United States Department of Agriculture

Soil Conservation Service

In cooperation with Purdue University Agricultural Experiment Station

Soil Survey of Kosciusko County, Indiana

HOW TO USE

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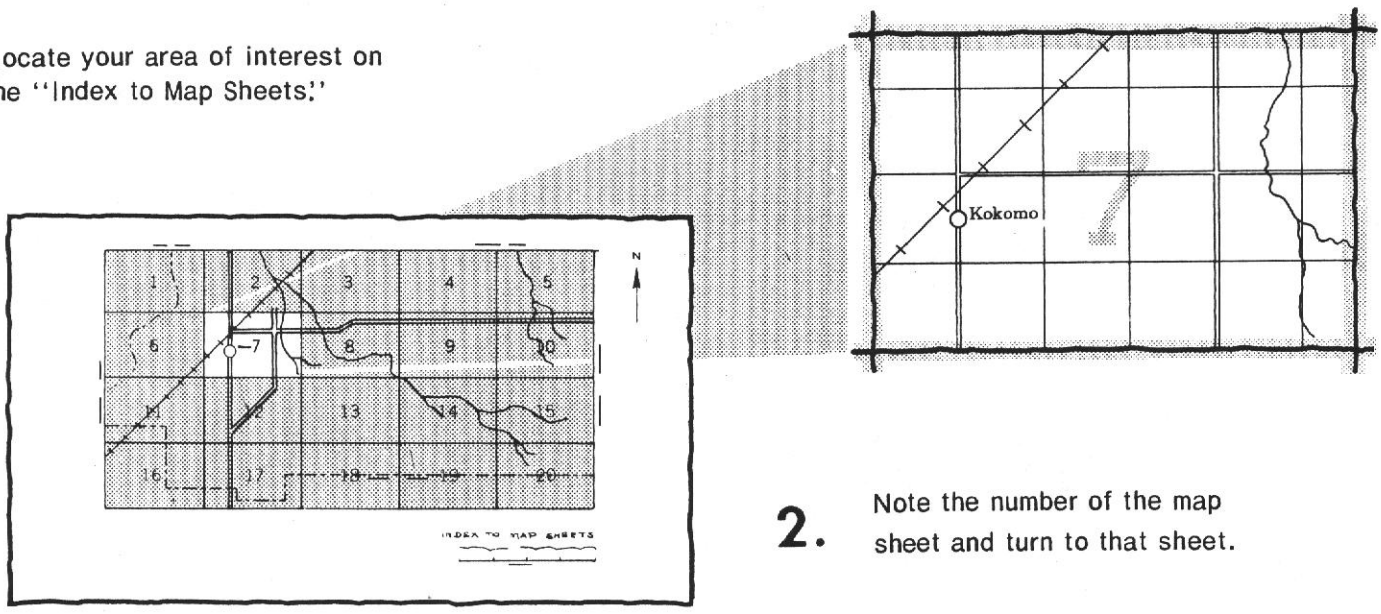

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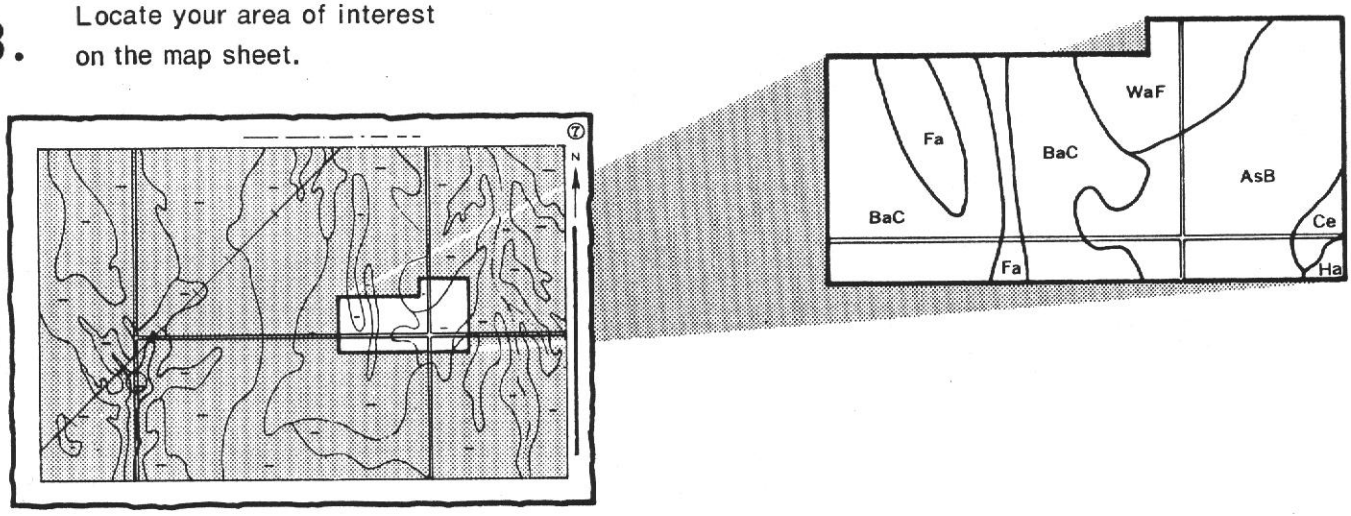

