minor extent are the somewhat poorly drained Blount and Haskins soils on broad flats and slightly higher lying rises and the well drained and moderately well drained Morley and Rawson soils on eroded knolls and side slopes.

Most of the acreage of this unit has been cleared. Most areas are used for cultivated crops. Some of the higher lying swells and knolls are used for residential subdivisions. Most of the lower lying areas have been drained.

If these soils are adequately drained, they are suited to cultivated crops. Wetness and the hazard of erosion are the main limitations.

The soils in this unit are suited to trees. Water-tolerant trees should be considered in planting. Wetness restricts harvesting to dry seasons or to periods when the ground is frozen.

This unit is poorly suited to sanitary facilities and building site developments. Slow or moderately slow permeability is the main limitation. Wetness is a limitation in the flatter, lower lying areas.

Areas dominated by nearly level, somewhat poorly drained and poorly drained soils on uplands and in upland depressions

These areas are on nearly level lake plains and outwash plains in the northern part of the county.

These areas make up about 11 percent of the county. They are used mainly for cultivated crops. These areas have poor potential for most urban uses.

12. Whitaker-Milford-Del Rey

Nearly level, somewhat poorly drained and poorly drained loamy and silty soils; on lake plains, terraces, and outwash plains

This map unit consists of nearly level plains that are characterized by barely discernible swales and swells. Most areas are drained by ditches. Slope ranges from 0 to 2 percent.

This map unit makes up about 11 percent of the county. It is about 30 percent Whitaker soils, 20 percent Milford soils, and 18 percent Del Rey soils. The rest is soils of minor extent.

The somewhat poorly drained Whitaker soils are on higher lying, broad flats and slight rises in the landscape. They have a surface layer of dark grayish brown loam and a subsoil of yellowish brown and light brownish gray, mottled clay loam, loam, and sandy loam. These soils cannot always be differentiated by visual means.

The poorly drained Milford soils are in broad depressional areas. They have a surface layer of black silty clay loam and a subsoil of dark gray, olive gray, and gray, mottled silty clay loam.

The somewhat poorly drained Del Rey soils are on higher lying, broad flats and slight rises that are similar to the Whitaker soils. They have a surface layer of dark grayish brown silt loam and a subsoil of brown, grayish brown, olive gray, and gray, mottled silty clay loam. These soils cannot always be differentiated by visual means.

Of minor extent are the well drained Martinsville soils on higher lying, nearly level or gently sloping areas and the very poorly drained Sebewa and Warners soils in depressional areas near the Milford soils. Also included are the somewhat poorly drained Selfridge soils on slight rises and the somewhat poorly drained Blount soils on the higher lying flats near the edge of the map unit.

Most of the acreage of this unit has been cleared. Most areas are used for cultivated crops. A few areas are used for woodland or permanent pasture. The uncleared acreage is made up of wet areas that are difficult to drain.

If these soils are adequately drained, they are suited to cultivated crops. Wetness is the main limitation.

The soils in this unit are suited to trees. Water-tolerant trees should be considered in planting. Wetness restricts harvesting to dry seasons or to periods when the ground is frozen.

This unit is poorly suited to sanitary facilities and building site developments. Wetness is the main limitation.

broad land use considerations

Deciding which land should be used for urban development is an important issue in the survey area. Each year a considerable amount of land is developed for urban use in Center, Jackson, Liberty, Morgan, Pine, Portage, Porter, Union, Washington, and Westchester townships. About 35,000 acres, or nearly 13 percent of the survey area, is urban or built-up land (*3*). The general soil map is most helpful for planning the general outline of urban areas; it cannot be used for the selection of sites for specific urban structures. The data about specific soils in this survey area can be helpful in planning future land use patterns.

Areas where the soils are so unfavorable that urban development is not desirable or nearly prohibitive are extensive in the survey area. The Suman-Fluvaquents map unit is on flood plains, and the hazard of erosion is severe. An extensive drainage system is required on wet soils in the Gilford-Maumee-Morocco map unit, the Bourbon-Gilford-Pinhook map unit, the Sebewa-Alida-Pinhook map unit, the Morley-Blount-Pewamo map unit, the Elliott-Markham-Pewamo map unit, the Whitaker-Milford-Del Rey map unit, and the Houghton-Adrian-Palms map unit. The Houghton-Adrian-Palms map unit has severe limitations because the soils consist of organic material. In addition, the steeper areas of Oakville soils in the Oakville-Maumee-Brems map unit, the steeper areas of Morley soils in the Morley-Blount-Pewamo map unit, and the steeper areas of Riddles and Tracy soils in the Riddles-Tracy map unit have severe limitations for urban development.

In contrast, the Door-Lydick map unit and the Tracy-Hanna map unit have many sites that can be developed for urban uses. Door, Lydick, and Tracy soils are well suited to urban development. Door and Lydick soils are also excellent farmland, but Hanna soils have moderate drainage limitations for both urban and agricultural uses.

Some units on the general soil map have good potential for cultivated crops but fair or poor potential for urban uses. These soils are severely limited for urban uses because of wetness. Slow or moderately slow permeability is a severe limitation for some soils, but if proper subsurface and surface drainage are provided, this limitation can be overcome. These soils have good potential for cultivated crops, because many farmers have provided sufficient drainage for crops.

Most of the soils of Porter County have good or fair potential for woodland. Commercially valuable trees are most common and generally grow more rapidly on the well drained soils of the Tracy-Hanna, Door-Lydick, and Riddles-Tracy map units than on other, wetter soils.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Morley silt loam, 6 to 12 percent slopes, eroded, is one of several phases in the Morley series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Urban land-Morley complex, 2 to 6 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. These dissimilar soils are described in each map unit. In addition, some of the more unusual or strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes some *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Some miscellaneous areas are large enough to be delineated on the soil maps. Some that are too small to be delineated are identified by a special symbol on the soil maps.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Ad—Adrian muck, drained. This nearly level or depressional, deep, very poorly drained soil is in old lake basins on outwash plains and along some of the established ditches. It is frequently ponded with surface runoff from adjacent higher lying soils. Areas are irregular in shape. They range from 5 to 100 acres but are dominantly about 25 acres.

In a typical profile, the surface layer is black muck about 18 inches thick. The underlying organic material is very dark gray muck about 12 inches thick. The substratum to a depth of 60 inches is very dark gray loamy sand and gray sand. In some small areas the organic surface layer is less than 16 inches thick. In other areas, loamy mineral material underlies the organic layer; the substratum is made up of alternating bands of sand and organic material; or coprogenous earth overlies the sand. Some areas are not drained.

Included with this soil in mapping are areas of Houghton muck. The included soil makes up about 8 percent of the unit.

This Adrian muck soil has very high available water capacity. Permeability is moderately slow to moderately rapid in the organic material and rapid in the substratum. The organic matter content of the surface layer is very high. Surface runoff is very slow or ponded. The surface layer is generally neutral. This soil has a seasonal high water table that is at the surface or ponded during much of the year. In nearly all areas of this soil, some method of drainage has been established. The surface layer is friable and is in good tilth.

Most of the acreage of this soil is farmed. Most areas are used for corn. Other areas are used for soybeans and pasture.

This soil is suited to corn, soybeans, and specialty crops if it is adequately drained. Wetness and the hazard of wind erosion are major limitations in use and management. Row crops can be grown most of the time. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage and the use of crop residue and cover crops help to control wind erosion and maintain tilth and content of organic matter.

This soil is suited to grasses for hay or pasture if adequate drainage is provided. If this soil is used for pasture, the major concern of management is overgrazing. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is not suited to trees for the production of timber. The water table at or near the surface is the main limitation. Undrained areas are in water-tolerant shrubs and trees.

This soil has severe limitations for building sites because of ponding and the instability of the organic material. The ponding condition after heavy rainfall is difficult to overcome. These soils are in the lowest part of the landscape and receive runoff from adjacent slopes. Pumping is needed for most drainage systems because adequate outlets are not available. Foundations and footings need to be placed on piling for stability of structures. This soil has severe limitations for local roads and streets because of ponding, frost action, and low strength. The organic material should be removed and suitable base material used as fill to strengthen the base. Lowering the water table by the use of ditches and possibly by pumping the ditches helps to reduce the frost action potential. This soil generally is not suitable for septic tank absorption fields because of ponding and the poor filtering qualities of the soil.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

Ag—Alida loam. This nearly level, deep, somewhat poorly drained soil is on broad flats of outwash plains. Areas are broad and irregular in shape. They range from 15 to 200 acres but are dominantly about 40 acres.

In a typical profile, the surface layer is very dark brown loam about 8 inches thick. The subsoil is about 47 inches thick. The upper part is brown and yellowish brown, mottled firm loam and clay loam; the middle part is pale brown and yellowish brown, mottled, friable sandy clay loam and yellowish brown, mottled friable sandy loam; and the lower part is gray shaly clay loam. The substratum is dark grayish brown, mottled, stratified shaly sandy clay loam and sand to a depth of 60 inches. In places the surface layer is fine sandy loam.

Included with this soil in mapping are a few small, slightly higher lying areas of moderately well drained Hanna soils and a few small, lower lying areas of poorly drained Pinhook soils. The included soils make up about 8 to 10 percent of the unit.

This Alida soil has moderate available water capacity. Permeability is moderate in the subsoil and rapid in the substratum. The organic matter content of the surface layer is high. Surface runoff is slow. The surface layer is generally strongly acid unless limed. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during the winter and spring. The surface layer is friable and is easily tilled through a wide range of moisture content.

Most of the acreage of this soil is farmed. Most areas are used for corn, soybeans, and small grain. Some areas are used for hay and pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Wetness and moderate available water capacity are the major limitations in use and management. If this soil is overdrained, it becomes droughty during dry periods. If it is adequately drained, a conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain tilth and content of organic matter.

This soil is well suited to grasses and legumes for hay or pasture if adequate drainage is provided. Deep rooted legumes such as alfalfa are not so well suited because of the high water table. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management.

Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for woodland. Plant competition is a moderate hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening of the base material with sand and gravel or resurfacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness. The water table can be lowered by the use of an adequate drainage system.

This soil is in capability subclass IIs and woodland suitability subclass 1o.

BaA—Blount silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on glacial till plains in the uplands. Areas are irregularly shaped. They range from 3 to 60 acres but are dominantly about 20 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 11 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown and grayish brown, mottled, firm silty clay loam and mottled, yellowish brown, gray, and light brownish gray, firm silty clay loam. The substratum is light olive brown silty clay loam to a depth of 60 inches. In places the combined surface layer and subsoil is more than 42 inches thick. In some areas there is less clay in the upper part of the profile than is typical.

Included with this soil in mapping are small areas of Pewamo soils in slight depressions and along drainageways and a few small, slightly elevated areas of Morley soils. The included soils make up about 10 to 12 percent of the unit.

This Blount soil has moderate available water capacity and slow or moderately slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow to medium. The surface layer is generally strongly acid unless limed. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is friable and is easily tilled through a moderate range of moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for trees.

This soil is suited to corn, soybeans, and small grain. Wetness is the main limitation in use and management. Row crops can be grown most of the time. This soil should not be worked when wet because of puddling. Subsurface drainage, conservation tillage, and the use of crop residue and cover crops help to improve and maintain tilth and content of organic matter.

This soil is well suited to grasses and legumes for hay or pasture if adequate drainage is provided. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for woodland. Seedling mortality and windthrow are severe hazards. Replanting of some seedlings may be needed. Seedlings survive and grow fairly well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Water moves slowly to drainage systems because of the slow or moderately slow permeability. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of frost action and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness and the slow absorption of liquid waste.

This soil is in capability subclass IIw and woodland suitability subclass 3c.

Br—Bourbon sandy loam. This nearly level, deep, somewhat poorly drained soil is on outwash plains. Areas are oblong or elongated. They range from 3 to 1,000 acres but are dominantly about 35 acres.

In a typical profile, the surface layer is very dark brown sandy loam about 9 inches thick. The subsurface layer is brown, mottled sandy loam about 3 inches thick. The subsoil is about 53 inches thick. The upper part is brown, mottled, friable loam; the middle part is yellowish brown, mottled, friable loamy sand; and the lower part is stratified, pale brown, loose sand and yellowish brown and brown, loose shaly sand. The substratum is dark gray, stratified sand and loamy sand to a depth of 70 inches. Small areas of soils have more clay in the upper part of the profile than is typical. Other areas have a thicker, dark surface layer.

Included with this soil in mapping are small areas of Gilford, Hanna, Pinhook, and Tracy soils. The included soils make up about 12 to 15 percent of the unit.

This Bourbon soil has moderate available water capacity and moderately rapid permeability. The organic matter content of the surface layer is high. Surface runoff is slow. The surface layer is strongly acid in unlimed areas. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is friable and is easily tilled.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Wetness is the major limitation in use and management. Wind erosion is a hazard during dry periods. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain tilth and content of organic matter and to control wind erosion.

This soil is well suited to grasses and legumes for hay or pasture if adequate drainage is provided. Adequate drainage also helps to control wind erosion. Deep rooted legumes such as alfalfa are poorly suited to this soil because of the high water table. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness and contributes to wind erosion. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet and very dry periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for woodland. Plant competition is a moderate hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of the frost action potential. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of wetness. Sanitary facilities should be connected to commercial sewers and treatment facilities. If facilities are not available, the water table can be lowered by the use of an adequate subsurface drainage system in combination with storm sewers.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

BtA—Brems sand, 0 to 3 percent slopes. This nearly level and gently sloping, deep, moderately well drained soil is on acid, outwash sands. Areas are oblong or elongated and range from 3 to 40 acres.

In a typical profile, the surface layer is very dark grayish brown sand about 12 inches thick. The subsoil is about 51 inches thick. The upper part is yellowish brown, very friable sand; the middle part is mottled, light yellowish brown and strong brown, loose sand; the lower part is dark brown and yellowish brown, mottled loamy sand and sand. The underlying material is gray and pale brown, mottled sand to a depth of 67 inches. In some areas the combined surface layer and subsoil is less than 35 inches thick.

Included with this soil in mapping are small areas of Bourbon and Hanna soils. Also included are slightly higher lying areas of Tyner soils and small, slightly lower lying areas of Morocco soils. The included soils make up about 3 to 12 percent of the unit.

This Brems soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is low. Surface runoff is slow. The surface layer is generally strongly acid unless limed. This soil has a seasonal high water table at a depth of 2 to 3 feet during winter and spring. The surface layer is very friable and is in good tilth.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for woodland. Christmas trees are grown in some areas.

This soil is suited to corn, soybeans, and small grain. Droughtiness and the hazard of wind erosion are the main limitations in use and management. Conservation tillage and the use of crop residue and cover crops help to improve and maintain tilth and content of organic matter.

This soil is suited to deep rooted legumes and drought-tolerant grasses for hay or pasture. These crops help to control wind erosion. Shallow rooted legumes such as clover are poorly suited because of the low available water capacity. If this soil is used for pasture, overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, and timely deferment of grazing during dry periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Seedling mortality is a severe hazard, and replanting of some seedlings may be needed. Seedlings survive and grow fairly well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings without basements and severe limitations for dwellings with basements because of wetness. Dwellings should be constructed without basements.

This soil has moderate limitations for local roads and streets because of wetness.

Limitations are severe for septic tank absorption fields because of wetness and the poor filtering qualities of the soil. The pollution of nearby shallow wells is a possibility.

This soil is in capability subclass IVs and woodland suitability subclass 3s.

ChB—Chelsea fine sand, 2 to 6 percent slopes. This gently sloping, deep, excessively drained soil is on sandy outwash plains and uplands. It is generally on convex summits, side slopes, and crests along the eastern side of the stream valley. Areas are oblong or elongated and range from 5 to 30 acres.

In a typical profile the surface layer is brown fine sand about 10 inches thick. The subsurface layer is light yellowish brown fine sand 26 inches thick. The subsoil to a depth of 80 inches is light yellowish brown fine sand that has bands of dark yellowish brown, massive, loamy sand 1/4 inch to 1 1/2 inches thick. In places these bands are brown. In some soils the sand is coarser and the bands are absent, and in other soils the bands are more than 6 inches thick above a depth of 60 inches.

Included with this soil in mapping are small areas of Tracy and Metea soils and small areas of Brems soils in slightly lower lying positions than Chelsea soil. Also included are areas of steeper soils and areas of nearly level soils. The included soils make up about 5 to 12 percent of the unit.

This Chelsea soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is low. Surface runoff is slow. The surface layer is generally medium acid to strongly acid unless limed. It is very friable and is easily tilled.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Droughtiness and a moderate hazard of wind erosion are major limitations in use and management. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to control wind erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to deep rooted grasses and legumes for hay or pasture. Shallow rooted legumes such as clover are not so well suited because of the low available water capacity. If this soil is used for pasture, overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is suited to trees. Seedling mortality is a moderate hazard, and replanting of some seedlings may be needed. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for dwellings with and without basements. Some earth moving is required for construction.

This soil has slight limitations for local roads and streets.

Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. Pollution of ground water supplies is a possibility.

This soil is in capability subclass IVs and woodland suitability subclass 3s.

ChC—Chelsea fine sand, 6 to 12 percent slopes. This moderately sloping, deep, excessively drained soil is on sandy outwash plains and uplands. It is mostly on single, irregularly shaped ridges and knolls. Areas are generally elongated and range from 3 to 20 acres.

In a typical profile, the surface layer is dark brown fine sand about 10 inches thick. The subsurface layer is dark yellowish brown and yellowish brown, loose fine sand 28 inches thick. The underlying material to a depth of 80 inches is yellowish brown, loose fine sand that has bands of dark brown sandy loam 1/2 inch to 1 1/2 inches thick. These bands have a combined thickness of 5 inches. In places the bands are dark yellowish brown or brown. In some areas the sand is coarser and the bands are absent, and in other areas the bands are more than 6 inches thick above a depth of 60 inches. In some areas the surface layer is yellowish brown.

Included with this soil in mapping are small areas of well drained Tracy and Metea soils. Also included are areas of soils that are steeper than Chelsea soil and areas of gently sloping soils. The included soils make up about 8 to 10 percent of the unit.

This Chelsea soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is low. Surface runoff is medium. The surface layer is generally medium acid to strongly acid unless limed. It is very friable and is easily tilled.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for woodland.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness and the hazard of erosion due to the moderate slopes are major limitations that effect use and management. Conservation tillage and the use of crop residue and cover crops help to control erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to deep rooted grasses and legumes for hay or pasture. Shallow rooted legumes such as clover are not so well suited because of the low available water capacity. If this soil is used for pasture, overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is suited to trees. Seedling mortality is a moderate hazard, and replanting of some seedlings may be needed. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements because of slope. Some earth moving is required for the construction of dwellings.

This soil has moderate limitations for local roads and streets because of slope. Placing roads on the contour helps to overcome this limitation.

Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. The number of lines can be reduced and then lengthened to obtain the desired size of field, or some lines can be placed at a greater depth than others so that all lines receive equal flow. Pollution of ground water supplies is a possibility.

This soil is in capability subclass VIs and woodland suitability subclass 3s.

De—Del Rey silt loam. This nearly level, deep, somewhat poorly drained soil is on lake plains. Areas are rounded or oblong. They range from 3 to 400 acres but are dominantly about 50 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 23 inches thick. The upper part is brown, mottled, very firm silty clay loam; the middle part is grayish brown, mottled, very firm silty clay loam; and the lower part is olive gray and gray, mottled, firm silty clay loam. The substratum is light olive brown, mottled silty clay loam to a depth of 60 inches. In some places the surface layer is silty clay loam, and in other places the subhorizons are stratified.

Included with this soil in mapping are a few small areas of Milford soils in slight depressions and along narrow drainageways. The included soil makes up about 8 percent of the unit.

This Del Rey soil has moderate available water capacity and slow permeability. The organic matter content is moderate. Surface runoff is slow. The surface layer is slightly acid to neutral. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is friable, but tillage is limited to periods when the water table is low.

Much of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for woodland.

If this soil is adequately drained, it is well suited to corn, soybeans, and small grain. Wetness is the main limitation that affects use and management. Excessive water can be removed by open ditches, subsurface drains, surface drains, or pumping; or by a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. The soil should not be worked when wet because of puddling. Conservation tillage and the use of crop residue and cover crops help to improve and maintain tilth and content of organic matter.

This soil is well suited to grasses and legumes for hay or pasture if adequate drainage is provided. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for woodland. Seedling mortality and windthrow are severe hazards. Replanting of some seedlings may be needed to maintain density of stands. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Water moves slowly to drainage systems because of slow permeability. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of frost action and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for sanitary facilities because of wetness and slow permeability.

This soil is in capability subclass IIw and woodland suitability subclass 3c.

DoA—Door loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on outwash plains. Areas are irregular in shape. They range from 3 to 50 acres but are dominantly about 25 acres.

In a typical profile, the upper part of the surface layer is black loam about 8 inches thick and the lower part is very dark brown, friable loam about 5 inches thick. The subsurface layer is very dark grayish brown, friable loam about 4 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is brown, friable loam or sandy clay loam; the middle part is yellowish brown, friable sandy loam and brown and grayish brown, friable, shaly sandy clay loam; and the lower part is strong brown and dark brown, firm shaly loam. In some areas the depth to sandy material is less than 36 inches. In other areas there is more sand throughout the profile.

Included with this soil in mapping are small areas of soils in small potholes which have a dark surface layer at least 24 inches thick and small areas of gently sloping soils around larger potholes. Also included are small areas of Tracy soils and small areas of Alida loam in narrow drainageways. The included soils make up about 10 percent of the unit.

This Door soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow to medium. The surface layer is generally very strongly acid unless limed. It is friable and is in good tilth.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and a very few areas are used for woodland.

This soil is well suited to corn, soybeans, and small grain. It is suited to intensive row cropping. Conservation tillage and the use of crop residue and cover crops help to improve and maintain tilth and content of organic matter.

This soil is well suited to grasses and legumes for hay or pasture if it is adequately limed. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is not rated for timber production because trees are not native to the mapped area. Where trees are planted, they are used for windbreaks.

This soil has moderate limitations for building sites because of the shrink-swell potential. Foundations and footings should be designed to prevent structural damage resulting from shrinking and swelling.

This soil has moderate limitations for local roads and streets because of the frost action potential and shrinking and swelling of the soil. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are slight for septic tank absorption fields.

This soil is in capability class I. It is not assigned to a woodland suitability subclass.

Du—Dune land. This steep and very steep, deep, excessively drained map unit is on low sand dunes and beach ridges. These areas are elongated and continue in an almost unbroken line along the shore of Lake Michigan.

Included in mapping are narrow bands of lake beach. Also included are small areas of stabilized sand dunes and areas on which dwellings have been built.

This unit has poor potential for all uses because of the slopes and instability of the sand. Attempts have been made to stabilize some areas with beach grasses, but the low available water capacity and continuous shifting of the sands make it difficult for plants to grow. The sands move with the winds and shift continuously. The slopes and loose sand hinder the use of equipment.

Dune land is not placed in a capability subclass.

Ed—Edwards muck, drained. This nearly level, deep, very poorly drained soil is in depressional areas within the outwash plains, till plains, and moraines. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas are irregular in shape and range from 3 to 40 acres.

In a typical profile, the surface layer is black muck about 10 inches thick. The underlying organic material is 12 inches thick. The upper part is black muck, and the lower part is dark reddish brown muck. The substratum is light gray and gray marl to a depth of 60 inches. In some small areas the muck is less than 16 inches thick, and in other areas the underlying material is mineral or sand.

Included with this soil in mapping are small areas of Houghton muck and areas where the organic material is very strongly acid to medium acid. The included soils make up about 5 to 8 percent of the unit.

This Edwards muck has very high available water capacity. Permeability is moderately slow to moderately rapid in the organic material and variable in the marl. The organic matter content of the surface layer is very high. Surface runoff is very slow. The surface layer is slightly acid to neutral. This soil has a seasonal high water table that is at the surface or ponded during a considerable part of the year. Nearly all areas of this soil have some kind of drainage system installed. The surface layer is neutral and friable and is in good tilth.

Most of the acreage of this soil is used for cultivated crops.

This soil is suited to corn, soybeans, and specialty crops if it is adequately drained. Wetness and the hazard of wind erosion are major limitations in use and management. Row crops can be grown most of the time. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage and the use of crop residue and cover crops help to maintain content of organic matter and good tilth and reduce the hazard of wind erosion.

This soil is suited to grasses for hay or pasture if adequate drainage is provided. If this soil is used for pasture, overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is not suited to trees for the production of timber. The water table at or near the surface is the main limitation. Water-tolerant shrubs and trees grow in the undrained areas.

This soil has severe limitations for building sites because of ponding and low strength. It is difficult to overcome the ponding that occurs after heavy rainfall. These areas are in the lowest part of the landscape and receive runoff from adjacent slopes. Pumping is needed for most drainage systems because adequate outlets are not available. Foundations and footings need to be placed on piling for stability of structures.

This soil has severe limitations for local roads and streets because of ponding, frost action, and low strength. The organic material should be removed and suitable base material used as fill to strengthen the base. Lowering the water table by the use of ditches and possibly by pumping the ditches helps to reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of ponding and slow or very slow permeability. The soil is generally not suitable for this use.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

ElA—Elliott silt loam, 0 to 3 percent slopes. This nearly level and gently sloping, deep, somewhat poorly drained soil is on glacial till plains in the uplands. Areas are irregularly shaped. They range from 5 to 80 acres but are dominantly about 25 acres.

In a typical profile, the surface layer is black silt loam about 10 inches thick. The subsurface layer is very dark grayish brown silt loam about 3 inches thick. The subsoil is about 23 inches. The upper part is yellowish brown, mottled, firm silty clay loam; and the lower part is mottled, light brownish gray and yellowish brown, firm silty clay loam. The substratum is yellowish brown, mottled silty clay loam to a depth of 60 inches. In places the combined surface layer and subsoil is more than 45 inches thick. In other places the surface layer is lighter colored.

Included with this soil in mapping are small areas of Pewamo soils in slight depressions and along drainageways. Also included are a few small, slightly elevated areas of Markham soils. The included soils make up about 8 to 10 percent of the unit.

This Elliot soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is high. Surface runoff is medium. The surface layer is generally medium acid unless limed. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is friable, but tillage is limited to periods when the water table is low.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture.

This soil is suited to corn, soybeans, and small grain. Wetness is the main limitation in use and management. If adequate drainage is provided, a cropping system that includes row crops most of the time can be used. This soil should not be worked when wet because of puddling. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture if adequate drainage is provided. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is not rated for the production of timber because trees are not native to the mapped area. If trees are planted, they are used as windbreaks.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Water moves slowly to drainage systems because of the moderately slow permeability. Dwellings should be constructed without basements. This soil has severe limitations for local roads and streets because of frost action and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic. Limitations are severe for septic tank absorption fields because of wetness and moderately slow permeability.

This soil is in capability subclass IIw. It is not assigned to a woodland suitability subclass.

EsA—Elston loam, 0 to 3 percent slopes. This nearly level to gently sloping, deep, well drained soil is on outwash plains. Areas are large and irregular in shape. They range from 5 to 150 acres but are dominantly about 100 acres.

In a typical profile, the surface layer is 18 inches thick. The upper 14 inches is loam, and the lower 4 inches is very dark grayish brown loam. The subsoil is about 36 inches thick. The upper part is brown, friable loam; the middle part is dark yellowish brown, friable loamy sand and brown, friable sandy clay loam; and the lower part is yellowish brown, friable sandy loam. The underlying material is brown sand to a depth of 60 inches. The solum is very strongly acid in some areas.

Included with this soil in mapping are small areas of Bourbon and Tracy soils. The included soils make up about 8 percent of the unit.

This Elston soil has moderate available water capacity and moderately rapid permeability. The organic matter content of the surface layer is high. Surface runoff is slow. The surface layer is generally medium acid to strongly acid unless limed. It is friable and is in good tilth.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture.

This soil is suited to corn, soybeans, and small grain. Droughtiness is the major limitation in use and management. Conservation tillage and the use of crop residue and cover crops help to maintain and improve the content of organic matter and maintain tilth.

This soil is suited to grasses and legumes for hay or pasture. Deep rooted legumes and drought-tolerant grasses are best suited to this soil. If this soil is used for pasture, overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, and timely deferment of grazing during dry periods help to keep the pasture and soil in good condition.

This soil is not rated for the production of timber because trees are not native to these soils. If trees are planted, they are used as windbreaks.

This soil has slight limitations for building sites and for local roads and streets. Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. The pollution of nearby shallow wells is a possibility.

This soil is in capability subclass IIs. It is not assigned to a woodland suitability subclass.

Fh—Fluvaquents. These deep, nearly level, somewhat poorly drained soils are on bottom lands. There are generally short steep slopes between these soils and the adjacent upland soils along Salt Creek. These soils are frequently flooded for short periods of time. Areas are irregular in shape. They range from 5 to 100 acres but are dominantly about 25 acres.

No one pedon is typical of Fluvaquents but in one of the more common the surface layer is dark gray or dark grayish brown loam, silt loam, sandy loam, or loamy sand. The underlying material has gray mottles and is characterized by strata of brownish yellow, dark grayish brown, and grayish brown loam, sandy loam, loamy sand, sand, and sandy clay loam.

Included with these soils in mapping are small areas of Adrian, Milford, Palms, Suman, and Whitaker soils. Also included are areas of sandy soils and areas of soils that do not have gray mottles in the upper 18 inches of the profile. The included soils make up as much as 20 percent of this map unit.

Fluvaquents have moderate available water capacity and permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer ranges from medium acid to neutral. These soils have a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is friable and is easily tilled.

Most of the acreage of these soils is in forest or pasture. Some areas are used for corn, soybeans, and small grain. Other areas are used for hay and pasture.

Fluvaquents are poorly suited to corn, soybeans, and small grain. Wetness and the hazard of flooding are limitations in use and management. If these soils are adequately drained and protected from flooding, a conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of these soils.

These soils are suited to grasses and legumes for hay or pasture. If the soils are adequately drained and protected from flooding, yields can be greatly increased. If the soils are used for pasture, overgrazing and grazing when they are wet are the major concerns of management. Grazing when the soils are wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soils in good condition.

Fluvaquents are suited to trees, and many areas are used for woodland. The use of equipment is restricted because of the seasonal high water table and flooding. Plant competition is a hazard, but seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling. Harvesting of timber and replanting of seedlings are commonly restricted to drier seasons of the year.

These soils have severe limitations for building sites because of flooding and wetness. They are not suitable for building sites. The flooding conditions are difficult to overcome because the flooding is caused by rising water from streams.

Fluvaquents have severe limitations for local roads and streets because of flooding and the frost action potential. Drainage ditches along roads help to lower the water table, remove flood waters, and reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of flooding and wetness. These soils are not suitable for septic tank absorption fields.

These soils are not assigned to a capability subclass or woodland suitability subclass.

Gf—Gilford sandy loam. This nearly level, deep, very poorly drained soil is on broad, glacial outwash plains. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas are large and irregular in shape. They range from 15 to 680 acres but are dominantly about 200 acres.

In a typical profile, the surface layer is very dark brown sandy loam about 12 inches thick. The subsurface layer is very dark gray sandy loam about 7 inches thick. The subsoil is about 18 inches thick. The upper part is dark gray, mottled, friable sandy loam and the lower part is dark grayish brown, mottled, very friable loamy sand. The underlying material is pale brown and yellowish brown sand to a depth of 49 inches and gray sand to a depth of 60 inches. In some areas the surface layer is sandy clay loam more than 10 inches thick, and in other areas the surface layer is mucky fine sandy loam. Some areas are strongly acid, and other areas have high concentrations of iron concretions.

Included with this soil in mapping are small areas of Pinhook soils and small, slightly elevated areas of Bourbon soils. The included soils make up about 5 to 12 percent of the unit.

This Gilford soil has moderate available water capacity. Permeability is moderately rapid in the subsoil and rapid in the substratum. The organic matter content of the surface layer is moderate. Surface runoff from cultivated areas is very slow, or it is ponded. The surface layer in most cultivated areas is slightly acid to neutral. This soil has a seasonal high water table that is above or within 1 foot of the surface during a significant part of the year. The surface layer is friable and is in good tilth.

Most of the acreage of this soil is used for cultivated crops. A few areas are used for pasture and woodland.

Most areas have been drained with subsurface drains and open ditches. Wetness is the major limitation in use and management. The adequately drained areas of this soil are well suited to corn, soybeans, and small grain. This soil is suited to intensive row cropping. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of the soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed to obtain high yields of forage or pasture crops. Deep rooted legumes such as alfalfa are poorly suited because of the high water table. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to trees. Only a few areas are used for woodland. The use of equipment is severely restricted. The hazards of plant competition, seedling mortality, and windthrow are severe. Harvesting of trees is generally delayed to extremely dry seasons or to periods when the ground is frozen. Water-tolerant species should be favored in stands. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding. Draining of areas is difficult because the soil is often in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers are commonly not available.

This soil has severe limitations for local roads and streets because of ponding and frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of ponding and the poor filtering qualities of the soil. Seepage of effluent into ground water supplies can cause pollution.

This soil is in capability subclass IIw and woodland suitability subclass 4w.

HaA—Hanna sandy loam, 0 to 3 percent slopes. This nearly level to gently sloping, deep, moderately well drained soil is on outwash plains. Areas are irregular in shape. They range from 5 to 120 acres but are dominantly about 50 acres.

In a typical profile, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsurface layer is yellowish brown, friable loam about 4 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable sandy clay loam and sandy loam; the middle part is mottled, yellowish brown, light gray, light brownish gray, and strong brown sandy loam; and the lower part is light gray and light brownish gray, friable loamy sand. The substratum is pale brown, mottled sand to a depth of 60 inches. The subsoil is sandy loam and loamy sand in some areas.

Included with this soil in mapping are small areas of Bourbon soils, areas of Gilford soils in lower lying positions, and areas of Tracy soils that are slightly elevated. The included soils make up about 12 percent of the unit.

This Hanna soil has moderate available water capacity. Permeability is moderate in the surface layer and subsoil and rapid in the underlying material. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is generally strongly acid in unlimed areas. This soil has a seasonal high water table that is at a depth of 3 to 6 feet during spring. The surface layer is friable and is easily tilled.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. The moderate available water capacity and acidity of the soil are the major limitations in use and management. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to maintain and improve the content of organic matter and tilth of the soil.

This soil is suited to grasses and legumes for hay or pasture if it is adequately limed. If the soil is used for pasture, overgrazing and grazing when the soil is wet are major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is a moderate hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for dwellings without basements. It has moderate limitations for houses with basements because of wetness.

This soil has severe limitations for local roads and streets because of frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of wetness and the poor filtering qualities of the soil. The water table can be lowered by the use of an adequate subsurface drainage system in combination with storm sewers.

This soil is in capability class I and woodland suitability subclass 1o.

HkA—Haskins loam, 0 to 2 percent slopes. This nearly level, deep, somewhat poorly drained soil is on beach ridges, terraces, and plains near lake plains or minor glacial lakes. Areas are irregular in shape. They range from 5 to 80 acres but are dominantly about 25 acres.

In a typical profile, the surface layer is dark grayish brown loam about 9 inches thick. The subsurface layer is grayish brown, mottled loam about 9 inches thick. The subsoil is about 30 inches thick. The upper part is dark yellowish brown, mottled, friable sandy clay loam; the middle part is dark brown, mottled, firm clay loam; and the lower part is brown, mottled, firm silty clay. The underlying material is gray, mottled silty clay to a depth of 55 inches and brown, mottled silty clay loam to a depth of 60 inches. In some areas the lower part of the subsoil is sandy clay loam. In other areas the upper part of the profile has more clay.

Included with this soil in mapping are small, slightly higher lying areas of Riddles and Rawson soils. Also included are small depressional areas of Pewamo soils. The included soils make up about 4 to 10 percent of the unit.

This Haskins soil has high available water capacity. Permeability is moderate in the upper part of the subsoil and slow or very slow in the lower part of the subsoil and in the underlying material. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is medium acid to strongly acid unless limed. This soil has a seasonal high water table that is at a depth of 1 foot to 2.5 feet during winter and spring. The surface layer is friable and is easily tilled.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Wetness is the major limitation in use and management. If adequate drainage is provided, continuous row cropping can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. Drainage is needed to obtain high yields of forage or pasture crops. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for woodland. Plant competition is a moderate hazard. Seasonal wetness can cause a slight delay in harvesting or planting. Water-tolerant species should be favored in stands. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, and girdling.

This soil has severe limitations for building sites because of wetness and the shrink-swell potential. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Water moves slowly to drainage systems because of slow or very slow permeability. Dwellings should be constructed without basements, and foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling of the soil.

This soil has severe limitations for local roads and streets because of frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness and slow or very slow permeability.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

Hm—Houghton muck, ponded. This deep, nearly level and depressional, very poorly drained soil is in very low lying areas on lake plains, outwash plains, till plains, and moraines. It formed in a marshland of aquatic and semi-aquatic vegetation such as cattails, rushes, sedges, water lilies, pondweeds, duckweeds, spatterdock, and water-tolerant trees and shrubs. These areas are generally covered with shallow water for most of the year and in some years they are covered with water all year. Areas are generally small. They range from 3 to 160 acres but are dominantly about 15 acres.

In a typical profile, the surface layer is black muck about 3 inches thick. The underlying muck to a depth of 60 inches is dark brown in the upper part and very dark grayish brown in the lower part.

Included with this soil in mapping are small areas of Adrian, Edwards, and Palms soils. Also included are small areas where mineral material from higher lying surrounding soils has washed over the muck and small areas of soils that are ponded. The included soils make up 10 to 15 percent of the map unit.

Most areas of this Houghton muck soil are used as wildlife habitat. They have good potential as wetland wildlife habitat and poor potential for all other uses. This wetland soil has the potential to produce more than 150 species of animals. It serves as a nursery for numerous aquatic animals. Areas adjacent to streams are spawning places for northern pike. Many ducks, geese, and other birds are dependent upon these protected wetlands for nesting and feeding places. These areas have important economic value. Trapping, fishing, and hunting are profitable enterprises. In places there are fees for hunting, fishing, and trapping privileges. Timber is produced in some areas.

Most areas of this soil serve as ground water recharge. They are valuable as natural flood control mechanisms and aid in water purification by trapping, filtering, and storing sediment and other pollutants and by recycling nutrients. These areas are fragile, and any alteration can cause lasting changes which seriously alter their natural function.

This soil has poor potential for building site development and sanitary facilities because of ponding and moderately slow permeability. The ponding condition is extremely difficult to overcome because the areas are in the lowest lying part of the landscape and receive water from adjacent slopes. Pumping is needed for most drainage systems because adequate outlets are not available.

This soil is in capability subclass VIIIw. It is not assigned to a woodland suitability subclass.

Ho—Houghton muck, drained. This nearly level or depressional, deep, very poorly drained soil is in bogs within lake plains, outwash plains, till plains, and moraines. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas are generally rounded or elongated. They range from 5 to 80 acres but are dominantly about 30 acres.

In a typical profile, the surface layer is black muck about 9 inches thick. The underlying organic material to a depth of 60 inches is dark reddish brown muck in the upper part, black muck in the middle part, and very dark gray muck in the lower part. Thin layers of coprogenous earth occur in some areas.

Included with this soil in mapping are small areas of Adrian, Edwards, Palms, and Wallkill soils. The included soils make up about 8 to 12 percent of the unit.

This Houghton muck soil has very high available water capacity and moderately slow to moderately rapid permeability. The organic matter content of the surface layer is very high. Surface runoff is very slow or ponded. The surface layer is slightly acid to medium acid. This soil has a seasonal high water table that is above or near the surface for part of the year. All areas of this soil have some kind of drainage system installed. The surface layer is friable and is in good tilth.

Most of the acreage of this soil is used for row crops and specialty crops. Some areas are used for pasture.

This soil is suited to corn, soybeans, and specialty crops. Wetness and the hazard of wind erosion are the major limitations in use and management. Row crops can be grown most of the time on adequately drained areas. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage and the use of crop residue and cover crops help to reduce the hazard of wind erosion.

This soil is suited to grasses for hay or pasture. Drainage is needed for high yields of forage or pasture crops. If this soil is used for pasture , overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is generally unsuitable for trees for the production of timber. The water table at or near the surface is the main limitation. Restricted use of equipment and the severe hazards of seedling mortality and windthrow are management concerns that are extremely difficult to overcome.

This soil has severe limitations for building sites because of ponding and low strength of material. It is difficult to overcome the ponding conditions that occur after heavy rainfall. The areas are in the lowest part of the landscape and receive runoff from adjacent slopes. Pumping is needed for most drainage systems because adequate outlets are not available. Foundations and footings should be placed on piling for stability of structures.

This soil has severe limitations for local roads and streets because of ponding, frost action, and low strength of material. The organic material should be removed and suitable base material used as fill to strengthen the base. Lowering the water table by the use of ditches and possibly by pumping the ditches and elevating the roadbed help to reduce the frost action potential.

This soil is not suitable for septic tank absorption fields. It has severe limitations because of ponding and moderately slow permeability.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

LyA—Lydick loam, 0 to 2 percent. This nearly level, deep, well drained soil is on outwash plains. Areas are large and irregular in shape. They range from 5 to 300 acres but are dominantly 100 acres.

In a typical profile, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is about 46 inches thick. The upper part is dark brown, friable loam; the middle part is dark brown and dark yellowish brown, firm clay loam and strong brown and dark brown, firm clay loam; and the lower part is yellowish brown and dark yellowish brown, stratified sandy clay loam, sandy loam, and sand. The underlying material is pale brown sand to a depth of 60 inches. In some areas the surface layer is silt loam, and in other areas the subsoil is loam. In places small depressional areas that have a dark surface layer more than 24 inches thick occur. Other small areas have slopes of more than 2 percent.

Included with this soil in mapping are small areas of Door, Elston, and Tracy soils. The included soils make up about 12 percent of the unit.

This Lydick soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is high. Surface runoff is slow. The surface layer is strongly acid unless limed. It is friable and is in good tilth.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a very few areas are used for woodland.

This soil is well suited to corn, soybeans, and small grain. It is suitable for intensive row cropping. Acidity of the soil is the main limitation in use and management. Conservation tillage and the use of crop residue and cover crops help to improve and maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture if it is adequately limed. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is not rated for the production of timber because trees are not native to the mapped area. Where trees are planted, they are used as windbreaks.

This soil has moderate limitations for building sites because of the shrink-swell potential. Footings and foundations should be designed to prevent structural damage due to shrinking and swelling of the soil.

This soil has severe limitations for local roads and streets because of low strength of material. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. Pollution of nearby shallow wells by effluent is a possibility.

This soil is in capability class I. It is not assigned to a woodland suitability subclass.

LyB—Lydick loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on outwash plains. Areas are generally elongated. They range from 3 to 75 acres but are dominantly about 20 acres.