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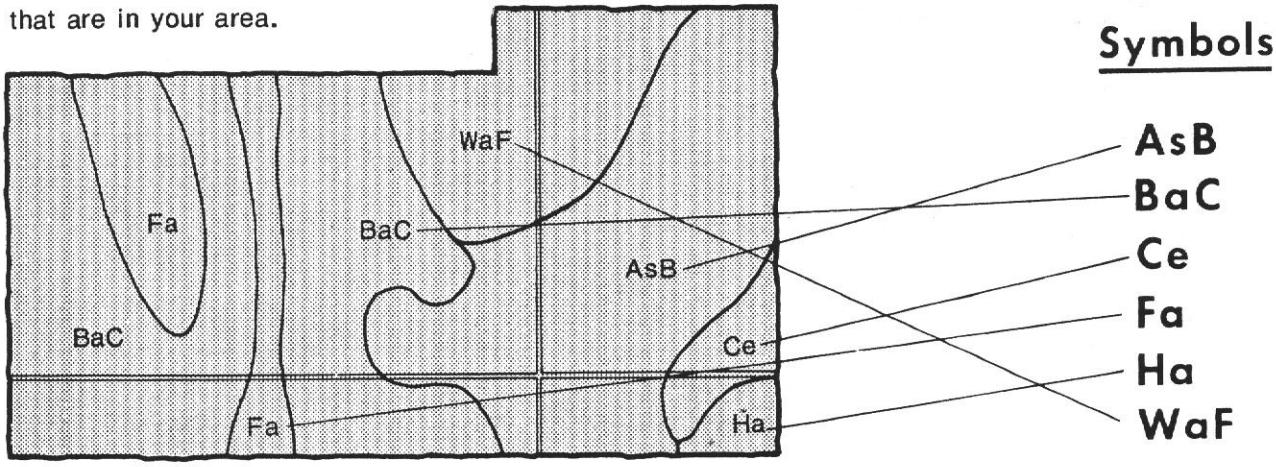
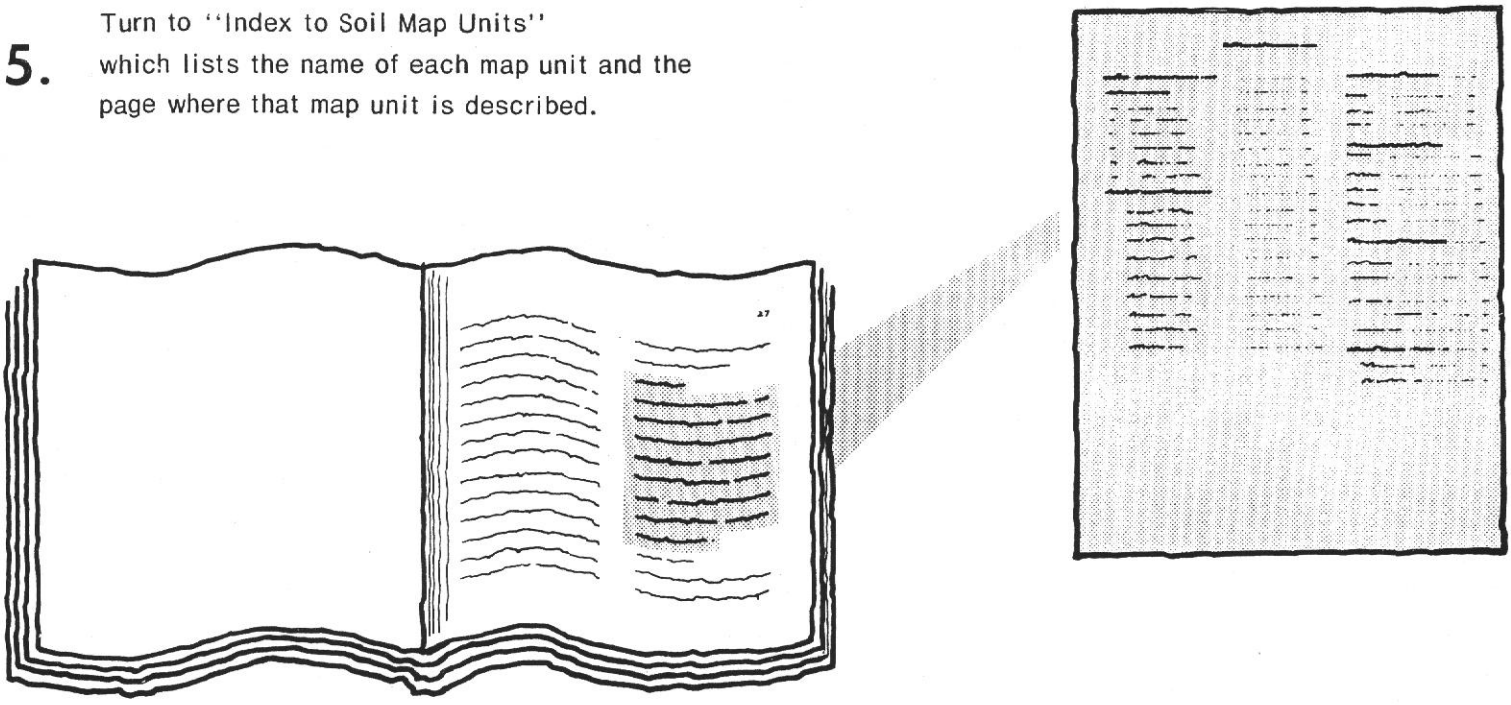
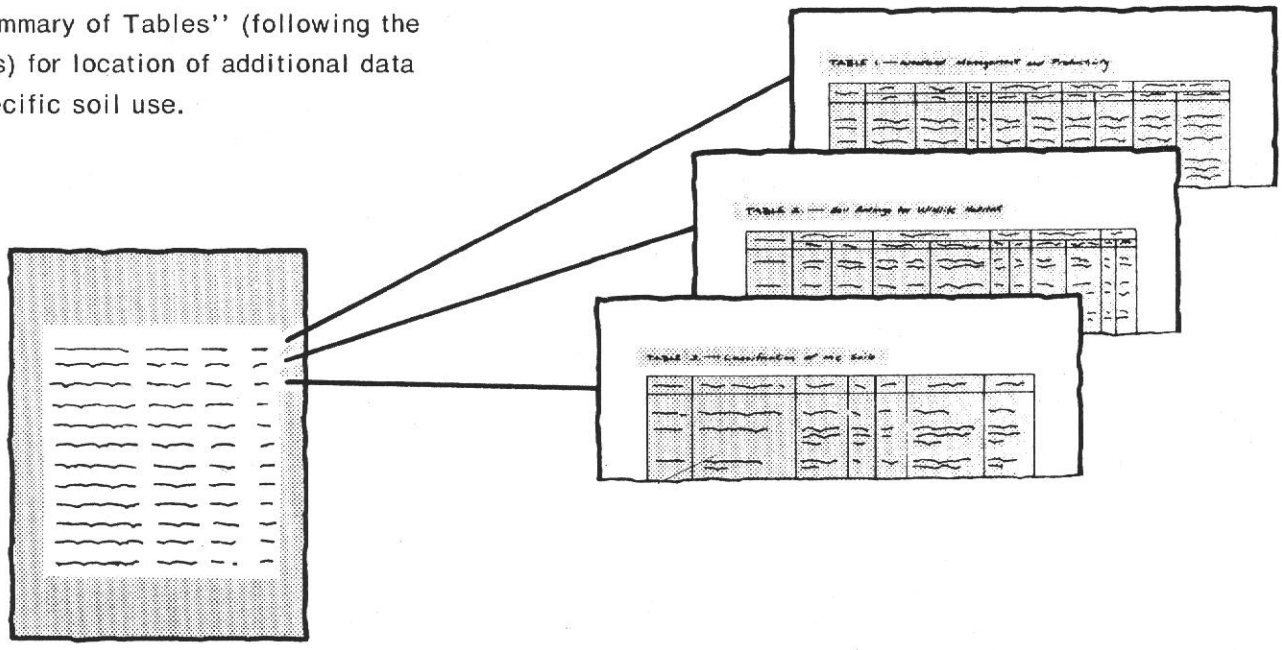