In a typical profile, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable loam; the middle part is dark brown and dark yellowish brown, firm clay loam and strong brown and dark brown, firm clay loam; and the lower part is yellowish brown and dark yellowish brown, stratified sandy clay loam, sandy loam, and sand. The underlying material is pale brown sand to a depth of 60 inches. In some areas the surface layer is silt loam, and in other areas the subsoil is loam. In places, small depressional areas have a dark surface layer more than 24 inches thick. Other small areas have slopes of more than 6 percent. Some small areas are nearly level.

Included with this soil in mapping are small areas of Door, Elston, and Tracy soils. The included soils make up about 12 percent of the unit.

This Lydick soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is high. Surface runoff is medium. The surface layer is strongly acid unless limed. It is friable and is in good tilth.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a very few areas are used for woodland.

This soil is well suited to corn, soybeans, and small grain. The hazard of erosion is the main limitation in use and management. Control of erosion is needed if cultivated crops are grown. Conservation tillage and the use of crop residue and cover crops help to improve and maintain tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture if it is adequately limed. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is not rated for the production of timber because trees are not native to the mapped area. Where trees are planted, they are used as windbreaks.

This soil has moderate limitations for building sites because of the shrink-swell potential. Foundations and footings should be designed to prevent structural damage caused by low strength and the shrinking and swelling. Retaining as much existing vegetative cover as possible during construction helps to reduce erosion. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as a final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of low strength. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. Pollution of nearby shallow wells by effluent is a possibility.

This soil is in capability subclass IIe. It is not assigned to a woodland suitability subclass.

McA—Markham silt loam, 0 to 2 percent slopes. This nearly level, deep, moderately well drained and well drained soil is on uplands. Areas are broad and irregular in shape. They range from 5 to 400 acres but are dominantly about 100 acres.

In a typical profile, the surface layer is very dark brown silt loam about 9 inches thick. The subsoil is about 34 inches thick. The upper part is dark brown, friable silt loam; the middle part is dark yellowish brown, firm silty clay loam; and the lower part is yellowish brown, firm and very firm silty clay loam. The underlying material is yellowish brown silty clay loam to a depth of 60 inches. In some areas the dark surface layer is thicker, and in other areas the soil is leached to a greater depth. Small areas that have a loamy surface layer and small areas that are underlain with sandy material also occur. A few small areas have slopes of more than 2 percent.

Included with this soil in mapping are small areas of nearly level Elliott soil. The included soil makes up about 8 percent of the unit.

This Markham soil has high available water capacity and moderately slow or slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is medium acid to neutral. This soil has a seasonal high water table that is at a depth of 3 to 6 feet during winter and spring. The surface layer is friable and can be tilled through a fairly wide range of moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to maintain and improve the content of organic matter and tilth of this soil.

This soil is suited to grasses and legumes for hay or pasture. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is the main hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for building sites because of the shrink-swell potential. It has moderate limitations for dwellings with basements because of wetness and shrink-swell. Footings and foundations should be designed to prevent structural damage caused by the shrinking and swelling of the soil. If dwellings are to be constructed with basements, foundation drains should be installed.

This soil has severe limitations for local roads and streets because of the frost action potential and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of the slow or moderately slow permeability and wetness. Where sanitary facilities are not available, the absorption field can be enlarged to overcome the slow permeability of the soil if the water table has been lowered by a drainage system.

This soil is in capability subclass IIw and woodland suitability subclass 2o.

McB—Markham silt loam, 2 to 6 percent slopes. This gently sloping, deep, moderately well drained and well drained soil is on uplands. Areas are irregular in shape. They range from 3 to 100 acres but are dominantly about 25 acres.

In a typical profile, the surface layer is black silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 2 inches thick. The subsoil is about 21 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle part is brown, mottled, firm silty clay loam; and the lower part is yellowish brown, mottled, firm silty clay loam. The underlying material is brown, mottled silty clay loam to a depth of 60 inches. In some areas most of the dark surface layer has been removed by erosion and the remaining soil has been mixed with material from the subsoil in plowing. In these areas the surface layer is lighter in color.

Included with this soil in mapping are small areas of nearly level Elliott soils. The included soils make up about 6 to 8 percent of the unit.

This Markham soil has high available water capacity and moderately slow or slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is medium acid to neutral. This soil has a seasonal high water table that is at a depth of 3 to 6 feet during winter and spring. The surface layer is friable and can be tilled through a fairly wide range of moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. The hazard of erosion is the major limitation in use and management. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the content of organic matter and tilth of this soil and reduce the hazard of erosion.

This soil is suited to grasses and legumes for hay or pasture. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is a hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings without basements because of the shrink-swell potential and moderate limitations for dwellings with basements because of wetness and the potential for shrink-swell. Footings and foundations should be designed to prevent structural damage caused by the shrinking and swelling of the soil. If dwellings are to be constructed with basements, foundation drains should be installed. Retaining as much existing vegetative cover as possible during construction helps to reduce soil erosion. If the vegetation has been removed, erosion can be reduced by stockpiling the topsoil, replacing it as a final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of the frost action potential and low strength. Drainage ditches along roads to lower the water table help to reduce the frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of the moderately slow permeability and wetness. Where sanitary facilities are not available, enlarging the absorption field can overcome the reduced permeability of the soil if the water table has been lowered by a drainage system.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

MfA—Martinsville loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on terraces, lake plains, and outwash plains. Areas are irregular in shape. They range from 10 to 150 acres but are dominantly about 40 acres.

In a typical profile, the surface layer is dark grayish brown loam about 10 inches thick. The subsurface layer is brown, friable loam about 2 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown, friable loam. The underlying material is yellowish brown and light yellowish brown sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Hanna, Rawson, and Whitaker soils. Also included are small areas of soils that have slopes of more than 2 percent and soils on short steep slopes next to stream bottoms. The included soils make up about 8 to 10 percent of the unit.

This Martinsville soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is medium acid to strongly acid unless limed. It is friable and can be easily tilled through a fairly wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for trees.

This soil is well suited to corn, soybeans, and small grain. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. If this soil is used for pasture, overgrazing or grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a moderate hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for building sites because of the shrink-swell potential. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling.

This soil has moderate limitations for local roads and streets because of low strength and the frost action potential. Strengthening the base material with sand and gravel helps to overcome the low strength of the material.

Limitations are slight for septic tank absorption fields.

This soil is in capability class I and woodland suitability subclass 1o.

MfB—Martinsville loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on terraces, lake plains, and outwash plains. Areas are irregular in shape. They range from 5 to 50 acres but are dominantly about 25 acres.

In a typical profile, the surface layer is very dark grayish brown loam about 6 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, friable loam; the middle part is yellowish brown, very friable loamy sand; and the lower part is brownish yellow, loose sand. The underlying material is yellowish brown, stratified sandy loam and sand to a depth of 60 inches. In places the surface layer is dark brown.

Included with this soil in mapping are small areas of Rawson, Riddles, and Whitaker soils. Also included are small areas of soils that have slopes of more than 6 percent, small areas of nearly level soils, and areas that have short steep slopes and are next to stream bottoms. The included soils make up about 12 to 15 percent of the unit.

This Martinsville soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is medium acid to strongly acid unless limed. The surface layer is friable and can be easily tilled through a fairly wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for trees.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Any conservation practice should fit the size of the delineation in which it is to be used. The use of crop residue and cover crops helps to improve and maintain the tilth and content of organic matter of the soil and to control erosion.

This soil is well suited to grasses and legumes for hay or pasture. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings because of the shrink-swell potential. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling. Retaining as much existing vegetative cover as possible during construction helps to reduce soil erosion. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as a final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has moderate limitations for local roads and streets because of low strength and the frost action potential. Strengthening the base material with sand and gravel helps to overcome the low strength of the material.

Limitations are slight for septic tank absorption fields.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

Mm—Maumee loamy sand. This nearly level, deep, very poorly drained soil is on outwash plains and lake plains. It is frequently ponded by surface runoff from adjacent higher lying areas. Areas are irregular in shape. They range from 5 to 300 acres but are dominantly about 135 acres.

In a typical profile the surface layer is 23 inches thick. The upper part is black loamy sand to a depth of about 10 inches, and the lower part is very dark gray, very friable loamy sand to a depth of about 23 inches. The subsoil is 15 inches thick. The upper part is grayish brown, mottled loamy sand, and the lower part is dark grayish brown, mottled sand. The underlying material is light brownish gray, mottled sand to a depth of 60 inches. In some small areas the subhorizons have more clay and silt. In other places, brownish areas occur that have higher concentrations of iron. These concentrations do not affect tillage operations or crop yield.

Included with this soil in mapping are small areas of Morocco and Newton soils. The included soils make up about 8 to 12 percent of the unit.

This Maumee soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is moderate. Surface runoff is very slow or ponded. The surface layer is generally slightly acid to neutral. This soil has a seasonal high water table that is above the surface or within 1 foot of the surface during a significant part of the year. Artificial drainage is needed for crop production. Nearly all areas of this soil have some kind of drainage system installed. The surface layer is friable and is in good tilth.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for small grain.

This soil is suited to corn, soybeans, and small grain. Wetness is the major limitation in use and management. If areas are drained, the soil can become droughty. A suitable drainage system is difficult to establish because adequate outlets generally are not available. If a suitable controlled drainage system is established, a cropping system that includes row crops most of the time can be used. If the drainage system is inadequate, small grain is difficult to grow because the high water table is at or near the surface during the growing season. Conservation tillage and the use of crop residue and cover crops help to maintain the content of organic matter and good tilth.

This soil is suited to grasses and legumes for hay or pasture because most areas are drained. Deep rooted legumes such as alfalfa are not so well suited because of the high water table. Overgrazing and grazing when the soil is wet are the major concerns of management if this soil is used for pasture. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to trees and only a few areas are used for woodland. The use of equipment is severely restricted. Harvesting and logging operations are delayed to drier seasons or to periods when the ground is frozen. The hazard of windthrow is severe because the water table is at or near the surface for long periods. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding. Drainage is difficult because most areas of this soil are in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems are commonly not available. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of ponding. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Elevating the road above the flooding level is commonly needed.

Limitations for septic tank absorption fields are severe because of ponding and the poor filtering qualities of the soil. Sanitary facilities should be connected to commercial sewers and treatment facilities. If facilities are not available, the water table can be lowered by the use of an adequate subsurface drainage system in combination with storm sewers. Pollution of nearby shallow wells is a possibility.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

Mn—Maumee loamy sand, ponded. This nearly level, deep, very poorly drained soil is on lake plains. It is ponded with surface runoff from adjacent higher lying areas for long periods. Areas are irregular in shape. They range from 40 to 300 acres but are dominantly about 100 acres.

In a typical profile, about 6 inches of water generally overlies the mineral material. The upper part of the mineral material is black loamy sand, the middle part is very dark gray loamy sand, and the lower part is grayish brown and pale brown sand and coarse sand. In some areas the surface is not covered with water, and in other areas the subhorizons have more clay.

Included with this soil in mapping are small areas of Adrian soils. The included soils make up about 6 to 8 percent of the unit.

This Maumee soil has low available water capacity and rapid permeability. The organic matter content of the upper part of the mineral material is high. The surface layer is generally slightly acid to neutral. This soil has a seasonal high water table that is about 6 inches above the surface during a significant part of the year. Artificial drainage is needed for crop production. The mineral surface layer is friable.

This soil is used mostly as wildlife habitat. It has good potential for use by wetland wildlife and poor potential for all other uses.

Most areas of this soil receive overflow from surrounding areas and from some of the adjoining low lying muck areas.

This soil is unsuitable for building sites and sanitary facilities because of ponding. Ponding is extremely difficult to overcome because the areas are in the lowest lying part of the landscape and they receive water from all adjacent slopes. Pumping is needed for most drainage systems because adequate outlets are not available.

This soil is in capability subclass Vw and woodland suitability subclass 4w.

MoB—Metea loamy fine sand, 1 to 6 percent slopes. This nearly level, deep, well drained soil is on the moraine and till plain. Areas are irregular or oblong in shape and range from 5 to 30 acres.

In a typical profile, the surface layer is dark brown loamy fine sand about 10 inches thick. The subsoil is about 55 inches thick. The upper part is yellowish brown, very friable loamy fine sand and sand; the middle part is dark brown, friable sand and dark brown, friable sandy clay loam; and the lower part is yellowish brown, firm clay loam. The underlying material is yellowish brown loam to a depth of 75 inches. In some areas the underlying material is clay loam, and in other areas slopes are less than 1 percent. In some small areas of this soil, slopes are more than 6 percent.

Included with this soil in mapping are small areas of Morley, Riddles, and Tracy soils. The included areas make up about 12 to 15 percent of the unit.

This Metea soil has moderate available water capacity. Permeability is very rapid in the upper layers of sand and moderate in the underlying material. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is medium acid unless limed. It is friable and is in good tilth.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. The moderate available water capacity is the major limitation in use and management. This soil is droughty during dry seasons. Wind erosion is a slight hazard. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Replanting of some seedlings may be needed because of the moderate hazard of seedling mortality. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for dwellings. It has moderate limitations for local roads and streets because of frost action. Strengthening the base material with sand and gravel helps to overcome the frost action potential.

Limitations are moderate for septic tank absorption fields because of the moderate permeability of the underlying material. Enlarging the size of the absorption field helps to overcome the reduced permeability.

This soil is in capability subclass IIIe and woodland suitability subclass 2s.

Mp—Milford silty clay loam. This nearly level, deep, poorly drained soil is on glacial lakebeds. Areas are broad and irregular in shape. They range from 10 to 300 acres but are dominantly about 50 acres.

In a typical profile, the surface soil is black silty clay loam about 12 inches thick. The subsoil is about 42 inches thick. The upper part is dark gray, mottled, very firm silty clay loam; the middle part is olive gray, mottled, very firm silty clay loam; and the lower part is gray, mottled, firm silty clay loam. The substratum is gray, mottled silty clay to a depth of 60 inches. In some places the surface soil is silt loam, and in other areas the underlying material is sand.

Included with this soil in mapping are a few small, slightly higher lying areas of Del Rey and Haskins soils. The included soils make up about 10 percent of the unit.

This Milford soil has high available water capacity and slow permeability. The organic matter content of the surface layer is high. Surface runoff is slow or ponded. The surface layer is medium acid unless limed. This soil has a seasonal high water table that is above the surface or within 2 feet of the surface during spring. Brief flooding sometimes occurs. The surface layer becomes cloddy and hard to work if the soil is tilled when wet.

Some of the acreage of this soil is drained and used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Wetness is the major limitation in use and management. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

Some areas of this soil can be used for grasses and legumes for hay or pasture without drainage, but drainage is generally beneficial. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but few trees are grown commercially. Seasonal wetness can cause a delay in harvesting or planting. Water-tolerant species should be favored in stands. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Water moves slowly to drainage systems because of moderately slow permeability. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of frost action, ponding, and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel reduces the shrinking and swelling of the soil and increases the strength of the material.

Limitations are severe for septic tank absorption fields because of ponding and moderately slow permeability. The soil is not suitable for septic tank absorption fields.

This soil is in capability subclass IIw. It is not assigned to a woodland suitability subclass.

MrB2—Morley silt loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, moderately well drained and well drained soil is on uplands. Areas are irregular in shape. They range from 3 to 100 acres but are dominantly about 25 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 34 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is yellowish brown, very firm silty clay loam. The substratum is yellowish brown silty clay loam to a depth of 60 inches. In some places the combined surface layer and subsoil is more than 48 inches thick, and in other severely eroded areas most of the surface layer has been lost. In some small areas, slopes are less than 2 percent. In other small areas, slopes are more than 6 percent.

Included with this soil in mapping are small areas of Blount, Rawson, and Riddles soils. The included soils make up about 12 to 15 percent of the unit.

This Morley soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is medium acid to neutral. This soil has a seasonal high water table that is at a depth of 3 to 6 feet. The surface layer is friable but becomes cloddy and hard to work if it is tilled when wet.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for pasture, and other areas are used for woodland.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, and grassed waterways or grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops also helps to control erosion as well as improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. These crops are effective in controlling wind and water erosion. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is the main hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings without basements because of the shrink-swell potential and moderate limitations for dwellings with basements because of wetness and the potential for shrink-swell.

Footings and foundations should be designed to prevent structural damage caused by the shrinking and swelling of the soil. If dwellings are constructed with basements, foundation drains should be installed. Retaining as much existing vegetative cover as possible during construction helps to reduce soil erosion. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as a final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of low strength. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of the moderately slow permeability and wetness. Where commercial sewers are not available, increasing the size of the absorption field helps to overcome the reduced permeability of the subsoil. Wetness can be reduced by installing an adequate drainage system.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

MrC2—Morley silt loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, moderately well drained and well drained soil is on uplands. Areas are irregular in shape and range from 3 to 50 acres.

In a typical profile, the surface layer is dark yellowish brown silt loam about 6 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is brown, mottled, firm silty clay loam. The substratum is yellowish brown, mottled, very firm silty clay loam to a depth of 60 inches. In some areas the combined surface layer and subsoil is more than 48 inches thick. In some small areas slopes are less than 6 percent. In other small areas, slopes are more than 12 percent. In some small, severely eroded areas, most of the surface layer has been lost and material from the subsoil mixed with the remaining surface layer material.

Included with this soil in mapping are small areas of Rawson and Riddles soils. The included soils make up 8 to 10 percent of the unit.

This Morley soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is medium acid to neutral. This soil has a seasonal high water table that is at a depth of 3 to 6 feet. The surface layer is friable, but it becomes cloddy and hard to work if tilled when wet.

Some of the acreage of this soil is used for small grain, corn, or soybeans. Some areas are used for pasture, and other areas are used for woodland.

This soil is poorly suited to cultivated crops. Erosion is a severe hazard if corn and soybeans are grown. Small grain can be rotated with meadow or pasture crops. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, and grassed waterways or grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops helps to control erosion and improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. These crops are effective in controlling wind and water erosion. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Plant competition is a hazard, but seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements because of slope and the shrink-swell potential. Wetness is a moderate limitation for dwellings with basements. Footings and foundations should be designed to prevent structural damage caused by low strength and by the shrinking and swelling of the soil. If dwellings are to be constructed with basements, foundation drains need to be installed. Unless dwellings are designed to fit the slope, extensive earth moving is required to level the area sufficiently for construction. Developing lots at random and retaining as much of the vegetative cover as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour and to build diversions between lots to intercept runoff. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of low strength. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of moderately slow permeability and wetness. Where commercial sewers are not available, increasing the size of the absorption field can overcome the reduced permeability of the soil. Wetness can be reduced by installing an adequate drainage system. The slopes may present problems in design of the absorption field. The number of lines can be reduced and then lengthened to obtain the desired size of field; or some lines can be placed at a greater depth than others so that all lines receive equal flow.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

MrD2—Morley silt loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, moderately well drained and well drained soil is on uplands. Areas are irregular in shape and range from 3 to 30 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is yellowish brown, firm silty clay loam about 20 inches thick. The substratum is yellowish brown, mottled silty clay loam to a depth of 60 inches. In some areas the combined surface layer and subsoil is more than 48 inches thick. In some small areas, slopes are less than 12 percent. In other small areas, slopes are more than 18 percent. Some small areas of soils are severely eroded. The included soils make up about 8 percent of the unit.

Included with this soil in mapping are small areas of Rawson and Riddles soils. The included soils make up about 8 percent of the unit.

This Morley soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is rapid. The surface layer is medium acid to neutral. This soil has a seasonal high water table that is at a depth of 3 to 6 feet. The surface layer is friable, but it becomes cloddy and hard to work if tilled when wet.

Most of the acreage of this soil is used for pasture.

This soil is poorly suited to cultivated crops. Erosion is severe if the soil is tilled. Surface runoff caused by the heavy texture and slow permeability of the soil hinders the growth of crops. Crops can be produced fairly easily, however, if this hazard is overcome. If this soil is planted to crops, crop rotation, conservation tillage, terraces, diversions, contour farming, and grassed waterways or grade stabilization structures are needed to help prevent excessive soil loss. The use of crop residue and cover crops helps to improve and maintain the tilth and content of organic matter of this soil and to control erosion.

This soil is suited to grasses and legumes for hay or pasture. These crops help to control wind and water erosion and to reduce the velocity of surface runoff. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotation grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. The use of equipment is moderately restricted because of slope. Special equipment is required for planting and harvesting. Seedling mortality, erosion, and plant competition are moderate hazards. However, seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of slope. Unless dwellings are designed to fit the slope, extensive earthmoving is required. Footings and foundations should be designed to prevent structural damage caused by the shrinking and swelling of the soil. Developing lots at random and retaining as much vegetative cover as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour and to build diversions between lots to intercept runoff. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of slope and low strength. Extensive road cuts can be needed. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support heavier loads.

Limitations are severe for septic tank absorption fields because of wetness, slope, and moderately slow permeability. If commercial sewers are not available, an alternate site should be selected. Machinery cannot be used on some of these slopes to install absorption fields. If the soil is used for filter fields, the size of the field needs to be increased to overcome the reduced permeability of the subsoil. Some lines can be placed at a greater depth than others to obtain equal flow to the lines; or only one or two lines can be used and extended for a greater distance to obtain the desired size of field.

This soil is in capability subclass IVe and woodland suitability subclass 2r.

MrE—Morley silt loam, 18 to 30 percent slopes. This moderately steep and steep, deep, moderately well drained and well drained soil is on uplands. Areas are generally long and narrow and range from 3 to 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, firm silty clay loam; the middle part is dark yellowish brown and yellowish brown, firm silty clay loam and yellowish brown, mottled, firm silty clay loam; and the lower part is yellowish brown, firm silty clay loam. The substratum is pale brown, mottled silty clay loam to a depth of 60 inches. In some areas the combined surface layer and subsoil is more than 48 inches thick. In some small areas, slopes are less than 18 percent. In other small areas, slopes are more than 30 percent. In places, small areas of this soil are severely eroded.

Included with this soil in mapping are small areas of Riddles soils. The included soils make up about 8 percent of the unit.

This Morley soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is rapid to very rapid. The surface layer is medium acid to neutral. This soil has a water table that is at a depth of 3 to 6 feet. The surface layer is friable.

Most of the acreage of this soil is used for woodland. The soil is generally not suitable for cultivated crops because of slope.

This soil is suited to grasses and legumes for hay or pasture. Crops need to be carefully seeded to control or prevent erosion until the plants are established. The steeper parts of the slopes should be used for pasture because hay production is difficult in the steeper areas. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. The use of equipment is moderately restricted because of slope. Special equipment is required for planting and harvesting trees. Seedling mortality, erosion, and plant competition are moderate hazards. Replanting of some seedlings may be needed. Seedlings have a better rate of survival and become established more quickly if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of slope. Extensive earthmoving is required to prepare suitable sites for dwellings. The design of the dwelling should be compatible with the slope. Footings and foundations should be designed to prevent structural damage caused by shrinking and swelling of the soil and to support buildings constructed on the slope.

This soil has severe limitations for local roads and streets because of slope and low strength. Extensive earth moving is required to prepare for roadways. Roads should be constructed on the contour to reduce excessive erosion. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness, slope, and moderately slow permeability. The soil is generally not suitable for septic tank absorption fields.

This soil is in capability subclass VIe and woodland suitablility subclass 2r.

MsC3—Morley silty clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, moderately well drained and well drained soil is on uplands. Areas are irregular in shape and range from 3 to 40 acres.

In a typical profile, the surface layer is dark yellowish brown silty clay loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is yellowish brown, mottled, firm silty clay loam. The underlying material is pale brown, mottled silty clay loam. In most places the surface layer has been mixed with the subsoil. In a few areas the surface layer is silt loam, and in a few places it is clay loam. Some small areas of soil are gently sloping, and some areas are strongly sloping.

Included with this soil in mapping are a few areas of Riddles soil. The included soil makes up about 7 percent of the unit.

This Morley soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is low. Surface runoff is rapid. The surface layer is slightly acid or neutral. This soil has a seasonal high water table that is at a depth of 3 to 6 feet. The surface layer is friable, but tillage needs to be delayed until the soil is dry enough to prevent puddling.

Some of the acreage of this soil is farmed. Mostly small grain is grown. Some areas are used for pasture, and other areas are used for woodland.

This soil is poorly suited to cultivated crops. Erosion is a severe hazard if corn and soybeans are grown. Small grain can be rotated with meadow or pasture crops. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, minimum tillage, terraces, diversions, contour farming, and grassed waterways or grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops helps to improve and maintain the tilth and content of organic matter of this soil and to control erosion.

This soil is well suited to grasses and legumes for hay or pasture. These crops are effective in controlling wind and water erosion. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements because of slope and the shrink-swell potential. In addition, wetness is a moderate limitation for dwellings with basements. Footings and foundations should be designed to prevent structural damage caused by shrinking and swelling. If dwellings are constructed with basements, foundation drains should be installed. Unless dwellings are designed to fit the slope, extensive earthmoving is required to level the area sufficiently for construction. Developing lots at random and retaining as much vegetative cover as possible in other areas help to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour and to build diversions between lots to intercept runoff. If the vegetation is removed, erosion can be reduced by hauling in topsoil, placing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of low strength. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of slow permeability and wetness. If sanitary facilities are not available, increasing the size of the absorption field can overcome the moderately slow permeability of the soil. Wetness can be reduced by installing an adequate drainage system. The slope may present problems in the design of the absorption field. The number of lines can be reduced and then lengthened to obtain the desired size of field; or some lines can be placed at a greater depth than others so that all lines receive equal flow.

This soil is in capability subclass IVe and woodland suitability subclass 2o.

Mx—Morocco loamy sand. This nearly level, deep, somewhat poorly drained soil is on outwash plains. Areas are irregular in shape or rounded. They range from 2 to 542 acres but are dominantly about 50 acres.

In a typical profile, the surface layer is very dark brown loamy sand about 9 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown, mottled, loose sand, and the lower part is brownish yellow, mottled, loose sand. The underlying material is light gray, mottled sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Tyner soils in higher lying positions, areas of Brems soils in slightly higher lying positions, and areas of Maumee and Newton soils in depressions. The included soils make up about 15 percent of the unit.

This Morocco soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is strongly acid or very strongly acid unless limed. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is very friable and is in good tilth.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Wetness and low available water capacity are the major limitations in use and management. Crops are subject to damage from drought. Wind erosion is a hazard during dry periods. If the soil is adequately drained, a conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to maintain organic matter and good tilth and to control wind erosion.

This soil is suited to grasses and legumes for hay or pasture. Drainage of the soil is beneficial for high yields of forage and pasture crops. Deep rooted legumes such as alfalfa are not so well suited because of the high water table. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness, and the soil becomes subject to wind erosion. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet and dry periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for woodland. The chances of seedling survival are enhanced if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Dwellings should be constructed without basements.

This soil has moderate limitations for local roads and streets because of frost action and wetness. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

This soil has severe limitations for septic tank absorption fields because of wetness and the poor filtering qualities of the soil. If sanitary facilities are not available, the water table can be lowered by the use of an adequate subsurface drainage system. Pollution of nearby shallow wells is a possibility.

This soil is in capability subclass IVs and woodland suitability subclass 3o.

Nf—Newton loamy fine sand. This nearly level, deep, very poorly drained soil is on acid outwash plains and lake plains. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas are rounded to oblong. They range from 3 to 200 acres but are dominantly about 50 acres.

In a typical profile, the surface layer is black loamy fine sand about 10 inches thick. The subsurface layer is very dark gray loamy fine sand about 8 inches thick. The upper part of the underlying material is gray, loose sand; the middle part is dark gray, loose sand and dark grayish brown, mottled, loose sand. The underlying material is gray, mottled sand to a depth of 60 inches. In some areas the dark surface layer is thicker than is typical. In some small areas the soil is less acid, and in other small areas there is more clay in the profile.

Included with this soil in mapping are small areas of Brems and Morocco soils. The included soils make up about 10 to 12 percent of the unit.

This Newton soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is high. Surface runoff is very slow or ponded. The surface layer is strongly acid unless limed. This soil has a seasonal high water table that is above the surface or within 1 foot of the surface during a significant part of year. Drainage is needed for crop production. In the southern part of the county, most areas of this soil have some kind of drainage system installed. If the soil is drained, the surface layer is friable and is in good tilth.

Some of the acreage of this soil in drained areas is used for cultivated crops. Some areas are used for pasture, and a few small areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Low available water capacity, the seasonal high water table, and the strong acidity of the soil are major limitations in use and management. A suitable drainage system is difficult to establish because adequate outlets are generally not available. Excessively drained areas can become droughty, and wind erosion is a hazard. If a suitable controlled drainage system is established, a conservation cropping system that includes row crops most of the time can be used. If the drainage system is inadequate, small grain does not grow well because the high water is at or near the surface during the growing season. Additions of lime according to soil tests and plant needs are necessary for the growth and production of crops. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture crops. Deep rooted legumes such as alfalfa are not so well suited because of the high water table. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness, and the soil can become subject to wind erosion. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to trees, but some trees are grown on this soil. The use of equipment is severely restricted. Because the water table is at or near the surface for extended periods, seedling mortality, windthrow, and plant competition are severe hazards. Harvesting of trees is generally delayed to extremely dry seasons or to periods when the ground is frozen. Water-tolerant species should be favored in stands. Replanting of some seedlings may be needed. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding. Drainage is difficult because most areas are in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers are commonly not available.

This soil has severe limitations for local roads and streets because of ponding. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of ponding and the poor filtering qualities of the soil. If sanitary facilities are not available, the water table can be lowered by the use of an adequate subsurface drainage system. Pollution of nearby shallow wells is a possibility.

This soil is in capability subclass IVw and woodland suitability subclass 4w.

OaC—Oakville fine sand, 4 to 12 percent slopes. This gently sloping and moderately sloping, deep, well drained soil is on lake plains, low sand dunes, and beach ridges. Areas are irregular in shape. They range from 5 to 110 acres but are dominantly about 35 acres.

In a typical profile, the surface layer is very dark grayish brown fine sand about 2 inches thick. The subsurface layer is brown fine sand about 5 inches thick. The subsoil is about 23 inches thick. The upper part is yellowish brown, loose fine sand, and the lower part is light yellowish brown, loose fine sand. The underlying material is pale brown fine sand to a depth of 60 inches. In some areas the surface layer is thicker, and in other areas the surface layer is dark yellowish brown or yellowish brown. Some areas are strongly acid in the surface layer and subsoil, and other areas are predominantly medium sand throughout the profile. In some areas of this soil, slopes are less than 4 percent. In other small areas, slopes are more than 12 percent.

This Oakville soil has low available water capacity and very rapid permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. Reaction of the surface layer is neutral.

Most of the acreage of this soil is used for woodland. Trees have been used to stabilize the movement of sand in these areas.

Trees grow fairly well on this soil. Seedling mortality is a hazard because of the droughtiness of this soil. Seedlings should be planted early in spring. Replanting of some seedlings is generally needed to maintain density of stands. Seedlings survive and grow fairly well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements and severe limitations for small commercial buildings because of slope. Some earthmoving is required for the construction of dwellings, and extensive earthmoving is required for small commercial buildings.

This soil has moderate limitations for local roads and streets because of slope. Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. Seepage of effluent and the possibility of pollution of nearby shallow wells is a hazard if septic tank absorption fields are used.

This soil is in capability subclass VIs and woodland suitability subclass 3s.

OaE—Oakville fine sand, 18 to 40 percent slopes. This strongly sloping and moderately steep, deep, well drained soil is on lake plains, low sand dunes, and beach ridges. Areas are irregular in shape. They range from 5 to 150 acres but are dominantly about 45 acres.

In a typical profile, the surface layer is dark grayish brown fine sand about 5 inches thick. The subsoil is about 30 inches thick. The upper part is yellowish brown, loose fine sand; the middle part is brownish yellow, loose fine sand; and the lower part is yellow, loose fine sand. The underlying material is very pale brown fine sand. In some areas the surface layer is thicker, and in other areas the surface layer is dark yellowish brown or yellowish brown. Some areas of this soil are strongly acid in the surface layer and subsoil. In some areas, slopes are less than 18 percent. In other areas, slopes are more than 40 percent.

This soil has low available water capacity and very rapid permeability. The organic matter content of the surface layer is moderate. Surface runoff is rapid.

Most of the acreage of this soil is in woodland. Trees have stabilized the sand movement in these areas. The potential is fair for trees. Some urban development has taken place on this soil.

This soil is fairly well suited to trees. The use of equipment is severely restricted. Because of the droughtiness of these sandy slopes, seedling mortality is a hazard if this soil is planted to trees. Seedlings should be planted as early in spring as is feasible to take advantage of available moisture. Replanting of some seedlings is generally needed. Erosion is a moderate limitation. Seedlings survive and grow fairly well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of slope. Extensive earthmoving may be required. The design of the dwelling should be compatible with the site. Foundations and footings should be constructed to provide stability for the structure and may need to be placed on pilings.

This soil has severe limitations for local roads and streets because of slope. Where feasible, roads should be placed on the contour.

Limitations are severe for septic tank absorption fields because of slope and the poor filtering qualities of the soil. Seepage of effluent and the pollution of nearby shallow wells is a hazard if septic tank absorption fields are used. If commercial sewers are not available, an alternate site should be selected for the filter field. Leveling the area and installing a series of three dry wells have been used successfully to overcome these severe limitations.

This soil is in capability subclass VIIs and woodland suitability subclass 3s.

Pa—Palms muck, drained. This nearly level or depressional, deep, very poorly drained soil is on lake plains, till plains, or moraines in basins that once were lakes or ponds. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas are oval or oblong. They range from 3 to 160 acres but are dominantly about 60 acres.

In a typical profile, the soil is mostly black muck about 30 inches thick. The underlying mineral material is dark gray clay loam to a depth of 60 inches. In places the organic matter is slightly acid to extremely acid. In some areas the organic material is less than 16 inches thick.

Included with this soil in mapping are small areas of Adrian, Edwards, and Houghton soils. The included soils make up about 12 to 15 percent of the unit.

This Palms muck soil has very high available water capacity. Permeability is moderately slow to moderately rapid in the organic layers and moderate to moderately slow in the loamy material. The organic matter content of the surface layer is very high. Surface runoff is very slow. The surface layer is generally slightly acid or medium acid. This soil has a seasonal high water table that is at the surface or ponded much of the year. The surface layer is friable and is in good tilth.

Most of the acreage of this soil is drained and is used for cultivated crops and specialty crops. Some areas are used for hay or pasture, and other areas are used for trees. Some areas are used as wildlife habitat.

This soil is suited to corn, soybeans, and specialty crops. Wetness and the hazard of wind erosion are major limitations in use and management. A conservation cropping system that includes row crops most of the time can be used. Soybeans are difficult to grow and harvest because of weeds. Conservation tillage and the use of crop residue and cover crops help to control wind erosion and to maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses for hay or pasture. Drainage is needed for high yields of forage or pasture crops. If this soil is used for pasture, overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is generally not suitable for the commercial production of trees. The water table at or near the surface is the main limitation. Restricted use of equipment and the hazards of seedling mortality and windthrow are extremely difficult to overcome. Water-tolerant shrubs and trees grow in the undrained areas.

This soil is poorly suited to building sites. It has severe limitations because of low strength and ponding. Ponding after heavy rainfall is difficult to overcome because the soil is in the lowest part of the landscape and receives runoff from adjacent slopes. Pumping is needed because suitable outlets for drainage systems such as storm sewers are commonly not available. Foundations and footings need to be placed on piling for stability of structures.

This soil has severe limitations for local roads and streets because of ponding, frost action, and low strength. The muck should be removed and suitable base material used as fill to strengthen the base. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

The soil is not suitable for septic tank absorption fields. Limitations are severe because of ponding and moderately slow permeability.

This soil is in capability subclass IIw and woodland suitability subclass 4w.

Pe—Pewamo silty clay loam. This nearly level, deep, very poorly drained soil is in depressional areas of till and lake plains and moraines. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas, which are irregular in shape or elongated, follow the drainageways or depressions. They range from 1 to 84 acres but are dominantly about 10 acres.

In a typical profile, the surface layer is very dark brown silty clay loam about 8 inches thick. The subsurface layer is very dark gray, mottled silty clay loam about 4 inches thick. The subsoil is about 34 inches thick. The upper part is dark gray, mottled, very firm silty clay loam; the middle part is olive gray, mottled, very firm silty clay loam; and the lower part is gray, mottled, firm silty clay loam. The underlying material is grayish brown, mottled silty clay loam to a depth of 60 inches. In some places the dark surface layer is less than 10 inches thick. In other places, thin layers of overwash material from surrounding soils cover the surface.

Included with this soil in mapping are a few small, slightly higher lying areas of Blount and Whitaker soils and some slightly lower lying depressional areas of Washtenaw soils. The included soils make up about 10 to 12 percent of the unit.

This Pewamo soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is high. Surface runoff is very slow or ponded. The surface layer is slightly acid or neutral. This soil has a seasonal high water table, and some depressional areas are ponded early in spring. The firm surface layer becomes cloddy and hard to work if tilled when wet.

Most of the acreage of this soil is drained and used for cultivated crops. A few areas are used for hay, pasture, or woodland.

This soil is well suited to corn, soybeans, and some kinds of small grain. It is poorly suited to winter wheat because ponding generally destroys the stands. Wetness is the main limitation in use and management. Excessive water can be removed by open ditches, tile drains, surface drains, pumping, or a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. Conservation tillage and the use of crop residue help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture crops. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. The use of equipment is severely restricted. Seedling mortality, windthrow, and plant competition are moderate hazards because the seasonal high water table is at or near the surface for long periods. Harvesting is generally delayed to extremely dry seasons or to periods when the ground is frozen. Replanting of some seedlings is needed to maintain density of stands. Water-tolerant species should be favored in stands. The chances of seedling survival and growth are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding. Drainage is difficult in most areas because this soil is commonly in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers generally are not available.

This soil has severe limitations for local roads and streets because of ponding, low strength, and frost action. Elevating the roadbed helps to overcome wetness. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of ponding and moderately slow permeability.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Ph—Pinhook loam. This nearly level, deep, poorly drained soil is on broad flats on outwash plains. Areas are broad and irregular in shape. They range from 2 to 48 acres but are dominantly about 15 acres.

In a typical profile, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is light brownish gray, mottled, friable sandy loam about 3 inches thick. The subsoil is about 38 inches thick. The upper part is light brownish gray, mottled, friable loam and sandy loam; the middle part is gray, mottled, friable sandy loam; and the lower part is grayish brown, mottled, friable loamy sand. The substratum is grayish brown sand to a depth of 60 inches. In some places the subsoil is not so thick. In other areas the surface layer is sandy loam.

Included with this soil in mapping are a few small areas of Bourbon, Gilford, and Hanna soils. The included areas make up 8 to 15 percent of the unit.

This Pinhook soil has high available water capacity. Permeability is moderately rapid in the surface layer and subsoil and rapid in the underlying material. The organic matter content of the surface layer is high. Surface runoff is slow. The surface layer is generally strongly acid unless limed. This soil has a seasonal high water table that is at the surface or at a depth of 1 foot during winter and spring. The surface layer is friable, but tillage is limited to periods when the water table is low.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for woodland.

This soil is well suited to corn, soybeans, and small grain. Wetness is the main limitation in use and management. Excessive water can be removed by open ditches, subsurface drains, pumping, or a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. Conservation tillage and the use of crop residue help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture crops. Deep rooted legumes such as alfalfa are not so well suited because of the high water table. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. The use of equipment is severely restricted. Harvesting and logging operations are delayed to dry seasons or to periods when the ground is frozen. The hazard of plant competition is severe, and the hazards of windthrow and seedling mortality are moderate. Replanting of some seedlings may be needed to maintain the density of stands. The chances of seedling survival and growth are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of wetness and frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential.

Limitations are severe for septic tank absorption fields because of wetness and the poor filtering qualities of the soil. If sanitary facilities are not available, the water table can be lowered by the use of an adequate subsurface drainage system.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Pk—Pits. This nearly level to very steep unit is on outwash plains, till plains, and the moraine. Areas are rectangular or irregular in shape and range from 3 to 50 acres.

In a typical area of Pits, the surface layer and underlying layers are brown sand and gravelly sand. Pits have been formed by mining operations and generally have steep side slopes. In some glacial outwash areas, strata of sand and silt are exposed.

Included with this unit in mapping are areas near glacial till where the exposed material is silty clay loam or silty clay.

Most areas of Pits have very little vegetative cover. Weeds and grasses grow in a few places.

Pits is not assigned to a capability subclass.

PlB—Plainfield sand, 2 to 6 percent slopes. This gently sloping, deep, excessively drained soil is on outwash plains, stream terraces, and glaciated uplands. Areas are irregular in shape. They range from 3 to 50 acres but are dominantly about 10 acres.

In a typical profile, the surface layer is very dark brown sand about 2 inches thick. The subsurface layer is dark brown sand about 3 inches thick. The subsoil is about 18 inches thick. The upper part is dark brown, loose sand; the middle part is dark yellowish brown, loose sand; and the lower part is strong brown, loose sand. The underlying material to a depth of 60 inches is yellowish brown sand. In some areas the surface layer is brown or dark grayish brown. Some areas are dominantly fine sand throughout the profile, and other areas have thin bands of loamy sand and sandy loam in the underlying material. In some small areas, slopes are more than 6 percent. In other small areas, slopes are less than 2 percent. Some areas of soil are slightly acid to neutral in the solum.

Included with this soil in mapping are small areas of the moderately well drained Brems soil. The included soil makes up about 6 to 9 percent of the unit.

This Plainfield soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is low. Surface runoff is slow. The surface layer is strongly acid unless limed. It is very friable and is easily tilled.

Most of the acreage of this soil is in woodland or pasture. Some areas are used for cultivated crops, and other areas are used for hay or pasture crops. Some areas are used for woodland.

This soil is poorly suited to corn, soybeans, and small grain. Droughtiness and the hazard of wind erosion are major limitations in use and management. A conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to control wind erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to deep rooted grasses and legumes for hay or pasture. Shallow rooted legumes such as clover are not so well suited because of low available water capacity. If this soil is used for pasture, overgrazing is the major concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is suited to trees. The hazard of seedling mortality is severe. Seedlings should be planted as early in spring as is feasible to take advantage of available moisture. Replanting of some seedlings can be expected. Chances for survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for dwellings with and without basements. Some earth moving is required for building construction. This soil has slight limitations for local roads and streets. Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. Pollution of nearby shallow wells is a possibility.

This soil is in capability subclass VIs and woodland suitability subclass 3s.

PlC—Plainfield sand, 6 to 12 percent slopes. This moderately sloping, deep, excessively drained soil is on outwash plains, stream terraces, and glaciated uplands. Areas are irregular in shape and range from 3 to 25 acres.

In a typical profile, the surface layer is brown sand about 2 inches thick. The subsoil is dark yellowish brown, very friable sand about 17 inches thick. The upper part of the underlying material to a depth of 54 inches is yellowish brown sand, and the lower part is light yellowish brown sand to a depth of 60 inches. Some areas of soils are dominantly fine sand throughout the profile, and some areas have thin bands of loamy sand and sandy loam in the underlying material. In some small areas, slopes are more than 12 percent. In other small areas, slopes are less than 6 percent. Some areas of soils are slightly acid to neutral in the surface layer and subsoil.