THIS SOIL SURVEY

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, handicap, or age.

Major fieldwork for this soil survey was performed in the period 1973 to 1983. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Kosciusko County Soil and Water Conservation District. Financial assistance was made available by Kosciusko County and the State of Indiana.

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.

Cover: Windbreaks on Riddles fine sandy loam, 6 to 12 percent slopes. The crop in the foreground is soybeans.

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Foreword

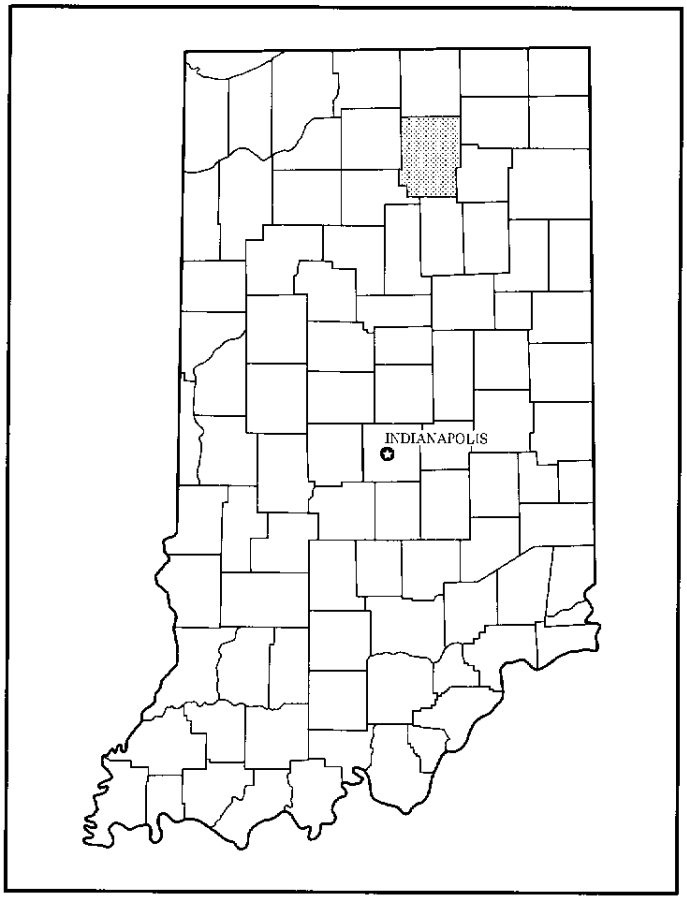
This soil survey contains information that can be used in land-planning programs in Kosciusko County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

Robert L. Eddleman
State Conservationist
Soil Conservation Service



Location of Kosciusko County in Indiana.

Soil Survey of Kosciusko County, Indiana

By Larry R. Staley, Soil Conservation Service

Fieldwork by Larry R. Staley, Rex A. Brock,
and Charles E. Froehle, Soil Conservation Service

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

Kosciusko County is in the north-central part of Indiana. It extends about 27 miles from north to south and about 21 miles from east to west. It has an area of 354,854 acres, or about 555 square miles. The city of Warsaw, which is centrally located in the county, is the county seat.

Most of the acreage in the county is farmed. Cash-grain farming and the raising of livestock are the major enterprises. Corn, soybeans, and wheat are the main crops. Poultry, hogs, and cattle are the main kinds of livestock. Specialty crops, such as mint, berries, garden vegetables, and sunflowers, are grown in a few areas.

The county has numerous businesses and industries. These are mainly in the Warsaw area, but some are at Milford, Syracuse, and Pierceton. The county has good potential for further business or industrial activity (*4*).

This soil survey updates the survey of Kosciusko County published in 1927 (*7*). It provides additional information and larger maps, which show the soils in greater detail.

General Nature of the County

This section gives general information about the county. It describes history and settlement, relief and drainage, water supply, climate, transportation facilities, and trends in population.