This Plainfield soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is low. Surface runoff is medium. The surface layer is strongly acid unless limed. It is very friable and is easily tilled.

Most of the acreage of this soil is used for woodland and pasture. Some areas are used for cultivated crops.

This soil is generally not suited to corn, soybeans, and small grain. Droughtiness and the hazards of wind and water erosion are major limitations in use and management.

This soil is suited to deep rooted grasses and legumes for hay or pasture. Shallow rooted legumes such as clover are not so well suited because of low available water capacity. If this soil is used for pasture, overgrazing is the main concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, and timely deferment of grazing help to keep the pasture and soil in good condition.

This soil is suited to trees. The hazard of seedling mortality is severe. Seedlings should be planted as early in spring as is feasible to take advantage of all available moisture. Replanting of some seedlings is commonly needed. Chances for survival and growth of seedlings are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements because of slope. Some earthmoving is required for the construction of dwellings.

This soil has moderate limitations for local roads and streets because of slope. Roads should be built on the contour to help reduce the hazard of erosion.

Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. Pollution of nearby shallow wells by leachates is a possibility.

This soil is in capability subclass VIs and woodland suitability subclass 3s.

RaB—Rawson loam, 2 to 6 percent slopes. This gently sloping, deep, well drained and moderately well drained soil is on convex ridgetops, knolls, and side slopes. Areas are irregular in shape. They range from 3 to 150 acres but are dominantly about 40 acres.

In a typical profile, the surface layer is brown loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown, friable loam; the middle part is dark yellowish brown, firm clay loam and brown, firm clay loam; and the lower part is yellowish brown, mottled, very firm silty clay loam. The substratum is brown, mottled silty clay loam to a depth of 60 inches. In some areas the lower part of the subsoil has less clay. In some small areas, slopes are less than 2 percent. In other small areas, slopes are more than 6 percent.

Included with this soil in mapping are small areas of Morley and Riddles soils. The included soils make up about 10 to 12 percent of the unit.

This Rawson soil has moderate available water capacity. Permeability is moderate in the subsoil and slow or very slow in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is medium. This soil has a seasonal high water table that is at a depth of 2.5 to 4 feet during spring. The surface layer is friable and can be tilled through a fairly wide range of moisture content. It is generally neutral or slightly acid.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for orchards.

This soil is well suited to corn, soybeans, and small grain. The hazard of erosion is the main limitation in use and management. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a moderate hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for dwellings with basements because of the high shrink-swell potential of the substratum and has slight limitations for dwellings without basements. Dwellings should be constructed without basements. Foundations and footings should be designed to prevent structural damage caused by shrinking and swelling of the soil.

This soil has moderate limitations for local roads and streets because of the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of slow or very slow permeability and wetness. Where sanitary facilities are not available, large absorption fields can be used to overcome the reduced permeability of the soil.

This soil is in capability subclass IIe and woodland suitability subclass 2o.

RaC2—Rawson loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained and moderately well drained soil is on convex ridgetops, knolls, and side slopes. Areas are generally elongated. They range from 2 to 60 acres but are dominantly about 10 acres.

In a typical profile, the surface layer is dark yellowish brown loam about 6 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable loam, and the lower part is brown, mottled, firm clay loam. The underlying material is light brownish gray, mottled silty clay loam to a depth of 60 inches. In some places the surface layer is yellowish brown, and in other places the surface layer is thinner and is mixed with the subsoil. In some areas nearly all of the surface layer has been eroded. In some small areas, slopes are less than 6 percent. In other small areas, slopes are more than 12 percent.

Included with this soil in mapping are small areas of Morley and Riddles soils. The included soils make up about 8 to 10 percent of the unit.

This Rawson soil has moderate available water capacity. Permeability is moderate in the subsoil and slow or very slow in the substratum. The organic matter content of the surface layer is moderate. Surface runoff is medium. This soil has a seasonal high water table that is at a depth of 2.5 to 4 feet during spring. The surface layer is friable and can be tilled through a fairly wide range of moisture content. It is generally neutral or slightly acid.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for orchards.

This soil is suited to corn, soybeans, and small grain. The hazard of erosion is the major limitation in use and management. A cropping system that includes row crops part of the time can be used. Conservation tillage, contour farming, and the use of crop residue and cover crops help to control erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, poor tilth, and excessive runoff. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a moderate hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for dwellings with basements because of the high shrink-swell potential and moderate limitations for dwellings without basements because of slope. Dwellings should be constructed without basements, and foundations and footings should be designed to prevent structural damage caused by shrinking and swelling. Developing lots at random and retaining the vegetative cover as much as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour and to build diversions between lots to intercept runoff. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area as quickly as possible to desirable grasses.

This soil has limitations for local roads and streets because of slope and frost action. Strengthening the base material with sand and gravel or replacing the base material with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of slow and very slow permeability and wetness. Where sanitary facilities are not available, large absorption fields can be used to overcome the reduced permeability of the soil. The number of lines can be reduced and then lengthened to obtain the desired size of field, or some lines can be placed at a greater depth than others so that all lines receive equal flow. In some areas, effluent may seep from lower parts of the slope.

This soil is in capability subclass IIIe and woodland suitability subclass 2o.

RIA—Riddles silt loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on the uplands. Areas are small and irregular in shape and range from 3 to 35 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 9 inches. The subsoil is dark yellowish brown, firm loam and clay loam about 32 inches thick. The underlying material is pale brown, mottled gravelly sandy clay loam and gravelly loam to a depth of 60 inches. In some places the subsoil is not so thick. In other places the surface layer is darker. In some small areas the content of gravel is 15 percent or more in the underlying material. In a few small areas, slopes are more than 2 percent.

Included with this soil in mapping are a few small areas of Blount soil. The included soil makes up 6 to 8 percent of the unit.

This Riddles soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow. Unless limed, the surface layer is medium acid or strongly acid. It is friable and is easily tilled through a fairly wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for orchards.

This soil is well suited to corn, soybeans, and small grain. Conservation tillage and the use of crop residue and cover crops help to maintain and improve the content of organic matter and tilth of the soil.

This soil is well suited to grasses and legumes for hay or pasture. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the main concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a moderate hazard, but seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for building sites because of the shrink-swell potential. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling.

This soil has moderate limitations for local roads and streets because of low strength and frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are moderate for septic tank absorption fields because of moderate permeability. Increasing the size of the septic tank absorption field helps to overcome the reduced permeability.

This soil is in capability class I and woodland suitability subclass 1o.

RIB—Riddles silt loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on broad, convex ridgetops and long side slopes of the uplands. Areas are generally broad and irregular in shape. They range from 10 to 220 acres but are dominantly about 60 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is dark yellowish brown and yellowish brown, firm loam about 38 inches thick. The underlying material is yellowish brown, mottled loam to a depth of 60 inches. In some places the subsoil is not so thick. In other small areas the underlying material is 15 percent or more gravel. There are small eroded areas of this soil on steeper slopes. In these areas the surface layer has been mixed with subsoil and is clay loam. In some areas, slopes are less than 2 percent, and in other areas, the slopes are more than 6 percent.

Included with this soil in mapping are a few small, low lying areas of Whitaker soils that are flatter than Riddles soil and a few areas of Morley and Tracy soils. The included soils make up about 8 to 10 percent of the unit.

This Riddles soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. Unless limed, the surface layer is medium acid or strongly acid. It is friable and is easily tilled through a fairly wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for orchards.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown.

Conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops also help to control erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind and water erosion. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a moderate hazard, but seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements because of the shrink-swell potential. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling. Retaining as much vegetative cover as possible during construction helps to reduce erosion. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as a final layer, and then reseeding the area to desirable grasses as quickly as possible. This soil has moderate limitations for local roads and streets because of low strength and frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are moderate for septic tank absorption fields because of moderate permeability. Increasing the size of the septic tank absorption field helps to overcome the reduced permeability.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

RmC2—Riddles loam, 6 to 12 percent slopes, eroded. This moderately sloping, deep, well drained soil is on broad, convex ridgetops; on side slopes; and along drainageways of the uplands. Areas are irregular in shape. They range from 3 to 180 acres but are dominantly about 20 acres.

In a typical profile, the surface layer is dark brown loam about 5 inches thick. The subsoil is dark yellowish brown or brown, firm sandy clay loam or gravelly sandy clay loam about 46 inches thick. The underlying material is dark yellowish brown sandy loam to a depth of 60 inches. In places the subsoil is not so thick. In other small areas the underlying material is 15 percent or more gravel. There are small, eroded areas of this soil on steeper slopes. In these places the surface layer has been mixed with the subsoil and is light clay loam. In a few small areas, slopes are more than 12 percent. In other small areas, slopes are less than 6 percent.

Included with this soil in mapping are a few small areas of Morley and Tracy soils. The included soils make up about 8 to 10 percent of the unit.

This Riddles soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is low as a result of the loss of soil by erosion. Surface runoff from cultivated areas is medium. The surface layer is medium acid or strongly acid unless limed. It is friable and is easily tilled through a fairly wide range in moisture content.

Some of the acreage of this soil is used for cultivated crops. Other areas are used for hay or pasture. A few areas are used for orchards.

This soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops help to control erosion and improve and maintain the tilth and content of organic matter of this soil.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind and water erosion. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a moderate hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements because of the shrink-swell potential and slope. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling. Some earth moving may be needed for the construction of dwellings. Developing lots at random and retaining as much vegetative cover as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour, and to build diversions between lots to intercept runoff. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has moderate limitations for local roads and streets because of low strength, slope, and frost action.

Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are moderate for septic tank absorption fields because of moderate permeability and slope. Increasing the size of the septic tank absorption field helps to overcome the reduced permeability. The slope can present problems in the design of the absorption field. The number of lines can be reduced and then lengthened to extend the field, or some lines can be placed at a greater depth than others so that all lines receive equal flow.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

RmD2—Riddles loam, 12 to 18 percent slopes, eroded. This strongly sloping, deep, well drained soil is on ridgetops, on side slopes, and along drainageways of the uplands. Areas are irregular in shape. They range from 5 to 47 acres but are dominantly about 15 acres.

In a typical profile, the surface layer is dark brown loam about 5 inches thick. The subsoil is about 46 inches thick. The upper part is dark yellowish brown, firm sandy clay loam; the middle part is dark yellowish brown, firm, gravelly sandy clay loam and dark yellowish brown, friable loamy sand; and the lower part is dark yellowish brown, firm, gravelly sandy clay loam. The underlying material is dark yellowish brown sandy loam to a depth of 60 inches. In some places the subsoil has less thickness. In some small areas, the content of gravel is 15 percent or more in the underlying material. In some small areas, slopes are less than 12 percent, and in other areas, the slopes are more than 18 percent.

Included with this soil in mapping are a few small areas of Morley and Tracy soils. The included soils make up about 8 to 10 percent of the unit.

This Riddles soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is low. Surface runoff is medium. The surface layer is medium acid or strongly acid unless limed. It is friable.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture crops, and other areas are used for orchards or woodland. The soil has fair potential for farm use and for most engineering uses.

This soil is poorly suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. Any conservation practice should fit the size of the delineation and be in accord with the practices used on surrounding cultivated soils. The use of crop residue and cover crops also helps to control erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind and water erosion. If the soil is used for pasture, overgrazing or grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a hazard if this soil is planted to trees. Seedlings survive and grow well if competing vegetation and erosion are controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of slope. Extensive earth moving is required for construction. Developing lots at random and retaining as much vegetative cover as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour and to build diversions between lots to intercept runoff. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of slope. Extensive road cuts may be needed. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of slope. Some lines can be placed at a greater depth than others so that all lines receive equal flow, or one or two lines can be used and lengthened to obtain the amount of field needed. Machinery cannot be used on some of these slopes to install the absorption fields.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

Sb—Sebewa loam, shaly sand substratum. This nearly level or depressional, deep, very poorly drained soil is on broad flats or in slight depressions where it is intermingled with poorly drained or very poorly drained soils. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas are generally broad and irregular in shape. They range from 3 to 700 acres but are dominantly about 100 acres.

In a typical profile, the surface layer is black loam about 8 inches thick. The subsurface layer is black loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is dark gray, mottled, firm sandy clay loam; the middle part is grayish brown, mottled, firm clay loam; and the lower part is dark gray, mottled, friable sandy loam. The underlying material is brown, loose shaly sand and fine gravel to a depth of 60 inches.

In some areas the surface layer is mucky loam. In other areas the combined surface layer and subsoil is more than 40 inches thick. Some areas of soils have higher concentrations of iron.

Included with this soil in mapping are a few small, slightly convex areas of better drained soils that have a dark surface layer that is similar in thickness to the plow layer of Sebewa soil and that has mottles in the subsoil. This included soil makes up about 8 to 10 percent of the unit.

This Sebewa soil has moderate available water capacity. Permeability is moderate in the subsoil and rapid in the underlying material. The organic matter content of the surface layer is high. Surface runoff is very slow. This soil has a seasonal high water table that is near or above the surface early in spring. The surface layer is friable. It is easy to till under proper moisture conditions, but it becomes cloddy and hard to work if tilled when wet.

Most of the acreage of this soil is used for cultivated crops. A few areas are used for hay or pasture or for woodland.

This soil is well suited to corn, soybeans, and some kinds of small grain. It is poorly suited to winter wheat because ponding generally destroys the stands. Wetness and the hazard of wind erosion are limitations in use and management. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. Conservation practices such as conservation tillage and the use of crop residue help to improve and maintain the tilth and content of organic matter of this soil and to control wind erosion.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture crops. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. If this soil is used for pasture, overgrazing or grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to reduce surface compaction and to maintain good tilth and plant density.

This soil is suited to trees. The use of equipment is severely restricted. The hazards of seedling mortality, windthrow, and plant competition are severe because the seasonal high water table is at or near the surface for long periods. Harvesting of trees is generally delayed to extremely dry seasons or to periods when the ground is frozen. Water-tolerant species should be favored in stands. Replanting of seedlings is commonly needed. Seedling survival and growth is improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding. Drainage of most areas is difficult because the soil is commonly in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers are commonly not available.

This soil has severe limitations for local roads and streets because of ponding and frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support heavier loads.

Limitations are severe for septic tank absorption fields because of ponding and the poor filtering qualities of the soil. Seepage of effluent into ground water supplies can cause pollution.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Se—Selfridge loamy fine sand. This nearly level, deep, somewhat poorly drained soil is in slightly convex areas on beach ridges, outwash plains, and low sand dunes. Areas are irregular in shape. They range from 2 to 200 acres but are dominantly about 20 acres.

In a typical profile, the surface layer is dark grayish brown loamy fine sand about 9 inches thick. The subsurface layer is brown, very friable loamy fine sand about 5 inches thick. The subsoil is about 28 inches thick. The upper part is pale brown, friable loamy sand; the middle part is yellowish brown, mottled, firm sandy clay loam; and the lower part is gray, mottled, very firm silty clay loam. The underlying material is brown and light brownish gray, mottled clay loam to a depth of 60 inches. In some small areas the surface layer is sandy, and in other small, slightly higher lying areas the upper part of the subsoil does not have gray mottles. Some areas of this soil are in small swales and depressions and the surface layer is dark.

Included with this soil in mapping are a few small areas of Blount soils and a few small, slightly higher lying areas of Brems soils. The included soils make up about 10 to 12 percent of the unit.

This Selfridge soil has moderate available water capacity. Permeability is rapid in the upper part of the subsoil and moderately slow in the lower part of the subsoil and underlying material. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is medium acid or slightly acid unless limed. This soil has a seasonal high water table that is at a depth of 1 foot to 2 feet during spring. It is very friable and is easily tilled through a fairly wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Wetness is the main limitation in use and management. Excessive water can be removed by open ditches, subsurface drains, pumping, or a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. Conservation practices such as the use of crop residue and cover crops help to maintain the tilth and improve and maintain the content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture crops. Deep rooted legumes such as alfalfa are poorly suited because of the seasonal high water table and the shallow depth to calcareous till or lacustrine material. If this soil is used for pasture, overgrazing is the main concern of management. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees. Seasonal wetness may cause a slight delay in harvesting or planting. Water-tolerant species should be favored in stands. Plant competition and seedling mortality are hazards if this soil is planted to trees. Replanting of some seedlings may be needed. Seedling survival and growth are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table. Dwellings should be constructed without basements.

This soil has severe limitations for local roads and streets because of frost action. Drainage ditches along roads to lower the water table help to reduce the frost action potential. Limitations are severe for septic tank absorption fields because of wetness and moderately slow permeability.

If sanitary facilities are not available, the water table can be lowered in this soil by the use of an adequate subsurface drainage system. Increasing the size of the absorption field in drained areas helps the septic systems to function more efficiently.

This soil is in capability subclass IIIw and woodland suitability subclass 3s.

So—Suman silt loam. This nearly level, deep, very poorly drained soil is on flood plains. It is frequently flooded for brief periods. Areas are generally elongated. They range from 3 to 125 acres but are dominantly about 12 acres.

In a typical profile, the surface layer is black silt loam about 7 inches thick. The subsurface layer is very dark gray, mottled clay loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is dark gray, mottled, firm clay loam, and the lower part is dark gray, mottled, friable sandy clay loam. The underlying material is light brownish gray, loose sand to a depth of 60 inches. In some areas the surface layer is dark gray, and in other areas the underlying material is stratified. A few areas of this soil decrease in organic matter content as depth increases. In some areas the subsoil is silt loam. Short steep slopes occur in this unit in about 50 to 60 percent of the soils along the edge of Salt Creek.

Included with this soil in mapping are small areas of Fluvaquents. Also included are areas of loamy sand or sand at a depth of less than 20 inches. The included soils make up about 8 to 10 percent of the unit.

This Suman soil has moderate available water capacity. Permeability is moderately slow in the subsoil and rapid in the underlying material. The organic matter content of the surface layer is high. Surface runoff is slow. The surface layer is slightly acid or neutral. This soil has a seasonal high water table that is at the surface or at a depth of 0.5 foot during a significant part of the year. Drainage is needed for crop production, and drainage systems have been installed in some areas. This soil has a firm surface layer that becomes cloddy and hard to work if it is tilled when wet.

Some of the acreage of this soil is used for cultivated crops. A few areas are used for hay or pasture or for woodland.

This soil is suited to corn, soybeans, and some kinds of small grain. It is poorly suited to winter wheat. Ponding or flooding generally destroys the stands unless the area is adequately protected from flooding. Wetness and the hazard of flooding are the main limitations in use and management. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. If drainage, adequate protection from flooding, and proper management are provided, this soil is suited to intensive row cropping. Conservation tillage and the use of crop residue help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture. Deep rooted legumes such as alfalfa are poorly suited because of the high water table. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to trees, and only a few areas are used for woodland. The use of equipment is severely restricted. The hazards of plant competition, seedling mortality, and windthrow are severe because the water table is at or near the surface for long periods. Harvesting of trees is generally delayed to extremely dry seasons or to periods when the ground is frozen. Water-tolerant species should be favored in stands. Replanting of some seedlings is needed to maintain the density of stands. Seedling survival and growth are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness and flooding. It is not suitable for building sites. Drainage of most areas is difficult because this soil is generally in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers are commonly not available. Protection from flood waters is difficult because flooding normally occurs when streams back out into these areas.

This soil has severe limitations for local roads and streets because of wetness, flooding, and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action potential. The conditions caused by flooding are difficult to overcome. Elevating the roadbed helps to overcome wetness. Strengthening of the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness, flooding, and moderately slow permeability. This soil is generally not suitable for septic tank absorption fields.

This soil is in capability subclass IIIw and woodland suitability subclass 2w.

TcA—Tracy sandy loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is on broad, flat areas of the uplands. Areas are generally broad and irregular in shape. They range from 2 to 500 acres but are dominantly about 30 acres.

In a typical profile, the surface layer is very dark brown sandy loam about 5 inches thick. The subsurface layer is brown sandy loam about 4 inches thick. The subsoil is about 51 inches thick. The upper part is dark brown and brown, friable, firm sandy loam, and the lower part is stratified, brown, shaly sandy clay loam and shaly loamy sand. The underlying material is mottled, brown and grayish brown, stratified loamy sand, sand, and shaly sand to a depth of 80 inches. In some places the subsoil is not so thick. In other places the underlying material is pale brown, stratified sand and loamy sand. In some areas of soils the depth to free carbonates is less than 60 inches. In a few areas, slopes are more than 2 percent.

Included with this soil in mapping are a few small areas of Riddles and Hanna soils. The included soils make up about 10 to 12 percent of the unit.

This Tracy soil has moderate available water capacity and permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow. The surface layer is friable and is easily tilled through a fairly wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for orchards and woodland.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to help control wind erosion if cultivated crops are grown. Conservation tillage and the use of crop residue and cover crops help to control wind erosion and to improve and maintain the tilth and content of organic matter of this soil. This soil is droughty during seasons when rainfall is poorly distributed.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind erosion. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for building sites. It has moderate limitations for local roads and streets because of frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic and to overcome the frost action potential.

This soil has slight limitations for septic tank absorption fields. If septic tank absorption fields are used, pollution of nearby shallow wells is a slight possibility.

This soil is in capability subclass IIs and woodland suitability subclass 1o.

TcB—Tracy sandy loam, 2 to 6 percent slopes. This gently sloping, deep, well drained soil is on broad, convex ridgetops and on long side slopes and toe slopes of the uplands. Areas are generally broad and irregular in shape. They range from 4 to 260 acres but are dominantly about 30 acres.

In a typical profile, the surface layer is dark grayish brown sandy loam about 7 inches thick. The subsurface layer is brown sandy loam about 2 inches thick. The subsoil is about 33 inches thick. The upper part is yellowish brown sandy loam, and the lower part is yellowish brown, friable sandy loam. The underlying material is yellowish brown and strong brown, stratified sandy loam, loamy sand, and sand to a depth of 60 inches. In some places the subsoil is not so thick. In other areas the depth to free carbonates is less than 60 inches. In a few small areas, slopes are less than 2 percent. In other areas, slopes are more than 6 percent.

Included with this soil in mapping are a few small areas of Riddles soil. The included soil makes up about 8 to 10 percent of the unit.

This Tracy soil has moderate available water capacity and permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and is easily tilled through a fairly wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for orchards and woodland.

This soil is well suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent excessive soil loss. The use of crop residue and cover crops also helps to control erosion and to improve and maintain the tilth and content of organic matter of this soil. This soil is droughty during seasons when rainfall is poorly distributed.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind and water erosion. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competiton is a hazard if the soil is planted to trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for dwellings with and without basements. Erosion is a hazard if the topsoil is disturbed. Retaining as much vegetative cover as possible during construction helps to reduce erosion. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has moderate limitations for local roads and streets because of frost action. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic and to reduce the possibility of frost heaving.

Limitations are slight for septic tank absorption fields. If septic tank absorption fields are used, pollution of nearby shallow wells is a possibility.

This soil is in capability subclass IIe and woodland suitability subclass 1o.

TcC—Tracy sandy loam, 6 to 12 percent slopes. This moderately sloping, deep, well drained soil is on convex ridgetops and side slopes of uplands. Areas are fairly small and irregular in shape and range from 2 to 40 acres.

In a typical profile, the surface layer is dark yellowish brown sandy loam about 10 inches thick. The subsoil is about 26 inches thick. The upper part is yellowish brown, very friable loam, and the lower part is dark yellowish brown, friable loamy sand and gravelly sand. The underlying material is yellowish brown, stratified loamy sand and sand to a depth of 60 inches. In some places the subsoil is not so thick. In other places most of the surface layer has been lost through erosion and is mixed with the subsoil. In these areas the surface layer is yellowish brown. Some areas of this soil are less than 60 inches deep to free carbonates. In some areas, slopes are less than 6 percent. In other areas, slopes are more than 12 percent.

Included with this soil in mapping are a few small areas of Riddles soil. The included soil makes up about 6 to 8 percent of the unit.

This Tracy soil has moderate available water capacity and permeability. The organic matter content of the surface layer is moderate. Surface runoff is medium. The surface layer is friable and is easily tilled through a fairly wide range in moisture content.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for orchards and woodland.

This soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, terraces, diversions, contour farming, grassed waterways, or grade stabilization structures help to prevent exessive soil loss. Any conservation practice should fit the size of the delineation and be in accord with the practices used on surrounding cultivated soils. The use of crop residue and cover crops also helps to control erosion and to improve and maintain the tilth and content of organic matter of this soil. This soil is droughty during seasons when rainfall is poorly distributed.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind and water erosion. If the soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a hazard. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has moderate limitations for dwellings with and without basements because of the slope. Developing lots at random and retaining as much vegetative cover as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be on the contour and to build diversions between lots to intercept runoff. If the vegetation has been removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has moderate limitations for local roads and streets because of slope and the frost action potential. Road cuts may be needed. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are moderate for septic tank absorption fields because of the slope. Some lines can be placed at a greater depth than others to obtain equal flow to the lines, or only one or two lines can be used and lengthened to obtain the amount of field needed. If septic tank absorption fields are used, pollution of nearby shallow wells is a slight possibility.

This soil is in capability subclass IIIe and woodland suitability subclass 1o.

TcD—Tracy sandy loam, 12 to 18 percent slopes. This strongly sloping, deep, well drained soil is on ridgetops and side slopes and along drainageways of uplands. Areas are irregular in shape. They range from 2 to 80 acres but are dominantly about 15 acres.

In a typical profile, the surface layer is dark brown sandy loam about 7 inches thick. The subsoil is about 31 inches thick. The upper part is dark yellowish brown, friable sandy loam; the middle part is dark yellowish brown, loose sand; and the lower part is yellowish brown, firm sandy clay loam. The underlying material is yellowish brown sand to a depth of 60 inches. In some areas the subsoil is not so thick. In other areas, depth to free carbonates is less than 60 inches and the profile is less acid than is typical. In a few small areas, slopes are less than 12 percent. In other areas, slopes are more than 18 percent.

Included with this soil in mapping are a few small areas of Chelsea and Riddles soils. The included soils make up about 8 to 10 percent of the unit.

This Tracy soil has moderate available water capacity and permeability. The organic matter content of the surface layer is moderate. Surface runoff is rapid. The surface layer is friable.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for orchards and trees.

This soil is suited to corn, soybeans, and small grain. Conservation practices are needed to control erosion and surface runoff if cultivated crops are grown. Crop rotation, conservation tillage, diversions, contour farming, and grassed waterways or grade stabilization structures help to prevent excessive soil loss. Any conservation practice should fit the size of the delineation and be in accord with the practices used on surrounding cultivated soils. The use of crop residue and cover crops also helps to control erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind and water erosion. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. Plant competition is a hazard if this soil is planted to trees. Seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of the slope. Developing lots at random and retaining as much vegetative cover as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour and to build diversions between lots to intercept runoff. If the vegetation is removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area to desirable grasses as quickly as possible.

This soil has severe limitations for local roads and streets because of slope. Extensive road cuts may be needed. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of slope. Some lines can be placed at a greater depth than others so that all lines receive equal flow, or one or two lines can be lengthened to obtain the amount of field needed. Machinery cannot be used on some of these slopes to install the absorption fields. If septic tank absorption fields are used, pollution of nearby shallow wells is a slight possibility.

This soil is in capability subclass IVe and woodland suitability subclass 1o.

TyA—Tyner loamy sand, 0 to 3 percent slopes. This nearly level, deep, well drained soil is on slightly convex areas that are generally broad and irregular in shape. Areas range from 3 to 750 acres but are dominantly about 65 acres.

In a typical profile, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is brown loamy sand about 3 inches thick. The subsoil is about 42 inches thick. It is dark yellowish brown, very friable or loose loamy sand and sand. The substratum is dark yellowish brown, mottled sand to a depth of 60 inches. Large, fairly uniform areas of sandy loam subsoil occur in some small areas. Other areas are sandy throughout the profile. In some small areas, the slope is more than 3 percent.

Included with this soil in mapping are a few small areas of Brems soils. The included soils make up about 6 to 8 percent of the unit.

This Tyner soil has moderate available water capacity and rapid permeability. The organic matter content of the surface layer is low. Surface runoff is slow. The surface layer is friable and is easily tilled through a wide range in moisture content.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and a few areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Droughtiness is the main limitation in use and management. Windbreaks, crop rotation, and conservation tillage are needed to help prevent excessive soil loss from wind erosion. The use of crop residue and cover crops also helps to control wind erosion and to improve and maintain the tilth and content of organic matter of this soil.

This soil can be planted to grasses and legumes for hay or pasture to effectively control wind erosion. Overgrazing and grazing when the soil is wet cause surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during dry periods help to keep the pasture and soil in good condition.

This soil is well suited to trees. A few areas are used for woodland. Seedling mortality is a moderate hazard because of the droughtiness. Replanting of some seedlings may be needed. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has slight limitations for building sites and for local roads and streets. Limitations are severe for septic tank absorption fields because of the poor filtering qualities of this soil. Pollution of nearby shallow wells is a possibility.

This soil is in capability subclass IIIs and woodland suitability subclass 3s.

UbA—Udorthents, 0 to 3 percent slopes. These nearly level and gently sloping soils are on outwash plains, lake plains, till plains, and moraines. Areas are fairly small, and are elongated or rounded. They range from 2 to 80 acres.

No one pedon is typical of Udorthents, but in one of the more common pedons the surface layer is dark brown or very dark grayish brown loam or silt loam. The underlying material is made up of solid waste and layers of soil about 6 to 10 inches thick. In places the surface layer is brown, dark yellowish brown, yellowish brown, or brownish gray loamy sand, loam, sandy clay loam, or silty clay loam. The disturbance of these areas is so great that identification of the soil cannot be made.

Included with these soils in mapping are a few small areas of soils that are sandy and a few small areas that are clay loam. Also included are a few small areas that have slopes of more than 6 percent. The included soils make up about 10 percent of the unit.

These Udorthents are idle land in areas where landfill operations have been completed. Weeds and grasses grow on the idle areas. In some areas, landfill operations are still active.

These soils are suited to grasses that can provide cover and protection from erosion. After the landfill has settled, these areas are suitable for some species of shrubs and trees. The areas can be used for recreation purposes that do not require structures or buildings.

These soils have very limited use. Because of the hazard of settling, only low cost shed type structures should be built on this soil for several years. Selection of alternate sites for dwellings, small commercial buildings, and local roads and streets is advisable.

These soils are not assigned to a capability subclass or woodland suitability subclass.

Uc—Urban land-Blount complex. This complex consists of areas of Urban land and nearly level and gently sloping, somewhat poorly drained Blount soil on glacial till plains in uplands. Areas are generally fairly large and range from 40 to 160 acres. Most areas are in the town of Valparaiso.

In a typical area of Urban land, streets, parking lots, shopping centers, houses, buildings, and other structures cover the surface so that recognition of the type of soil cannot be made. About 55 percent of the complex is Urban land.

In a typical profile of Blount soil, the surface layer is dark grayish brown silt loam about 11 inches thick. The subsoil is about 27 inches thick. It is yellowish brown, grayish brown, gray, and light brownish gray, mottled, firm and very firm silty clay loam. The underlying material is light olive brown silty clay loam to a depth of 60 inches. This soil makes up about 40 percent of the complex.

Included with this complex in mapping are a few depressional areas of Pewamo soils that are wetter than Blount soil. Also included are some higher lying areas of Morley soils. The included soils make up about 5 percent of the unit.

The Blount soil has moderate available water capacity and slow or moderately slow permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow to medium. Unless the surface layer is limed, it is medium acid or strongly acid. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring.

Most of the acreage of this soil is used for building site development. A few areas are idle or are used for playgrounds or recreation facilities.

This soil is not used for crops, forage, or woodland. If small areas are used for garden plots and lawns, lime and fertilizer should be added according to soil tests and plant needs. If trees and shrubs are planted, competing plants need to be controlled until the seedlings are established.

The Blount soil has severe limitations for building sites because of wetness. Dwellings should be constructed without basements. An adequate drainage system, in combination with storm sewers, is needed to satisfactorily lower the water table.

This soil has severe limitations for local roads and streets because of frost action and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness and moderately slow or slow permeability. Sanitary facilities should be connected to commercial sewers and treatment facilities.

This complex is not assigned to a capability subclass. Urban land is not assigned to a woodland suitability class. The Blount soil is woodland suitability subclass 3c.

UcG—Udorthents, loamy, 3 to 30 percent slopes. These nearly level to steep soils are on outwash plains, lake plains, till plains, and moraines. Areas are fairly small and range from 3 to 100 acres.

No one pedon is typical of Udorthents, but in one of the more common pedons the surface layer is dark brown or brown sandy loam or loam. Some areas are very dark grayish brown, dark yellowish brown, yellowish brown, or brownish gray loamy sand, sandy clay loam, silt loam, or light silty clay loam. In some places, the underlying material has gray mottles. In other places, the material is stratified, yellowish brown, brownish yellow, brown, and pale brown loam, sandy loam, loamy sand, sandy clay loam, and silty clay loam. In some areas the surface layer and some of the underlying layers have been removed or the surface layer has been reworked and mixed with the underlying layers. In other areas the upper layers of loamy material have been transported from another site. The disturbance of these areas is so great that identification of the soil cannot be made.

Included with these soils in mapping are areas of soils that are sandy and a few areas of soils that are clay loam. Also included are areas that have very steep slopes as a result of cuts made to remove soil material, and a few small areas that surround small bodies of water. The included soils make up about 15 percent of the unit.

These Udorthents are used for commercial building sites, borrow pits, interstate highway interchanges, and other large projects that require extensive earthmoving.

These soils are suited to grasses that can provide cover and protection from erosion in sloping areas. If grasses for cover and protection are planted, additions of lime and fertilizer should be made according to soil tests and plant needs. These tests are needed because of the extreme variability of the soil material.

These soils are used for large construction sites. They are not suitable for the construction of dwellings. Limitations for construction sites are generally overcome by extensive earthmoving. Erosion should be controlled.

Limitations for septic tank absorption fields are variable. Onsite investigations are needed.

These soils are not assigned to a capability subclass or woodland suitability subclass.

Ud—Urban land-Brems complex. This complex consists of areas of Urban land and nearly level and gently sloping, moderately well drained Brems soil on outwash plains. Areas are generally large and range from 40 to 300 acres. Most areas are in the town of Portage.

In a typical area of Urban land, streets, parking lots, shopping centers, dwellings, buildings, and other structures cover the surface so that recognition of the soil cannot be made. About 55 percent of the area is Urban land.

In a typical profile of Brems soil, the surface layer is very dark grayish brown sand about 12 inches thick. The subsoil is about 51 inches thick. The upper part is yellowish brown, very friable sand; the middle part is mottled, light yellowish brown, and strong brown, loose sand and mottled, dark brown, firm loamy sand; the lower part is mottled, yellowish brown, loose sand. The underlying material to a depth of 67 inches is gray and pale brown sand. This soil makes up about 40 percent of the area.

Included with this complex in mapping are a few higher lying, sloping areas of Oakville soils and a few lower lying areas of Morocco and Selfridge soils. The included soils make up about 5 to 7 percent of the unit.

The Brems soil has low available water capacity and rapid permeability. The organic matter content of the surface layer is low. Unless the surface layer is limed, it is medium acid or strongly acid. This soil has a seasonal high water table that is at a depth of 2 to 3 feet during winter and spring.

Most of the acreage of this soil is used for building site development. A few areas are idle or are used for playgrounds or recreation facilities.

This soil is not used for crops, forage, or woodland. If small areas are used for garden plots and lawns, lime and fertilizer should be added according to soil tests and plant needs. Droughtiness is a limitation and watering of lawns and garden plots is generally needed. If trees and shrubs are planted, seedling mortality is a hazard. Sufficient moisture needs to be applied at regular intervals until the plants are established.

The Brems soil has moderate limitations for dwellings without basements because of wetness and severe limitations for dwellings with basements because of wetness. Dwellings should be constructed without basements.

This soil has moderate limitations for local roads and streets because of wetness.

Limitations are severe for septic tank absorption fields because of wetness and the poor filtering qualities of the soil. Pollution of nearby shallow wells is a possibility. Commercial sewer hookup should be utilized.

This complex is not assigned to a capability subclass. Urban land is not assigned to a woodland suitability subclass. The Brems soil is in woodland suitability subclass 3s.

Ue—Urban land-Martinsville complex. This complex consists of areas of Urban land and nearly level, well drained Martinsville soil on terraces, lake plains, and outwash plains. Areas are fairly large and range from 40 to 200 acres. Most areas are in the town of Chesterton.

In a typical area of Urban land, streets, parking lots, shopping centers, dwellings, buildings, and other structures cover the surface so that recognition of the type of soil cannot be made. About 55 percent of the area is Urban land.

In a typical profile of Martinsville soil, the surface layer is dark grayish brown loam about 10 inches thick. The subsurface layer is brown loam about 2 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown, firm silty clay loam; the middle part is yellowish brown, firm clay loam; and the lower part is yellowish brown, friable loam. The underlying material is yellowish brown and light yellowish brown, mottled, very friable sandy loam to a depth of 60 inches. This soil makes up about 40 percent of the area. Some areas are loam throughout the profile.

Included with this complex in mapping are a few higher lying areas of Tracy soils that are sandier than the Martinsville soil and a few lower lying areas of Whitaker soils. The included soils make up about 5 percent of the unit.

The Martinsville soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Unless the surface layer is limed, it is medium acid or strongly acid.

Most of the acreage of this soil is used for building site development. A few areas are idle or are used for playgrounds or recreation facilities.

This soil is not used for crops, forage, or woodland. If small areas are used for garden plots and lawns, lime and fertilizer should be added according to soil tests and plant needs. If trees and shrubs are planted, competing plants need to be controlled until the seedlings are established.

The Martinsville soil has moderate limitations for building sites because of the shrink-swell potential. Foundations and footings should be designed to prevent structural damage caused by the shrinking and swelling. This soil has moderate limitations for local roads and streets because of low strength and frost action. Strengthening the base material with sand and gravel helps to overcome the low strength of the material. Limitations are slight for septic tank absorption fields.

This complex is not assigned to a capability subclass. Urban land is not assigned to a woodland suitability subclass. The Martinsville soil is in woodland suitability subclass 1o.

UmB—Urban land-Morley complex, 2 to 6 percent slopes. This complex consists of areas of Urban land and gently sloping, moderately well drained and well drained Morley soil on uplands. Areas are generally large and range from 40 to 200 acres. Most areas are in the town of Valparaiso.

In a typical area of Urban land, streets, parking lots, shopping centers, dwellings, buildings, and other structures cover the surface so that recognition of the type of soil cannot be made. About 55 percent of the area is Urban land.

In a typical profile of Morley soil, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 34 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is yellowish brown, mottled, very firm silty clay loam. The underlying material is yellowish brown, firm, calcareous silty clay loam to a depth of 60 inches. This soil makes up about 40 percent of the area. In a few places the subsoil is brown, and gray mottles are absent. In a few other places the surface layer is loam. In a few areas, slopes are more than 6 percent. In a few other areas, slopes are less than 2 percent.

Included with this complex in mapping are a few areas of Blount soils that are wetter than the Morley soil and a few depressional areas of Pewamo soils. The included soils make up about 5 percent of the unit.

The Morley soil has high available water capacity and moderately slow permeability. The organic matter content of the surface layer is moderate. Unless the surface layer is limed, it is medium acid or strongly acid. This soil has a seasonal high water table that is at a depth of 3 to 6 feet in winter and spring.

Most of the acreage of this soil is used for building site development. A few areas are idle or are used for playgrounds or recreation facilities.

This soil is not used for crops, forage, or woodland. If small areas are used for garden plots and lawns, lime and fertilizer should be added according to soil tests and plant needs. If trees and shrubs are planted, competing plants need to be controlled until the seedlings are established.

The Morley soil has moderate limitations for building sites because of the shrink-swell potential and moderate limitations for dwellings with basements because of wetness. Footings and foundations should be designed to prevent structural damage caused by the shrinking and swelling. If dwellings are constructed with basements, foundation drains should be installed. Some earthmoving may be required. Retaining as much vegetative cover as possible during construction helps to reduce erosion. If the vegetation has been removed, erosion can be reduced by stockpiling the topsoil, replacing it as the final layer, and then reseeding the area as quickly as possible to desirable grasses.

This soil has severe limitations for local roads and streets because of low strength. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of moderately slow or slow permeability and wetness. Sanitary facilities should be connected to commercial sewers and treatment facilities. Where commercial facilities are not available, large absorption fields can be used to overcome the reduced permeability of the soil. Wetness can be reduced by installing an adequate drainage system.

This complex is not assigned to a capability subclass. Urban land is not assigned to a woodland suitability subclass. The Morley soil is in woodland suitability subclass 2o.

UpB—Urban land-Psamments complex, 0 to 6 percent slopes. This complex consists of areas of Urban land and nearly level, well drained to excessively drained soils on low sand dunes and beach ridges. Areas are generally large and range from 10 to 800 acres. Most areas are along the shore of Lake Michigan.

In a typical area of Urban land, streets, parking lots, dwellings, buildings, and other structures cover the surface so that recognition of the type of soil cannot be made. About 55 percent of the area is Urban land.

No one pedon is typical of Psamments, but one of the more common pedons is pale brown, loose fine sand to a depth of 60 inches or more. Because this soil has been disturbed by moving, it is not in its original state. The dunes have been leveled and the low areas have been filled to provide the nearly level topography required for use by industry. This soil makes up about 40 percent of the area. Some areas are very pale brown or yellowish brown sand.

Included with this complex in mapping are a few depressional areas of Adrian and Maumee soils. The included soils make up about 5 percent of the unit.

The Psamments have low available water capacity and very rapid permeability. The organic matter content of the surface layer is very low. The surface layer varies widely in reaction, depending on the source of the replacement surface material.

Most of the acreage of this soil is used for building site development. A few areas are idle or are used for recreation facilities.

This soil is not used for crops, forage, or woodland. If small areas are used for lawns, lime and fertilizer should be added according to soil tests and plant needs. Droughtiness is a limitation and watering of lawns is commonly needed. If trees and shrubs are planted, seedling mortality is a hazard unless sufficient moisture is applied at regular intervals until the seedlings are established.

Psamments have slight limitations for building sites and for local roads and streets. Limitations are severe for septic tank absorption fields because of the poor filtering qualities of the soil. If septic tank absorption fields are used, seepage of effluent and the pollution of nearby shallow wells is a possibility. Wetness also can be a limitation for septic tank absorption fields, depending on conditions prior to land leveling. Sanitary facilities should be connected to commercial sewers and treatment facilities.

This complex is not assigned to a capability subclass or woodland suitability subclass.

Uw—Urban land-Whitaker complex. This complex consists of areas of Urban land and nearly level, somewhat poorly drained Whitaker soil on terraces, lake plains, and outwash plains. Areas are generally large and range from 30 to 120 acres. Most areas are in the town of Chesterton.