History and Settlement

Until the treaties of 1832 between the U.S. Government and the Miamis and Pottawatomies, the Indians used the survey area as their hunting ground. The Indians were forced to live in the Musquabuck, Monoquet, Che-ko-see, Mo-ta, and Flatbelly Reservations for 4 years. Then they were forced to move to a reservation in Kansas. After the Indians left, the floodgates were opened to settlers who were eagerly waiting in Elkhart County to preempt the rich, nearly level farmland in the northern part of the survey area. Milford and Leesburg were the first communities to be settled.

Kosciusko County was organized in 1835. Hon. John Chapman named the county after Thaddeus Kosciusko, a Polish general. There was much competition in choosing a county seat. Oswego, Leesburg, and Monoquet were the first thriving villages. In 1835, however, Warsaw was made the county seat. The county court and commissioners were moved from Leesburg to Warsaw.

Relief and Drainage

The terrain in Kosciusko County varies widely. It includes the nearly level till plains and old lakebeds in the northwestern part of the county and the rolling, highly dissected moraines and alluvial bottom land in the southeastern part.

The highest elevation in the county is 1,025 feet above sea level. It is in an area north of Dewart Lake, in Turkey Creek Township, section 19. The lowest elevation is about 760 feet above sea level. It is in an area in Jackson Township where the Eel River flows into Wabash County.

The county is in three major drainage basins. The northwestern part is drained by the Illinois River, and the north-central and northeastern parts are drained by the

St. Joseph River. The rest of the county is drained by the Wabash River (*3*).

Water Supply

Ground water is the major source of water in Kosciusko County. This supply is stored in deposits of glacial sand and gravel overlying Devonian bedrock formations. Surface water supplies are available in the more than 90 natural lakes in the county. The lakes have a total surface area of about 10,000 acres. They provide enough water for recreational, agricultural, and industrial uses. The county also has more than 200 manmade lakes or ponds. The overall water supply in the county is expected to meet future municipal, industrial, and agricultural needs.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Kosciusko County is cold in winter and quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and thus minimizes summer drought on most soils. The normal annual precipitation is adequate for all of the crops that are suited to the temperature and growing season in the county.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Warsaw, Indiana, in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter the average temperature is 26 degrees F, and the average daily minimum temperature is 17 degrees. The lowest temperature on record, which occurred at Warsaw on January 16, 1972, is -25 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred on July 17, 1976, is 103 degrees.

Growing degree days are shown in table 1. 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 35.5 inches. Of this, nearly 22 inches, or about 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 5.67 inches at Warsaw on September 16, 1958. Thunderstorms occur on about 40 days each year. Tornadoes and severe thunderstorms occur occasionally. These storms are usually local in extent and of short duration and cause damage in scattered areas.

The average seasonal snowfall is about 26 inches. The greatest snow depth at any one time during the period of record was 13 inches. On the average, 14 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 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 40 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Transportation Facilities

Kosciusko County has nearly 131 miles of state and federal roads. It has 1,333 miles of county roads, 233 miles of which are graveled. The major transportation routes are U.S. Highway 30 and State Roads 13, 14, 15, 19, and 25.

Three airports serve the county. The largest is at Warsaw. It provides charter service to Ft. Wayne and South Bend. The smaller airports are at Syracuse and Mentone. Two bus lines serve travelers from a terminal in Warsaw. Thirteen truck lines provide overnight service. Thirty-six freight trains cross the county, but there are no railroad terminals within the county.

Trends in Population

The population of Kosciusko County is about 58,000. The population density is 105 people per square mile. Between 1960 and 1970, the population increased by 19.2 percent, from 40,373 to 48,127. It increased by about 20 percent between 1970 and 1980. This growth rate is likely to result in major shifts in land use, particularly in Wayne and Turkey Creek Townships (*6*).

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The

unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough

observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another 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 association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The names, descriptions, and delineations of the soils identified on the general soil map of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the associations.

Soil Descriptions

Dominantly Nearly Level and Depressional Soils That Are Very Poorly Drained; on Uplands

These soils are in broad depressions, in marshes, and around the perimeter of lakes and ponds. A few areas are interspersed with slightly higher swells or hillocks. The soils make up about 9 percent of the county. They are used for corn, soybeans, and specialty crops in areas where an adequate drainage system can be maintained. Undrained areas are idle or are used as woodland or native pasture. Wetness and soil blowing are the main management concerns in cultivated areas. The soils are severely limited as sites for residential development.

1. Houghton-Palms Association

Mucky soils that are very poorly drained and formed in organic material; on uplands

This association is characterized by a nearly level or depressional topography. The surface drainage pattern is poorly defined, and water ponds in low areas during wet periods.

This association makes up about 9 percent of the county. It is about 46 percent Houghton soils, 16 percent Palms soils, and 38 percent minor soils (fig. 1).

The nearly level Houghton soils are in depressions on moraines, outwash plains, and till plains. They typically consist of black muck to a depth of more than 51 inches.

The nearly level Palms soils are in depressions on moraines, lake plains, till plains, and outwash plains. Typically, the surface soil is black muck. The subsoil is olive gray sandy clay loam and loam, and the underlying material is dark gray gravelly coarse sand.

Minor in this association are the very poorly drained Gilford and Sebewa soils on slight swells and around the edges of large depressions, Edwards soils and Histosols and Aquolls in scattered areas throughout the association, and the somewhat excessively drained Coloma soils on widely spaced hillocks.

This association is used for a variety of purposes. Large areas adjacent to lakes have been filled and developed for urban uses. Most areas that have not been filled are idle and support cattails, sedges, and a variety of water-tolerant shrubs. Areas at some distance from bodies of water are drained and are used mainly for corn or soybeans. A small acreage is used for specialty crops, such as carrots and mint. Wetness, ponding, and soil blowing are the main management concerns in farmed areas. An adequate drainage system should be installed and maintained. Windbreaks can help to control soil blowing.

The major soils are poorly suited to trees. Woodlots have many undesirable tree species and are frequently grazed. Wetness and ponding limit the use of equipment to dry periods or to periods when the ground is frozen.