In a typical area of Urban land, streets, parking lots, shopping centers, dwellings, buildings, and other structures cover the surface so that recognition of the type of soil cannot be made. About 55 percent of the area is Urban land.

In a typical profile of Whitaker soil, the surface layer is dark grayish brown loam about 11 inches thick. The subsoil is about 26 inches thick. The upper part is brown, dark yellowish brown, yellowish brown, and gray, mottled, firm clay loam, and the lower part is grayish brown, mottled, friable sandy loam. The underlying material is yellowish brown and light brownish gray, stratified loam and sandy loam. This soil makes up about 40 percent of the area.

Included with this unit in mapping are a few depressional areas of Sebewa soils that are wetter than the Whitaker soil. In a few small areas, slopes are more than 2 percent and gray mottles do not occur in the upper part of the subsoil. The included soil makes up about 5 percent of the unit.

The Whitaker soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Unless the surface layer is limed, it is medium acid or strongly acid. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring.

Most of the acreage of this soil is used for building site development. A few areas are idle or are used for playgrounds or recreation facilities.

This soil is not used for crops, forage, or woodland. If small areas are used for garden plots and lawns, lime and fertilizer should be added according to soil tests and plant needs. If trees and shrubs are planted, competing plants need to be controlled until the seedlings are established.

The Whitaker soil has severe limitations for building sites because of wetness. Dwellings should be constructed without basements. An adequate drainage system in combination with storm sewers is needed to satisfactorily lower the water table.

This soil has severe limitations for local roads and streets because of frost action and low strength.

Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening of the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness. Sanitary facilities should be connected to commercial sewers and treatment facilities. If facilities are not available, the water table can be lowered by the use of an adequate subsurface drainage system in combination with storm sewers.

This complex is not assigned to a capability subclass. Urban land is not assigned to a woodland suitability subclass. The Whitaker soil is in woodland suitability subclass 3o.

Wa—Wallkill silt loam. This nearly level, deep, very poorly drained soil is in narrow depressional areas and around broad, flat organic areas adjoining uplands. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas are generally fairly small and somewhat elongated. They range from 1 acre to 22 acres but are dominantly about 4 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled silt loam about 8 inches thick. The subsoil is about 13 inches thick. The upper part is dark gray, mottled, firm silt loam, and the lower part is dark grayish brown, mottled, friable silt loam. The underlying mineral material is black, mottled, friable silt loam to a depth of 32 inches and dark reddish brown muck to a depth of 60 inches. In some areas the surface layer is lighter colored than the Wallkill soil, and in some places the alluvium is less than 20 inches thick.

Included with this soil in mapping are a few depressional areas of Pewamo soil. The included soil makes up about 8 to 10 percent of the unit.

This soil has high available water capacity. Permeability is moderate in the mineral soil and moderately slow to moderately rapid in the organic material. The organic matter content of the surface layer is high. Surface runoff is very slow. This soil has a seasonal high water table that is at or near the surface for prolonged periods, and ponding occurs in some areas early in spring. The surface layer is friable and is easy to till under proper moisture conditions.

Some of the acreage of this soil is used for cultivated crops. Some areas are used for hay or pasture, and other areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. It is poorly suited to winter wheat because ponding generally destroys the stands. Wetness is the main limitation in use and management. Excessive water can be removed by subsurface drains, surface drains, grassed waterways, pumping, or a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. Conservation tillage and the use of crop residue help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. Overgrazing and grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to trees, and only a few areas are used for woodland. The use of equipment is severely restricted. The hazards of seedling mortality and windthrow are severe because the seasonal high water table is at or near the surface for long periods. Harvesting of trees is generally delayed to extremely dry seasons or to periods when the ground is frozen. Water-tolerant species should be favored in stands. Replanting of some seedlings is generally needed. The chances of seedling survival and growth are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding and low strength. Drainage is difficult in most areas because the soil is commonly in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers are generally not available. Foundations and footings need to be placed on pilings for stability of structures.

This soil has severe limitations for local roads and streets because of low strength, ponding, and frost action. The organic matter should be removed and suitable base material used as fill to strengthen the base. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Limitations are severe for septic tank absorption fields because of ponding.

This soil is in capability subclass IIIw and woodland suitability subclass 4w.

We—Warners silt loam. This nearly level, deep, very poorly drained soil is on flood plains. It is frequently flooded. Areas are irregular in shape. They range from 3 to 50 acres but are dominantly about 10 acres.

In a typical profile, the surface layer is black silt loam about 10 inches thick. The subsurface layer is very dark gray silty clay loam about 4 inches thick. The underlying material to a depth of 60 inches is grayish brown, firm silty clay loam in the upper part and light gray and gray marl in the lower part. In some small areas, less than 12 inches of mineral material overlies the marl. In other areas, carbonates are throughout the profile.

Included with this soil in mapping are small areas of Edwards and Gilford soils. The included soils make up about 6 to 8 percent of the unit.

This Warners soil has low available water capacity. Permeability is moderately slow or moderate in the mineral material and variable in the marl. The organic matter content of the surface layer is high. Surface runoff is very slow. This soil has a seasonal high water table that is at or near the surface for prolonged periods, and ponding occurs in some areas early in spring. The surface layer is neutral or mildly alkaline. It is friable and easy to till under proper moisture conditions.

Most of the acreage of this soil is drained and used for cultivated crops. Some areas are used for hay or pasture, and some areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. It is poorly suited to winter wheat because flooding and ponding generally destroy the stands. Wetness is the main limitation in use and management. Excessive water can be removed by open ditches, surface drains, pumping, or a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. Conservation tillage and the use of crop residue help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. Overgrazing and grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is poorly suited to trees, and only a few areas are used for woodland. The use of equipment is severely restricted. The hazards of seedling mortality and windthrow are severe because the seasonal high water table is at or near the surface for long periods. Harvesting of trees is generally delayed to extremely dry seasons or to periods when the ground is frozen. Water-tolerant species should be favored in stands. The replanting of seedlings is commonly needed to maintain the density of stands. Chances of seedling survival and growth are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of flooding and ponding. It is not suitable for building sites. Drainage of most areas is difficult because this soil is commonly in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers are generally not available.

This soil has severe limitations for local roads and streets because of ponding, flooding, and frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Limitations are severe for septic tank absorption fields because of ponding and flooding.

This soil is in capability subclass IIIw and woodland suitability subclass 5w.

Wh—Washtenaw silt loam. This nearly level, deep, very poorly drained soil is in depressional areas on moraines, till plains, and outwash plains. It is frequently ponded with surface runoff from adjacent higher lying areas. Areas, which are small and generally somewhat elongated, range from 1 acre to 15 acres.

In a typical profile, the surface layer is dark grayish brown silt loam about 8 inches thick. The underlying material is dark grayish brown, friable silt loam to a depth of 22 inches and dark grayish brown, mottled, friable silt loam to a depth of 30 inches. The buried soil extends to a depth of 70 inches. Between a depth of 30 and 37 inches, it is black, firm silt loam; between a depth of 37 and 62 inches, it is black, mottled, firm clay loam; and between a depth of 62 and 70 inches, it is gray, firm silty clay loam. The underlying material is gray, mottled silty clay loam to a depth of 80 inches. In areas of prairie soils the surface layer is black. In a few areas, outwash is less than 20 inches thick.

Included with this soil in mapping are small areas of Pewamo and Wallkill soils. The included soils make up about 10 to 12 percent of the unit.

This Washtenaw soil has very high available water capacity and slow or moderately slow permeability. Surface runoff is very slow or ponded. This soil has a seasonal high water table that is at or near the surface for prolonged periods, and ponding occurs in some areas in winter and spring.

Most of the acreage of this soil is drained and is used for cultivated crops. Some areas are used for hay or pasture, and some areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. It is poorly suited to winter wheat because flooding and ponding generally destroy the stands. Wetness is the main limitation in use and management. Excessive water can be removed by open ditches, subsurface drains, surface drains, pumping, or a combination of these practices. If drainage and proper management are provided, this soil is suited to intensive row cropping. Conservation tillage and the use of crop residue help to improve and maintain the tilth and content of organic matter of this soil.

This soil is suited to grasses and legumes for hay or pasture. Drainage is needed for high yields of forage or pasture. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for trees. The use of equipment is severely restricted. The hazards of seedling mortality and plant competition are severe because the seasonal high water table is at or near the surface for prolonged periods. Harvesting of trees is commonly delayed to extremely dry seasons or to periods when the ground is frozen. Water-tolerant species should be favored in stands. The replanting of seedlings is needed to maintain the density of stands. Seedling survival and growth are improved if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of ponding. Drainage is difficult in most areas because this soil is often in the lowest lying part of the landscape. Pumping is needed because suitable outlets for drainage systems such as storm sewers are generally not available.

This soil has severe limitations for local roads and streets because of ponding and frost action. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening of the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic. Limitations are severe for septic tank absorption fields because of ponding and moderately slow or slow permeability.

This soil is in capability subclass IIw and woodland suitability subclass 2w.

Wt—Whitaker loam. This nearly level, deep, somewhat poorly drained soil is on terraces, lake plains, and outwash plains. Areas are irregular in shape. They range from 3 to 104 acres but are dominantly about 20 acres.

In a typical profile, the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is about 32 inches thick. The upper part is mottled, yellowish brown, and light brownish gray, firm clay loam; the middle part is yellowish brown, mottled, firm clay loam and friable loam; and the lower part is light brownish gray, mottled, friable sandy loam. The underlying material is yellowish brown, mottled, stratified loam, fine sand, and clay loam to a depth of 60 inches. In some areas the subsoil is not so thick, and in a few small areas the subsoil is brown. Small areas of this soil have more sand throughout the profile. In some small areas, the slopes are more than 2 percent.

Included with this soil in mapping are small areas of Blount and Sebewa soils. The included soils make up about 10 to 12 percent of the unit.

This Whitaker soil has high available water capacity and moderate permeability. The organic matter content of the surface layer is moderate. Surface runoff is slow. This soil has a seasonal high water table that is at a depth of 1 foot to 3 feet during winter and spring. The surface layer is friable and is easily tilled.

Most of the acreage of this soil is used for cultivated crops. Some areas are used for hay and pasture, and some areas are used for woodland.

This soil is suited to corn, soybeans, and small grain. Wetness is the main limitation in use and management. If adequate drainage is provided, a conservation cropping system that includes row crops most of the time can be used. Conservation tillage and the use of crop residue and cover crops help to improve and maintain the tilth and content of organic matter of this soil.

This soil is well suited to grasses and legumes for hay or pasture. Drainage is beneficial for high yields. Deep rooted legumes such as alfalfa are not so well suited as shallow rooted legumes. If this soil is used for pasture, overgrazing and grazing when the soil is wet are the major concerns of management. Grazing when the soil is wet causes surface compaction and poor tilth. Overgrazing reduces plant density and plant hardiness. Proper stocking rates, rotational grazing, timely deferment of grazing, and restricted use during wet periods help to keep the pasture and soil in good condition.

This soil is suited to trees, but only a few areas are used for woodland. Plant competition is the main hazard if this soil is planted to trees. Seasonal wetness can cause a slight delay in harvesting or planting. Water-tolerant species should be favored in stands. The seedlings survive and grow well if competing vegetation is controlled. Unwanted trees and shrubs can be controlled or removed by site preparation or by spraying, cutting, or girdling.

This soil has severe limitations for building sites because of wetness. An adequate drainage system, in combination with storm sewers, is needed to satisfactorily lower the water table. Dwellings and small commercial buildings should be constructed without basements.

This soil has severe limtations for local roads and streets because of the frost action and low strength. Drainage ditches along roads help to lower the water table and reduce the frost action potential. Strengthening the base material with sand and gravel or replacing the base with more suitable material helps to support vehicular traffic.

Limitations are severe for septic tank absorption fields because of wetness. If sanitary facilities are not available, the water table can be lowered by the use of an adequate subsurface drainage system.

This soil is in capability subclass IIw and woodland suitability subclass 3o.

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Charles H. Walker, district conservationist, Soil Conservation Service, assisted in the preparation of this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

More than 176,405 acres in the survey area was used for crops and pasture in 1967, according to the Conservation Needs Inventory. Of this total, 11,010 acres was used for permanent pasture; 99,421 acres for row crops, mainly corn and soybeans; 29,653 acres for close growing crops, mainly wheat and oats; and 18,163 acres for rotation hay and pasture. The rest was idle cropland used for conservation purposes (*3*).

The potential is good for increased production of food in Porter County. Production could be considerably increased if the latest crop production technology was used throughout the county. The application of such technology can be greatly facilitated through the use of this soil survey.

Acreage in crops and pasture has been gradually decreasing as more land is taken for urban development. In 1967 there was approximately 24,967 acres of urban and built-up land in the county. This rate has been increasing by approximately 2,000 acres per year. The use of this soil survey to help make land use decisions is described in the section "General soil map units". These decisions will influence the future role of farming in the county.

Soil drainage is the major soil problem in about 70 percent of the cropland and pasture in Porter County (fig. 3). Most of the very poorly drained Adrian, Edwards, Gilford, Houghton, Maumee, Newton, Palms, Pewamo, Sebewa, Suman, Wallkill, Warners, and Washtenaw soils have been satisfactorily drained and are used for farm crops. However, a few areas of poorly drained soils cannot be economically drained. These soils are in depressional areas, and drainage ditches have to be deep and extend for great distances for a suitable outlet. Many areas of Houghton soils are in depressions, and very few are satisfactorily drained.

Without artificial drainage, the somewhat poorly drained soils are so wet that crops are damaged during most years. The Alida, Blount, Bourbon, Del Rey, Elliott, Fluvaquents, Haskins, and Selfridge soils are somewhat poorly drained. They make up about 76,348 acres.

The design of both surface and subsurface drainage

Figure 3.—The water table in Maumee loamy sand in the background is at nearly the same level as the water level of the drainage ditch.

systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of the very poorly drained soils used for intensive row cropping. Drains should be more closely spaced in soils that have slow permeability than in soils that are more permeable. Tile drainage is slow in Milford and Pewamo soils. Finding adequate outlets for tile drainage is difficult in many areas of Houghton, Milford, Pewamo, and Suman soils.

Because organic soils oxidize and subside when the pore space is filled with air, special drainage systems are needed to control the depth and the period of drainage. Keeping the water table at the level required by crops during the growing season and raising it to the surface during other parts of the year minimizes the oxidation and subsidence of organic soils. Information on drainage design for each kind of soil is available in the Technical Guide in local offices of the Soil Conservation Service.

Erosion is the major concern on approximately 32 percent of the cropland and pasture in Porter County. If the slope is more than 2 percent, erosion is a hazard. Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils that have a clayey subsoil, such as Markham, Morley, and Rawson soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Brems, Chelsea, Elston (fig. 4), Metea, Plainfield, Tracy, and Tyner soils. Second, soil erosion results in sediment entering streams. Control of erosion minimizes the pollution of streams by sediment and improves water quality for municipal use, for recreation, and for fish and wildlife.

Wind erosion on sandy soils is damaging because the surface layer is lost or the soil piles up excessively in places. If plants are fairly small, the wind can drive the sand grains with enough force to damage or destroy small plants. Wind erosion commonly occurs on soils that have a fairly deep water table, such as Brems, Chelsea, Elston, Metea, Oakville, Plainfield, Tracy, and Tyner soils. Erosion takes place at any time these soils have little or no vegetative cover. Fairly level, wet sandy soils, such as Bourbon, Maumee, Morocco, Newton, and Selfridge soils, are also subject to wind erosion if they have been drained and the water table lowered for crop

Figure 4.—Wind erosion on Elston loam, 0 to 3 percent slopes. The surface has been left smooth and unprotected after plowing.

production and there is little or no vegetative cover. Wind erosion can remove the surface layer of muck soils, such as Adrian, Edwards, Houghton, and Palms soils, if adequate protection and vegetative cover are not provided and the water table has been lowered. Control of wind erosion minimizes loss of the surface soil and reduces pile up of soils in ditches, on roadways, in fence rows, and behind windbreaks. It also helps to control the pollution of streams by sediment.

Erosion control practices provide surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, legume and grass forage crops in the cropping system reduce erosion on sloping land, add nitrogen to the soil, and improve tilth for the following crop.

Contour farming is not practical in Porter County because slopes are so short and irregular. On the soils in this county, cropping systems that provide substantial vegetative cover are required to control erosion unless minimum tillage is practiced. Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area, but they are more difficult to use successfully on eroded soils, such as Markham and Morley soils. Conservation tillage for corn, which is increasing in use throughout the county, is also effective in reducing erosion on sloping soils. This practice can be adapted to most soils in the survey area, but it is more difficult to use successfully on soils that have a clayey surface layer.

Diversions and parallel tile outlet terraces are used to shorten the length of slope and are effective in reducing sheet, rill, and gully erosion. They are most effective on deep, well drained soils that are highly susceptible to erosion. Terracing reduces soil loss and the associated loss of fertilizer elements, helps to control sediment and the resulting crop damage and damage to water courses, and reduces the need for grassed waterways which take up productive land that could be used for row crops. It makes farming on the contour easier so that less fuel is used by equipment, and it reduces the amount of pesticides entering water courses. Many areas of the Tracy soils are suitable for terracing.

Grassed waterways are needed in many of the sloping soils in Porter County, such as Morley and Tracy soils. In addition, many areas of Blount and Pewamo soils need waterways where a large watershed drains across these soils. In these soils, subsurface drainage is generally needed beneath the waterways.

Because of the large number of open ditches in the county, many grade stabilization structures are needed. These structures help to reduce erosion in places where surface water drains into an open ditch. In addition, these structures are commonly needed in open ditches where the grade is excessive. In these places, water moves so rapidly that the sides and bottoms of some channels tend to erode.

Wind erosion is a hazard on Adrian, Houghton, and Palms soils if they are drained. Wind erosion can damage these muck soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, using surface mulch, or keeping surfaces rough through proper tillage minimizes wind erosion on these soils. Windbreaks of adapted shrubs effectively reduce wind erosion on muck soils. Wind erosion also occurs on the dark mineral soils if they are barren (see fig. 4). Soils that are plowed in the fall are very susceptible to wind erosion the following spring.

Soil fertility is naturally low or moderate in most of the soils on uplands and terraces in the survey area. These soils are strongly acid or medium acid. Plant nutrients are naturally higher in soils on flood plains, such as Fluvaquents and Suman soils. Those soils are neutral or mildly alkaline. The very poorly drained Edwards, Gilford, Milford, Sebewa, Warners, and Washtenaw soils are in slightly depressional areas and receive runoff from adjacent upland soils. They generally are slightly acid or neutral.

Most upland and terrace soils generally require applications of ground limestone to raise the pH level for good growth of alfalfa and other crops that require nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Many of the soils used for crops in the survey area have a surface layer of silt loam that is moderate in content of organic matter. Generally, the structure of such soils is moderate to weak. Intense rainfall may cause the formation of a crust on the surface layer that is hard when dry and impervious to water. Once a hard crust forms, infiltration is reduced and runoff is increased. Regular additions of crop residue, manure, and other organic material help to improve the soil structure and reduce crust formation.

Fall plowing is generally not a good practice on the sloping soils because of erosion. Wind erosion is a management concern on soils that have a sandy surface layer.

Tilth is a concern on the dark, clayey Milford and Pewamo soils because they commonly stay wet until late in spring. If these soils are plowed when wet, they tend to become very cloddy when dry, and good seedbeds are difficult to prepare. Chiseling or plowing in the fall generally results in good tilth in the spring.

Field crops suited to the soils and climate of Porter County include many crops that are not now commonly grown. Corn and soybeans are the main row crops. Wheat and oats are the common close growing crops. Rye could be grown, and grass seed could be produced from bromegrass, fescue, redtop, and bluegrass.

Special crops are of limited commercial importance in the survey area. Only a small acreage is used for vegetables and fruits. Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and fruits. The Hanna, Martinsville, Metea, and Tracy soils on slopes of less than 6 percent are suitable for special crops. They make up about 15,352 acres. The Tracy soils would need to be irrigated for optimum production. Crops can generally be planted and harvested earlier on all of these soils than on the other soils in the survey area.

If the muck soils are adequately drained, they are also well suited to a wide range of vegetable crops. The Adrian, Edwards, Houghton, and Palms muck soils make up about 9,797 acres.

Most of the well drained soils are suitable for orchards and nursery plants. However, soils in low lying positions where frost is frequent and air drainage is poor generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

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

Class I soils have slight limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

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

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on the soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that a few trees may be blown down by normal winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blow down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, lovegrass, bluegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, ragweed, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, beech, wild cherry, sweetgum, apple, hawthorn, dogwood, hickory, elderberry, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite, pheasants, doves, meadowlarks, field sparrows, cottontails, red foxes, and woodchucks.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkeys, ruffed grouse, woodcocks, thrushes, woodpeckers, squirrels, gray foxes, raccoons, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrats, mink, and beaver.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 13 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 16.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 17, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, and frequent. *None* means that flooding is not probable and *frequent* that it occurs on an average of more than once in 2 years. Duration expressed as *very brief* indicates that flooding lasts less than 2 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations generally can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*5*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Adrian series

The Adrian series consists of deep, very poorly drained soils in old lake basins on outwash plains and along established ditches. These soils formed in organic deposits overlying sand. Permeability is moderately slow to moderately rapid in the organic material and rapid in the underlying sandy material. Slopes are 0 to 2 percent.

Adrian soils are similar to Edwards, Houghton, and Palms soils. Edwards soils have 16 to 50 inches of organic material overlying marl, and Palms soils have 16 to 50 inches of organic material overlying loamy mineral material. Houghton soils formed in deposits of organic material that are more than 51 inches thick.

Typical pedon of Adrian muck, drained, in an idle field 1,600 feet north and 100 feet west of the southeast corner of sec. 22, T. 37 N., R. 6 W.

Oa1—0 to 18 inches; black (10YR 2/1) sapric material broken and rubbed; less than 5 percent fiber, less than 1 percent rubbed; weak medium subangular blocky structure parting to moderate medium granular; friable; primarily herbaceous fibers; about 5 percent mineral material; very strongly acid; abrupt wavy boundary.
Oa2—18 to 30 inches; very dark gray (10YR 3/1) sapric material broken and rubbed; less than 5 percent fiber, less than 1 percent rubbed; weak medium subangular blocky structure parting to moderate medium granular; friable; primarily herbaceous fibers; about 25 percent mineral material; strongly acid; gradual wavy boundary.
IIC1—30 to 34 inches; very dark gray (10YR 2/1) loamy sand; weak coarse subangular blocky structure; friable; medium acid; abrupt smooth boundary.
IIC2—34 to 60 inches; gray (10YR 6/1) sand; single grain; loose; slight effervescence; mildly alkaline.

The depth to the sandy IIC horizon is 16 to 50 inches. The material is derived primarily from herbaceous plants. The organic part has a pH of less than 5.5 in calcium chloride. The surface layer is black (10YR 2/1 or N 2/0). The subsurface and bottom tiers have hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Some horizons are black (N 2/0) or very dark gray (N 3/0). The organic layer immediately above the sandy IIC horizon contains 40 percent mineral material in some pedons.

The IIC horizon is sand, loamy sand, gravelly sand, or gravelly loamy sand. It has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. It ranges from medium acid to moderately alkaline. Some pedons are 5 to 30 percent gravel, by volume, in the IIC horizon.

Alida series

The Alida series consists of deep, somewhat poorly drained soils on outwash plains. These soils formed in glacial outwash that contains a fairly large amount of shale. Permeability is moderate in the solum and rapid in the substratum. Slopes are 0 to 2 percent.

Alida soils are similar to Bourbon soils and are commonly adjacent to Gilford, Hanna, Lydick, and Pinhook soils. Bourbon soils have less clay in the subsoil than the Alida soils, and Gilford soils have a thicker dark surface layer. Hanna soils do not have low chroma mottles in the upper part of the solum. Lydick soils do not have low chroma mottles in the solum. Pinhook soils have less clay in the solum than Alida soils and have a gray subsoil.

Typical pedon of Alida loam, in a cultivated field 310 feet south and 900 feet west of the center of sec. 33, T. 34 N., R. 5 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many roots; 5 percent gravel; strongly acid; abrupt smooth boundary.
B1—8 to 11 inches; brown (10YR 5/3) loam; weak fine subangular blocky structure; friable; few roots; very dark grayish brown (10YR 3/2) root and worm channels; 5 percent gravel; strongly acid; clear wavy boundary.
B21t—11 to 13 inches; yellowish brown (10YR 5/4) loam; few fine faint pale brown (10YR 6/3) mottles; moderate fine and medium subangular blocky structure; firm; few roots; thin patchy dark brown (10YR 3/3) clay films on faces of peds and as linings in voids; 5 percent gravel; very strongly acid; clear wavy boundary.
B22t—13 to 18 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; few roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds and as linings in voids; 15 percent gravel; few fine black (10YR 2/1) concretions; very strongly acid; clear wavy boundary.
B23t—18 to 25 inches; pale brown (10YR 6/3) sandy clay loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak medium and coarse subangular blocky structure; firm; thin patchy dark brown (10YR 3/3) clay films on faces of some peds and as linings in voids; 15 percent gravel; few fine black (10YR 2/1) concretions; very strongly acid; gradual wavy boundary.
B24t—25 to 36 inches; yellowish brown (10YR 5/4) sandy clay loam; many coarse distinct gray (10YR 6/1) mottles; weak coarse subangular blocky structure; friable; 15 percent gravel; few fine black (10YR 2/1) concretions; very strongly acid; clear wavy boundary.
B31—36 to 49 inches; yellowish brown (10YR 5/4) sandy loam; many coarse distinct light brownish gray (10YR 6/3) mottles; massive; friable; 13 percent gravel; few fine black (10YR 2/1) concretions; strongly acid; clear wavy boundary.
B32g—49 to 55 inches; gray (10YR 5/1) shaly clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; 40 percent shale; strongly acid; gradual wavy boundary.
Cg—55 to 60 inches; dark grayish brown (10YR 4/2) stratified shaly sandy clay loam and sand; many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; loose; 20 percent shale; slightly acid.

Thickness of the solum ranges from 40 to 60 inches.

The Ap horizon has hue of 10YR, value 2 or 3, and chroma of 1 or 2. Some pedons have an A2 horizon that has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The A horizon is dominantly loam, but in some pedons it is silt loam or sandy loam.

The matrix of the B horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6 with mottles of chroma of 1 or 2. The upper 20 inches of the argillic horizon averages between 25 and 35 percent clay.

Blount series

The Blount series consists of deep, somewhat poorly drained soils on upland till plains. These soils formed in calcareous glacial till. Permeability is slow or moderately slow. Slopes range from 0 to 3 percent.

Blount soils are similar to the Del Rey, Elliott, and Haskins soils. The Del Rey soils formed in lacustrine deposits. The Elliott soils are prairie soils and have a dark surface layer. The Haskins soils are loamy in the upper part of the profile.

Typical pedon of Blount silt loam, 0 to 3 percent slopes, in a cultivated field 720 feet north and 1,380 feet west of the center of sec. 14, T. 34 N., R. 7 W.

Ap—0 to 11 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

B1t—11 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak fine subangular blocky structure; firm; 2 percent gravel; medium acid; clear wavy boundary.

B21tg—14 to 20 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/4) mottles; moderate fine and medium angular and subangular blocky structure; firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; few patchy dark gray (10YR 4/1) organic stains; 3 percent fine gravel; strongly acid; clear wavy boundary.

B22t—20 to 27 inches; mottled yellowish brown (10YR 5/4), gray (10YR 5/1), and light brownish gray (10YR 6/2) silty clay loam; moderate medium prismatic structure parting to moderate medium angular and subangular blocky; very firm; thick continuous dark gray (10YR 4/1) clay films on faces of prisms and common distinct medium dark gray (10YR 4/1) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains; 3 percent fine gravel; strongly acid; clear wavy boundary.

B23t—27 to 31 inches; mottled yellowish brown (10YR 5/4), gray (10YR 5/1), and light brownish gray (10YR 6/2) silty clay loam; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; firm; thin continuous dark gray (10YR 4/1) clay films on faces of peds and prisms; few black (10YR 2/1) iron and manganese oxide stains; 6 percent fine gravel; slight effervescence; mildly alkaline; clear wavy boundary.

B3—31 to 38 inches; mottled yellowish brown (10YR 5/4), gray (10YR 5/1), and light brownish gray (10YR 6/2) silty clay loam; weak, coarse, subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains; 9 percent fine gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C—38 to 60 inches; light olive brown (2.5Y 5/4) silty clay loam; common medium distinct gray (10YR 6/1) mottles; massive; firm; common white (10YR 8/1) calcareous deposits; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 42 inches.

The Ap horizon is dark gray (10YR 4/1) or dark grayish brown (10YR 4/2) silt loam or loam. Where the soil has not been disturbed, the A1 horizon is less than 5 inches thick and has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 6. It is silty clay loam, clay loam, clay, or silty clay. The upper part averages between 35 and 48 percent clay and ranges from medium acid to very strongly acid. The lower part ranges from medium acid to moderately alkaline.

The C horizon is silty clay loam or clay loam.

Bourbon series

The Bourbon series consists of deep, somewhat poorly drained soils on outwash plains, valley trains, and sandy lake plains. These soils formed in loamy and sandy glaciofluvial deposits. Permeability is moderately rapid. Slopes are 0 to 2 percent.

Bourbon soils are similar to Alida and Hanna soils and are adjacent to Gilford, Pinhook, and Tracy soils. The Alida soils are loam, clay loam, and sandy clay loam in the B horizon. Hanna soils do not have a dark surface layer. Gilford soils have a thicker dark surface layer than the Bourbon soils, a dominantly gray profile, and are in lower lying areas. Pinhook soils have a dominantly gray profile and are in slightly lower lying areas. Tracy soils have a brown subsoil, do not have mottles, and are on the higher lying areas surrounding the Bourbon soils.

Typical pedon of Bourbon sandy loam, in a cultivated field 300 feet south and 20 feet east of the center of sec. 24, T. 34 N., R. 5 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few fine roots; 2 percent shale fragments; slightly acid; abrupt smooth boundary.

A2—9 to 12 inches; brown (10YR 5/3) sandy loam, very pale brown (10YR 7/3) dry; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) organic coatings on faces of peds; a few fine prominent black (10YR 2/1) iron-manganese accumulations; 2 percent shale fragments; very strongly acid; clear wavy boundary.

B21t—12 to 25 inches; brown (10YR 5/3) loam; many medium faint grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds and in pores; 2 percent shale fragments; very strongly acid; clear wavy boundary.

IIB22t—25 to 30 inches; yellowish brown (10YR 5/4) loamy sand; few fine distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; few fine roots; thin discontinuous gray (10YR 5/1) clay films on faces of peds and as bridging between sand grains; thin discontinuous dark yellowish brown (10YR 4/4) organic coatings on faces of peds; 10 percent shale fragments; very strongly acid; clear wavy boundary.

IIB31—30 to 50 inches; stratified pale brown (10YR 6/3) sand and yellowish brown (10YR 5/6) shaly sand; single grain; loose; many coarse distinct dark brown (7.5YR 4/4) soft iron segregations; 15 percent shale fragments; very strongly acid; clear wavy boundary.

IIB32—50 to 65 inches; brown (10YR 4/3) shaly sand; few fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; 30 percent shale fragments; medium acid; clear wavy boundary.

IIC—65 to 70 inches; dark gray (10YR 4/1) stratified sand and loamy sand; single grain; loose; 10 percent shale fragments; neutral; clear wavy boundary.

Thickness of the solum ranges from 40 to 70 inches. Coarse fragments range from 1 to 30 percent in the solum.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is sandy loam or loamy sand. If the soil has not been cultivated, there is an A1 horizon.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It ranges from medium acid to very strongly acid.

Brems series

The Brems series consists of deep, moderately well drained soils on outwash plains. These soils formed in acid outwash sand. The wind has reworked the sand in places. Permeability is rapid. Slopes range from 0 to 3 percent.

Brems soils are similar to Hanna soils and are adjacent to Morocco, Plainfield, and Tyner soils. Hanna soils have more clay in the subsoil than the Brems soils and have 5 to 15 percent coarse fragments throughout the solum. Morocco soils have a grayer subsoil and are in lower lying positions. Plainfield and Tyner soils are in higher lying, sloping positions and do not have low chroma mottles in the profile.

Typical pedon of Brems sand, 0 to 3 percent slopes, in an idle field 2,000 feet south and 180 feet west of the northeast corner of sec. 9, T. 32 N., R. 5 W.

Ap—0 to 12 inches; very dark grayish brown (10YR 3/2) sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; common roots; medium acid; abrupt smooth boundary.

B21—12 to 24 inches; yellowish brown (10YR 5/4) sand; common medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure parting to weak fine granular; very friable; few roots; very strongly acid; clear wavy boundary.

B22—24 to 31 inches; light yellowish brown (10YR 6/4) sand; common medium faint light gray (10YR 7/2) and strong brown (7.5YR 5/6) mottles; single grain; loose; common light gray (10YR 7/2) uncoated sand grains; few very dark gray (10YR 3/1) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

B23—31 to 45 inches; strong brown (7.5YR 5/8) sand; many medium distinct light gray (10YR 7/2) and yellowish brown (10YR 5/6) mottles; single grain; loose; few medium prominent dusky red (2.5YR 3/2) splotches; very strongly acid; clear wavy boundary.

B24—45 to 55 inches; dark brown (10YR 5/6) loamy sand; few medium distinct gray (10YR 5/1) mottles; massive; firm; many lenses of light gray (10YR 7/2) uncoated medium sand grains; single grain; loose; common very dark gray (10YR 3/1) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

B3—55 to 63 inches; yellowish brown (10YR 5/6) sand; single grain; loose; very strongly acid; clear wavy boundary.

C—63 to 67 inches; gray (10YR 5/1) and pale brown (10YR 6/3) sand; few medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; strongly acid.

Thickness of the solum ranges from 35 to 70 inches.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. It is loamy sand or sand and ranges from slightly acid to strongly acid, depending on past liming practices.

The B2 horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 8. It is loamy sand or sand. Mottles with chroma of 2 or less are between a depth of 20 and 36 inches. The B2 horizon ranges from medium acid to very strongly acid.

The C horizon is medium or fine sand.

Chelsea series

The Chelsea series consists of deep, excessively drained soils on sandy outwash plains and uplands. These soils formed in sandy outwash material and windblown sand. Permeability is rapid. Slopes range from 2 to 12 percent.

Chelsea soils are similar to Oakville and Plainfield soils and are adjacent to Brems, Morocco, and Tracy soils. Oakville and Plainfield soils do not have a thin banded Bt horizon above a depth of 60 inches. Brems and Morocco soils are mottled and are in lower lying areas. Tracy soils have more clay in the control section than the Chelsea soils and have shale fragments in the profile.

Typical pedon of Chelsea fine sand, 2 to 6 percent slopes, in a cultivated field 460 feet east and 175 feet north of the southwest corner of sec. 13, T. 35 N., R. 7 W.

Ap—0 to 10 inches; brown (10YR 4/3) fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

A21—10 to 22 inches; light yellowish brown (10YR 6/4) fine sand, very pale brown (10YR 7/4) dry; single grain; loose; common roots; medium acid; gradual wavy boundary.

A22—22 to 36 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; few roots; medium acid; abrupt wavy boundary.

A&B—36 to 80 inches; light yellowish brown (10YR 6/4) fine sand (A part); single grain; loose; bands of dark yellowish brown (10YR 4/4) loamy sand (B part); massive; very friable; bands are 1/4 inch to 1 1/2 inches thick and spaced 4 to 9 inches apart with a cumulative thickness of 4 inches above a depth of 60 inches; strongly acid.

Thickness of the solum ranges from 48 to 96 inches. The texture is dominantly fine sand. Material as coarse as gravel is absent to a depth of 40 inches or more, and carbonates are absent to a depth of 60 inches or more.

The thickness and color of the A1 or Ap horizon range considerably because these soils are very susceptible to wind erosion and to intense rodent activity. On uneroded sites the A1 horizon has hue of 10YR, value of 3, and chroma of 1 or 2 and is as much as 6 inches thick. It is fine sand or loamy fine sand. Cultivated and eroded areas that have Ap horizons have hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4 and is medium acid or strongly acid.

These soils have an A&B horizon. The B horizon part has lamellae 1/4 inch to 2 inches thick with hue of 10YR or 7.5YR, and value and chroma of 3 or 4. It is sandy loam or loamy sand. Depth to the uppermost lamellae ranges from 27 to 48 inches, and the cumulative thickness within a depth of 60 inches is less than 6 inches.

Del Rey series

The Del Rey series consists of deep, somewhat poorly drained soils on lake plains. These soils formed in calcareous, silty or clayey lacustrine deposits. Permeability is slow. Slopes are 0 to 2 percent.

Del Rey soils are similar to Blount, Milford, and Whitaker soils. Blount soils have more sand in the solum than the Del Rey soils and formed in calcareous glacial till. Milford soils have a dark surface layer and are in lower lying depressional areas. Whitaker soils have more sand in the solum.

Typical pedon of Del Rey silt loam, in an idle area 150 feet west and 400 feet south of the center of sec. 11, T. 36 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; medium acid; abrupt smooth boundary.

B21t—8 to 17 inches; brown (10YR 5/3) silty clay loam; common medium distinct grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; very firm; thin patchy grayish brown (10YR 5/2) clay films; slightly acid; clear wavy boundary.

B22t—17 to 26 inches; grayish brown (10YR 5/2) silty clay loam; many fine and medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular and angular blocky; very firm; thin discontinuous dark grayish brown (10YR 4/2) clay films; neutral; clear wavy boundary.

B3g—26 to 31 inches; olive gray (5Y 5/2) and gray (5Y 6/l) silty clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles; weak medium and coarse prismatic structure parting to weak coarse subangular blocky; firm; strong effervescence; moderately alkaline; clear wavy boundary.

C—31 to 60 inches; light olive brown (2.5Y 5/4) silty clay loam; many medium and coarse distinct gray (5Y 6/1) and olive gray (5Y 5/2) mottles; massive; firm; few hard 1/4 to 1/2 inch carbonate concretions in the upper half of the horizon; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 24 to 48 inches.

The A1 or Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. It is silt loam or loam. In some pedons the A2 horizon is distinctly mottled with chroma of 2 or less.

The B horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 to 6. It is silty clay loam or silty clay. The upper 20 inches averages more than 35 percent clay. The lower part ranges from slightly acid to moderately alkaline. The most clayey part of the B horizon is 35 to 45 percent clay, and the entire B horizon averages from 35 to 42 percent clay.

The C horizon is of uniform texture, or it is stratified. Strata are thin sandy bands and layers of silt loam, silty clay loam, or silty clay. If strata are absent, the horizon is dominantly silt loam or silty clay loam.

Door series

The Door series consists of deep, well drained soils on outwash plains. These soils formed in glacial outwash containing a fairly large amount of shale. Permeability is moderate. Slopes are 0 to 2 percent.

Door soils are similar to Elston soils and are adjacent to Lydick soils. The Elston soils have more sand throughout the solum than the Door soils. Lydick soils have a thinner dark surface layer.

Typical pedon of Door loam, 0 to 2 percent slopes, in a cultivated field 380 feet west and 740 feet north of the southeast corner of sec. 32, T. 35 N., R. 5 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; moderate medium and fine granular structure; friable; many medium and fine roots; medium acid; abrupt smooth boundary.

A12—8 to 13 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many medium and fine roots; slightly acid; clear wavy boundary.

A3—13 to 17 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky and moderate medium granular structure; friable; many medium and fine roots; very dark brown (10YR 2/2) organic lining in voids and fillings in worm casts; strongly acid; clear wavy boundary.

B21t—17 to 24 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds and linings in some pores; few 1/8- to 1/2-inch pebbles and few fine shale fragments; very dark grayish brown (10YR 3/2) linings in some voids and in old root channels; strongly acid; clear wavy boundary.

B22t—24 to 31 inches; brown (10YR 4/3) sandy clay loam; moderate medium subangular blocky structure; friable; common fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; few yellowish brown (10YR 5/6), dark reddish brown (5YR 2/2), and black (10YR 2/1) iron and manganese oxide accumulations; few 1/8- to 1/2-inch pebbles; 5 percent fine shale fragments; strongly acid; clear wavy boundary.

B23t—31 to 39 inches; yellowish brown (10YR 5/4) sandy loam; moderate medium and coarse subangular blocky structure; friable; thin discontinuous dark yellowish brown (10YR 4/4) and dark brown (10YR 3/3) clay films on faces of peds and linings in some voids; few fine yellowish brown (10YR 5/6) iron and manganese oxide accumulations; 15 percent fine gravel and shale fragments; strongly acid; clear wavy boundary.

B24t—39 to 51 inches; brown (10YR 5/3) shaly sandy clay loam; weak medium and coarse subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds and coatings on shale fragments; few fine yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) iron and manganese oxide accumulations; 20 percent shale fragments; very strongly acid; clear wavy boundary.

B31—51 to 66 inches; brown (10YR 5/3) and grayish brown (10YR 5/2) shaly sandy clay loam; weak coarse subangular blocky structure; friable; fine dark reddish brown (5YR 2/2) and common fine yellowish brown (10YR 5/6) iron and manganese oxide accumulations; 20 percent shale fragments and 5 percent coarse gravel; very strongly acid; abrupt wavy boundary.

B32—66 to 80 inches; strong brown (7.5YR 5/6) and dark brown (7.5YR 4/4) shaly sandy loam; weak coarse subangular blocky structure; firm, slightly cemented; thin yellowish red (5YR 4/6) clay films on pebbles; horizon is layered and high in iron oxides; 20 percent shale fragments and 5 percent coarse gravel; medium acid.

Thickness of the solum ranges from 48 to 85 inches. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. The A horizon is loam, sandy loam, or silt loam and ranges from neutral to medium acid. The A horizon is 1 to 12 percent shale and gravel.

The B2t horizon commonly has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 5. It is strongly acid or very strongly acid and is commonly loam or sandy clay loam. Subhorizons include sandy loam or clay loam or shaly or gravelly analogs of these textures. The B2t horizon is 5 to 30 percent shale and gravel. The B3 horizon has hue and value similar to the B2t horizon, but chroma ranges from 2 to 6.

The C horizon is commonly sand, gravelly sand, or shaly sand. It ranges from medium acid to neutral directly below the solum and is moderately alkaline at a depth ranging from 6 to 8 feet.

Edwards series

The Edwards series consists of deep, very poorly drained soils on concave depressional flats that were sites of shallow ponds or bogs. Permeability is moderately slow to moderately rapid in the organic material and variable in the marl. Slopes are 0 to 1 percent.

Edwards soils are similar to Adrian, Houghton, and Palms soils. Adrian soils formed in 16 to 50 inches of organic material and are underlain by sand, and Palms soils formed in 16 to 50 inches of organic material and are underlain by mineral material. Houghton soils formed in deposits of organic material that is more than 51 inches thick.