The major soils are generally unsuited to residential development because of ponding, low strength, and a high potential for frost action.

Dominantly Nearly Level to Moderately Sloping Soils That Are Well Drained; on Uplands

These soils are on broad outwash plains, terraces, low moraines, and till plains. They make up about 22 percent of the county. Most areas are used for cultivated crops.

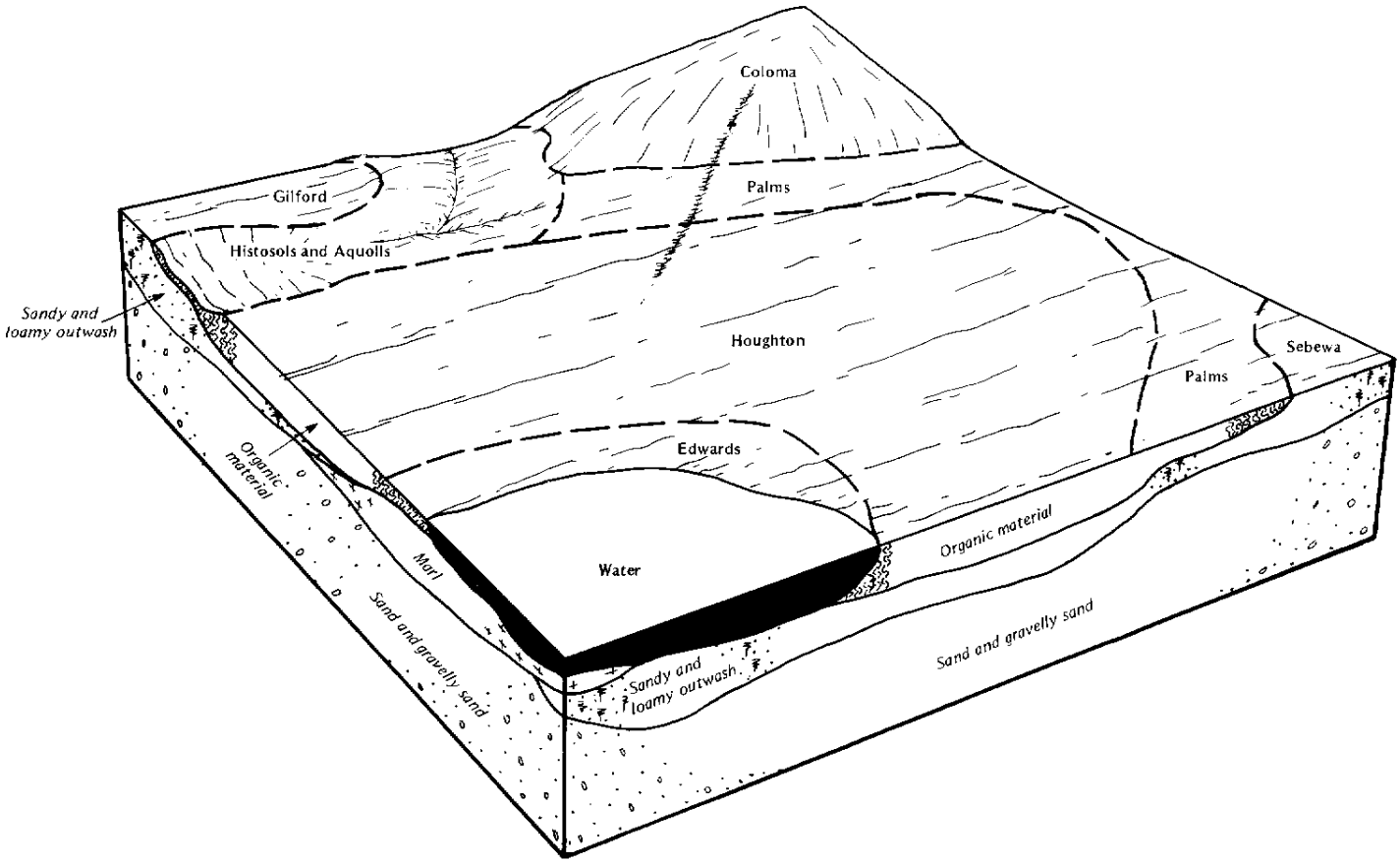


Figure 1.—Pattern of soils and parent material in the Houghton-Palms association.

Droughtiness and erosion are the main management concerns.

2. Ormas-Kosciusko Association

Sandy and loamy soils that are well drained and formed in outwash deposits; on uplands

This association is on broad plains and terraces interspersed with the swells and swales of low moraines. The surface drainage pattern is poorly defined. Water ponds in depressions during wet periods.

This association makes up about 19 percent of the county. It is about 33 percent Ormas soils, 30 percent Kosciusko soils, and 37 percent minor soils.

The nearly level to moderately sloping Ormas soils are on outwash plains, old river terraces, and low moraines. Typically, the surface layer is brown loamy sand. The subsurface layer is yellowish brown loamy sand and sand. The subsoil is brown sandy loam in the upper part and brown gravelly sandy loam in the lower part. The underlying material is brown and dark yellowish brown gravelly coarse sand.

The nearly level to moderately sloping Kosciusko soils are on outwash plains and moraines. Typically, the surface layer is dark grayish brown sandy loam. The subsoil is yellowish brown sandy loam in the upper part, brown and reddish brown gravelly sandy clay loam in the next part, and dark brown gravelly loamy sand in the lower part. The underlying material is light yellowish brown coarse sand and gravelly coarse sand.

Minor in this association are the Boyer, Riddles, Homer, Brady, Gilford, and Sebewa soils. The well drained Boyer soils are on outwash plains and terraces. They are shallower to the underlying material than the Ormas soils and contain less clay than the Kosciusko soils. The well drained Riddles soils are on low moraines. They are deeper to the underlying material than the Kosciusko soils and contain more clay than the Ormas soils. The somewhat poorly drained Homer and Brady soils are in drainageways and swales. The very poorly drained Gilford and poorly drained and very poorly drained Sebewa soils are in nearly level areas along the

major streams, in potholes, and along poorly defined drainageways.