Typical pedon of Edwards muck, drained, in a cultivated field 1,660 feet east and 80 feet north of the center of sec. 10, T. 34 N., R. 6 W.

Oa1—0 to 10 inches; black (N 2/0) sapric material, broken, rubbed and pressed; about 5 percent fibers, less than 2 percent rubbed; moderate fine granular structure; friable; many roots; primarily herbaceous fibers; 30 to 35 percent mineral material; sodium pyrophosphate brown (10YR 5/3); medium acid; abrupt smooth boundary.

Oa2—10 to 15 inches; black (10YR 2/1) sapric material, very dark gray (5YR 3/1) rubbed and pressed; about 5 percent fibers, less than 2 percent rubbed; weak medium subangular blocky structure; friable; many roots; primarily herbaceous fibers; 20 to 25 percent mineral material; common fine prominent reddish brown (5YR 4/4) stains lining old root channels; sodium pyrophosphate dark brown (10YR 4/3); medium acid; abrupt wavy boundary.

Oa3—15 to 22 inches; dark reddish brown (5YR 3/2) sapric material, broken, rubbed and pressed; about 10 percent fibers, less than 2 percent rubbed; weak coarse subangular blocky structure; friable; common roots; primarily herbaceous fibers; 20 to 25 percent mineral material; common medium distinct yellowish red (5YR 5/6) stains lining old root channels; brown (7.5YR 4/4); medium acid; abrupt wavy boundary.

IILca1—22 to 48 inches; light gray (10YR 7/2) marl, white (10YR 8/1) shell remnants; massive; friable; few roots; brownish yellow (10YR 6/6) and yellowish brown (10YR 5/6) organic stains in linings of old root channels; violent effervescence; moderately alkaline; gradual wavy boundary.

IILca2—48 to 60 inches; gray (10YR 5/1) marl; massive; friable; strong effervescence; moderately alkaline.

The depth to the Lca horizon ranges from 16 to 49 inches. The fiber primarily is derived from herbaceous plants. Reaction throughout the organic material ranges from medium acid to mildly alkaline. Snail shells commonly are in the organic layers immediately above the marl and are mixed throughout the layers in some pedons. A layer of coprogenous earth less than 2 inches thick is present immediately above the marl in some pedons.

The surface tier of sapric material has hue of 10YR, value of 2, and chroma of 1 or 2, broken face and rubbed, or it is black (N 2/0). It is typically less than 10 percent rubbed fiber. The subsurface and bottom tiers of sapric material have hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 to 3, broken face and rubbed. Some horizons have hue of N and value of 2 or 3.

The Lca horizon has hue of 10YR, value of 5 to 8, and chroma of 1 or 2. In some pedons the marl has a layer of sandy material less than 12 inches thick within a depth of 51 inches.

Elliott series

The Elliott series consists of deep, somewhat poorly drained soils on till plains. These soils formed in calcareous silty clay loam or clay loam glacial till, and in many places they have a surface mantle of glacial drift or loess. Permeability is moderately slow. Slopes range from 0 to 3 percent.

Elliott soils are similar to the Blount, Del Rey, and Haskins soils and are associated with Markham and Riddles soils. Blount, Del Rey, and Haskins soils do not have a mollic epipedon. Del Rey soils formed in lacustrine deposits and have less sand and coarse fragments in the lower part of the profile than the Elliott soils. Haskins soils have a loam or sandy loam surface layer. Markham soils do not have mottles in the upper part of the subsoil and are on higher lying areas. Riddles soils are in gently sloping to strongly sloping areas adjacent to the Elliott soils. They do not have mottles in the upper part of the B horizon and have more sand throughout the profile than the Elliott soils.

Typical pedon of Elliott silt loam, 0 to 3 percent slopes, in a cultivated field 700 feet west and 160 feet south of the northeast corner of sec. I, T. 35 N., R. 7 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

A3—10 to 13 inches; very dark grayish brown (10YR 3/2) silt loam; weak medium granular structure; friable; common roots; few black (10YR 2/1) fillings in root and worm channels; 5 percent gravel; slightly acid; clear wavy boundary.

B21t—13 to 22 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct light brownish gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; firm; few roots; few black (10YR 2/1) fillings in root and worm channels; thin continuous very dark grayish brown (10YR 3/2) clay films on surfaces of peds; 5 percent gravel; neutral; clear wavy boundary.

B22t—22 to 29 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; firm; few roots; grayish brown (10YR 5/2) clay films on faces of peds; neutral; clear wavy boundary.

B3—29 to 36 inches; mottled, light brownish gray (10YR 6/2) and yellowish brown (10YR 5/4) silty clay loam;

weak coarse subangular blocky structure; firm; few roots; few black (10YR 2/1) fillings in root and worm channels; strong effervescence; moderately alkaline; gradual wavy boundary.

C—36 to 60 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct gray (10YR 6/1) mottles; massive; firm; accumulations of white (10YR 8/2) filaments and threads of secondary lime; violent effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 45 inches.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silt loam or silty clay loam. The A3 horizon commonly has one unit of value higher.

Some pedons have a B1 horizon instead of an A3 horizon. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. It is silty clay loam or silty clay. The clay content of the B2t horizon ranges from 35 to 50 percent, and in the upper 20 inches it ranges from 35 to 45 percent. The B horizon ranges from medium acid to neutral in the upper part and from neutral to moderately alkaline in the lower part.

The C horizon is silty clay loam or clay loam and is from 0 to 10 percent gravel.

Elston series

The Elston series consists of deep, well drained soils on outwash plains. These soils formed in sandy and loamy glacial outwash deposits. Permeability is rapid. Slopes range from 0 to 3 percent.

Elston soils are similar to the Door soils and are commonly adjacent to Hanna, Lydick, and Tracy soils. Door soils have more clay throughout the solum than the Elston soils. Hanna and Tracy soils do not have a thick dark surface layer. Lydick soils have more clay throughout the solum and have a thinner dark surface layer than the Elston soils.

Typical pedon of Elston loam, 0 to 3 percent slopes, in a cultivated field 640 feet west and 801 feet south of the center of sec. 32, T. 34 N., R. 5 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

A12—9 to 14 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; common fine roots; strongly acid; clear wavy boundary.

A13—14 to 18 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; common fine roots; strongly acid; clear wavy boundary.

B21t—18 to 28 inches; brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; few patchy faint thin clay films on faces of peds; strongly acid; abrupt smooth boundary.

B22t—28 to 36 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium subangular blocky structure; friable; fine roots; few patchy faint thin clay films on faces of peds; strongly acid; abrupt wavy boundary.

B23t—36 to 45 inches; brown (7.5YR 5/4) sandy clay loam; common fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; 15 percent gravel and shale; few dark reddish brown (5YR 3/3) iron oxide accumulations; medium acid; clear wavy boundary.

B3—45 to 54 inches; yellowish brown (10YR 5/4) sandy loam; common medium distinct pale brown (10YR 6/3) mottles; weak very fine subangular blocky structure; friable; 10 percent gravel and shale; medium acid; abrupt wavy boundary.

C—54 to 60 inches; brown (10YR 5/3) sand; single grain; loose; slightly acid.

Thickness of the solum ranges from 42 to 72 inches. The texture is dominantly medium and coarser sand.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is loam or sandy loam and ranges from neutral to strongly acid, depending on past liming practices.

The B2t horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 or 4. It is loam, sandy clay loam, sandy loam, or loamy sand and rangés from medium acid to very strongly acid. The upper 20 inches of the argillic horizon averages between 12 and 18 percent clay.

The C horizon ranges from medium acid to moderately alkaline.

Gilford series

The Gilford series consists of deep, very poorly drained soils on glacial outwash plains. These soils formed in loamy and sandy glacial outwash, lacustrine sediment, or stream alluvium. Permeability is moderately rapid in the subsoil and rapid in the substratum. Slopes are 0 to 2 percent.

Gilford soils are similar to Maumee, Newton, and Sebewa soils and are commonly adjacent to Bourbon soils. Maumee soils are sandy. Newton soils are sandy and strongly acid. Sebewa soils have more clay and less sand in the subsoil than the Gilford soils. Bourbon soils have a thinner dark surface layer and a brown, mottled subsoil.

Typical pedon of Gilford sandy loam, in a cultivated field 250 feet south and 1,400 feet east of the northwest corner of sec. 34, T. 33 N., R. 5 W.

Ap—0 to 12 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) dry; weak medium granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

A12—12 to 19 inches; very dark gray (10YR 3/1) sandy loam, dark gray (10YR 4/1) dry; common medium faint dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) mottles; weak fine and medium subangular blocky structure; friable; few roots; slightly acid; clear wavy boundary.

B2g—19 to 33 inches; dark gray (10YR 4/1) sandy loam; common medium and coarse distinct dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/4), and dark grayish brown (10YR 4/2) mottles; weak medium and coarse subangular blocky structure; friable; thin discontinuous black (10YR 2/1) and very dark gray (10YR 3/1) organic stains and coatings on faces of peds; many old root channels lined with very dark grayish brown (10YR 3/2) material; slightly acid; clear wavy boundary.

B3g—33 to 37 inches; dark grayish brown (10YR 4/2) loamy sand; many medium and coarse faint dark gray (10YR 4/1) and few medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very friable; few old root channels lined with very dark grayish brown (10YR 3/2) material; neutral; abrupt wavy boundary.

C1—37 to 49 inches; pale brown (10YR 6/3) and yellowish brown (10YR 5/6) sand; single grain; loose; few old root channels lined with very dark grayish brown (10YR 3/2) material; slight effervescence; mildly alkaline; clear wavy boundary.

C2—49 to 60 inches; gray (10YR 6/1) sand; common coarse faint pale brown (10YR 6/3) mottles; single grain; loose; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 30 to 44 inches. The thickness of the mollic epipedon ranges from 10 to 22 inches. The solum is 0 to 10 percent fine gravel.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is dominantly sandy loam, but the range includes loam, fine sandy loam, and loamy sand. The A horizon is slightly acid or neutral.

The B2g horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sandy loam or fine sandy loam and has thin subhorizons of loam, sandy clay loam, clay loam, and loamy sand. Mottles are common to few and faint to prominent. Splotches of soft dark brown iron and manganese oxides are common in many pedons.

The C horizon is dominantly sand. Thin strata of gravelly sand, sandy loam, or clay loam are in some pedons. The C horizon ranges from neutral to moderately alkaline.

Hanna series

The Hanna series consists of deep, moderately well drained soils on outwash plains. These soils formed in loamy and sandy outwash containing a fairly large amount of shale. Permeability is moderate in the solum and rapid in the underlying material. Slopes range from 0 to 3 percent.

Hanna soils are similar to Alida and Bourbon soils and are commonly adjacent to Lydick, Pinhook, and Tracy soils. The Alida and Bourbon soils have a darker surface layer than the Hanna soils. Lydick soils have a dark surface layer and do not have low chroma mottles. Pinhook soils have a dark surface layer and a gray subsoil. Tracy soils are on higher lying areas and on slopes and do not have low chroma mottles.

Typical pedon of Hanna sandy loam, 0 to 3 percent slopes, in a cultivated field 1,020 feet west and 1,600 feet north of the center of sec. 7, T. 33 N., R. 5 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, light gray (10YR 7/2) dry; weak medium and fine granular structure; friable; many roots; medium acid; abrupt smooth boundary.

A2—8 to 12 inches; yellowish brown (10YR 5/4) loam; weak medium granular structure; friable; common roots; common dark grayish brown (10YR 4/2) fillings in root channels and worm casts; medium acid; clear wavy boundary.

B21t—12 to 20 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate medium subangular blocky structure; friable; common roots; 5 percent shale fragments and gravel; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—20 to 30 inches; yellowish brown (10YR 5/6) sandy loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium and coarse subangular blocky structure; friable; few roots; 3 percent shale fragments and gravel; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of blocky peds; few fine black (10YR 2/1) iron and manganese oxide concretions; very strongly acid; clear wavy boundary.

B23t—30 to 42 inches; mottled yellowish brown (10YR 5/6), light gray (10YR 7/2), light brownish gray (l0YR 6/3), and strong brown (7.5YR 5/6) sandy loam; weak coarse subangular blocky structure; friable; few roots; 5 percent shale fragments and gravel; few fine black (10YR 2/1) iron and manganese oxide concretions; very strongly acid; clear wavy boundary.

B3g—42 to 54 inches; light gray (10YR 7/2) and light brownish gray (10YR 6/2) loamy sand; many coarse distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very friable; 10 percent shale fragments and gravel; strongly acid; clear wavy boundary.

C—54 to 60 inches; pale brown (10YR 6/3) sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; 5 percent shale fragments and gravel; strongly acid.

Thickness of the solum ranges from 40 to 70 inches. The gravel in the solum ranges from 3 to 25 percent.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. It is sandy loam or loam. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 5. It is sandy loam or loam.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam, sandy clay loam, or loam. Mottles with chroma of 2 or less are in the upper 10 inches of the argillic horizon. The B2t horizon dominantly averages between 14 and 18 percent clay and is strongly acid or very strongly acid.

The C horizon is sand and has strata of gravelly sand, sandy clay loam, and loam in some pedons. It has few to many shale fragments. Reaction is medium acid or strongly acid.

Haskins series

The Haskins series consists of deep, somewhat poorly drained soils on till plains. These soils formed in loamy material overlying fine textured, calcareous till or lacustrine material. Permeability is moderate in the upper part of the solum and slow or very slow in the lower part and in the underlying clayey material. Slopes are 0 to 2 percent.

Haskins soils are similar to Blount soils and are adjacent to Rawson and Riddles soils. Blount soils are not loamy in the upper part of the profile. Rawson soils do not have gray mottles in the upper part of the subsoil. Riddles soils have a brown subsoil and do not have the fine textured underlying material of the Haskins soils.

Typical pedon of Haskins loam, 0 to 2 percent slopes, in a cultivated field 350 feet east and 850 feet south of the northwest corner of sec. 33, T. 36 N., R. 6 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

A2—9 to 18 inches; grayish brown (10YR 5/2) loam; many medium distinct dark yellowish brown (10YR 4/4) and brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; 5 percent gravel and shale fragments; neutral; clear wavy boundary.

B21t—18 to 32 inches; dark yellowish brown (10YR 5/4) sandy clay loam; common medium distinct gray (10YR 5/1) mottles; moderate medium and fine subangular blocky structure; friable; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; black (10YR 2/1) iron and manganese oxide accumulations; 10 percent gravel and shale fragments; slightly acid; clear wavy boundary.

B22t—32 to 40 inches; dark brown (10YR 5/4) clay loam; common medium distinct dark grayish brown (10YR 4/2) mottles; moderate fine and medium subangular blocky structure; firm; thin continuous very dark gray (10YR 3/1) clay films on faces of peds; 10 percent gravel and shale fragments; neutral; clear wavy boundary.

IIB3—40 to 48 inches; brown (10YR 5/3) silty clay; many medium distinct gray (N 6/0) mottles; moderate medium prismatic structure; firm; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC1—48 to 55 inches; gray (5YR 5/1) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; light gray (10YR 7/1) calcium carbonate accumulations; strong effervescence; moderately alkaline; clear wavy boundary.

IIC2—55 to 60 inches; brown (10YR 5/3) silty clay loam; common medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; massive; firm; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 32 to 50 inches. It typically extends into the underlying fine textured material. The content of gravel ranges from 2 to 20 percent in the upper part of the solum and from 0 to 10 percent in the lower part of the solum and fine textured underlying material.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is loam, sandy loam, or fine sandy loam. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. Reaction ranges from neutral to medium acid in the A horizon.

The B2t horizon has hue of 10YR and 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is slightly acid or neutral. The IIB horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3; or it is neutral and has value of 4 or 5. The IIB horizon is silty clay, clay loam, or silty clay loam. Reaction ranges from slightly acid to mildly alkaline.

The IIC horizon is silty clay, clay loam, and silty clay loam. It is mildly alkaline or moderately alkaline.

Houghton series

The Houghton series consists of deep, very poorly drained soils in bogs within lake plains, outwash plains, till plains, and moraines. These soils formed in deep deposits of organic material. Permeability is moderately slow to moderately rapid. Slopes are 0 to 2 percent.

Houghton soils are similar to Adrian, Edwards, and Palms soils. All of those soils formed in 16 to 50 inches of organic material and are underlain by mineral material.

Typical pedon of Houghton muck, ponded, in an idle area 1,680 feet north and 120 feet west of the southeast corner of sec. 2, T. 36 N., R. 6 W.

Oa1—0 to 3 inches; black (10YR 2/1) sapric material, broken and rubbed; 5 percent fiber, less than 2 percent rubbed; weak fine subangular blocky structure; friable; many fine and very fine roots; primarily herbaceous fibers; very strongly acid; clear smooth boundary.

Oa2—3 to 10 inches; dark brown (10YR 3/3) sapric material, black (10YR 2/1) rubbed; 50 percent fiber, 5 percent rubbed; weak very thick platy structure; friable; common fine and very fine roots; primarily herbaceous fibers; very strongly acid; clear wavy boundary.

Oa3—10 to 34 inches; very dark grayish brown (10YR 3/2) sapric material, very dark brown (10YR 2/2) rubbed; 40 percent fiber, less than 2 percent rubbed; massive; friable; common fine and very fine roots; primarily herbaceous fibers; very strongly acid; clear wavy boundary.

Oa4—34 to 66 inches; very dark grayish brown (10YR 3/2) sapric material, very dark brown (10YR 2/2) rubbed; many yellowish brown (10YR 5/6) fibers that change to very dark brown (10YR 2/2) on exposure to air; 25 percent fiber, less than 2 percent rubbed; massive; friable; very strongly acid.

The organic layers are more than 51 inches thick. The organic material is primarily herbaceous. Layers within the control section have hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 to 3; or they are neutral and have value of 2 or 3. Chroma and value change from 0.5 unit to 2 units from the broken face to rubbed colors. Broken faces become darker on brief exposure to air. The organic layers range from medium acid to very strongly acid.

Lydick series

The Lydick series consists of deep, well drained soils on outwash plains. These soils formed in loamy outwash sediment. Permeability is moderate. Slopes range from 0 to 6 percent.

Lydick soils are similar to and adjacent to Alida, Door, Hanna, and Tracy soils. Alida soils have gray mottles in the subsoil. Door soils have a deeper, dark surface layer than the Lydick soils. Hanna and Tracy soils do not have dark surface layers. Hanna soils have gray mottles in the lower part of the subsoil. Tracy soils have more sand throughout the solum.

Typical pedon of Lydick loam, 0 to 2 percent slopes, in a cultivated field 1,620 feet west and 320 feet south of the northeast corner of sec. 27, T. 35 N., R. 5 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common roots; slightly acid; abrupt smooth boundary.

B21t—9 to 16 inches; dark brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; few roots; many continuous distinct thin dark brown (10YR 3/3) clay films on faces of peds; strongly acid; clear wavy boundary.

B22t—16 to 21 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium subangular blocky structure; firm; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds and linings of root channels; 5 percent gravel; strongly acid; clear wavy boundary.

B23t—21 to 29 inches; dark brown (7.5YR 4/4) clay loam; weak medium and coarse subangular blocky structure; firm; few yellowish red (5YR 5/8) splotches; thin discontinuous dark brown (10YR 4/3) clay films on pebbles and on some faces of peds; about 10 percent gravel and weathered shale fragments; strongly acid; clear wavy boundary.

B24t—29 to 43 inches; strong brown (7.5YR 5/6) and dark brown (7.5YR 4/4) clay loam; weak coarse subangular blocky structure; firm; thin patchy dark brown (10YR 4/3) clay films on pebbles; about 15 percent gravel and weathered shale fragments; very strongly acid; clear wavy boundary.

B3—43 to 55 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) stratified sandy clay loam, sandy loam, and sand; massive; very friable; about 15 percent gravel and weathered shale fragments; few red (2.5YR 4/8) splotches; strongly acid; abrupt wavy boundary.

IIC—55 to 60 inches; pale brown (10YR 6/3) sand; single grain; loose; few red (2.5YR 4/8) splotches; slight effervescence; mildly alkaline.

Thickness of the solum ranges from 42 to 65 inches.

The Ap or A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is loam or sandy loam. Some pedons have an A2 horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The A2 horizon is loam or sandy loam.

The B2t horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam, clay loam, or sandy clay loam. Reaction is strongly acid or very strongly acid. The B horizon is 5 to 15 percent coarse fragments.

The C horizon typically is sand. Strata of gravelly sand, sandy clay loam, loam, and sandy loam high in shale fragments are present in some pedons.

Markham series

The Markham series consists of deep, well drained and moderately well drained soils on uplands. These soils formed in clay loam and silty clay loam glacial till. Permeability is slow or moderately slow. Slopes range from 0 to 6 percent.

Markham soils are similar to the Morley soils and are commonly adjacent to Blount and Elliott soils. Morley and Blount soils do not have a dark surface layer. Blount and Elliott soils have mottles of low chroma in the upper 6 inches of the subsoil.

Typical pedon of Markham silt loam, 2 to 6 percent slopes, in a cultivated field 1,300 feet west and 380 feet north of the southeast corner of sec. 36, T. 36 N., R. 7 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many roots; slightly acid; abrupt smooth boundary.

A2—8 to 10 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; many roots; black (10YR 2/1) fillings in root channels and worm casts; medium acid; clear wavy boundary.

B21t—10 to 18 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine and medium subangular blocky structure; firm; common roots; thin distinct brown (10YR 4/3) clay films on faces of peds; strongly acid; gradual wavy boundary.

B22t—18 to 22 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; few roots; thin discontinuous brown (10YR 4/3) clay films on faces of peds; about 3 percent fine gravel; medium acid; clear wavy boundary.

B23t—22 to 28 inches; brown (10YR 5/3) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few roots; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; about 3 percent gravel; neutral; clear wavy boundary.

B3—28 to 31 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; firm; few roots; 10 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C—31 to 60 inches; brown (10YR 5/3) silty clay loam with thin strata of silt between a depth of 48 and 54 inches; many medium distinct light brownish gray (10YR 6/3) mottles; massive; firm; about 13 percent gravel; accumulations of white (10YR 8/2) filaments and threads of secondary lime; violent effervescence; moderately alkaline.

Thickness of the solum ranges from 20 to 48 inches.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam or silty clay. The B21t and B22t horizons range from strongly acid to slightly acid. The B23t and B3 horizons have few to many mottles of low chroma and are slightly acid to moderately alkaline.

The C horizon is silty clay loam or clay loam.

Martinsville series

The Martinsville series consists of deep, well drained soils on terraces, lake plains, and outwash plains. These soils formed in stratified, loamy sediment. Permeability is moderate. Slopes range from 0 to 6 percent.

Martinsville soils are similar to Hanna, Rawson, and Riddles soils and are commonly adjacent to Del Rey and Whitaker soils. The Hanna soils have less clay in the subsoil than the Martinsville soils. Rawson soils have more clay in the lower part of the subsoil. Riddles soils do not have stratification in the lower part of the solum. Del Rey and Whitaker soils have mottles in the subsoil and are in lower lying positions.

Typical pedon of Martinsville loam, 0 to 2 percent slopes, in a cultivated field 940 feet east and 150 feet south of the northwest corner of sec. 16, T. 36 N., R. 6 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

A2—10 to 12 inches; brown (10YR 5/3) loam; weak medium platy structure parting to weak medium granular; friable; medium acid; clear wavy boundary.

B21t—12 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine and medium subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds; medium acid; clear wavy boundary.

B22t—26 to 36 inches; yellowish brown (10YR 5/4) clay loam; moderate medium and coarse subangular blocky structure; firm; thin discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine black (10YR 2/1) iron stains; strongly acid; clear wavy boundary.

B23t—36 to 46 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure; friable; thin patchy dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

C—46 to 60 inches; yellowish brown (10YR 5/4) and light yellowish brown (10YR 6/4) sandy loam; few fine faint light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; massive; very friable; strongly acid.

Thickness of the solum ranges from 36 to 60 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is loam or silt loam.

Some pedons have a B1 horizon. The B2t horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam, sandy clay loam, loam, or silty clay loam. The upper 20 inches of the control section averages between 20 and 35 percent clay. The B2t horizon is medium acid or strongly acid. Some pedons have a B3 horizon.

Maumee series

The Maumee series consists of deep, very poorly drained soils on outwash plains and lake plains. These soils formed in sandy sediment. Permeability is rapid. Slopes are 0 to 2 percent.

Maumee soils are similar to Gilford and Newton soils. Gilford soils have more clay and silt in the control section than the Maumee soils. Newton soils are more acid.

Typical pedon of Maumee loamy sand, in a cultivated field 160 feet east and 700 feet north of the southwest corner of sec. 32, T. 33 N., R. 5 W.

Ap—0 to 10 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; few fine and medium roots; slightly acid; abrupt smooth boundary.

A12—10 to 23 inches; very dark gray (10YR 3/1) loamy sand; common coarse distinct dark grayish brown (10YR 4/2) and few fine distinct dark yellowish brown (10YR 3/6) mottles; weak coarse subangular blocky structure; very friable; few fine roots; neutral; clear wavy boundary.

C1g—23 to 32 inches; grayish brown (10YR 5/2) loamy sand; common coarse distinct dark gray (10YR 4/1) and very dark gray (10YR 3/1), and few fine distinct dark yellowish brown (10YR 4/6) mottles; single grain; loose; few fine roots; neutral; clear wavy boundary.

C2g—32 to 38 inches; dark grayish brown (10YR 4/2) sand; common medium distinct yellowish brown (10YR 5/4) mottles; single grain; loose; few fine roots; neutral; abrupt wavy boundary.

C3g—38 to 60 inches; light brownish gray (10YR 6/2) sand; common medium distinct brownish yellow (10YR 6/6) mottles; single grain; loose; neutral.

The thickness of the mollic epipedon ranges from 14 to 24 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2; or it is black (N 2/0). It is loamy sand, fine sandy loam, or sand and is slightly acid or neutral.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is sand or loamy sand and is neutral or mildly alkaline.

Metea series

The Metea series consists of deep, well drained soils on glacial moraines and till plains. These soils formed in water or wind-laid sands or loamy sands overlying loamy till. Permeability is very rapid in the upper sandy part of the profile and moderate in the lower part. Slopes range from 1 to 6 percent.

Metea soils are similar to Chelsea soils and are adjacent to Riddles, Morley, and Rawson soils. Chelsea soils do not have an argillic horizon. The Riddles, Morley, and Rawson soils do not have sand or loamy sand in the upper part of the solum.

Typical pedon of Metea loamy fine sand, 1 to 6 percent slopes, in a cultivated field 2,060 feet west and 60 feet south of the northeast corner of sec. 10, T. 36 N., R. 5 W.

Ap—0 to 10 inches; dark brown (10YR 3/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; many medium and fine roots; slightly acid; abrupt smooth boundary.

B21—10 to 24 inches; yellowish brown (10YR 5/6) loamy fine sand; weak fine subangular blocky structure; very friable; many fine roots; slightly acid; gradual wavy boundary.

B22—24 to 32 inches; yellowish brown (10YR 5/6) sand; single grain; loose; slightly acid; clear wavy boundary.

B23t—32 to 38 inches; dark brown (7.5YR 4/4) sand; weak coarse subangular blocky structure; friable; clay bridging between sand grains; strongly acid; clear wavy boundary.

IIB24t—38 to 52 inches; dark brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; clay bridging between sand grains; medium acid; clear wavy boundary.

IIB25t—52 to 65 inches; yellowish brown (10YR 5/6) clay loam; many medium distinct weak red (2.5YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin light yellowish brown (10YR 6/4) clay films lining voids; medium acid; abrupt wavy boundary.

IIC—65 to 75 inches; yellowish brown (10YR 5/6) loam; many medium distinct grayish brown (2.5Y 5/2) mottles; massive; friable; thin strata of sand, sandy loam, and clay loam; neutral.

The thickness of the solum ranges from 36 to 70 inches. Thickness of the loamy sand or sand upper horizons ranges from 20 to 40 inches.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 4. If the A horizon has not been disturbed, it is 1 inch to 3 inches thick and has hue of 10YR, value of 3, and chroma of 1 or 2. In some pedons there is an A2 horizon that is 1 inch to 3 inches thick and has hue of 10YR, value of 5 or 6, and chroma of 2 or 3. The A horizon is loamy sand, loamy fine sand, or sand and ranges from neutral to medium acid.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand, loamy fine sand, or sand and ranges from neutral to strongly acid. The IIB2t horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 8. It is clay loam or sandy clay loam. Subhorizons are loam and sandy loam. The IIB horizon is slightly acid or medium acid.

The IIC horizon is loam, clay loam, or silty clay loam.

Milford series

The Milford series consists of deep, poorly drained soils on glacial lakebeds. These soils formed in lacustrine material. Permeability is slow. Slopes are 0 to 2 percent.

Milford soils are similar to Pewamo soils and are commonly adjacent to Del Rey and Whitaker soils. Pewamo soils are in morainic areas and have till pebbles throughout the solum. Del Rey soils do not have a mollic epipedon and are in slightly higher lying areas. Whitaker soils are also in slightly higher lying areas and have more sand throughout the profile than the Milford soils.

Typical pedon of Milford silty clay loam, in a cultivated field 1,740 feet south and 160 feet east of the center of sec. l0, T. 36 N., R. 6 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; common fine iron and manganese oxide concretions; neutral; abrupt smooth boundary.

A12—8 to 12 inches; black (10YR 2/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; firm; common fine iron and manganese oxide concretions; neutral; clear wavy boundary.

B21g—12 to 23 inches; dark gray (5Y 4/1) silty clay loam; common medium distinct olive (5Y 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; thin patchy very dark gray (5Y 3/1) clay films on faces of peds; many fine iron and manganese oxide concretions; neutral; clear wavy boundary.

B22g—23 to 32 inches; olive gray (5Y 5/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) and olive (5Y 5/6) mottles; moderate medium prismatic structure parting to strong medium angular blocky; very firm; thin patchy dark gray (5Y 4/1) clay films on faces of peds; few fine iron and manganese oxide accumulations; neutral; clear wavy boundary.

B23g—32 to 39 inches; olive gray (5Y 5/2) silty clay loam; many medium and coarse distinct olive (5YR 5/4) mottles; weak coarse prismatic structure parting to moderate coarse angular blocky; very firm; thin patchy gray (5Y 5/1) clay films on faces of peds; few fine iron and manganese accumulations; very dark gray (5Y 3/1) organic coatings on faces of peds; neutral; clear wavy boundary.

B3g—39 to 54 inches; gray (5Y 6/1) silty clay loam; common medium distinct light olive brown (2.5Y 5/6) and olive (5Y 5/4) mottles; weak coarse subangular blocky structure; firm; few fine iron and manganese accumulations; thin discontinuous lenses of sandy clay loam and clay loam; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—54 to 60 inches; gray (5Y 5/1) silty clay; common medium distinct olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/4) mottles; massive; very firm; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 36 to 60 inches. Thickness of the mollic epipedon ranges from 12 to 18 inches.

The Ap or A1 horizon is black (N 2/0, 10YR 2/1, or 5Y 2/1) or very dark gray (N 3/0, 10YR 3/1, or 5Y 3/1). It is silty clay loam or silty clay.

The B2 horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. The B21 and B22 horizons are silty clay loam or silty clay and range from medium acid to neutral. The B23 and B3 horizons are silty clay loam, clay loam, or silty clay and are neutral to moderately alkaline.

The C horizon has strata of silty clay and silty clay loam. Thin layers of clay loam and sandy loam are present in some pedons. Reaction ranges from neutral to moderately alkaline.

Morley series

The Morley series consists of deep, well drained and moderately well drained soils on uplands. These soils formed in calcareous, moderately fine textured glacial till. Permeability is moderate. Slopes range from 2 to 30 percent.

Morley soils are similar to Markham soils and are commonly adjacent to Blount, Elliott, and Pewamo soils. Markham soils have a mollic surface layer. Blount and Elliott soils are on nearly level or slightly concave flats and have gray mottles in the upper part of the subsoil. Elliott soils have a dark surface layer. Pewamo soils are in lower lying depressional areas and have a mollic epipedon.

Typical pedon of Morley silt loam, 2 to 6 percent slopes, eroded, in a cultivated field 2,120 feet south and 50 feet west of the northeast corner of sec. I, T. 34 N., R. 7 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

B21t—8 to 13 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; firm; thin patchy brown (10YR 5/3) clay films on faces of peds and in old root channels; thin discontinuous gray (10YR 6/1), dry silt coatings on faces of peds; few small pebbles; medium acid; clear wavy boundary.

B22t—13 to 20 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine and medium prismatic structure parting to moderate medium angular and subangular blocky; very firm; thin continuous brown (10YR 5/3) clay films on faces of peds and in old root channels; few pebbles; strongly acid; clear wavy boundary.

B23t—20 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium prismatic structure parting to moderate and strong medium angular and subangular blocky; very firm; thin continuous brown (10YR 5/3) clay films on faces of peds and in old root channels; few small black (10YR 2/1) iron stains; 6 percent gravel; medium acid; clear wavy boundary.

B24t—30 to 37 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium prismatic structure parting to moderate coarse subangular blocky; very firm; thin continuous brown (10YR 5/3) clay films on faces of peds; few small black (10YR 2/1) iron stains; 6 percent gravel; neutral; clear wavy boundary.

B3t—37 to 42 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; firm; thin discontinuous brown (10YR 5/3) clay films on faces of peds; 11 percent gravel; neutral; clear wavy boundary.

C—42 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive; firm; yellowish red (5YR 4/8) iron stains; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 48 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have an A2 horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. Undisturbed areas have A1 horizons less than 5 inches thick that have hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The Bt horizon has hue of 10YR and 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam, clay loam, or silty clay. Reaction is strongly acid or medium acid in the upper part and ranges from neutral to moderately alkaline in the lower part.

The C horizon is silty clay loam or clay loam.

Morocco series

The Morocco series consists of deep, somewhat poorly drained soils on outwash plains. These soils formed in outwash sand. Permeability is rapid. Slopes are 0 to 2 percent.

Morocco soils are similar to Bourbon, Maumee, and Newton soils and are adjacent to Brems and Pinhook soils. Bourbon soils have more clay in the control section than the Morocco soils. Maumee and Newton soils have a deep, dark surface layer and are in lower lying positions. Brems soils do not have mottles of low chroma in the upper part of the solum and are in higher lying positions. Pinhook soils have more clay in the solum than the Morocco soils.

Typical pedon of Morocco loamy sand, in a cultivated field 2,500 feet north and 2,540 feet west of the southeast corner of sec. 4, T. 32 N., R. 5 W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loamy sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; few very fine roots; slightly acid; abrupt smooth boundary.

B21—9 to 13 inches; yellowish brown (10YR 5/4) sand; common medium distinct brownish yellow (10YR 6/8) mottles; single grain; loose; few very fine roots; medium acid; clear smooth boundary.

B22—13 to 20 inches; yellowish brown (10YR 5/4) sand; common medium distinct light brownish gray (10YR 6/2) mottles; single grain; loose; few very fine roots; strongly acid; clear smooth boundary.

B23—20 to 32 inches; brownish yellow (10YR 6/6) sand; many coarse distinct light gray (10YR 7/1) mottles; single grain; loose; very strongly acid; clear wavy boundary.

C1—32 to 48 inches; light gray (10YR 7/2) sand; common medium distinct brownish yellow (10YR 6/6) mottles; single grain; loose; strongly acid; clear wavy boundary.

C2—48 to 60 inches; light gray (10YR 7/1) sand; common medium distinct light yellowish brown (10YR 6/4) mottles; single grain; loose; medium acid.

The thickness of the solum ranges from 24 to 48 inches.

The A1 or Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loamy sand or sand and ranges from slightly acid to very strongly acid, depending on past liming practices. Some pedons have an A2 horizon that has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is loamy sand or sand.

The B2 horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 3 to 8. The upper part of the B horizon to a depth of about 24 inches has chroma of 3 to 6 and mottles with chroma of 1 or 2. The B horizon ranges from medium acid to very strongly acid.

The C horizon ranges from medium acid to very strongly acid.

Newton series

The Newton series consists of deep, very poorly drained soils on nearly level flats or in depressional areas. These soils formed in sandy sediment that is strongly acid or very strongly acid. Permeability is rapid. Slopes are 0 to 2 percent.

Newton soils are similar to Maumee soils and are commonly adjacent to Brems, Morocco, and Plainfield soils. Maumee soils are less acid in the solum than the Newton soils. Brems and Morocco soils are in higher lying positions and are not dominantly gray in the upper part of the profile. Plainfield soils are browner than the Newton soils and are on the surrounding sandy slopes.

Typical pedon of Newton loamy fine sand, in a cultivated field 760 feet east and 100 feet north of the southwest corner of sec. 3, T. 32 N., R. 5 W.

Ap—0 to 10 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; medium acid; abrupt smooth boundary.

A3—10 to 18 inches; very dark gray (10YR 3/1) loamy fine sand; weak fine granular structure; very friable; medium acid; clear wavy boundary.

C1g—18 to 27 inches; gray (10YR 5/1) sand; single grain; loose; few very dark gray (10YR 3/1) fillings in root channels; strongly acid; clear wavy boundary.

C2g—27 to 33 inches; dark gray (5Y 4/1) sand; single grain; loose; many very dark gray (10YR 3/1) fillings in root channels; strongly acid; clear wavy boundary.

C3g—33 to 41 inches; dark grayish brown (2.5Y 4/2) sand; few medium distinct yellowish brown (10YR

5/4) mottles; single grain; loose; strongly acid; clear wavy boundary.

C4g—41 to 46 inches; dark grayish brown (2.5Y 4/2) sand; common medium distinct light yellowish brown (2.5Y 6/4), light gray (2.5Y 7/2), and yellow (2.5Y 7/6) mottles; single grain; loose; strongly acid; clear wavy boundary.

C5g—46 to 60 inches; gray (10YR 5/1) sand; common coarse distinct pale yellow (2.5Y 7/4) and olive yellow (2.5Y 6/6) mottles; single grain; loose; very strongly acid.

The thickness of the solum ranges from 10 to 24 inches.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loamy fine sand or fine sand and is medium acid or strongly acid.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Mottling is present in the C horizon, and chroma ranges from 1 to 8. The C horizon is strongly acid or very strongly acid. Some pedons have a thin sandy loam layer below a depth of 40 inches, and some pedons are medium acid below a depth of 40 inches.

Oakville series

The Oakville series consists of deep, well drained soils on outwash plains, sand dunes, and beach ridges. These soils formed in fine sand. Permeability is very rapid. Slopes range from 4 to 40 percent.

Oakville soils are similar to Brems, Chelsea, Plainfield, and Tyner soils and are commonly adjacent to Maumee, Morocco, and Newton soils. Brems soils have mottles with chroma of 2 or less within a depth of 40 inches. Chelsea soils have a thin banded Bt horizon. Plainfield soils are less than 50 percent fine and very fine sand in the control section. Tyner soils generally average more than 10 percent silt and clay in the control section. Maumee and Newton soils have a gray subsoil and are in low lying areas between ridges of the Oakville soils. Morocco soils have mottles in the subsoil and are in slightly convex positions.

Typical pedon of Oakville fine sand, 4 to 12 percent slopes, in a wooded area 1,760 feet south and 50 feet east of the northwest corner of sec. 9, T. 37 N., R. 5 W.

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) fine sand, dark gray (10YR 4/1) dry; single grain; loose; slightly acid; abrupt smooth boundary.

A2—2 to 7 inches; brown (10YR 5/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; medium acid; clear wavy boundary.

B21—7 to 18 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; medium acid; clear wavy boundary.

B22—18 to 25 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; medium acid; clear wavy boundary.

B3—25 to 30 inches; light yellowish brown (10YR 6/4) fine sand; single grain; loose; slightly acid; gradual wavy boundary.

C—30 to 60 inches; pale brown (10YR 6/3) fine sand; single grain; loose; neutral.

The thickness of the solum ranges from 18 to 40 inches. Reaction ranges from medium acid to neutral. The control section averages between 50 and 90 percent fine sand with as much as 25 percent very fine sand and less than 10 percent silt and clay.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loamy sand or fine sand. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2 horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6. It is fine sand or sand.

The C horizon is fine sand or sand and ranges from medium acid to neutral.

Palms series

The Palms series consists of deep, very poorly drained soils on lake plains, till plains, or moraines in basins that formerly were lakes or ponds. The soils formed in deposits of organic material and in the underlying loamy mineral material. Permeability is moderately slow to moderately rapid in the organic layers and moderate or moderately slow in the loamy material. Slopes are 0 to 2 percent. These Palms soils are more acid than is defined for the series, but this difference does not alter the usefulness or behavior of the soils.

Palms soils are similar to Adrian, Edwards, and Houghton soils and are commonly adjacent to Morley, Riddles, and Tracy soils. Adrian and Edwards soils have 16 to 50 inches of organic material. Adrian soils are underlain by sand, and Edwards soils are underlain by marl. Houghton soils have organic deposits more than 51 inches thick. The Morley, Riddles, and Tracy soils are mineral soils on slopes adjacent to depressional areas of the Palms soils.

Typical pedon of Palms muck, drained, in an idle field 1,350 feet south and 440 feet west of the center of sec. 12, T. 35 N., R. 5 W.

Oap—0 to 10 inches; black (10YR 2/1) sapric material, broken and rubbed; about 5 percent fibers, less than 5 percent rubbed; weak medium granular structure; very friable; many roots; primarily herbaceous fibers; 30 to 35 percent mineral material; very strongly acid; abrupt smooth boundary.

Oa2—10 to 24 inches; black (N 2/0) sapric material, black (10YR 2/1) rubbed; about 10 percent fibers, less than 5 percent rubbed; weak medium subangular blocky structure; firm; common roots; primarily herbaceous fibers; 26 percent mineral material; many strong brown (7.5YR 5/6) iron accumulations along old root channels; extremely acid; abrupt smooth boundary.

Oa3—24 to 28 inches; black (N 2/0) sapric material, black (10YR 2/1) rubbed; about 5 percent fibers, less than 5 percent rubbed; massive; friable; few roots; primarily herbaceous fibers; 60 percent mineral material; many strong brown (7.5YR 5/6) iron accumulations along old root channels; extremely acid; clear wavy boundary.

Oa4—28 to 30 inches; very dark gray (10YR 3/0) sapric material, very dark gray (10YR 3/1) rubbed, grayish brown (10YR 5/2) pressed; about 5 percent fibers, less than 5 percent rubbed; massive; friable; primarily herbaceous fibers; 70 percent mineral material; many sulfur crystals (pyrite) in root channels; extremely acid; abrupt wavy boundary.

IIC—30 to 60 inches; dark gray (10YR 4/1) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; neutral.

The depth to the loamy IIC horizon ranges from 16 to 50 inches. The fiber material primarily is derived from herbaceous plants.