This association is used mainly for cultivated crops, hay, or pasture. Some areas are used as woodland or urban land. A few areas are surface mined for sand and gravel. The well drained soils tend to be droughty. Draining some of the deep depressions is difficult. Erosion is a hazard on the more sloping soils.

The major soils are fairly well suited to trees. The wooded areas are small and generally have been used as pasture. Drought-tolerant tree species should be selected for planting. Measures that improve the timber stand are needed in most woodlots.

The major soils are well suited to residential development. They have few limitations if they are used as sites for dwellings. They are limited as sites for septic tank absorption fields because of a poor filtering capacity, which can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, only nearby shallow wells are in danger of contamination. The minor soils in depressions, drainageways, swales, and potholes and on flood plains are not suited to building site development because of wetness, ponding, and flooding.

3. Shipshe-Carmi Association

Loamy soils that are well drained and formed in outwash deposits; on uplands

This association is on a broad outwash plain characterized by a few small, narrow breaks or depressions. The surface drainage pattern is poorly defined.

This association makes up about 3 percent of the county. It is about 69 percent Shipshe soils, 30 percent Carmi soils, and 1 percent minor soils.

The Shipshe soils are nearly level and gently sloping. Typically, the surface layer is very dark brown sandy loam. The subsoil is dark reddish brown very gravelly sandy loam in the upper part and dark reddish brown very gravelly sandy clay loam in the lower part. The underlying material is brown sand and very gravelly coarse sand.

The Carmi soils are nearly level. Typically, the surface layer is black loam. The subsoil is dark brown sandy loam in the upper part and brown gravelly loamy sand in the lower part. The underlying material is brown sand and very gravelly coarse sand.

Minor in this association are the poorly drained and very poorly drained Sebewa soils in potholes and along poorly defined drainageways.

This association is used mostly for cultivated crops or hay. Some areas are used as woodland or pasture. The major soils are droughty. Erosion is a hazard on the gently sloping breaks.

The major soils are fairly well suited to trees. The wooded areas are small and generally have been used as pasture. Drought-tolerant tree species should be selected for planting. Measures that improve the timber stand are needed in most woodlots.

The major soils are well suited to building site development. They have few limitations if they are used as sites for dwellings. They are limited as sites for septic tank absorption fields because of a poor filtering capacity, which can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, only nearby shallow wells are in danger of contamination. The minor soils in drainageways and potholes are not suited to building site development because of ponding.

Dominantly Nearly Level, Gently Sloping, and Depressional Soils That Are Somewhat Poorly Drained to Very Poorly Drained; on Uplands

These soils are on broad outwash plains, terraces, and moraines. They make up about 21 percent of the county. Most areas are drained and are used for cultivated crops. Wetness and ponding are the main management concerns.

4. Crosier-Barry Association

Loamy soils that are somewhat poorly drained and poorly drained and formed in glacial till; on uplands

This association is on till plains and moraines that have slight swells and depressions. The surface drainage pattern is poorly defined, and water ponds in the depressions during wet periods.

This association makes up about 8 percent of the county. It is about 54 percent Crosier soils, 29 percent Barry soils, and 17 percent minor soils (fig. 2).

The somewhat poorly drained, nearly level and gently sloping Crosier soils are on swells and on side slopes along drainageways. Typically, the surface layer is dark grayish brown loam. The subsoil is grayish brown and brown clay loam. The underlying material is brown loam.

The poorly drained, nearly level Barry soils are in swales, on broad flats, and in drainageways. Typically, the surface layer is black loam. The subsoil is dark gray fine sandy loam in the upper part and olive gray loam in the lower part. The underlying material is brown loam.

Minor in this association are the Aubbeenaubbee, Palms, Metea, and Wawasee soils. Aubbeenaubbee soils are somewhat poorly drained and are in landscape positions similar to those of the Crosier soils. They have a thick surface layer of sandy loam. Palms soils are very poorly drained and are in deep depressions. Their surface soil is muck. Metea and Wawasee soils are well drained and are on low knolls and ridges.

This association is used mainly for cultivated crops, hay, or pasture. Wetness and ponding are the major limitations. Subsurface drains have been installed in most areas.

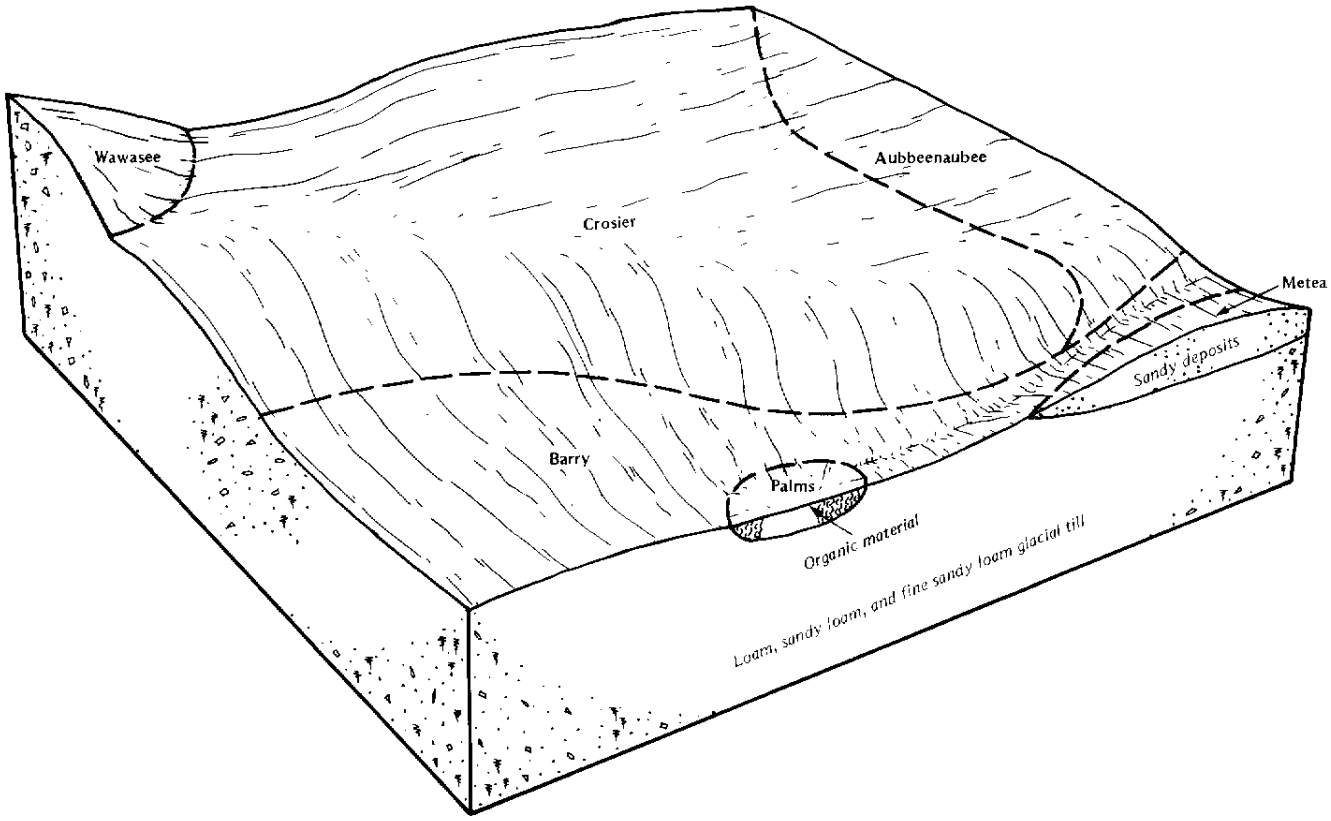


Figure 2.—Pattern of soils and parent material in the Crosier-Barry association.

A few undrained areas are used as woodlots. The major soils are fairly well suited to trees. Water-tolerant tree species should be selected for planting. The use of most logging equipment is limited during wet periods.

The major soils are poorly suited or generally unsuited to building site development. Surface and subsurface drains are needed to remove excess water. Wetness, ponding, and restricted permeability severely limit the use of these soils as sites for septic tank absorption fields.

5. Rensselaer-Whitaker Association

Loamy soils that are very poorly drained and somewhat poorly drained and formed in lacustrine sediments; on uplands

This association is on outwash plains and terraces that have slight swells and depressions. The surface drainage pattern is poorly defined. Water ponds in the depressions during wet periods.

This association makes up about 5 percent of the county. It is about 35 percent Rensselaer soils, 35 percent Whitaker soils, and 30 percent minor soils (fig. 3).

The very poorly drained, nearly level Rensselaer soils are on broad, low flats and in drainageways and depressions. Typically, the surface layer is very dark brown loam, and the subsurface layer is black silty clay loam. The subsoil is gray sandy clay loam in the upper part and gray sandy loam in the lower part. The underlying material is gray and olive brown, stratified loamy sand, sandy loam, and silt loam.

The somewhat poorly drained, nearly level Whitaker soils are on swells and on the side slopes along shallow drainageways. Typically, the surface layer is dark grayish brown loam, and the subsurface layer is grayish brown loam. The subsoil is yellowish brown and dark grayish brown clay loam. The underlying material is multicolored, stratified sandy loam, loam, loamy sand, and silt loam.

Minor in this association are the Bronson, Coloma, Martinsville, and Palms soils. Bronson soils are moderately well drained and are in landscape positions similar to or slightly higher than those of the Whitaker soils. Coloma soils are somewhat excessively drained and are on knobs, ridgetops, and east-facing slopes. Martinsville soils are well drained and are on the higher terraces, ridges, and knobs. Palms soils are very poorly