The surface tier mainly has hue of 10YR, value of 2, and chroma of 1 or 2. It is strongly acid or very strongly acid. The organic part of the subsurface and bottom tiers has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 1 to 3; or it is neutral and has value of 2 or 3. It is extremely acid or very strongly acid. In some pedons the organic material in the layer above the IIC horizon is about 70 percent mineral material. The IICg horizon ranges from fine sandy loam to clay loam. It ranges from slightly acid to moderately alkaline.

Pewamo series

The Pewamo series consists of deep, very poorly drained soils in depressional areas on till plains, lake plains, and moraines. These soils formed in glacial till or in lacustrine sediment. Permeability is moderately slow. Slopes are 0 to 2 percent.

Pewamo soils are similar to Milford soils and are commonly adjacent to Blount, Elliott, and Morley soils. Milford soils formed in lacustrine material and do not have till pebbles. Blount and Elliott soils have a subhorizon in the upper part of the subsoil that is dominantly brown with gray mottles. They are on slightly higher lying, nearly level areas. Blount soils do not have a thick, dark surface layer. Morley soils have a brown subsoil and are on the surrounding slopes.

Typical pedon of Pewamo silty clay loam, in a pasture 1,470 feet south and 300 feet east of the center of sec. 34, T. 36 N., R. 6 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; firm; many fibrous roots; neutral; abrupt smooth boundary.

A3—8 to 12 inches; very dark gray (10YR 3/1) silty clay loam; few fine distinct yellowish brown (10YR 5/4) mottles; moderate fine angular blocky structure; firm; many fibrous roots; neutral; clear wavy boundary.

B21tg—12 to 17 inches; dark gray (5Y 4/1) silty clay loam; many medium distinct yellowish brown (10YR 5/4) and olive (5Y 5/4) mottles; moderate medium angular blocky structure; very firm; many roots; thin continuous very dark gray (10YR 3/1) clay films on faces of peds and in old root channels; neutral; clear wavy boundary.

B22tg—17 to 31 inches; olive gray (5Y 5/2) silty clay loam; moderate medium distinct olive (5Y 5/4) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium angular blocky; very firm; common fine roots; thin continuous to medium dark gray (10YR 4/1) clay films on faces of peds; neutral; clear wavy boundary.

B23tg—31 to 46 inches; gray (5Y 5/1) silty clay loam; many medium distinct light olive brown (2.5Y 5/4) mottles; weak coarse prismatic structure; firm; few fine roots; thin discontinuous very dark gray (10YR 4/1) clay films on faces of peds and prisms and in old root channels; few fine pebbles; slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—46 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; many medium distinct gray (5Y 5/1) and light olive brown (2.5Y 5/4) mottles; massive; firm; few fine pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 32 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 14 inches.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay loam and is slightly acid or neutral.

The B2t horizon has hue of 2.5Y, 5Y, or 10YR; value of 4 to 6; and chroma of 1 or 2. It ranges from slightly acid to mildly alkaline.

The C horizon is clay loam or silty clay loam and ranges from neutral to moderately alkaline.

Pinhook series

The Pinhook series consists of deep, poorly drained soils on outwash plains. These soils formed in loamy and sandy glacial outwash. Permeability is moderately rapid in the solum and rapid in the underlying material. Slopes are 0 to 2 percent.

Pinhook soils are similar to Bourbon soils and are associated with Gilford and Hanna soils. Bourbon soils have a subsoil that is dominantly brown with gray mottles. Gilford soils have a mollic epipedon and are slightly acid or neutral in the solum. They are in lower lying positions. Hanna soils are brown in the upper part of the B horizon and are in slightly higher lying positions.

Typical pedon of Pinhook loam, in a cultivated field 2,504 feet east and 1,835 feet north of the southwest corner of sec. 25, T. 34 N., R. 5 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; many fine roots; few fine continuous pores; slightly acid; abrupt smooth boundary.
A2—9 to 12 inches; light brownish gray (10YR 6/2) sandy loam; few medium distinct yellowish brown (10YR 5/8) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few fine continuous vertical tubular pores; strongly acid; clear wavy boundary.
B21t—12 to 16 inches; light brownish gray (10YR 6/2) loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; 5 percent gravel and shale fragments; few fine roots; common fine continuous vertical tubular pores; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; very strongly acid; gradual wavy boundary.
B22t—16 to 25 inches; light brownish gray (10YR 6/2) sandy loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; few fine roots; common fine continuous vertical tubular pores; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds; 5 percent gravel and shale fragments; very strongly acid; gradual wavy boundary.
B23t—25 to 35 inches; gray (10YR 6/1) sandy loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak medium and fine subangular blocky structure; friable; few fine roots; few fine continuous vertical tubular pores; thin patchy clay films on faces of peds; 5 percent gravel and shale fragments; strongly acid; gradual irregular boundary.
B3—35 to 50 inches; grayish brown (10YR 5/2) loamy sand; many coarse distinct yellowish brown (10YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; few fine continuous tubular pores; strongly acid; gradual wavy boundary.
C—50 to 60 inches; grayish brown (10YR 5/2) sand; many medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; 5 percent gravel and shale fragments; strongly acid.

The thickness of the solum ranges from 40 to 56 inches.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is loam or sandy loam and is medium acid to neutral. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is loam or sandy loam and is strongly acid or very strongly acid.

The B2t horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is loam or sandy loam and is strongly acid or very strongly acid. Some pedons have horizons with as much as 15 percent gravel and many shale fragments.

The C horizon is loamy sand or sand and is as much as 30 percent gravel and shale fragments. It is strongly acid or very strongly acid.

Plainfield series

The Plainfield series consists of deep, excessively drained soils on outwash plains, stream terraces, and glaciated uplands. These soils formed in sandy drift. Permeability is rapid. Slopes range from 2 to 12 percent.

Plainfield soils are similar to Chelsea, Oakville, and Tyner soils and are commonly adjacent to Brems and Morocco soils. The Chelsea soils have a thin banded Bt horizon. Oakville soils average more than 50 percent fine sand and very fine sand in the control section. Tyner soils average more than 10 percent silt and clay in the control section. Brems and Morocco soils are mottled above a depth of 40 inches. They are in flat areas that are lower lying than Plainfield soils.

Typical pedon of Plainfield sand, 2 to 6 percent slopes, in a wooded area 15 feet south and 440 feet west of the northeast corner of sec. 9, T. 32 N., R. 5 W.

O1—0 to 1 inch; leaf litter; very weak fine granular structure; abrupt smooth boundary.
A1—1 to 3 inches; very dark brown (10YR 2/2) sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; many fine grass roots; strongly acid; abrupt smooth boundary.
A2—3 to 6 inches; dark brown (10YR 3/3) sand, pale brown (10YR 6/3) dry; weak medium granular structure; very friable; many fine roots; very strongly acid; clear smooth boundary.
B21—6 to 10 inches; dark brown (10YR 4/4) sand; single grain; loose; many fine roots; strongly acid; clear wavy boundary.
B22—10 to 17 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; few fine roots; medium acid; gradual wavy boundary.
B3—17 to 24 inches; strong brown (7.5YR 5/6) sand; single grain; loose; few fine roots; medium acid; gradual wavy boundary.
C1—24 to 44 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few medium roots; 5 percent dark shale fragments; medium acid; gradual wavy boundary.
C2—44 to 55 inches; yellowish brown (10YR 5/4) sand; single grain; loose; medium acid; diffuse wavy boundary.
C3—55 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; slightly acid.

Thickness of the solum ranges from 18 to 34 inches. The control section averages less than 50 percent fine and very fine sand and has 25 percent or more very coarse, coarse, and medium sand and less than 10 percent silt and clay.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 2. Cultivated areas have an Ap horizon that has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A1 or Ap horizon is sand or loamy sand and ranges from strongly acid to neutral.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It ranges from medium acid to very strongly acid.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 4 to 8. It ranges from strongly acid to neutral.

Rawson series

The Rawson series consists of deep, well drained and moderately well drained soils on beach ridges, moraines, and outwash plains. These soils formed in loamy material and in the underlying till or lacustrine material. Permeability is moderate in the upper part of the solum and slow or very slow in the lower part and in the underlying material. Slopes range from 2 to 12 percent.

Rawson soils are similar to Morley soils and are commonly adjacent to Haskins and Riddles soils. Morley soils are not loamy in the upper part of the profile. Haskins soils are mottled in the upper part of the subsoil. Riddles soils do not have as much clay in the lower part of the subsoil as the Rawson soils.

Typical pedon of Rawson loam, 2 to 6 percent slopes, in a cultivated field 1,150 feet south and 300 feet east of the center of sec. 34, T. 36 N., R. 6 W.

Ap—0 to 8 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate medium and fine granular structure; friable; few fine pebbles; neutral; abrupt smooth boundary.

B1—8 to 16 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; few fine pebbles; slightly acid; clear wavy boundary.

B21t—16 to 23 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium subangular blocky structure; firm; thin discontinuous brown (10YR 4/3) clay films on faces of peds; 10 percent gravel and shale fragments; medium acid; clear wavy boundary.

B22t—23 to 35 inches; brown (7.5YR 4/4) clay loam; weak medium and coarse subangular blocky structure; firm; thin discontinuous brown (10YR 4/3) clay films on faces of peds; 10 percent gravel and shale fragments; medium acid; clear wavy boundary.

IIB3—35 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; many medium distinct grayish brown (10YR 5/2), brown (10YR 5/3), and yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; few medium very dark grayish brown (10YR 3/2) organic stains; few fine pebbles; slightly acid; gradual wavy boundary.

IIC—44 to 60 inches; brown (10YR 5/3) silty clay loam; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; very firm; few fine pebbles; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 30 to 48 inches. The solum extends into the underlying fine textured material. Gravel content ranges from 2 to 20 percent in the upper part of the solum and from 0 to 10 percent in the lower part of the solum and underlying material.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam, sandy loam, fine sandy loam, and silt loam and is slightly acid or neutral. The B2t horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 3 to 6, and has common to many distinct mottles. It is loam, clay loam, or sandy clay loam and is as much as 15 percent gravel and shale fragments. Reaction ranges from very strongly acid to slightly acid. The IIB horizon is silty clay, clay loam, or silty clay loam and may be as much as 10 percent gravel and shale fragments. It ranges from slightly acid to mildly alkaline.

The IIC horizon has lenses of coarse silty clay loam or silt loam in some pedons.

Riddles series

The Riddles series consists of deep, well drained soils on till plains and moraines. These soils formed in loamy glacial till. Permeability is moderate. Slopes range from 0 to 18 percent.

Riddles soils are similar to Metea, Morley, and Rawson soils and are associated in the landscape with Tracy and Whitaker soils. Metea soils have more sand in the upper part of the solum. Morley soils have more clay throughout the solum, and Rawson soils have more clay in the lower part of the solum. Tracy soils have less clay in the B horizon, and the underlying material is sand and gravel. Whitaker soils are in flatter areas than the Riddles soils. They have mottles of low chroma in the upper 18 inches of the solum, and are stratified in the underlying material.

Typical pedon of Riddles silt loam, 2 to 6 percent slopes, in a cultivated field 2,220 feet north and 660 feet east of the southwest corner of sec. 21, T. 35 N., R. 5 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

B1—10 to 15 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; firm; neutral; clear wavy boundary.

B21—15 to 22 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; firm; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; 2 to 5 percent gravel; medium acid; clear wavy boundary.

B22t—22 to 32 inches; dark yellowish brown (10YR 4/4) loam; few yellowish red (5YR 4/8) mottles; moderate medium subangular blocky structure; firm; thin continuous dark brown (10YR 3/3) clay films on faces of peds; 5 to 8 percent gravel; medium acid; clear wavy boundary.

B23t—32 to 39 inches; yellowish brown (10YR 5/4) loam; few yellowish red (5YR 4/8) mottles; moderate medium and coarse subangular blocky structure; firm; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds and around some pebbles; 10 to 15 percent gravel and shale fragments; strongly acid; clear wavy boundary.

B3—39 to 48 inches; yellowish brown (10YR 5/4) loam; few yellowish red (5YR 4/8) mottles; weak coarse subangular blocky structure; firm; few old root channels with organic stains; thin patchy dark brown (10YR 4/3) clay films on faces of some peds; 10 to 15 percent gravel; slightly acid; clear wavy boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) loam; few yellowish red (5YR 4/8) mottles; massive; friable; compact in place; mildly alkaline.

Thickness of the solum ranges from 40 to 72 inches.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. It is loam, silt loam, or sandy loam and ranges from medium acid to neutral.

The B2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is loam, clay loam, or sandy clay loam, and in some pedons it is sandy loam or silty clay loam. The B2 horizon is as much as 15 percent gravel and shale fragments. Reaction ranges from strongly acid to neutral.

The C horizon is loam or sandy loam. It ranges from neutral to moderately alkaline.

Sebewa series

The Sebewa series consists of deep, very poorly drained soils on outwash plains and terraces. These soils formed in loamy glacial outwash. Permeability is moderate in the solum and rapid in the underlying material. Slopes are 0 to 2 percent.

Sebewa soils are similar to Gilford soils and are associated in the landscape with Alida, Bourbon, Maumee, and Pinhook soils. Gilford soils have less clay throughout the solum than the Sebewa soils. Alida and Bourbon soils have a dark surface layer that is less than 10 inches thick. They are dominantly brown below the plow layer and are in higher lying positions. Maumee soils are sandy throughout the profile. Pinhook soils have a dark surface layer that is less than 10 inches thick. They are more acid in the solum than the Sebewa soils and are in slightly higher lying positions.

Typical pedon of Sebewa loam, shaly sand substratum, in a cultivated field 150 feet north and 1,760 feet west of the southeast corner of sec. 24, T. 35 N, R. 5 W.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common fine roots; 8 percent fine shale fragments; neutral; abrupt smooth boundary.

A12—8 to 12 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; common fine roots; 8 percent fine shale fragments; neutral; clear wavy boundary.

B21g—12 to 16 inches; dark gray (10YR 4/1) sandy clay loam; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few fine roots; 5 percent shale fragments; neutral; clear wavy boundary.

B22tg—16 to 35 inches; grayish brown (2.5Y 5/2) clay loam; few fine distinct dark brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; few fine roots; thin continuous dark yellowish brown (10YR 4/4) clay films on faces of peds; 5 percent shale fragments; neutral; clear wavy boundary.

B3—35 to 37 inches; dark gray (YR 4/1) sandy loam; few fine and medium distinct dark brown (7.5YR 3/2) and dark grayish brown (2.5Y 4/2) mottles; weak medium subangular blocky structure; friable; 10 percent shale fragments; neutral; clear irregular boundary.

IIC—37 to 60 inches; brown (10YR 5/3) shaly sand and fine gravel; single grain; loose; 30 percent shale fragments; slight effervescence; mildly alkaline.

The thickness of the solum is 28 to 40 inches. Content of shale ranges from 0 to 12 percent in the A horizon and upper part of the B horizon and from 5 to 25 percent in the lower part of the B horizon.

The Ap and A12 horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2. They are loam, silt loam, or clay loam.

The B2 horizon has hue of 10YR, 2.5Y or 5Y; value of 4 to 6; and chroma of 1 or 2; or it is neutral and has value of 4 to 6. It is sandy clay loam, loam, clay loam, or shaly clay loam.

The IIC horizon is shaly coarse sand, shaly and gravelly sand, or coarse sand.

Selfridge series

The Selfridge series consists of deep, somewhat poorly drained soils on beach ridges, outwash areas, or low sand dunes. These soils formed in sandy deposits and are underlain by loamy till or lacustrine material. Permeability is rapid in the upper part of the solum and moderately slow in the lower part and in the underlying material. Slopes are 0 to 2 percent.

Selfridge soils are similar to Haskins soils and are adjacent to Blount and Rawson soils. Haskins soils have more clay in the upper part of the profile than the Selfridge soils. Blount soils do not have a sandy surface layer. Rawson soils have a brown subsoil and are in sloping positions.

Typical pedon of Selfridge loamy fine sand, in an idle field 760 feet east and 2,018 feet north of the southwest corner of sec. 15, T. 37 N, R. 5 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; many roots; medium acid; abrupt smooth boundary.

A2—9 to 14 inches; brown (l0YR 5/3) loamy fine sand; common medium distinct light brownish gray (20YR 6/2) mottles; weak thick platy structure parting to weak medium granular; very friable; common roots; slightly acid; clear wavy boundary.

B1—14 to 24 inches; pale brown (10YR 6/3) loamy sand; common medium distinct light brownish gray (10YR 6/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; very friable; few roots; few fine black (10YR 2/1) iron and manganese oxide concretions; neutral; abrupt wavy bundary.

B21t—24 to 27 inches; yellowish brown (10YR 5/4) sandy clay loam; many medium and coarse distinct brown (7.5YR 5/2) and strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; firm; few roots; thin discontinuous strong brown (7.5YR 5/6) clay films on faces of peds; neutral; abrupt wavy boundary.

IIB22tg—27 to 42 inches; gray (10YR 5/1) silty clay loam; few medium prominent strong brown (7.5YR 5/8) and many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; very firm; thin patchy grayish brown (10YR 5/2) clay films on faces of blocky peds; 3 percent gravel; strong effervescence; mildly alkaline.

IICg—42 to 60 inches; brown (10YR 5/3) and light brownish gray (10YR 6/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; massive; very firm; accumulations of white (10YR 8/1) filaments and threads of secondary lime; 3 percent gravel; strong effervescence; moderately alkaline.

Thickness of the solum ranges from 24 to 42 inches. The thickness of loamy fine sand or loamy sand is 20 to 30 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. Uncultivated areas have an A1 horizon that has value of 2 or 3. The A2 horizon has hue of 10YR and 7.5YR, value of 4 to 6, and chroma of 2 to 4 and is mottled. The A horizon ranges from neutral to medium acid.

The B1 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is loamy fine sand, fine sand, or loamy sand and ranges from neutral to medium acid. The IIBt horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 to 3 and is mottled. It is silty clay loam or clay loam and ranges from slightly acid to mildly alkaline.

The IIC horizon is similar to the IIBt horizon in range of color and texture and is mildly alkaline or moderately alkaline.

Suman series

The Suman series consists of deep, very poorly drained soils on flood plains of major streams or along narrow stream bottoms. These soils formed in alluvium. Permeability is moderately slow in the subsoil and rapid in the underlying material. Slopes are 0 to 2 percent.

Suman soils are similar to Milford, Pewamo, and Sebewa soils and are associated with Fluvaquents. Milford and Pewamo soils have more clay in the control section than the Suman soils and do not have a sandy substratum. Pewamo and Sebewa soils regularly decrease in content of organic matter as they increase in depth. Fluvaquents are in slightly higher lying areas and do not have a dark surface layer that is more than 10 inches thick.

Typical pedon of Suman silt loam, in a cultivated field 960 feet north and 2,340 feet west of the southeast corner of sec. 5, T. 32 N, R. 5 W.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; many medium roots; 1 percent fine shale fragments and fine gravel; slightly acid; abrupt smooth boundary.

A12—7 to 13 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; few medium distinct dark yellowish brown (10YR 4/4) mottles; weak coarse subangular blocky structure; firm; many medium roots; 1 percent fine shale fragments; neutral; clear wavy boundary.

B21g—13 to 28 inches; dark gray (10YR 4/1) clay loam; many coarse prominent yellowish red (5YR 4/8) and common medium faint gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; few fine roots; 1 percent fine shale fragments; neutral; gradual wavy boundary.

B22g—28 to 37 inches; dark gray (10YR 4/1) sandy clay loam with some bands of sandy loam and thin strata of light brownish gray (10YR 6/2) loamy sand; many coarse prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; friable; few fine roots; 1 percent fine shale fragments; neutral; abrupt wavy boundary.

IIC—37 to 60 inches; light brownish gray (10YR 6/2) sand and coarse sand; single grain; loose; 1 percent fine shale fragments; neutral.

Thickness of the solum ranges from 20 to 40 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The Ap or A1 horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2; or it is black (N 2/0). It is silt loam, silty clay loam, clay loam, or loam.

The B horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2; or it is dark gray (N 4/0) or gray (N 5/0) and has few to many distinct mottles. It is clay loam, silty clay loam, or sandy clay loam.

The C horizon is sand, coarse sand, or loamy sand.

Tracy series

The Tracy series consists of deep, well drained soils on outwash plains. These soils formed in glacial outwash having a fairly large amount of shale fragments and a low amount of carbonates. Permeability is moderate. Slopes range from 0 to 18 percent.

Tracy soils are similar to Door, Elston, and Lydick soils and are commonly adjacent to Hanna and Riddles soils. Door and Elston soils have a mollic epipedon, Lydick soils have a dark surface layer 7 to 10 inches thick, and Hanna soils have mottles within a depth of 40 inches and are in slightly lower lying positions than the Tracy soils. Door and Lydick soils have more clay in the solum, and Riddles soils have more clay throughout the profile.

Typical pedon of Tracy sandy loam, 0 to 2 percent slopes, in a wooded area 708 feet south and 280 feet east of the center of sec. 30, T. 34 N., R. 5 W.

A1— 0 to 5 inches; very dark brown (10YR 2/2) sandy loam, very pale brown (10YR 7/3) dry; moderate medium and coarse granular structure; friable; strongly acid; abrupt smooth boundary.

A2—5 to 9 inches; brown (10YR 4/3) sandy loam; weak medium platy structure; friable; common fine vesicular voids; few very dark grayish brown (10YR 3/2) worm casts; thin very dark gray sand coatings on faces of peds (dry), color disappears when moistened; very strongly acid; clear wavy boundary.

B1—9 to 13 inches; dark brown (7.5YR 4/4) sandy loam; weak medium and fine subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds and as linings in some voids; thin very fine gray sand coatings on faces of some peds; few very dark grayish brown (10YR 3/2) worm casts; few fine pebbles and shale fragments; very strongly acid; clear wavy boundary.

B21t—13 to 24 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; thin nearly continuous clay films on faces of peds and as linings in voids; few fine random voids; dark brown (7.5YR 3/3) films on faces of peds; 10 percent fine gravel and shale fragments; very strongly acid; clear wavy boundary.

B22t—24 to 33 inches; dark brown (7.5YR 4/4) sandy loam; moderate medium and coarse subangular blocky structure; firm; thin nearly continuous clay films on faces of peds and as linings in voids; dark brown (7.5YR 3/3 and 4/4) films on faces of peds; few fine dark reddish brown iron oxide accumulations; 10 percent gravel and shale fragments; very strongly acid; clear wavy boundary.

B23t—33 to 47 inches; brown (7.5YR 5/4) sandy loam; weak medium and coarse subangular blocky structure; firm; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds and as linings in some voids; brown (7.5YR 4/4) coatings on faces of peds; few fine yellowish brown (10YR 5/8) iron oxide accumulations; 15 percent fine gravel and shale fragments; very strongly acid; clear wavy boundary.

B3t—47 to 60 inches; stratified brown (7.5YR 5/4) shale sandy clay loam and brown (10YR 5/3) shaly loamy sand; weak coarse subangular blocky structure; firm and loose; thin discontinuous dark brown (7.5YR 3/3) clay films on faces of peds and thick dark brown (7.5YR 3/3) clay films on surfaces of some shale fragments and in some cleavage planes; 20 percent gravel and shale fragments; very strongly acid; clear wavy boundary.

IIC—60 to 80 inches; mottled brown (10YR 5/3) and grayish brown (10YR 5/2) stratified loamy sand, sand, and shaly sand; single grain; loose; medium acid.

Thickness of the solum ranges from 36 to 70 inches.

The A1 horizon has hue of 10YR, value of 2 or 3, and chroma of 2. It is loam or sandy loam. Cultivated areas have an Ap horizon that has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 3 or 4. These areas are loam or sandy loam. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is loam or sandy loam.

The B2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. Some subhorizons have chroma of 5 or 6. The B2 horizon is loam, sandy loam, or clay loam and is 5 to 20 percent gravel and shale fragments. It is strongly acid or very strongly acid. The B3 horizon is 15 to 30 percent gravel and shale fragments and is strongly acid or very strongly acid.

The C horizon has strata of sand, loamy sand, shaly sand, and sandy clay loam. It ranges from medium acid to neutral.

Tyner series

The Tyner series consists of deep, well drained soils on outwash plains. These soils formed in sand and loamy sand and have significant amounts of fine shale fragments. Slopes range from 0 to 3 percent.

Tyner soils are similar to Brems and Plainfield soils and are adjacent to Hanna and Tracy soils. Brems soils are mottled in the lower part of the subsoil. Plainfield soils have a higher content of sand throughout the profile than the Tyner soils, and Hanna and Tracy soils have more clay. Hanna soils are mottled in the lower part of the subsoil and are in slightly lower lying positions than the Tyner soils.

Typical pedon of Tyner loamy sand, 0 to 3 percent slopes, in a cultivated field 150 feet west and 345 feet south of the center of sec. 12, T. 34 N., R. 5 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; 1 percent shale fragments; neutral; abrupt smooth boundary.

A2—9 to 12 inches; brown (10YR 4/3) loamy sand; weak thick platy structure; very friable; few fine roots; 2 percent shale fragments; few worm casts filled with material from Ap horizon; neutral; clear wavy boundary.

B2—12 to 29 inches; dark yellowish brown (10YR 4/4) loamy sand; weak medium and coarse subangular blocky structure; very friable; few fine roots; 2 percent shale fragments; slightly acid; clear irregular boundary.

B31—29 to 48 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; few fine roots; 2 percent shale fragments; medium acid; clear wavy boundary.

B32—48 to 54 inches; dark yellowish brown (10YR 4/4) loamy sand; weak coarse subangular blocky structure; very friable; weakly cemented; 5 percent shale fragments and fine gravel; strongly acid; clear wavy boundary.

C—54 to 60 inches; dark yellowish brown (10YR 4/4) sand; common medium distinct brown (10YR 5/3) mottles; single grain; loose; yellowish red (5YR 4/6) iron stains; strongly acid.

The thickness of the solum is 36 to 60 inches.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. The A horizon is as much as 5 percent gravel and shale fragments. It ranges from neutral to medium acid.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loamy sand or sand and is as much as 10 percent gravel and shale fragments. Reaction ranges from strongly acid to slightly acid.

The C horizon is fine sand or sand and ranges from medium acid to very strongly acid.

Wallkill series

The Wallkill series consists of deep, very poorly drained soils on flood plains or on margins of organic soils adjacent to the uplands. These soils formed in alluvium and are underlain by organic material. Permeability is moderate in the mineral soil and moderately slow to moderately rapid in the organic material. Slopes are 0 to 2 percent.

Wallkill soils are adjacent to Houghton, Morley, Palms, and Riddles soils. The Houghton and Palms soils are organic soils near the center of depressional areas. Morley and Riddles soils are mineral soils on sloping uplands surrounding the Wallkill soils.

Typical pedon of Wallkill silt loam, in a cultivated field 140 feet east and 620 feet south of the northwest corner of sec. 13, T. 36 N., R. 5 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; common fine and medium roots; neutral; abrupt smooth boundary.

A2—8 to 16 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct dark yellowish brown (10YR 3/6) mottles; weak medium subangular blocky structure; friable; common fine and medium roots; slightly acid; clear smooth boundary.

B1g—16 to 23 inches; dark gray (10YR 4/1) silt loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure; firm; common fine and medium roots; dark reddish brown (5YR 3/4) iron stains; neutral; clear wavy boundary.

B2g—23 to 29 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; common fine and medium roots; dark reddish brown (5YR 3/4) iron stains; black (10YR 2/1) organic fillings; slightly acid; clear wavy boundary.

C—29 to 32 inches; black (N 2/0) and dark grayish brown (10YR 4/2) silt loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; friable; common fine and medium roots; dark reddish brown (5YR 3/4) iron stains; slightly acid; abrupt smooth boundary.

IIOa1—32 to 40 inches; dark reddish brown (5YR 3/2) sapric material, black (10YR 2/1) rubbed; about 60 percent fiber, about 8 percent rubbed; moderate thin platy structure; friable; primarily herbaceous fibers; slightly acid; clear wavy boundary.

IIOa2—40 to 60 inches; dark reddish brown (5YR 3/2) sapric material, very dark brown (10YR 2/2) rubbed; about 60 percent fiber, about 8 percent rubbed; massive; friable; primarily herbaceous fibers; slightly acid.

The mineral soil overlying the organic material ranges from 30 to 40 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 or 2. It is loam or silt loam and ranges from medium acid to neutral. The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is loam or silt loam and ranges from medium acid to neutral. In some pedons the Bg horizon is absent and in some pedons the Bg horizon extends to the contact with the organic layers.

The underlying IIO horizon is hemic or sapric. Reaction ranges from very strongly acid to slightly acid.

Warners series

The Warners series consists of deep, very poorly drained soils on flood plains or margins of lakes. These soils formed in alluvial material over a marl substratum. Permeability is moderately slow or moderate in the mineral material and is variable in the underlying marl. Slopes are 0 to 2 percent.

Warners soils are similar to Edwards soils and are commonly associated with Suman soils. The Edwards soils developed in muck overlying marl. The Suman soils are not underlain with marl.

Typical pedon of Warners silt loam, in an idle field 2,280 feet south and 340 feet west of the northeast corner of sec. 8, T. 35 N., R. 6 W.

Ap—0 to 10 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A12—10 to 14 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine and medium subangular blocky structure; firm; many fine roots; neutral; clear smooth boundary.

Cg—14 to 24 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; common fine roots; common fine continuous vertical tubular pores; slight effervescence; mildly alkaline; clear wavy boundary.

IILca1—24 to 45 inches; light gray (10YR 7/1) marl; common medium distinct yellowish brown (10YR 5/8) mottles; massive; friable; violent effervescence; moderately alkaline.

IILca2—45 to 60 inches; gray (10YR 5/1) marl; massive; friable; many fine white (10YR 8/1) shells; strong effervescence; moderately alkaline.

Depth to marl or to friable material impregnated with carbonates ranges from 12 to 32 inches.

The A1 or Ap horizon has hue of 10YR, value of 2, and chroma of 1 or 2. It is silt loam, loam, or silty clay loam and ranges from slightly acid to mildly alkaline.

The Cg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. It is loam, silt loam, or silty clay loam and is neutral or mildly alkaline. The IILca horizons have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. They are marl or material impregnated with carbonates.

Washtenaw series

The Washtenaw series consists of deep, very poorly drained, nearly level soils in depressional areas on moraines, till plains, and outwash plains. These soils formed in alluvium and the underlying glacial drift. Permeability is slow or moderately slow. Slopes are 0 to 2 percent.

Washtenaw soils are similar to Fluvaquents and Wallkill soils and are associated with Morley, Pewamo, and Riddles soils. Fluvaquents do not have buried A and B horizons. Wallkill soils have an organic layer at a depth of 20 to 40 inches. The Morley and Riddles soils have brown subsoils and are on the sloping uplands surrounding the Washtenaw soils. Pewamo soils do not have buried A and B horizons and are in slightly lower lying positions near the center of depressional areas.

Typical pedon of Washtenaw silt loam, in a cultivated field 810 feet west and 210 feet north of the center of sec. 4, T. 35 N., R. 6 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light gray (2.5Y 7/2) dry; weak medium and fine granular structure; friable; neutral; abrupt smooth boundary.

C1—8 to 22 inches; dark grayish brown (10YR 4/2) silt loam; weak coarse granular structure; friable; few very thin brown (10YR 5/3) strata; neutral; clear wavy boundary.

C2—22 to 30 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct dark yellowish brown (10YR 5/4) mottles; weak medium platy structure; friable; thin discontinuous very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds; neutral; clear wavy boundary.

IIA1b—30 to 37 inches; black (10YR 2/1) silt loam; moderate medium subangular blocky structure; firm; few thin dark gray (10YR 4/1) strata; neutral; clear wavy boundary.

IIB21b—37 to 62 inches; black (10YR 2/1) clay loam; few fine and medium distinct dark gray (10YR 4/1) and light olive brown (2.5Y 5/4) mottles; moderate medium angular and subangular blocky structure; firm; neutral; clear wavy boundary.

IIB22gb—62 to 70 inches; gray (5Y 5/1) silty clay loam; weak medium and coarse subangular blocky structure; firm; neutral; clear wavy boundary.

IICg—70 to 80 inches; gray (5Y 5/1) silty clay loam; few fine distinct light olive brown (2.5Y 5/4) mottles; massive; firm; neutral.

Thickness of the overwash material ranges from 20 to 40 inches, and thickness of the underlying buried soil ranges from 24 to 40 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is silt loam and is slightly acid or neutral.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Mottles are few or common, faint or distinct, and fine to medium. The C horizon is silt loam and is slightly acid or neutral.

The IIB21b horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silt loam, loam, silty clay loam, or clay loam and is slightly acid or neutral.

The IICg horizon is till or outwash sand and gravel and is mildly alkaline or moderately alkaline.

Whitaker series

The Whitaker series consists of deep, somewhat poorly drained soils on terraces, lake plains, and outwash plains. These soils formed in stratified, loamy sediment. Permeability is moderate. Slopes are 0 to 2 percent

Whitaker soils are similar to Blount, Del Rey, and Selfridge soils and are associated with Martinsville, Milford, and Riddles soils. Blount and Del Rey soils have more clay than Whitaker soils, and Blount soils have underlying material of calcareous glacial till. Selfridge soils have a sandy surface layer and are underlain by calcareous, lacustrine material or glacial till. Martinsville soils have a brown subsoil that is not mottled. Milford soils have a dark surface layer and are in slightly lower lying areas. Riddles soils have a brown subsoil and are in higher lying areas.

Typical pedon of Whitaker loam, in a cultivated field 480 feet north and 75 feet east of the center of sec. 9, T. 36 N., R. 6 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light gray (10YR 7/2) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

B21t—9 to 15 inches; mottled, yellowish brown (10YR 5/4) and light brownish gray (10YR) 6/2) clay loam; moderate fine and medium subangular blocky structure; firm; many fine and medium pores; thin discontinuous gray (10YR 6/1) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains; slightly acid; clear wavy boundary.

B22t—15 to 24 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine pores; thin continuous gray (10YR 6/1) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains; medium acid; clear wavy boundary.

B23t—24 to 28 inches; yellowish brown (10YR 5/4) loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; thin discontinuous gray (10YR 6/1) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains; strongly acid; clear wavy boundary.

B3—28 to 41 inches; light brownish gray (10YR 6/2) sandy loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak coarse subangular blocky structure; friable; few black (10YR 2/1) iron and manganese oxide stains; medium acid; gradual wavy boundary.

C—41 to 60 inches; yellowish brown (10YR 5/6), stratified fine sand, loam, and clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; very friable; medium acid.

Thickness of the solum ranges from 36 to 55 inches.

The Ap horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 3. It is loam or silt loam. Some pedons have A2 horizons.

The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is clay loam, loam, sandy clay loam, silty clay loam, or sandy loam and ranges from strongly acid to slightly acid.

The C horizon is stratified silt loam, loam, fine sand, and silty clay loam.

formation of the soils

In this section the major factors of soil formation and their degree of importance in the formation of the soils in the county are described.

factors of soil formation

Soil is produced by soil forming processes acting on materials deposited or accumulated by geologic agents. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that is formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil profile. It may be much or little, but some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials of the soils of Porter County were deposited by glaciers or by melt water from the glaciers. Some of these materials have been reworked and redeposited by subsequent actions of water and wind. These glaciers covered the county several times. The most recent melted 12,000 to 15,000 years ago. Although parent materials are of common glacial origin, their properties vary greatly, sometimes within a small area, depending on how the materials were deposited. The dominant parent materials in Porter County were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material laid down directly by glaciers with a minimum of water action. It consists of particles of different sizes that are mixed together. Some small pebbles in glacial till have sharp corners, indicating that they have not been worn by water washing. The glacial till in Porter County is calcareous and firm. Its texture is silty clay loam in most places. The Blount soils are an example of soils that formed in glacial till. These soils typically are fine textured and have well developed structure.

Outwash materials were deposited by running water from melting glaciers. The size of the particles that make up outwash material varies according to speed of the stream of water in which the particles were carried. When the fast moving water slowed down, the coarser particles were deposited. The finer particles, such as very fine sand, silt, and clay, were carried by water moving more slowly. Outwash deposits generally consist of layers of particles of similar size, such as sand and gravel. The Bourbon soils formed in such deposits of outwash material.

Lacustrine materials were deposited from still, or ponded, glacial melt water. Because the coarser fragments dropped out of moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in still water. Lacustrine deposits are silty or clayey. In Porter County, soils that formed in lacustrine deposits are typically fine textured. The Milford soils are an example of soils that formed in lacustrine material.

Alluvial material was deposited by floodwaters of present streams in recent time. This material ranges in texture, depending on the speed of the water from which it was deposited. The alluvium deposited along a swift stream like Salt Creek is coarser textured than that deposited along a slow, sluggish stream like the Kankakee River. The Fluvaquents and Suman soils are examples of alluvial soils.

Organic material was made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in lakes and depressions in outwash plains and till plains. Grasses and sedges growing around the edges of these lakes died and fell into the water. Because of the wetness of the areas, the plants did not decompose but remained around the edges of the lakes. Later tamarack and other water-tolerant trees grew in these areas. When these trees died, their residue became part of the accumulation of organic material. Eventually the lakes were filled with organic material and developed into areas of peat. Subsequently, in most areas, the plant remains decomposed and became muck. In other areas, the material has changed little since deposition. The Houghton soils are an example of soils that formed in organic material.

plant and animal life

Plants have been the principal organism influencing the soils in Porter County. Bacteria, fungi, and earthworms have also been important influences. Plants and animals have added organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kind of plants that grew on the soil. The remains of these plants accumulated on the surface, decayed, and eventually became a part of the organic matter. Roots of the plants provided channels for downward movement of water through the soil and added organic matter as they decayed. Bacteria in the soil helped to break down the organic material so that it could be used by growing plants.

Most areas of Porter County were covered with mixed forests. Some areas were covered with prairie grasses. Differences in natural soil drainage and small changes in the parent material affected the composition of the forest species.

In general, the well drained Tracy and Riddles soils were mainly covered with oak, beech, ash, walnut, sugar maple, and soft maple; the well drained Oakville soils, with white pine and scrub oak; and the well drained Door and Elston soils, by grasses such as big bluestem, little bluestem, indiangrass, and by groves of bur oak trees. The wet soils were covered with soft maple, ash, swamp white oak, basswood, cedar, and tamarack trees. The soils in the marshes were covered by marsh plants such as sedges, rushes, and coarse grasses. Sphagnum and other mosses grew in a few wet soils. The Gilford and Sebewa soils, which developed under wet conditions, have considerable organic matter; the Adrian and Houghton soils, which developed under high water, are organic soils. Most of the soils of Porter County that developed under wet conditions have a high content of organic matter. In general, those soils that produced dominantly forest vegetation have less accumulation of organic matter than the soils that produced dominantly grass vegetation.

climate

Climate is important in the formation of soils. It determines the kind of plant and animal life on and in the soil. It determines the amount of water available for weathering of minerals and the transporting of soil material. Climate, through its influence on temperatures in the soil, determines the rate of chemical reaction that occurs in the soil. However, the influences of climate generally apply to areas larger than the relatively small area of a county.

The cool, humid climate of Porter County is presumed to be similar to that which existed when the soils formed. These soils are different from soils that formed in a dry, warm climate or those that formed in a hot, moist climate. The climate is uniform throughout Porter County, although its effect is modified locally by the proximity of Lake Michigan. For more detailed information about the climate of Porter County, see the section "General nature of the county."

relief

Relief, or topography, has influenced the soils of Porter County through its influence on natural drainage, erosion, plant cover, and soil temperature. In Porter County, slopes range from 0 to 45 percent. Natural soil drainage ranges from well drained on the ridgetops to very poorly drained in the depressional areas.

Relief influences the formation of soils by affecting runoff and drainage. Drainage, by affecting the aeration of the soils, influences the color of the soil. Runoff is greatest on the steepest slopes. In low areas, water is temporarily ponded. Generally, water and air move freely through soils that are well drained and slowly through soils that are very poorly drained. Well aerated soils that have iron and aluminum compounds are generally brightly colored and oxidized. Poorly aerated soils are dull gray and mottled. In Porter County, the Tracy soils are an example of well drained, well aerated soils. The Maumee soils are an example of poorly aerated, very poorly drained soils. Between the very poorly drained and well drained soils are soils that are poorly drained, somewhat poorly drained, and moderately well drained.

time

Time, usually a long time, is required by the agents of soil formation to form distinct horizons. The differences in length of time that the parent materials have been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, and other soils develop slowly.

The soils in Porter County range from young to mature. The glacial deposits from which many of the soils formed have been exposed to soil forming factors for a long enough time to allow distinct horizons to develop within the soil profile. The Morley soils are an example of older soils.

Some soils, however, that formed in recent alluvial sediment have not been in place long enough for distinct horizons to develop. The Suman soils are an example of young soils.

The Morley and Riddles soils are older soils which show the effect of time on leaching of lime from the soil. The parent material of the Morley and Riddles soils had about the same amount of lime as the C horizon of these soils has today.

In another comparison, the Milford soils were submerged and protected from leaching for many years, whereas, the Tracy soils were above water and subjected to leaching. As a result, the Milford soils are leached to a depth of about 39 inches, and the Tracy soils are leached to a depth of about 60 inches. In addition, the Tracy soils are much more permeable than the Milford soils. The effectiveness of leaching is reflected in the depth to which the soils are leached of lime. The Riddles soils are leached to a depth of about 70 inches, whereas the Morley soils have free lime and are calcareous at a depth of about 42 inches. This difference is probably caused by the passage of more water through the more permeable Riddles soils.

processes of soil formation

Several processes have been active in the formation of the soils of Porter County. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; and the liberation and translocation of silicate clay minerals. In most soils, more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all of the soils of the county. The content of organic matter in some soils is low and in other soils is high. Generally, the soils that have the most organic matter have a thick, black surface layer. The Gilford and Sebewa soils have high organic matter content.

Carbonates and bases have been leached from the upper part of the profile of nearly all of the soils in the county. Leaching is generally believed to precede the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from A and B horizons of well drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by an acid reaction. Leaching of wet soils is slow because the water table is high or because water moves slowly through such soils.

Clay accumulates in pores and other voids and forms films on the surfaces along which water moves. Leaching of bases and translocation of silicate clays are important processes in horizon differentiation in the soils of Porter County. The Morley soils are an example in which translocated silicate clays have accumulated in the B2t horizon in the form of clay films.

The reduction and transfer of iron, or gleying, has occurred in all of the very poorly drained and somewhat poorly drained soils of the county. In the naturally wet soils, this process has been an important factor in horizon differentiation. The gray subsoil indicates the redistribution of iron oxides. The reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower horizons or completely out of the profile. Mottles, which are present in some horizons, indicate the segregation of iron.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bottom land. The normal flood plain of a stream, subject to flooding.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves all or part of the crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual.* The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	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

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature[1]						Precipitation[1]				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[2]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	31.8	15.6	23.7	57	-15	11	2.00	1.06	2.76	6	11.4
February---	35.7	19.1	27.4	59	-10	10	1.66	.86	2.30	5	10.5
March------	45.2	27.1	36.2	75	4	80	2.66	1.71	3.51	7	7.5
April------	60.0	38.2	49.1	82	20	282	4.53	2.78	6.10	10	2.5
May--------	71.2	47.7	59.5	90	30	605	3.69	2.44	4.82	8	.0
June-------	80.3	57.4	68.9	94	40	867	4.20	2.63	5.60	7	.0
July-------	83.2	61.4	72.3	96	46	1,001	4.27	2.77	5.62	8	.0
August-----	81.9	59.8	70.9	94	43	958	3.75	1.88	5.27	6	.0
September--	75.8	52.9	64.4	93	33	732	3.76	1.52	5.57	6	.0
October----	65.6	43.2	54.4	86	24	446	3.51	1.44	5.18	6	.3
November---	49.1	32.1	40.6	73	10	105	2.68	1.73	3.53	7	4.6
December---	36.2	21.8	29.0	64	-9	27	2.60	1.24	3.70	6	10.1
Year-----	59.7	39.7	49.7	97	-16	5,124	39.31	33.13	45.22	82	46.9

[1]Recorded in the period 1951-75 at Valparaiso, Ind.

[2]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature[1]		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 15	May 1	May 15
2 years in 10 later than--	April 11	April 26	May 11
5 years in 10 later than--	April 4	April 18	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	October 26	October 16	September 29
2 years in 10 earlier than--	October 30	October 20	October 5
5 years in 10 earlier than--	November 7	October 28	October 16

[1]Recorded in the period 1951-75 at Valparaiso, Ind.

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature during growing season[1]		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	201	173	149
8 years in 10	206	180	155
5 years in 10	215	192	166
2 years in 10	225	205	178
1 year in 10	230	212	184

[1]Recorded in the period 1951-75 at Valparaiso, Ind.

TABLE 4.--POTENTIAL AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent of area	Cultivated farm crops	Hay and pasture	Woodland	Urban uses
	Pct				
Suman-Fluvaquents	2	Fair: flooding, wetness.	Fair: flooding, wetness.	Poor: wetness. floods.	Poor: flooding, wetness.
Houghton-Adrian-Palms	1	Fair: ponding, soil blowing.	Fair: ponding.	Poor: ponding, wetness.	Poor: ponding, low strength.
Oakville-Maumee-Brems	8	Poor: slope, low available water capacity.	Poor: slope, low available water capacity.	Fair: low available water capacity.	Fair: slope.
Gilford-Maumee-Morocco	5	Good	Good	Poor: ponding, wetness.	Poor: ponding, wetness.
Bourbon-Gilford-Pinhook	12	Good	Good	Fair: wetness.	Poor: wetness, ponding.
Sebewa-Alida-Pinhook	8	Good	Good	Fair: ponding, wetness.	Poor: ponding, wetness.
Door-Lydick	4	Good	Good	Not rated	Good.
Tracy-Hanna	3	Good	Good	Good	Good.
Riddles-Tracy	13	Fair: slope.	Good	Good	Fair: slope.
Morley-Blount-Pewamo	26	Fair: slope, wetness.	Good	Good	Poor: permeability.
Elliott-Markham-Pewamo	7	Good	Good	Good	Poor: wetness, permeability.
Whitaker-Milford-Del Ray	11	Good	Good	Fair: wetness.	Poor: wetness.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ad	Adrian muck, drained	2,619	1.0
Ag	Alida loam	6,241	2.3
BaA	Blount silt loam, 0 to 3 percent slopes	14,261	5.2
Br	Bourbon sandy loam	13,670	5.0
BtA	Brems sand, 0 to 3 percent slopes	3,727	1.4
ChB	Chelsea fine sand, 2 to 6 percent slopes	569	0.2
ChC	Chelsea fine sand, 6 to 12 percent slopes	612	0.2
De	Del Rey silt loam	5,339	2.0
DoA	Door loam, 0 to 2 percent slopes	4,192	1.5
Du	Dune land	980	0.4
Ed	Edwards muck, drained	644	0.2
ElA	Elliott silt loam, 0 to 3 percent slopes	9,439	3.5
EsA	Elston loam, 0 to 3 percent slopes	1,256	0.5
Fh	Fluvaquents	3,971	1.5
Gf	Gilford sandy loam	12,844	4.7
HaA	Hanna sandy loam, 0 to 3 percent slopes	4,186	1.5
HkA	Haskins loam, 0 to 2 percent slopes	3,058	1.1
Hm	Houghton muck, ponded	3,215	1.2
Ho	Houghton muck, drained	2,953	1.1
LyA	Lydick loam, 0 to 2 percent slopes	3,824	1.4
LyB	Lydick loam, 2 to 6 percent slopes	1,484	0.5
McA	Markham silt loam, 0 to 2 percent slopes	812	0.3
McB	Markham silt loam, 2 to 6 percent slopes	2,970	1.1
MfA	Martinsville loam, 0 to 2 percent slopes	2,123	0.8
MfB	Martinsville loam, 2 to 6 percent slopes	1,116	0.4
Mm	Maumee loamy sand	7,283	2.7
Mn	Maumee loamy sand, ponded	1,438	0.5
MoB	Metea loamy fine sand, 1 to 6 percent slopes	540	0.2
Mp	Milford silty clay loam	6,003	2.2
MrB2	Morley silt loam, 2 to 6 percent slopes, eroded	18,621	6.7
MrC2	Morley silt loam, 6 to 12 percent slopes, eroded	4,351	1.6
MrD2	Morley silt loam, 12 to 18 percent slopes, eroded	2,479	0.9
MrE	Morley silt loam, 18 to 30 percent slopes	1,769	0.7
MsC3	Morley silty clay loam, 6 to 12 percent slopes, severely eroded	1,099	0.4
Mx	Morocco loamy sand	3,705	1.4
Nf	Newton loamy fine sand	1,211	0.4
OaC	Oakville fine sand, 4 to 12 percent slopes	3,955	1.5
OaE	Oakville fine sand, 18 to 40 percent slopes	3,285	1.2
Pa	Palms muck, drained	1,519	0.6
Pe	Pewamo silty clay loam	9,805	3.6
Ph	Pinhook loam	6,734	2.5
Pk	Pits	165	0.1
PlB	Plainfield sand, 2 to 6 percent slopes	1,347	0.5
PlC	Plainfield sand, 6 to 12 percent slopes	463	0.2
RaB	Rawson loam, 2 to 6 percent slopes	3,427	1.3
RaC2	Rawson loam, 6 to 12 percent slopes, eroded	804	0.3
RlA	Riddles silt loam, 0 to 2 percent slopes	3,194	1.2
RlB	Riddles silt loam, 2 to 6 percent slopes	10,905	4.0
RmC2	Riddles loam, 6 to 12 percent slopes, eroded	3,462	1.3
RmD2	Riddles loam, 12 to 18 percent slopes, eroded	2,093	0.8
Sb	Sebewa loam, shaly sand substratum	20,046	7.3
Se	Selfridge loamy fine sand	845	0.3
So	Suman silt loam	5,266	1.9
TcA	Tracy sandy loam, 0 to 2 percent slopes	3,912	1.4
TcB	Tracy sandy loam, 2 to 6 percent slopes	5,804	2.1
TcC	Tracy sandy loam, 6 to 12 percent slopes	2,577	0.9
TcD	Tracy sandy loam, 12 to 18 percent slopes	1,333	0.5
TyA	Tyner loamy sand, 0 to 3 percent slopes	2,393	0.9
UbA	Udorthents, 0 to 3 percent slopes	196	0.1
Uc	Urban land-Blount complex	862	0.3
UcG	Udorthents, loamy, 3 to 30 percent slopes	912	0.3
Ud	Urban land-Brems complex	858	0.3
Ue	Urban land-Martinsville complex	983	0.4
UmB	Urban land-Morley complex, 2 to 6 percent slopes	1,116	0.4
UpB	Urban land-Psamments complex, 0 to 6 percent slopes	4,350	1.6
Uw	Urban land-Whitaker complex	321	0.1
Wa	Wallkill silt loam	777	0.3
We	Warners silt loam	744	0.3
Wh	Washtenaw silt loam	2,706	1.0
Wt	Whitaker loam	8,409	3.1
	Water	1,828	0.7
	Total	272,000	100.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only soils suitable for these crops are listed]

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Ad--- Adrian	75	23	---	---	---
Ag--- Alida	115	40	46	3.8	7.6
BaA--- Blount	100	35	48	4.3	7.2
Br--- Bourbon	80	30	35	3.0	6.0
BtA--- Brems	70	24	32	2.3	4.6
ChB--- Chelsea	57	21	---	2.0	---
ChC--- Chelsea	---	---	---	1.5	---
De--- Del Rey	115	37	49	4.5	---
DoA--- Door	115	40	46	3.8	7.6
Ed--- Edwards	90	34	---	---	---
ElA--- Elliott	128	45	55	5.1	---
EsA--- Elston	95	33	43	3.1	6.2
Gf--- Gilford	120	42	54	4.0	8.0
HaA--- Hanna	105	37	42	3.4	6.8
HkA--- Haskins	110	44	46	4.4	---
Ho--- Houghton	115	34	---	---	---
LyA--- Lydick	110	38	44	3.6	7.2
LyB--- Lydick	105	37	42	3.4	6.8
McA--- Markham	112	37	49	4.4	---
McB--- Markham	111	37	49	4.4	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
MfA----------------------- Martinsville	120	42	48	4.0	8.0
MfB----------------------- Martinsville	120	42	48	4.0	8.0
Mm------------------------ Maumee	110	38	50	3.6	7.2
MoB----------------------- Metea	85	30	42	2.8	---
Mp------------------------ Milford	131	48	56	5.2	---
MrB2---------------------- Morley	102	35	47	4.3	---
MrC2---------------------- Morley	100	34	46	4.2	---
MrD2---------------------- Morley	90	---	41	3.7	---
MrE----------------------- Morley	---	---	---	3.1	---
MsC3---------------------- Morley	85	---	39	3.6	---
Mx------------------------ Morocco	80	28	36	2.6	5.2
Nf------------------------ Newton	100	35	45	3.3	6.6
OaC----------------------- Oakville	---	---	---	1.8	---
Pa------------------------ Palms	105	42	---	---	---
Pe------------------------ Pewamo	110	40	50	4.0	---
Ph------------------------ Pinhook	115	40	46	3.8	7.6
PlB, PlC------------------ Plainfield	---	---	---	2.0	---
RaB----------------------- Rawson	105	38	46	4.2	---
RaC2---------------------- Rawson	90	28	38	3.8	---
RlA----------------------- Riddles	120	42	48	4.0	8.0
RlB----------------------- Riddles	115	40	46	3.8	7.6
RmC2---------------------- Riddles	105	37	42	3.4	6.8
RmD2---------------------- Riddles	90	32	36	3.0	6.0

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Winter wheat	Grass-legume hay	Tall fescue
	Bu	Bu	Bu	Ton	AUM*
Sb------------------------- Sebewa	105	36	50	4.6	---
Se------------------------- Selfridge	90	33	42	3.2	---
So------------------------- Suman	120	42	45	4.6	9.2
TcA------------------------ Tracy	105	37	42	3.4	6.8
TcB------------------------ Tracy	105	37	42	3.4	6.8
TcC------------------------ Tracy	95	33	38	3.1	6.2
TcD------------------------ Tracy	80	28	32	2.6	5.2
TyA------------------------ Tyner	70	24	32	2.3	4.6
Wa------------------------- Wallkill	100	---	---	3.5	6.5
We------------------------- Warners	100	30	---	3.0	---
Wh------------------------- Washtenaw	130	46	52	4.3	8.6
Wt------------------------- Whitaker	125	44	50	4.1	8.2

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	17,519	---	---	---
II	170,381	44,327	114,645	11,409
III	31,995	11,734	17,868	2,393
IV	19,479	7,004	4,474	8,001
V	1,438	---	1,438	---
VI	8,146	1,769	---	6,377
VII	3,285	---	---	3,285
VIII	3,215	---	3,215	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Ad: Adrian	4w	Slight	Severe	Severe	Severe	White ash	51	
						Red maple	51	
						Quaking aspen	56	
						Black willow	---	
						Silver maple	76	
Ag: Alida	1o	Slight	Slight	Slight	Slight	White oak	80	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak	95	
						Yellow-poplar	95	
						Northern red oak	75	
BaA: Blount	3c	Slight	Slight	Severe	Severe	White oak	65	Eastern white pine, red pine, yellow-poplar.
						Northern red oak	65	
						Green ash	---	
						Bur oak	---	
						Pin oak	---	
Br: Bourbon	3o	Slight	Slight	Slight	Slight	White oak	70	Eastern white pine, European larch, red maple, American sycamore.
						Pin oak	90	
						Eastern white pine	70	
						Quaking aspen	85	
BtA: Brems	3s	Slight	Slight	Severe	Slight	Northern red oak	70	Eastern white pine, red pine, jack pine.
						Red pine	72	
						Eastern white pine	65	
						Jack pine	70	
ChB, ChC: Chelsea	3s	Slight	Slight	Moderate	Slight	White oak	70	Eastern white pine, red pine, jack pine.
						Red pine	72	
						Eastern white pine	83	
						Jack pine	70	
						Quaking aspen	72	
						Northern red oak	70	
De: Del Rey	3c	Slight	Slight	Severe	Severe	White oak	70	White oak, northern red oak, green ash, bur oak, eastern white pine.
						Northern red oak	70	
						Green ash	---	
						Bur oak	---	
DoA: Door	---	---	---	---	---		---	Eastern white pine, red pine, black walnut, black locust, white ash, yellow-poplar.
Ed: Edwards	4w	Slight	Severe	Severe	Severe	White ash	51	
						Red maple	51	
						Quaking aspen	56	
						Black willow	---	
						Silver maple	76	
ElA: Elliott	---	---	---	---	---		---	White oak, black walnut, northern red oak, green ash, sugar maple, eastern white pine.
EsA: Elston	---	---	---	---	---		---	Eastern white pine, red pine, black walnut, white ash, sugar maple.
Gf: Gilford	4w	Slight	Severe	Severe	Severe	Pin oak	70	Eastern white pine, European larch, white ash, pin oak.
						Eastern white pine	55	
						Bigtooth aspen	70	
						Red maple	60	

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
HaA Hanna	1o	Slight	Slight	Slight	Slight	Northern red oak White oak Yellow-poplar White ash	90 90 98 ---	Eastern white pine, red pine, black walnut, white ash, yellow-poplar.
HkA Haskins	2o	Slight	Slight	Slight	Slight	White oak Northern red oak Pin oak	75 80 90	Red maple, white ash, eastern white pine, yellow-poplar.
Ho Houghton	4w	Slight	Severe	Severe	Severe	White ash Red maple Quaking aspen Black willow Silver maple	51 51 56 --- 76	
LyA, LyB Lydick	---	---	---	---	---		---	Eastern white pine, red pine, black walnut, white ash, yellow-poplar.
McA, McB Markham	2o	Slight	Slight	Slight	Slight	White oak Northern red oak Yellow-poplar Black walnut	80 80 90 ---	White oak, black walnut, northern red oak, green ash, sugar maple, eastern white pine.
MfA, MfB Martinsville	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum	90 98 76	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
Mm, Mn Maumee	4w	Slight	Severe	Slight	Severe	Pin oak Eastern white pine Bigtooth aspen Silver maple	70 55 70 ---	European larch, pin oak.
MoB Metea	2s	Slight	Slight	Moderate	Slight	White oak Yellow-poplar Eastern white pine Red pine	80 86 75 75	Eastern white pine, red pine, yellow-poplar, black walnut.
Mp Milford	---	---	---	---	---		---	Pin oak, green ash, eastern hemlock, Norway spruce, red maple.
MrB2, MrC2 Morley	2o	Slight	Slight	Slight	Slight	White oak Northern red oak Yellow-poplar Black walnut Bur oak Northern red oak Shagbark hickory Bur oak	80 80 90 --- --- --- --- ---	White oak, black walnut, green ash, eastern white pine, red pine, northern red oak, yellow-poplar.
MrD2, MrE Morley	2r	Moderate	Moderate	Moderate	Slight	White oak Northern red oak Yellow-poplar Black walnut Bur oak Northern red oak Shagbark hickory Bur oak	80 80 90 --- --- --- --- ---	White oak, black walnut, green ash, eastern white pine, red pine, northern red oak.
MsC3 Morley	2o	Slight	Slight	Slight	Slight	White oak Northern red oak Yellow-poplar Black walnut Bur oak Shagbark hickory	80 80 90 --- --- ---	White oak, black walnut, green ash, eastern white pine, red pine, northern red oak, yellow-poplar.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Mx Morocco	3o	Slight	Slight	Slight	Slight	Northern red oak Pin oak Eastern white pine	70 85 65	Eastern white pine, European larch, red maple, American sycamore, northern red oak.
Nf Newton	4w	Slight	Severe	Severe	Severe	Pin oak Eastern white pine Eastern cottonwood	70 55 70	Eastern white pine, pin oak, eastern cottonwood, European larch.
OaC Oakville	3s	Slight	Slight	Severe	Slight	White oak Red pine Eastern white pine Jack pine	70 78 85 68	Eastern white pine, red pine, jack pine.
OaE Oakville	3s	Moderate	Severe	Severe	Slight	White oak Red pine Eastern white pine Jack pine	70 78 85 68	Eastern white pine, red pine, jack pine.
Pa Palms	4w	Slight	Severe	Severe	Severe	White ash Red maple Quaking aspen Black willow Silver maple	51 51 56 --- 76	
Pe Pewamo	2w	Slight	Severe	Moderate	Moderate	Pin oak Swamp white oak Red maple White ash Eastern cottonwood Green ash	90 --- 71 71 98 ---	White ash, eastern white pine, red maple, green ash, pin oak, eastern cottonwood.
Ph Pinhook	2w	Slight	Severe	Moderate	Moderate	Pin oak White oak Sweetgum	86 75 90	Eastern white pine, red maple, white ash, pin oak.
PlB, PlC Plainfield	3s	Slight	Slight	Severe	Slight	Black oak White oak Black cherry Scarlet oak Northern red oak	70 65 --- 68 ---	Red pine, eastern white pine, jack pine.
RaB, RaC2 Rawson	2o	Slight	Slight	Slight	Slight	White oak Northern red oak	75 80	Eastern white pine, yellow-poplar, black walnut, northern red oak.
RlA, RlB, RmC2, RmD2 Riddles	1o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Sweetgum Northern red oak	90 98 76 90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut, white oak.
Sb Sebewa	2w	Slight	Severe	Severe	Severe	Pin oak White ash White oak Red maple American basswood	88 75 72 --- ---	Eastern white pine, white ash, green ash, pin oak.
Se Selfridge	3s	Slight	Slight	Moderate	Slight	Quaking aspen American beech Black oak Red maple Sugar maple Black cherry American basswood	60 --- --- --- --- --- ---	Eastern white pine, black cherry, Austrian pine, red pine.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Trees to plant
So: Suman	2w	Slight	Severe	Severe	Severe	Pin oak	85	Eastern white pine, red maple, white ash, pin oak.
						Red maple	---	
						Swamp white oak	---	
						White ash	---	
TcA, TcB, TcC, TcD: Tracy	1o	Slight	Slight	Slight	Slight	Northern red oak	90	Eastern white pine, red pine, black walnut, black locust, white ash, yellow-poplar.
						White oak	90	
						Yellow-poplar	98	
TyA: Tyner	3s	Slight	Slight	Moderate	Slight	White oak	70	Eastern white pine, red pine, jack pine.
						Red pine	72	
						Eastern white pine	65	
						Jack pine	70	
						Quaking aspen	72	
						Northern red oak	70	
Uc*: Urban land.								
Blount	3c	Slight	Slight	Severe	Severe	White oak	65	Eastern white pine, red pine, yellow-poplar, northern red oak.
						Northern red oak	65	
						Green ash	---	
						Bur oak	---	
						Pin oak	---	
Ud*: Urban land.								
Brems	3s	Slight	Slight	Severe	Slight	Northern red oak	70	Eastern white pine, red pine, jack pine.
						Red pine	72	
						Eastern white pine	65	
						Jack pine	70	
Ue*: Urban land.								
Martinsville	1o	Slight	Slight	Slight	Slight	White oak	90	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar	98	
UmB*: Urban land.								
Morley	2o	Slight	Slight	Slight	Slight	White oak	80	White oak, black walnut, green ash, eastern white pine, red pine, northern red oak.
						Northern red oak	80	
						Yellow-poplar	90	
						Black walnut	---	
						Bur oak	---	
						Shagbark hickory	---	
Uw*: Urban land.								
Whitaker	3o	Slight	Slight	Slight	Slight	White oak	70	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak	85	
						Yellow-poplar	85	
						Northern red oak	75	
Wa: Wallkill	4w	Slight	Severe	Severe	Severe	Pin oak	80	
						Red maple	65	
We: Warners	5w	Slight	Severe	Severe	Severe	Red maple	55	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
Wh Washtenaw	2w	Slight	Severe	Severe	Moderate	Pin oak Northern red oak Red maple Silver maple White ash American basswood White oak	86 75 70 --- --- --- ---	Eastern white pine, red maple, white ash, pin oak, northern red oak.
Wt Whitaker	3o	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Northern red oak	70 85 85 75	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ad-----------------Adrian	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Tall purple willow, medium purple willow.	Northern white-cedar.	Lombardy poplar.
Ag-----------------Alida	---	Blackhaw, cornelian cherry dogwood, Amur honeysuckle, rose-of-sharon, American cranberrybush, shadblow serviceberry.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.
BaA----------------Blount	Gray dogwood, redosier dogwood, arrowwood.	Autumn-olive, silky dogwood.	Amur maple, eastern redcedar, flowering dogwood.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood.
Br-----------------Bourbon	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood.	Tall purple willow	Eastern white pine, pin oak.	---
BtA----------------Brems	American hazel, European privet.	Tamarisk, late lilac, forsythia, autumn-olive.	Austrian pine, tall purple willow.	Eastern white pine, red pine, jack pine.	---
ChB, ChC-----------Chelsea	---	Eastern redcedar, northern white-cedar, Russian-olive, Siberian crabapple, silver buffaloberry, Tatarian honeysuckle, Siberian peashrub.	Bur oak, ponderosa pine, jack pine, green ash, common hackberry.	---	---
De-----------------Del Rey	Redosier dogwood, gray dogwood, arrowwood.	Silky dogwood, autumn-olive.	Amur maple, eastern redcedar, flowering dogwood.	Eastern white pine, Norway spruce, Douglas-fir.	Eastern cottonwood.
DoA----------------Door	Mockorange---------	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock---	Norway spruce------	Honeylocust, eastern white pine.
Du*. Dune land					
Ed-----------------Edwards	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
ElA----------------- Elliott	Gray dogwood, redosier dogwood.	Silky dogwood, autumn-olive, Amur honeysuckle.	Russian-olive, eastern redcedar.	Eastern white pine, Norway spruce, Douglas-fir.	American sycamore, eastern cottonwood.
EsA----------------- Elston	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	---	Eastern white pine, Norway spruce, honeylocust.
Fh*. Fluvaquents					
Gf------------------ Gilford	Gray dogwood, dwarf purple willow.	Redosier dogwood, hawthorn, silky dogwood, shadblow serviceberry.	Northern white-cedar, tall purple willow, laurel willow.	Pin oak, eastern white pine.	Lombardy poplar.
HaA----------------- Hanna	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
HkA----------------- Haskins	---	Gray dogwood, medium purple willow, silky dogwood, hawthorn, American cranberrybush, redosier dogwood.	Norway spruce, northern white-cedar.	Eastern white pine, pin oak, European alder.	---
Hm. Houghton					
Ho------------------ Houghton	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
LyA, LyB------------ Lydick	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Honeylocust, eastern white pine.
McA, McB------------ Markham	Redosier dogwood, gray dogwood, arrowwood.	Autumn-olive, silky dogwood.	Amur maple, eastern redcedar, flowering dogwood.	Eastern white pine, Norway spruce, Douglas-fir.	Eastern cottonwood.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
MfA, MfB: Martinsville	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
Mm, Mn: Maumee	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood.	Medium purple willow.	Pin oak, eastern white pine.	---
MoB: Metea	American hazel, European privet.	Forsythia, late lilac, tamarisk, autumn-olive.	---	Red pine, eastern white pine, jack pine, Austrian pine.	---
Mp: Milford	Redosier dogwood, gray dogwood.	Oriental arborvitae, Amur maple, silky dogwood.	Russian-olive, baldcypress.	Green ash, Norway spruce.	Eastern cottonwood, pin oak, American sycamore.
MrB2, MrC2, MrD2, MrE, MsC3: Morley	Mockorange	Amur honeysuckle, late lilac, autumn-olive, blackhaw, American cranberrybush.	Eastern redcedar	Norway spruce, red pine, eastern white pine, eastern hemlock, Douglas-fir.	---
Mx: Morocco	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood.	Tall purple willow	Eastern white pine, pin oak.	---
Nf: Newton	Gray dogwood	Redosier dogwood, silky dogwood, dwarf purple willow.	Tall purple willow	Pin oak, eastern white pine.	---
OaC, OaE: Oakville	American hazel, European privet.	Tamarisk, late lilac, forsythia, autumn-olive.	Austrian pine, jack pine.	Red pine	Eastern white pine.
Pa: Palms	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
Pe: Pewamo	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
Ph: Pinhook	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
Pk*. Pits					
PlB, PlC: Plainfield	American hazel	Tamarisk, late lilac, forsythia, autumn-olive.	---	Eastern white pine, red pine, Austrian pine, jack pine.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
RaB, RaC2: Rawson	---	Nannyberry viburnum, silky dogwood, forsythia, Amur honeysuckle, redosier dogwood.	Northern white-cedar, European alder, eastern redcedar, autumn-olive.	Norway spruce	Eastern white pine.
RlA, RlB, RmC2, RmD2: Riddles	Mockorange	European burningbush, blackhaw, lilac, Amur honeysuckle, American cranberrybush.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
Sb: Sebewa	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
Se: Selfridge	---	Silky dogwood	Eastern white pine, northern white-cedar, Austrian pine.	Norway spruce	Green ash.
So: Suman	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
TcA, TcB, TcC, TcD: Tracy	---	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, winged euonymus, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
TyA: Tyner	American hazel, European privet.	Autumn-olive, forsythia, late lilac, tamarisk.	---	Red pine, eastern white pine, jack pine, Austrian pine.	---
UbA*. Udorthents					
Uc*: Urban land.					
Blount	Gray dogwood, redosier dogwood, arrowwood.	Autumn-olive, silky dogwood.	Amur maple, eastern redcedar, flowering dogwood.	Norway spruce, eastern white pine, Douglas-fir.	Eastern cottonwood.
UcG*. Udorthents					
Ud*: Urban land.					
Brems	American hazel, European privet.	Tamarisk, late lilac, forsythia, autumn-olive.	Austrian pine, tall purple willow.	Eastern white pine, red pine, jack pine.	---
Ue*: Urban land.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of-- <8	8-15	16-25	26-35	>35
Ue*:					
Martinsville	Mockorange	European burningbush, blackhaw, late lilac, Amur honeysuckle, shadblow serviceberry, American cranberrybush, autumn-olive.	Eastern hemlock	Norway spruce	Eastern white pine, honeylocust.
UmB*: Urban land.					
Morley	Mockorange	Amur honeysuckle, late lilac, autumn-olive, blackhaw, American cranberrybush.	Eastern redcedar	Norway spruce, red pine, eastern white pine, eastern hemlock, Douglas-fir.	---
UpB*: Urban land.					
Psamments.					
Uw*: Urban land.					
Whitaker	---	Autumn-olive, Amur honeysuckle, American cranberrybush, blackhaw, shadblow serviceberry, arrowwood, cornelian cherry dogwood, rose-of-sharon.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.
Wa Wallkill	Gray dogwood, dwarf purple willow.	Amur honeysuckle, redosier dogwood, silky dogwood.	Northern white-cedar, tall purple willow, medium purple willow.	---	Lombardy poplar.
We. Warners					
Wh Washtenaw	Gray dogwood, dwarf purple willow.	Redosier dogwood, silky dogwood, Amur honeysuckle.	Northern white-cedar, medium purple willow, tall purple willow.	---	Lombardy poplar.
Wt Whitaker	---	Autumn-olive, Amur honeysuckle, American cranberrybush, blackhaw, shadblow serviceberry, arrowwood, cornelian cherry dogwood, rose-of-sharon.	---	Norway spruce, white spruce, American basswood.	Eastern white pine.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ad-- Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Ag-- Alida	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BaA-- Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Br-- Bourbon	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BtA-- Brems	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
ChB-- Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
ChC-- Chelsea	Severe: too sandy.	Severe: too sandy.	Severe: too sandy, slope.	Severe: too sandy.	Moderate: droughty.
De-- Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
DoA-- Door	Slight--	Slight--	Slight--	Slight--	Slight.
Du*. Dune land					
Ed-- Edwards	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
ElA-- Elliott	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
EsA-- Elston	Slight--	Slight--	Slight--	Slight--	Slight.
Fh*. Fluvaquents					
Gf-- Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
HaA-- Hanna	Slight--	Slight--	Moderate: small stones.	Slight--	Slight.
HkA-- Haskins	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Hm: Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Ho: Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
LyA: Lydick	Slight	Slight	Slight	Slight	Slight.
LyB: Lydick	Slight	Slight	Moderate: slope.	Slight	Slight.
McA: Markham	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.	Slight.
McB: Markham	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
MfA: Martinsville	Slight	Slight	Slight	Severe: erodes easily.	Slight.
MfB: Martinsville	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
Mm, Mn: Maumee	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MoB: Metea	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Mp: Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MrB2: Morley	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
MrC2: Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MrD2, MrE: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
MsC3: Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Mx: Morocco	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
Nf: Newton	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OaC: Oakville	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: slope, droughty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OaE-------------------- Oakville	Severe: too sandy, slope.	Severe: too sandy, slope.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
Pa--------------------- Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Pe--------------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ph--------------------- Pinhook	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Pk*. Pits					
PlB-------------------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
PlC-------------------- Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
RaB-------------------- Rawson	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight-----------	Slight.
RaC2------------------- Rawson	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight-----------	Moderate: slope.
RlA-------------------- Riddles	Slight-----------	Slight-----------	Moderate: small stones.	Slight-----------	Slight.
RlB-------------------- Riddles	Slight-----------	Slight-----------	Moderate: slope, small stones.	Slight-----------	Slight.
RmC2------------------- Riddles	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----------	Moderate: slope.
RmD2------------------- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Sb--------------------- Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Se--------------------- Selfridge	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
So--------------------- Suman	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.
TcA-------------------- Tracy	Slight-----------	Slight-----------	Moderate: small stones.	Slight-----------	Slight.
TcB-------------------- Tracy	Slight-----------	Slight-----------	Moderate: slope, small stones.	Slight-----------	Slight.
TcC-------------------- Tracy	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----------	Moderate: slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
TcD-------- Tracy	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
TyA-------- Tyner	Slight	Slight	Moderate: small stones.	Slight	Moderate: droughty.
UbA*. Udorthents					
Uc*: Urban land.					
Blount-------	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
UcG*. Udorthents					
Ud*: Urban land.					
Brems--------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Ue*: Urban land.					
Martinsville-----	Slight	Slight	Moderate: slope.	Severe: erodes easily.	Slight.
UmB*: Urban land.					
Morley--------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
UpB*: Urban land.					
Psamments.					
Uw*: Urban land.					
Whitaker-------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.
Wa-------- Wallkill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
We-------- Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Wh-------- Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Wt-------- Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Ad-------- Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ag-------- Alida	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BaA-------- Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Br-------- Bourbon	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BtA-------- Brems	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor.
ChB, ChC-------- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
De-------- Del Rey	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
DoA-------- Door	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Du*. Dune land										
Ed-------- Edwards	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
ElA-------- Elliott	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
EsA-------- Elston	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Fh*. Fluvaquents										
Gf-------- Gilford	Fair	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
HaA-------- Hanna	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
HkA-------- Haskins	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Hm-------- Houghton	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Ho-------- Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
LyA, LyB-------- Lydick	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
McA, McB-------- Markham	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MfA, MfB-------- Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Mm, Mn: Maumee	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MoB: Metea	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Mp: Milford	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
MrB2: Morley	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MrC2: Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MrD2, MrE: Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MsC3: Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Mx: Morocco	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Fair	Fair	Poor.
Nf: Newton	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
OaC: Oakville	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
OaE: Oakville	Very poor.	Very poor.	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Pa: Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Poor.
Pe: Pewamo	Good	Fair	Fair	Fair	Fair	---	Good	Fair	Fair	Good.
Ph: Pinhook	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
Pk*. Pits										
PlB: Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
PlC: Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
RaB: Rawson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RaC2: Rawson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RlA, RlB: Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
RmC2: Riddles	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
RmD2: Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Sb: Sebewa	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Se: Selfridge	Poor	Fair	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
So: Suman	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
TcA, TcB: Tracy	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
TcC: Tracy	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
TcD: Tracy	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
TyA: Tyner	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
UbA*. Udorthents										
Uc*: Urban land.										
Blount	Fair	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
UcG*. Udorthents										
Ud*: Urban land.										
Brems	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor.
Ue*: Urban land.										
Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
UmB*: Urban land.										
Morley	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
UpB*: Urban land.										
Psamments.										
Uw*: Urban land.										
Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Wa: Wallkill	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
We: Warners	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
Wh-----------------Washtenaw	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wt-----------------Whitaker	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ad----------------- Adrian	Severe: ponding, cutbanks cave, excess humus.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
Ag----------------- Alida	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BaA---------------- Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Br----------------- Bourbon	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BtA---------------- Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
ChB---------------- Chelsea	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
ChC---------------- Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
De----------------- Del Rey	Severe: wetness, too clayey.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
DoA---------------- Door	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
Du*. Dune land						
Ed----------------- Edwards	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength. frost action.	Severe: excess humus, ponding.
ElA---------------- Elliott	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
EsA---------------- Elston	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
Fh*. Fluvaquents						
Gf----------------- Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
HaA---------------- Hanna	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Severe: frost action.	Slight.
HkA---------------- Haskins	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Hm----------------- Houghton	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: ponding, excess humus.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ho----------------- Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: excess humus, ponding.
LyA---------------- Lydick	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
LyB---------------- Lydick	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
McA---------------- Markham	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
McB---------------- Markham	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
MfA---------------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
MfB---------------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action.	Slight.
Mm, Mn------------ Maumee	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
MoB---------------- Metea	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Moderate: droughty.
Mp----------------- Milford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
MrB2--------------- Morley	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
MrC2--------------- Morley	Moderate: too clayey, dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MrD2, MrE---------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
MsC3--------------- Morley	Moderate: too clayey, dense layer, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Mx----------------- Morocco	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
Nf----------------- Newton	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
OaC---------------- Oakville	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OaE----------------- Oakville	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pa----------------- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: ponding, excess humus.
Pe----------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Ph----------------- Pinhook	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Pk*. Pits						
PlB----------------- Plainfield	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Severe: droughty.
PlC----------------- Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
RaB----------------- Rawson	Moderate: too clayey, dense layer, wetness.	Slight----------	Severe: shrink-swell.	Moderate: slope.	Moderate: frost action.	Slight.
RaC2----------------- Rawson	Moderate: too clayey, dense layer, wetness.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
RlA----------------- Riddles	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
RlB----------------- Riddles	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
RmC2----------------- Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
RmD2----------------- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sb----------------- Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
Se----------------- Selfridge	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
So----------------- Suman	Severe: cutbanks cave, wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: wetness, floods.
TcA----------------- Tracy	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Slight.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
TcB: Tracy	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
TcC: Tracy	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
TcD: Tracy	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
TyA: Tyner	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
UbA*. Udorthents						
Uc*: Urban land.						
UcG*: Udorthents						
Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ud*: Urban land.						
Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
Ue*: Urban land.						
Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
UmB*: Urban land.						
Morley	Moderate: too clayey, dense layer.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
UpB*: Urban land.						
Psamments.						
Uw*: Urban land.						
Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Wa: Wallkill	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, low strength.	Severe: ponding.
We: Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Wh---------------- Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Wt---------------- Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ad: Adrian	Severe: ponding, poor filter.	Severe: seepage, ponding, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Ag: Alida	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
BaA: Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Br: Bourbon	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, wetness.
BtA: Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
ChB: Chelsea	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
ChC: Chelsea	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
De: Del Rey	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
DoA: Door	Slight	Moderate: seepage.	Severe: seepage.	Slight	Fair: too clayey, small stones.
Du*. Dune land					
Ed: Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding.
ElA: Elliott	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
EsA: Elston	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Fh*. Fluvaquents					
Gf: Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HaA: Hanna	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
HkA: Haskins	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Hm: Houghton	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
Ho: Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, sepage.	Poor: ponding, excess humus.
LyA: Lydick	Severe: poor filter.	Moderate: seepage.	Severe: seepage.	Slight	Fair: too clayey.
LyB: Lydick	Severe: poor filter.	Moderate: seepage, slope.	Severe: seepage.	Slight	Fair: too clayey.
McA, McB: Markham	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
MfA: Martinsville	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
MfB: Martinsville	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
Mm, Mn: Maumee	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, too sandy, ponding.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
MoB: Metea	Moderate: percs slowly.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Mp: Milford	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
MrB2: Morley	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
MrC2: Morley	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, wetness.
MrD2, MrE: Morley	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MsC3: Morley	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, wetness.
Mx: Morocco	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
Nf: Newton	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: too sandy, seepage, ponding.
OaC: Oakville	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
OaE: Oakville	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy, slope.	Severe: seepage, slope.	Poor: too sandy, slope, seepage.
Pa: Palms	Severe: percs slowly, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Pe: Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Ph: Pinhook	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness, thin layer.
Pk*. Pits					
PlB: Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
PlC: Plainfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
RaB: Rawson	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
RaC2: Rawson	Severe: wetness, percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
RlA: Riddles	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
RlB: Riddles	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
RmC2: Riddles	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RmD2 Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Sb Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
Se Selfridge	Severe: percs slowly, wetness.	Severe: wetness, seepage.	Severe: wetness.	Severe: wetness, seepage.	Poor: wetness.
So Suman	Severe: floods, wetness, percs slowly.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness, seepage, too sandy.
TcA Tracy	Slight	Moderate: seepage.	Severe: seepage.	Slight	Good.
TcB Tracy	Slight	Moderate: seepage, slope.	Severe: seepage.	Slight	Good.
TcC Tracy	Moderate: slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: slope.
TcD Tracy	Severe: slope, poor filter.	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
TyA Tyner	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
UbA*. Udorthents					
Uc*: Urban land.					
Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
UcG*. Udorthents					
Ud*: Urban land.					
Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Ue*: Urban land.					
Martinsville	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, thin layer.
UmB*: Urban land.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
UmB*:					
Morley	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
UpB*:					
Urban land.					
Psamments.					
Uw*:					
Urban land.					
Whitaker	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
Wa: Wallkill	Severe: ponding.	Severe: ponding, seepage.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding.
We: Warners	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Wh: Washtenaw	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
Wt: Whitaker	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ad-------- Adrian	Poor: wetness, low strength.	Probable--------	Improbable: too sandy.	Poor: wetness, excess humus.
Ag-------- Alida	Fair: wetness.	Probable--------	Improbable: too sandy.	Fair: small stones, area reclaim.
BaA-------- Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Br-------- Bourbon	Fair: low strength, wetness.	Probable--------	Improbable: excess fines.	Good.
BtA-------- Brems	Fair: wetness.	Probable--------	Improbable: too sandy.	Poor: too sandy.
ChB, ChC-------- Chelsea	Good--------	Probable--------	Improbable: too sandy.	Poor: too sandy.
De-------- Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
DoA-------- Door	Good--------	Probable--------	Probable--------	Fair: small stones, area reclaim.
Du*. Dune land				
Ed-------- Edwards	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
ElA-------- Elliott	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
EsA-------- Elston	Good--------	Probable--------	Improbable: too sandy.	Fair: small stones, area reclaim.
Fh*. Fluvaquents				
Gf-------- Gilford	Poor: wetness.	Probable--------	Improbable: too sandy.	Poor: wetness.
HaA-------- Hanna	Good--------	Probable--------	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
HkA-------- Haskins	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
Hm-------- Houghton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ho: Houghton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
LyA, LyB: Lydick	Good	Probable	Improbable: too sandy.	Fair: small stones.
McA, McB: Markham	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MfA, MfB: Martinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Mm, Mn: Maumee	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
MoB: Metea	Poor: thin layer.	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.
Mp: Milford	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MrB2, MrC2: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
MrD2, MrE: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
MsC3: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Mx: Morocco	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
Nf: Newton	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
OaC: Oakville	Good	Probable	Improbable: too sandy.	Poor: too sandy.
OaE: Oakville	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Pa: Palms	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
Pe: Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ph: Pinhook	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Pk*. Pits				
PlB, PlC: Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
RaB, RaC2: Rawson	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RlA, RlB---------- Riddles	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
RmC2---------- Riddles	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
RmD2---------- Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Sb---------- Sebewa	Poor: wetness.	Probable----------	Improbable: excess fines.	Poor: wetness, small stones, area reclaim.
Se---------- Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, area reclaim, small stones.
So---------- Suman	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: wetness.
TcA, TcB---------- Tracy	Good----------	Probable----------	Improbable: too sandy.	Fair: small stones, area reclaim.
TcC---------- Tracy	Good----------	Probable----------	Improbable: too sandy.	Fair: slope, small stones, area reclaim.
TcD---------- Tracy	Fair: slope.	Probable----------	Improbable: too sandy.	Poor: slope.
TyA---------- Tyner	Good----------	Probable----------	Improbable: too sandy.	Poor: thin layer.
UbA*. Udorthents				
Uc*: Urban land.				
Blount----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
UcG*. Udorthents				
Ud*: Urban land.				
Brems----------	Fair: wetness.	Probable----------	Improbable: too sandy.	Poor: too sandy.
Ue*: Urban land.				
Martinsville----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
UmB*: Urban land.				
Morley----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
UpB*:				
Urban land.				
Psamments.				
Uw*:				
Urban land.				
Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wa Wallkill	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
We Warners	Poor: wetness, frost action.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wh Washtenaw	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wt Whitaker	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Ad: Adrian	Severe: seepage.	Severe: seepage, ponding, excess humus.	Severe: slow refill, cutbanks cave.	Ponding, frost action, subsides.	Ponding, soil blowing, too sandy.	Wetness.
Ag: Alida	Severe: seepage.	Severe: wetness.	Severe: cutbanks cave.	Frost action	Wetness	Wetness.
BaA: Blount	Slight	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Br: Bourbon	Severe: seepage.	Severe: seepage.	Moderate: deep to water.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness.
BtA: Brems	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
ChB: Chelsea	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
ChC: Chelsea	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
De: Del Rey	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
DoA: Door	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
Du*. Dune land						
Ed: Edwards	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Wetness.
ElA: Elliott	Slight	Moderate: piping, wetness.	Severe: no water.	Frost action	Wetness	Wetness.
EsA: Elston	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy	Favorable.
Fh*. Fluvaquents						
Gf: Gilford	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, too sandy, soil blowing.	Wetness, rooting depth.
HaA: Hanna	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Deep to water	Too sandy, soil blowing.	Favorable.
HkA: Haskins	Moderate: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily, rooting depth.
Hm: Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ho------------------ Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding, soil blowing.	Wetness.
LyA----------------- Lydick	Moderate: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Favorable--------	Favorable.
LyB----------------- Lydick	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Favorable--------	Favorable.
McA----------------- Markham	Slight------------	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
McB----------------- Markham	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
MfA----------------- Martinsville	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
MfB----------------- Martinsville	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Mm, Mn-------------- Maumee	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, too sandy, soil blowing.	Wetness, droughty.
MoB----------------- Metea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
Mp------------------ Milford	Slight------------	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly, frost action.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
MrB2---------------- Morley	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
MrC2, MrD2, MrE, MsC3--------------- Morley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily, rooting depth.
Mx------------------ Morocco	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy, soil blowing.	Wetness, droughty.
Nf------------------ Newton	Severe: seepage.	Severe: piping, seepage, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, too sandy, soil blowing.	Wetness, droughty.
OaC, OaE------------ Oakville	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Slope, droughty.
Pa------------------ Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, frost action, subsides.	Ponding, soil blowing.	Wetness.
Pe------------------ Pewamo	Slight------------	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding----------	Wetness.
Ph------------------ Pinhook	Severe: seepage.	Severe: wetness, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness----------	Wetness, rooting depth.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Pk*. Pits						
PlB----- Plainfield	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
PlC----- Plainfield	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, too sandy, soil blowing.	Droughty, slope.
RaB----- Rawson	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness-----	Rooting depth, percs slowly.
RaC2----- Rawson	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Slope, rooting depth, percs slowly.
RlA----- Riddles	Moderate: seepage.	Slight-----	Severe: no water.	Deep to water	Favorable-----	Favorable.
RlB----- Riddles	Moderate: seepage, slope.	Slight-----	Severe: no water.	Deep to water	Favorable-----	Favorable.
RmC2, RmD2----- Riddles	Severe: slope.	Slight-----	Severe: no water.	Deep to water	Slope-----	Slope.
Sb----- Sebewa	Severe: seepage.	Severe: seepage, ponding.	Moderate: slow refill, cutbanks cave.	Frost action, cutbanks cave, ponding.	Too sandy, ponding.	Wetness.
Se----- Selfridge	Severe: seepage.	Severe: wetness.	Severe: slow refill, cutbanks cave.	Frost action---	Wetness, soil blowing, erodes easily.	Wetness, erodes easily, rooting depth.
So----- Suman	Severe: seepage.	Severe: seepage, wetness, piping.	Severe: cutbanks cave, slow refill.	Floods, frost action, cutbanks cave.	Wetness, too sandy.	Wetness.
TcA----- Tracy	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
TcB----- Tracy	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing---	Favorable.
TcC, TcD----- Tracy	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope.
TyA----- Tyner	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Too sandy, soil blowing.	Droughty.
UbA*. Udorthents						
Uc*: Urban land.						
Blount-----	Slight-----	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
UcG*. Udorthents						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ud*: Urban land.						
Brems	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Ue*: Urban land.						
Martinsville	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
UmB*: Urban land.						
Morley	Moderate: slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily, rooting depth.
UpB*: Urban land.						
Psamments.						
Uw*: Urban land.						
Whitaker	Moderate: seepage.	Severe: wetness.	Moderate: slow refill, cutbanks cave.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.
Wa Wallkill	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, poor outlets, frost action.	Ponding	Wetness.
We Warners	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, poor outlets.	Ponding	Wetness.
Wh Washtenaw	Moderate: seepage.	Severe: piping, ponding.	Severe: slow refill.	Percs slowly, frost action, ponding.	Ponding, erodes easily.	Wetness, percs slowly, erodes easily.
Wt Whitaker	Moderate: seepage.	Severe: wetness.	Moderate: slow refill, cutbanks cave.	Frost action	Erodes easily, wetness.	Wetness, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ad------------- Adrian	0-30	Sapric material	Pt	A-8	---	---	---	---	---	---	---
	30-60	Sand, loamy sand, fine sand.	SP, SM	A-2, A-3, A-1	0	80-100	60-100	35-75	0-30	---	NP
Ag------------- Alida	0-8	Loam------------	CL, ML, CL-ML	A-4, A-6	0	100	90-100	75-95	50-85	25-35	3-12
	8-36	Loam, clay loam, sandy clay loam.	SC, CL	A-4, A-6	0	95-100	90-100	80-95	35-75	24-35	8-14
	36-55	Sandy loam, shaly clay loam.	SC, SM-SC	A-2-4, A-4	0-5	90-100	85-100	60-90	30-50	20-30	4-10
	55-60	Stratified shaly sandy clay loam and sand.	SM, SP-SM	A-3, A-2-4	0-5	80-95	70-90	50-90	5-40	---	NP
BaA------------ Blount	0-11	Silt loam--------	ML, CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	3-15
	11-38	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	90-100	80-95	35-60	15-35
	38-60	Silty clay loam, clay loam.	CL	A-6	0-10	90-100	90-100	80-100	70-90	25-40	10-25
Br------------- Bourbon	0-12	Sandy loam-------	SM, SM-SC	A-2, A-4	0-5	95-100	75-99	40-65	15-40	<25	NP-7
	12-25	Sandy loam, loam, shaly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	90-100	75-99	45-80	20-45	15-35	2-16
	25-65	Loamy sand, sand, shaly sand.	SM	A-2, A-4	0-5	80-100	75-99	40-70	15-40	---	NP
	65-70	Stratified coarse sand to shaly sand.	SP, SP-SM, SM	A-1, A-3	0-5	75-90	45-85	40-70	3-15	---	NP
BtA------------ Brems	0-12	Sand-------------	SM, SP-SM	A-2-4, A-3	0	100	85-100	50-85	5-15	---	NP
	12-67	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
ChB------------ Chelsea	0-10	Fine sand--------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	10-80	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
ChC------------ Chelsea	0-10	Fine sand--------	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	10-80	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
De------------- Del Rey	0-8	Silt loam--------	CL, ML, CL-ML	A-6, A-4, A-7	0	95-100	95-100	90-98	75-95	25-50	5-20
	8-31	Silty clay loam, silty clay.	CH, CL	A-7, A-6	0	95-100	95-100	90-100	70-95	35-55	15-30
	31-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	95-100	95-100	90-100	70-95	30-50	5-25
DoA------------ Door	0-17	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	90-100	70-90	25-35	5-15
	17-39	Sandy loam, loam, sandy clay loam.	CL, SC, SM-SC, CL-ML	A-6, A-4, A-2-6, A-2-4	0	75-95	70-90	60-90	30-70	20-35	5-20
	39-80	Sandy loam, shaly sandy loam, shaly sandy clay loam.	SM-SC, SC, GC, GM-GC	A-2-4, A-4, A-1-B	0-2	60-95	55-90	35-80	20-50	15-25	5-10
Du*. Dune land											
Ed------------- Edwards	0-22	Sapric material	Pt	A-8	0	---	---	---	---	---	---
	22-60	Marl-------------	---	---	0	100	95-100	80-90	60-80	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ElA-------------- Elliott	0-13	Silt loam---------	CL	A-6, A-4	0	95-100	95-100	95-100	80-100	30-40	8-18
	13-36	Silty clay, silty clay loam.	CH, CL	A-6, A-7	0-5	95-100	95-100	90-100	75-100	30-52	11-26
	36-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-5	95-100	95-100	90-100	70-95	28-45	11-24
EsA-------------- Elston	0-18	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	20-35	5-15
	18-45	Loamy sand, loam, sandy clay loam.	SM, CL, SC, ML	A-4, A-6	0	95-100	75-95	50-80	35-65	<30	NP-15
	45-54	Loamy sand, sandy loam.	SP-SM, SM, SC, SM-SC	A-2-4, A-3, A-1-B	0-3	95-100	75-95	45-75	5-30	<25	NP-10
	54-60	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-B	0-3	95-100	70-95	40-70	5-25	---	NP
Fh*. Fluvaquents											
Gf--------------- Gilford	0-19	Sandy loam--------	SC, SM-SC	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	4-10
	19-33	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	20-35	15-30	NP-8
	33-60	Loamy sand, sand	SM, SP, SP-SM	A-3, A-1-B, A-2-4	0	90-100	85-100	18-60	3-20	---	NP
HaA-------------- Hanna	0-12	Sandy loam, loam	SC, SM-SC	A-2-4, A-4	0	95-100	85-100	60-70	30-40	20-30	5-10
	12-30	Loam, sandy loam, sandy clay loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0	85-100	75-95	50-90	35-70	20-30	5-15
	30-42	Loamy sand to sandy loam.	SM, SP-SM	A-2-4, A-3, A-1-B	0	80-100	65-90	40-70	5-15	---	NP
	42-60	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-1-B	0-5	80-95	60-90	30-70	5-15	---	NP
HkA-------------- Haskins	0-18	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	90-100	75-100	60-90	25-40	5-20
	18-40	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A-6, A-4	0	85-100	75-100	60-85	40-65	20-40	7-20
	40-60	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	100	90-100	90-100	80-95	35-65	15-40
Hm--------------- Houghton	0-66	Sapric material	Pt	A-8	0	---	---	---	---	---	---
Ho--------------- Houghton	0-60	Sapric material	Pt	A-8	0	---	---	---	---	---	---
LyA, LyB--------- Lydick	0-9	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	90-100	70-90	25-35	5-15
	9-43	Clay loam, sandy clay loam, loam.	CL	A-6	0	85-95	80-90	75-90	60-75	30-40	18-28
	43-55	Sandy loam, sandy clay loam, sand.	SC, SM-SC	A-2-4	0-2	85-95	80-90	55-65	25-35	15-25	5-10
	55-60	Stratified sand to gravelly sand.	SM, SP-SM	A-1-B, A-3, A-2-4	0-5	80-95	70-80	40-60	5-15	---	NP
McA, McB--------- Markham	0-10	Silt loam---------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	85-95	23-40	6-17
	10-31	Silty clay, silty clay loam.	CL, CH	A-7	0-10	95-100	90-100	85-100	80-90	40-54	15-28
	31-60	Silty clay loam, clay loam.	CL	A-7, A-6	0-10	95-100	90-100	85-95	80-90	30-45	13-26

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments ,> 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MfA, MfB---------- Martinsville	0-12	Loam--------------	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-90	22-33	4-12
	12-36	Clay loam, silty clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	90-100	65-90	40-90	20-35	8-20
	36-46	Sandy loam, sandy clay loam, loam.	SM, ML	A-2-4, A-4	0	100	90-100	60-80	30-60	30-40	2-8
	46-60	Stratified sand to sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4	0	95-100	85-100	80-95	40-60	<25	4-9
Mm, Mn----------- Maumee	0-23	Loamy sand--------	SM	A-2-4	0	95-100	90-100	65-85	20-30	<30	NP-5
	23-60	Sand, loamy sand.	SP, SP-SM	A-1-B, A-3, A-2-4	0	85-100	75-95	18-60	3-10	<30	NP
MoB-------------- Metea	0-10	Loamy fine sand	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	10-38	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	10-35	---	NP
	38-65	Clay loam, sandy clay loam, silty clay loam.	CL, SC	A-6, A-7	0	90-100	90-95	75-95	40-75	25-50	12-30
	65-75	Loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0-3	85-95	80-90	75-90	50-75	25-40	5-18
Mp--------------- Milford	0-12	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	80-95	40-60	20-35
	12-54	Silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	100	95-100	90-100	75-100	40-60	20-40
	54-60	Silty clay, silty clay loam.	CL	A-6, A-7	0	97-100	95-100	90-100	70-100	30-50	15-30
MrB2, MrC2, MrD2, MrE------------- Morley	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	85-95	25-40	5-15
	8-42	Silty clay loam, clay loam.	CL	A-6	0-10	95-100	90-100	85-95	80-90	25-40	10-20
	42-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-45	10-25
MsC3------------- Morley	0-8	Silty clay loam	CL	A-6	0-5	95-100	90-100	85-95	80-90	25-40	10-20
	8-42	Silty clay loam, clay loam.	CL	A-6	0-10	95-100	90-100	85-95	80-90	25-40	10-20
	42-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-45	10-25
Mx--------------- Morocco	0-9	Loamy sand-------	SM, SM-SC	A-2-4	0	100	100	50-85	15-35	<20	NP-5
	9-60	Fine sand, sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
Nf--------------- Newton	0-18	Loamy fine sand	SM, SM-SC	A-2-4	0	100	100	50-75	15-30	<20	NP-5
	18-60	Fine sand, sand, loamy fine sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-75	5-25	---	NP
OaC, OaE--------- Oakville	0-7	Fine sand--------	SM, SP, SP-SM	A-2, A-3	0	100	100	50-85	0-35	---	NP
	7-60	Fine sand--------	SM, SP, SP-SM	A-2, A-3	0	100	95-100	65-95	0-25	---	NP
Pa--------------- Palms	0-30	Sapric material	Pt	---	---	---	---	---	---	---	---
	30-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
Pe--------------- Pewamo	0-12	Silty clay loam	CL	A-6	0-5	95-100	90-100	90-100	70-90	25-40	10-20
	12-46	Clay loam, clay, silty clay loam.	CL, CH	A-6, A-7	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	46-60	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	90-100	70-90	30-45	14-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ph---------------- Pinhook	0-9	Loam-------------	CL, CL-ML	A-4, A-6	0	100	85-95	75-90	50-70	20-30	5-15
	9-50	Sandy loam, loam, loamy sand.	SC, CL, SM, ML	A-6, A-4, A-2	0	95-100	65-95	50-90	20-65	15-35	NP-15
	50-60	Stratified gravelly sandy loam to sand.	SM, SP-SM, SW-SM	A-3, A-2-4	0-5	80-100	65-95	35-65	5-25	---	NP
Pk*. Pits											
PlB, PlC---------- Plainfield	0-6	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	75-100	75-100	40-80	3-35	---	NP
	6-60	Sand-------------	SP	A-3, A-1, A-2	0	75-100	75-100	40-70	1-4	---	NP
RaB, RaC2--------- Rawson	0-16	Loam-------------	CL-ML, CL	A-4, A-6	0	95-100	85-100	70-100	55-90	25-40	4-16
	16-35	Clay loam, sandy clay loam, gravelly sandy clay loam.	SC, CL	A-4, A-6	0	85-100	75-100	60-85	35-65	20-40	7-20
	35-60	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	100	90-100	90-100	80-95	35-65	15-40
RlA, RlB---------- Riddles	0-10	Silt loam--------	CL	A-4, A-6	0	95-100	85-95	80-90	60-75	20-35	8-15
	10-48	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	48-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
RmC2, RmD2-------- Riddles	0-10	Loam-------------	CL	A-4, A-6	0	95-100	85-95	80-90	60-75	20-35	8-15
	10-48	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	48-60	Clay loam, sandy loam, loam.	CL, SM, SC, ML	A-4, A-6, A-2	0-3	85-95	80-90	50-90	30-70	15-30	2-15
Sb---------------- Sebewa	0-12	Loam-------------	CL, CL-ML	A-4, A-6	0	95-100	80-100	75-95	50-90	22-35	6-12
	12-37	Sandy clay loam, sandy loam, clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	37-60	Sand and gravel	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
Se---------------- Selfridge	0-24	Loamy fine sand, loamy sand.	SM, SM-SC	A-2	0-5	95-100	95-100	70-85	20-35	<20	NP-5
	24-27	Sandy clay loam--	SM, SC, SM-SC	A-2, A-4	0-5	95-100	95-100	65-80	25-45	15-30	NP-10
	27-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-90	25-50	10-25
So---------------- Suman	0-13	Silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	90-100	75-95	60-85	20-35	5-15
	13-37	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0	100	90-100	65-95	50-85	30-50	10-30
	37-60	Sand, coarse sand	SM, SP-SM	A-3, A-2-4, A-1-B	0	100	90-100	40-75	5-25	---	NP
TcA, TcB, TcC, TcD-------------- Tracy	0-9	Sandy loam-------	SM, SC, SM-SC	A-2-4, A-4	0	90-100	85-100	60-70	30-40	20-30	3-10
	9-47	Loam, sandy loam	ML, SM, SC, CL	A-4, A-6	0	95-100	80-95	65-90	35-70	22-33	3-12
	47-60	Stratified shaly sandy clay loam to shaly loamy sand.	SC, SM, SM-SC	A-2-4, A-4	0	95-100	70-85	70-85	25-50	20-30	3-10
	60-80	Stratified loamy sand to shaly sand.	SM, SP-SM	A-1-B, A-3, A-2-4	0-5	80-95	55-85	30-65	5-20	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
TyA----------------- Tyner	0-12	Loamy sand--------	SM	A-2-4	0	90-100	85-95	50-75	15-25	---	NP
	12-60	Sand, loamy sand	SM, SP-SM	A-2-4	0	90-100	85-95	50-70	10-30	---	NP
UbA*. Udorthents											
Uc*: Urban land.											
Blount-----------	0-11	Silt loam---------	ML, CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	3-15
	11-38	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	90-100	80-95	35-60	15-35
	38-60	Silty clay loam, clay loam.	CL	A-6	0-10	90-100	90-100	80-100	70-90	25-40	10-25
UcG*. Udorthents											
Ud*: Urban land.											
Brems-------------	0-12	Fine sand---------	SM, SP-SM	A-2-4, A-3	0	100	85-100	50-85	5-15	---	NP
	12-67	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-25	---	NP
Ue*: Urban land.											
Martinsville-----	0-12	Loam--------------	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-90	22-33	4-12
	12-36	Clay loam, silty clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	90-100	65-90	40-90	20-35	8-20
	36-46	Sandy loam, sandy clay loam, loam.	SM, ML	A-2-4, A-4	0	100	90-100	60-80	30-60	30-40	2-8
	46-60	Stratified sand to sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4	0	95-100	85-100	80-95	40-60	<25	4-9
UmB*: Urban land.											
Morley------------	0-8	Silt loam---------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	85-95	25-40	5-15
	8-42	Silty clay loam, clay loam.	CL	A-6	0-10	95-100	90-100	85-95	80-90	25-40	10-20
	42-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-45	10-25
UpB*: Urban land.											
Psamments.											
Uw*: Urban land.											
Whitaker---------	0-9	Loam--------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	4-12
	9-41	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-47	12-26
	41-60	Stratified coarse sand to clay.	CL, SC, ML, SM	A-4	0	98-100	98-100	60-85	40-60	15-25	3-9
Wa----------------- Wallkill	0-8	Silt loam---------	ML, SM, OL	A-5, A-7	0	95-100	90-100	70-100	40-90	40-50	5-15
	8-32	Silt loam, loam, gravelly silt loam.	CL, CL-ML, SM-SC, SC	A-4	0	75-100	70-100	60-100	40-90	15-25	5-10
	32-60	Sapric material, hemic material.	Pt	A-8	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
We---------------- Warners	0-10	Silt loam--------	ML, CL, OL	A-7, A-5	0	95-100	95-100	90-100	70-95	42-50	5-15
	10-24	Silt loam, loam, silty clay loam.	ML, CL	A-4	0	95-100	95-100	90-100	70-95	15-30	5-10
	24-60	Marl-------------	---	---	0	---	---	---	---	---	---
Wh---------------- Washtenaw	0-37	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	37-80	Silt loam, clay loam, silty clay loam.	CL, ML	A-6, A-4	0	100	100	90-100	70-90	27-36	4-12
Wt---------------- Whitaker	0-9	Loam-------------	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	60-90	22-33	4-12
	9-41	Clay loam, loam, sandy loam.	CL	A-6, A-7	0	100	95-100	90-100	70-80	30-47	12-26
	41-60	Stratified coarse sand to clay.	CL, SC, ML, SM	A-4	0	98-100	98-100	60-85	40-60	15-25	3-9

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
Ad------------------ Adrian	0-30	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.8	<2	-----------	----	---	3	55-75
	30-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	<2	Low--------	----			
Ag------------------ Alida	0-8	12-22	1.30-1.45	0.6-2.0	0.20-0.24	4.5-6.0	<2	Low--------	0.28	5	5	2-5
	8-36	22-30	1.35-1.50	0.6-2.0	0.15-0.19	4.5-5.5	<2	Low--------	0.28			
	36-55	8-16	1.40-1.60	2.0-6.0	0.09-0.11	5.1-5.5	<2	Low--------	0.28			
	55-60	1-5	1.60-1.75	>6.0	0.05-0.07	5.6-6.0	<2	Low--------	0.15			
BaA----------------- Blount	0-11	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	<2	Low--------	0.43	3	6	2-3
	11-38	35-50	1.40-1.70	0.06-0.6	0.06-0.10	4.5-6.5	<2	Moderate	0.43			
	38-60	30-35	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	<2	Moderate	0.43			
Br------------------ Bourbon	0-12	10-20	1.40-1.55	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low--------	0.20	5	3	3-5
	12-25	10-18	1.40-1.55	2.0-6.0	0.10-0.17	4.5-6.5	<2	Low--------	0.24			
	25-65	10-18	1.40-1.55	2.0-6.0	0.07-0.16	4.5-5.8	<2	Low--------	0.24			
	65-70	3-10	1.60-1.80	>20	0.03-0.06	5.6-7.3	<2	Low--------	0.15			
BtA----------------- Brems	0-12	2-6	1.50-1.65	6.0-20	0.07-0.09	5.1-6.5	<2	Low--------	0.17	5	1	.5-1
	12-67	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	<2	Low--------	0.17			
ChB----------------- Chelsea	0-10	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	10-80	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	<2	Low--------	0.17			
ChC----------------- Chelsea	0-10	8-15	1.50-1.55	6.0-20	0.10-0.15	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	10-80	5-10	1.55-1.70	6.0-20	0.06-0.08	5.1-5.5	<2	Low--------	0.17			
De------------------ Del Rey	0-8	20-30	1.30-1.50	0.6-2.0	0.22-0.24	5.1-6.5	<2	Low--------	0.43	3	6	2-3
	8-31	35-45	1.35-1.55	0.06-0.2	0.12-0.20	6.1-8.4	<2	Moderate	0.43			
	31-60	25-35	1.45-1.65	0.06-0.2	0.09-0.11	7.9-8.4	<2	Moderate	0.43			
DoA----------------- Door	0-17	15-24	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low--------	0.28	5	5	.5-2
	17-39	22-30	1.40-1.60	0.6-2.0	0.15-0.19	5.1-5.5	<2	Moderate	0.28			
	39-80	18-27	1.45-1.65	0.6-2.0	0.12-0.14	5.1-5.5	<2	Low--------	0.28			
Du*. Dune land												
Ed------------------ Edwards	0-22	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	<2	-----------	----	---	3	55-75
	22-60	---	---	---	---	7.4-8.4	<2	-----------	----			
ElA----------------- Elliott	0-13	24-27	1.05-1.30	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.28	4	6	4-5
	13-36	35-45	1.30-1.60	0.2-0.6	0.11-0.20	5.6-7.8	<2	Moderate	0.28			
	36-60	27-35	1.50-1.70	0.2-0.6	0.14-0.20	7.4-8.4	<2	Moderate	0.28			
EsA----------------- Elston	0-18	10-20	1.30-1.45	2.0-6.0	0.17-0.22	5.6-6.0	<2	Low--------	0.28	4	5	2-6
	18-45	10-23	1.35-1.60	2.0-6.0	0.12-0.18	4.5-6.0	<2	Low--------	0.20			
	45-54	4-10	1.45-1.65	2.0-6.0	0.08-0.13	5.6-6.0	<2	Low--------	0.20			
	54-60	1-5	1.60-1.75	>20	0.05-0.07	7.4-8.4	<2	Low--------	0.15			
Fh*. Fluvaquents												
Gf------------------ Gilford	0-19	10-20	1.50-1.70	2.0-6.0	0.13-0.15	6.1-7.3	<2	Low--------	0.20	4	3	2-4
	19-33	8-17	1.60-1.80	2.0-6.0	0.12-0.14	6.1-7.3	<2	Low--------	0.20			
	33-60	3-12	1.70-1.90	6.0-20	0.05-0.08	6.6-8.4	<2	Low--------	0.15			
HaA----------------- Hanna	0-12	12-20	1.35-1.55	0.6-2.0	0.13-0.15	5.1-7.3	<2	Low--------	0.24	5	3	1-3
	12-30	22-30	1.40-1.60	0.6-2.0	0.12-0.19	4.5-5.5	<2	Low--------	0.24			
	30-42	3-12	1.50-1.70	6.0-20	0.12-0.14	5.1-5.5	<2	Low--------	0.24			
	42-60	2-8	1.60-1.75	6.0-20	0.05-0.07	5.6-6.0	<2	Low--------	0.24			
HkA----------------- Haskins	0-18	12-20	1.35-1.50	0.6-2.0	0.18-0.22	5.1-7.3	<2	Low--------	0.37	4	5	1-4
	18-40	18-35	1.50-1.70	0.6-2.0	0.12-0.16	5.1-7.3	<2	Low--------	0.37			
	40-60	35-55	1.60-1.80	<0.2	0.08-0.12	6.6-8.4	<2	High-------	0.37			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
Hm---------------- Houghton	0-66	---	0.08-0.30	0.2-6.0	0.35-0.45	6.6-7.3	<2	-----------	----	---	8	>70
Ho---------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	<2	-----------	----	---	3	>70
LyA, LyB----------	0-9	15-24	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	<2	Low--------	0.28	5	5	2-5
Lydick	9-43	22-30	1.40-1.60	0.6-2.0	0.19-0.21	4.5-6.0	<2	Moderate	0.28			
	43-55	6-12	1.40-1.60	0.6-2.0	0.12-0.14	5.6-6.0	<2	Low--------	0.28			
	55-60	2-8	1.60-1.75	6.0-20	0.05-0.10	5.6-7.3	<2	Low--------	0.15			
McA, McB----------	0-10	22-27	1.10-1.40	0.6-2.0	0.22-0.24	5.6-6.5	<2	Low--------	0.37	3	6	2-3
Markham	10-31	35-45	1.40-1.60	0.06-0.6	0.11-0.20	5.1-7.8	<2	Moderate	0.37			
	31-60	27-38	1.60-1.85	0.06-0.6	0.14-0.20	7.4-8.4	<2	Moderate	0.37			
MfA, MfB----------	0-12	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low--------	0.37	5	5	1-3
Martinsville	12-36	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	<2	Moderate	0.37			
	36-46	10-25	1.40-1.60	0.6-2.0	0.12-0.14	5.6-6.5	<2	Low--------	0.24			
	46-60	3-23	1.50-1.70	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low--------	0.24			
Mm, Mn------------	0-23	2-10	1.60-1.75	6.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2	2-4
Maumee	23-60	2-10	1.60-1.75	6.0-20	0.05-0.07	6.1-8.4	<2	Low--------	0.17			
MoB---------------	0-10	3-8	1.45-1.60	>20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	.5-2
Metea	10-38	2-10	1.50-1.70	>20	0.06-0.11	5.1-7.3	<2	Low--------	0.17			
	38-65	25-35	1.50-1.70	0.6-2.0	0.15-0.19	5.6-7.3	<2	Moderate	0.32			
	65-75	20-30	1.40-1.65	0.6-2.0	0.05-0.19	7.4-8.4	<2	Low--------	0.32			
Mp----------------	0-12	35-42	1.35-1.55	0.6-2.0	0.12-0.23	5.6-7.3	<2	High-------	0.28	5	4	5-6
Milford	12-54	35-42	1.45-1.65	0.06-0.2	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
	54-60	20-30	1.50-1.70	0.2-0.6	0.20-0.22	7.4-8.4	<2	Moderate	0.43			
MrB2, MrC2, MrD2, MrE---------------	0-8	22-27	1.35-1.60	0.6-2.0	0.20-0.24	5.1-6.5	<2	Low--------	0.43	3	6	2-3
Morley	8-42	27-40	1.50-1.70	0.2-0.6	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
	42-60	27-40	1.60-1.90	0.2-0.6	0.09-0.20	6.6-8.4	<2	Moderate	0.43			
MsC3--------------	0-8	27-35	1.40-1.60	0.2-0.6	0.18-0.22	5.1-6.5	<2	Moderate	0.43	2	7	2-3
Morley	8-42	27-40	1.50-1.70	0.2-0.6	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
	42-60	27-40	1.60-1.90	0.2-0.6	0.09-0.20	6.6-8.4	<2	Moderate	0.43			
Mx----------------	0-9	1-6	1.40-1.60	6.0-20	0.10-0.12	5.1-6.5	<2	Low--------	0.17	5	2	.5-2
Morocco	9-60	1-6	1.50-1.70	6.0-20	0.05-0.07	4.5-6.0	<2	Low--------	0.17			
Nf----------------	0-18	3-7	1.45-1.60	6.0-20	0.10-0.12	5.1-6.0	<2	Low--------	0.17	5	2	2-4
Newton	18-60	2-7	1.60-1.75	6.0-20	0.05-0.07	4.5-5.5	<2	Low--------	0.17			
OaC, OaE----------	0-7	0-10	1.27-1.56	>20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-2
Oakville	7-60	0-10	1.26-1.67	>20	0.06-0.08	5.6-7.3	<2	Low--------	0.15			
Pa----------------	0-30	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-8.4	<2	-----------	----	---	3	>75
Palms	30-60	7-35	1.46-2.00	0.2-2.0	0.14-0.22	6.1-8.4	<2	Low--------	----			
Pe----------------	0-12	27-40	0.91-1.55	0.6-2.0	0.17-0.22	6.1-7.3	<2	Moderate	0.24	5	6	2-5
Pewamo	12-46	35-50	1.39-1.78	0.2-0.6	0.12-0.20	6.1-7.8	<2	Moderate	0.24			
	46-60	30-40	1.51-1.80	0.2-0.6	0.14-0.18	7.4-8.4	<2	Moderate	0.24			
Ph----------------	0-9	10-20	1.35-1.50	2.0-6.0	0.20-0.22	4.5-7.3	<2	Low--------	0.32	4	5	3-5
Pinhook	9-50	8-17	1.60-1.80	2.0-6.0	0.12-0.19	4.5-5.5	<2	Low--------	0.32			
	50-60	3-12	1.70-1.90	6.0-20	0.05-0.07	5.1-7.3	<2	Low--------	0.10			
Pk*. Pits												
PlB, PlC----------	0-6	4-9	1.35-1.65	6.0-20	0.04-0.09	4.5-7.3	<2	Low--------	0.17	5	1	<1
Plainfield	6-60	1-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.0	<2	Low--------	0.17			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
RaB, RaC2: Rawson	0-16	12-20	1.35-1.50	0.6-2.0	0.18-0.22	4.5-7.3	<2	Low	0.32	4-3	5	1-4
	16-35	18-35	1.50-1.72	0.6-2.0	0.12-0.16	4.5-7.8	<2	Low	0.32			
	35-60	35-55	1.60-1.82	<0.2	0.08-0.12	7.4-7.8	<2	High	0.32			
RlA, RlB, RmC2, RmD2: Riddles	0-10	8-16	1.30-1.50	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low	0.32	5	5	.5-2
	10-48	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	<2	Moderate	0.32			
	48-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	<2	Low	0.32			
Sb: Sebewa	0-12	10-25	1.15-1.60	0.6-2.0	0.18-0.22	6.1-7.8	<2	Low	0.24	4	5	1-4
	12-37	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	<2	Low	0.24			
	37-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	<2	Low	0.10			
Se: Selfridge	0-24	2-15	1.25-1.41	6.0-20	0.10-0.12	5.6-7.3	<2	Low	0.15	5	2	1-4
	24-27	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	<2	Low	0.15			
	27-60	18-35	1.47-1.90	0.2-0.6	0.14-0.20	7.4-8.4	<2	Moderate	0.37			
So: Suman	0-13	10-20	1.30-1.45	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low	0.32	5	6	4-8
	13-37	20-32	1.40-1.60	0.2-0.6	0.17-0.20	6.1-7.8	<2	Moderate	0.32			
	37-60	3-10	1.60-1.75	6.0-20	0.04-0.09	6.1-7.8	<2	Low	0.10			
TcA, TcB, TcC, TcD: Tracy	0-9	8-16	1.40-1.55	0.6-2.0	0.13-0.15	4.5-5.5	<2	Low	0.24	5-4	3	.5-2
	9-47	8-18	1.40-1.60	0.6-2.0	0.12-0.19	4.5-5.0	<2	Low	0.24			
	47-60	3-24	1.45-1.65	0.6-2.0	0.10-0.17	4.5-5.0	<2	Low	0.10			
	60-80	3-8	1.60-1.75	6.0-20	0.05-0.10	5.6-6.0	<2	Low	0.10			
TyA: Tyner	0-12	3-10	1.55-1.70	6.0-20	0.10-0.12	5.1-6.5	<2	Low	0.17	5	2	.5-2
	12-60	3-10	1.55-1.70	6.0-20	0.09-0.11	4.5-6.0	<2	Low	0.17			
UbA*. Udorthents												
Uc*: Urban land.												
Blount	0-12	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	<2	Low	0.43	3	6	2-3
	12-38	35-50	1.40-1.70	0.06-0.6	0.06-0.10	4.5-6.5	<2	Moderate	0.43			
	38-60	30-35	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	<2	Moderate	0.43			
UcG*. Udorthents												
Ud*: Urban land.												
Brems	0-12	2-6	1.50-1.65	6.0-20	0.07-0.09	5.1-6.5	<2	Low	0.17	5	1	.5-1
	12-67	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	<2	Low	0.17			
Ue*: Urban land.												
Martinsville	0-12	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low	0.37	5	5	1-3
	12-36	18-30	1.40-1.60	0.6-2.0	0.17-0.20	5.1-6.0	<2	Moderate	0.37			
	36-46	10-25	1.40-1.60	0.6-2.0	0.12-0.14	5.6-6.5	<2	Low	0.24			
	46-60	3-23	1.50-1.70	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low	0.24			
UmB*: Urban land.												
Morley	0-8	22-27	1.35-1.60	0.6-2.0	0.20-0.24	5.1-6.5	<2	Low	0.43	3	6	2-3
	8-42	27-40	1.50-1.70	0.2-0.6	0.18-0.20	5.1-6.5	<2	Moderate	0.43			
	42-60	27-40	1.60-1.90	0.2-0.6	0.09-0.20	6.6-8.4	<2	Moderate	0.43			
UpB*: Urban land.												
Psamments.												

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
Uw*:												
Urban land.												
Whitaker	0-9	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low	0.37	5	5	1-3
	9-41	18-30	1.40-1.60	0.6-2.0	0.15-0.19	5.1-6.0	<2	Moderate	0.37			
	41-60	3-18	1.50-1.70	0.6-6.0	0.19-0.21	6.6-8.4	<2	Low	0.37			
Wa Wallkill	0-8	10-27	1.15-1.40	0.6-2.0	0.16-0.21	5.1-7.3	<2	Low	0.49	3	---	4-12
	8-32	15-27	1.15-1.45	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low	0.43			
	32-60	---	---	0.2-6.0	0.19-0.22	5.6-7.3	<2	Low	----			
We Warners	0-10	---	---	0.2-2.0	0.17-0.22	6.1-7.8	<2	Low	----	---	---	---
	10-24	---	---	0.2-2.0	0.16-0.20	7.4-7.8	<2	Low	----			
	24-60	---	---	---	---	7.9-8.4	<2	Low	----			
Wh Washtenaw	0-37	15-27	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low	0.37	5	5	3-7
	37-80	15-27	1.30-1.50	0.06-0.6	0.20-0.22	6.1-7.3	<2	Low	0.37			
Wt Whitaker	0-9	8-17	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low	0.37	5	5	1-3
	9-41	18-30	1.40-1.60	0.6-2.0	0.15-0.19	5.1-6.0	<2	Moderate	0.37			
	41-60	3-18	1.50-1.70	0.6-6.0	0.19-0.21	6.6-8.4	<2	Low	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

[See text for definitions of terms such as "brief," "apparent," and "perched." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ad----------------- Adrian	A/D	None--------	---	---	+.5-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
Ag----------------- Alida	B	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	Moderate	High.
BaA---------------- Blount	C	None--------	---	---	1.0-3.0	Perched	Jan-May	>60	---	High-----	High-----	High.
Br----------------- Bourbon	B	None--------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High-----	Low------	Moderate.
BtA---------------- Brems	A	None--------	---	---	2.0-3.0	Apparent	Jan-Apr	>60	---	Low------	Low------	High.
ChB, ChC----------- Chelsea	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
De----------------- Del Rey	C	None--------	---	---	1.0-3.0	Apparent	Jan-May	>60	---	High-----	High-----	Low.
DoA---------------- Door	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Du**. Dune land												
Ed----------------- Edwards	B/D	None--------	---	---	+.5-0.5	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.
ElA---------------- Elliott	C	None--------	---	---	1.0-3.0	Perched	Mar-May	>60	---	High-----	High-----	Moderate.
EsA---------------- Elston	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
Fh**. Fluvaquents												
Gf----------------- Gilford	B/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Moderate.
HaA---------------- Hanna	B	None--------	---	---	3.0-6.0	Apparent	Mar-Apr	>60	---	High-----	Moderate	High.
HkA---------------- Haskins	C	None--------	---	---	1.0-2.5	Perched	Jan-Apr	>60	---	High-----	High-----	Moderate.
Hm----------------- Houghton	D	None--------	---	---	+2-0.5	Apparent	Sep-Jun	>60	---	High-----	High-----	Low.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ho----------------- Houghton	A/D	None---------	---	---	+.5-1.0	Apparent	Sep-Jun	>60	---	High------	High------	Low.
LyA, LyB----------- Lydick	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Moderate.
McA, McB----------- Markham	C	None---------	---	---	3.0-6.0	Perched	Mar-May	>60	---	High------	Moderate	Moderate.
MfA, MfB----------- Martinsville	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Mm, Mn------------- Maumee	A/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High------	Moderate.
MoB---------------- Metea	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Mp----------------- Milford	B/D	None---------	---	---	+.5-2.0	Apparent	Mar-Jun	>60	---	High------	High------	Low.
MrB2, MrC2, MrD2, MrE, MsC3--------- Morley	C	None---------	---	---	3.0-6.0	Perched	Mar-May	>60	---	Moderate	High------	Moderate.
Mx----------------- Morocco	B	None---------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	Moderate	Low-------	High.
Nf----------------- Newton	A/D	None---------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	Moderate	High------	High.
OaC, OaE----------- Oakville	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Moderate.
Pa----------------- Palms	A/D	None---------	---	---	+.5-1.0	Apparent	Nov-May	>60	---	High------	High------	Moderate.
Pe----------------- Pewamo	C/D	None---------	---	---	+1-1.0	Apparent	Dec-May	>60	---	High------	High------	Low.
Ph----------------- Pinhook	B/D	None---------	---	---	0-1.0	Apparent	Jan-May	>60	---	High------	High------	High.
Pk**. Pits												
PlB, PlC----------- Plainfield	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	High.
RaB, RaC2---------- Rawson	B	None---------	---	---	2.5-4.0	Perched	Jan-Apr	>60	---	Moderate	High------	High.

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth*	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
RlA, RlB, RmC2, RmD2: Riddles	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Sb: Sebewa	B/D	None	---	---	+1-1.0	Apparent	Sep-May	>60	---	High	High	Low.
Se: Selfridge	C	None	---	---	1.0-2.0	Apparent	Nov-May	>60	---	High	High	Low.
So: Suman	B/D	Frequent	Very brief	Nov-Jun	0-0.5	Apparent	Nov-Jun	>60	---	High	High	Low.
TcA, TcB, TcC, TcD: Tracy	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	High.
TyA: Tyner	A	None	---	---	>6.0	---	---	>60	---	Low	Low	High.
UbA**. Udorthents												
Uc**: Urban land.												
Blount	C	None	---	---	1.0-3.0	Perched	Jan-May	>60	---	High	High	High.
UcG**. Udorthents												
Ud**: Urban land.												
Brems	A	None	---	---	2.0-3.0	Apparent	Jan-Apr	>60	---	Low	Low	High.
Ue**: Urban land.												
Martinsville	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
UmB**: Urban land.												
Morley	C	None	---	---	3.0-6.0	Perched	Mar-May	>60	---	Moderate	High	Moderate.
UpB**: Urban land.												
Psamments.												
Uw**: Urban land.												

See footnotes at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth*	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Uw**:												
Whitaker----------	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.
Wa----------------- Wallkill	D	None--------	---	---	+.5-0.5	Apparent	Sep-Jun	>60	---	High-----	Moderate	Moderate.
We----------------- Warners	D	None--------	---	---	+.5-0.5	Apparent	Nov-Jun	>60	---	High-----	High-----	Low.
Wh----------------- Washtenaw	C/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
Wt----------------- Whitaker	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	Moderate.

* A plus sign under "High water table--Depth" indicates ponding.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Alida	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Bourbon	Coarse-loamy, mixed, mesic Aquultic Hapludalfs
Brems	Mixed, mesic Aquic Udipsamments
Chelsea	Mixed, mesic Alfic Udipsamments
Del Rey	Fine, illitic, mesic Aeric Ochraqualfs
Door	Fine-loamy, mixed, mesic Ultic Hapludalfs
Edwards	Marly, euic, mesic Limnic Medisaprists
Elliott	Fine, illitic, mesic Aquic Argiudolls
Elston	Coarse-loamy, mixed, mesic Typic Argiudolls
Fluvaquents	Loamy, mixed, mesic Fluvaquents
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Hanna	Coarse-loamy, mixed, mesic Aquultic Hapludalfs
Haskins	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Houghton	Euic, mesic Typic Medisaprists
Lydick	Fine-loamy, mixed, mesic Mollic Hapludalfs
Markham	Fine, illitic, mesic Mollic Hapludalfs
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Maumee	Sandy, mixed, mesic Typic Haplaquolls
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Milford	Fine, mixed, mesic Typic Haplaquolls
Morley	Fine, illitic, mesic Typic Hapludalfs
Morocco	Mixed, mesic Aquic Udipsamments
Newton	Sandy, mixed, mesic Typic Humaquepts
Oakville	Mixed, mesic Typic Udipsamments
*Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Pinhook	Coarse-loamy, mixed, mesic Mollic Ochraqualfs
Plainfield	Mixed, mesic Typic Udipsamments
Rawson	Fine-loamy, mixed, mesic Typic Hapludalfs
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Suman	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Fluvaquentic Haplaquolls
Tracy	Coarse-loamy, mixed, mesic Ultic Hapludalfs
Tyner	Mixed, mesic Typic Udipsamments
Udorthents	Loamy, mixed, mesic Udorthents
Wallkill	Fine-loamy, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Warners	Fine-silty, carbonatic, mesic Fluvaquentic Haplaquolls
Washtenaw	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs

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