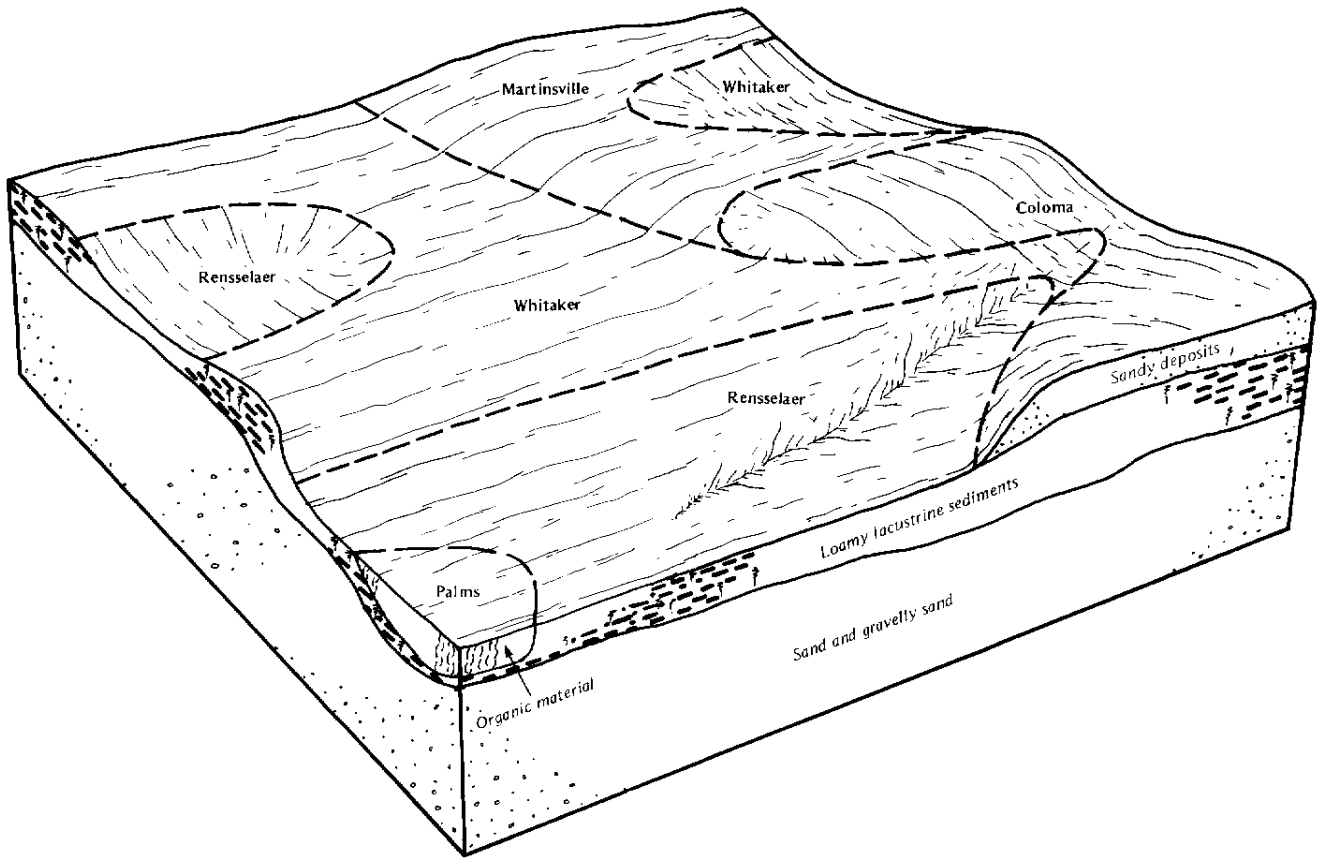


Figure 3.—Pattern of soils and parent material in the Rensselaer-Whitaker association.

drained and are in depressions. Their surface soil is muck.

This association is used mainly for cultivated crops, hay, or pasture. Wetness is the major limitation, and ponding is a hazard in the depressions. Subsurface drains have been installed in most areas.

A few undrained areas are used as woodlots. The major soils are fairly well suited to trees. Water-tolerant tree species should be selected for planting. The use of most logging equipment is limited during wet periods.

The major soils are poorly suited or generally unsuited to building site development. Surface and subsurface drains are needed to remove excess water. Wetness and ponding severely limit the use of these soils as sites for septic tank absorption fields.

6. Sebewa-Gilford Association

Loamy soils that are poorly drained and very poorly drained and formed in outwash deposits; on uplands

This association is characterized by a nearly level topography that has slight swells and depressions. The surface drainage pattern is poorly defined. Water ponds in the depressions during wet periods.

This association makes up about 8 percent of the county. It is about 47 percent Sebewa soils, 18 percent Gilford soils, and 35 percent minor soils.

The poorly drained and very poorly drained, nearly level Sebewa soils are on broad outwash plains and terraces. Typically, the surface layer is black loam. The subsoil is gray clay loam and sandy clay loam in the upper part and dark gray loam in the lower part. The underlying material is grayish brown sand and gravelly coarse sand.

The very poorly drained, nearly level Gilford soils are on broad outwash plains. Typically, the surface layer is black sandy loam, and the subsurface layer is very dark gray fine sandy loam. The subsoil is grayish brown loamy sand in the upper part and dark gray sandy clay loam, sandy loam, and loamy sand in the lower part. The underlying material is grayish brown sand and gravelly coarse sand.

Minor in this association are the Boyer, Bronson, Kosciusko, and Ormas soils. Boyer, Kosciusko, and Ormas soils are well drained and are on knolls, knobs, and sloping breaks along drainageways. Bronson soils are moderately well drained and are on slight swells.

This association is used mainly for cultivated crops, hay, or pasture. Wetness is the major limitation, and ponding is a hazard in the depressions. Subsurface drains have been installed in most areas.

A few undrained areas are used as woodlots. The major soils are fairly well suited to trees. Water-tolerant tree species should be selected for planting. The use of most logging equipment is limited during wet periods.

The major soils are generally unsuited to building site development and septic tank absorption fields because of the ponding.

Dominantly Nearly Level to Steep Soils That Are Well Drained; on Uplands

These soils are on moraines and till plains. They make up about 16 percent of the county. Most areas are used for cultivated crops. Many areas of sloping and moderately steep soils are wooded or pastured. Erosion and droughtiness are the main management concerns.

7. Riddles-Ormas-Kosciusko Association

Loamy and sandy soils that are well drained and formed in glacial till and outwash deposits; on uplands

This association is characterized by a nearly level to steep topography dominated by knobs, prominent ridges, and deep depressions. The surface drainage pattern is moderately well defined. Lakes and marshes are in the depressions on the lower parts of the landscape.

This association makes up about 6 percent of the county. It is about 31 percent Riddles soils, 25 percent Ormas soils, 24 percent Kosciusko soils, and 20 percent minor soils.

The nearly level to strongly sloping Riddles soils are on ridgetops and the highest knobs on the landscape. Typically, the surface layer is dark brown fine sandy loam. The subsoil is dark yellowish brown fine sandy loam in the upper part, brown sandy clay loam in the next part, and dark yellowish brown and yellowish brown loam in the lower part. The underlying material is yellowish brown loam.

The nearly level to moderately sloping Ormas soils are at the lower elevations and on east- and south-facing slopes. Typically, the surface layer is brown loamy sand. The subsurface layer is yellowish brown loamy sand and sand. The subsoil is brown sandy loam in the upper part and brown gravelly sandy loam in the lower part. The underlying material is brown and dark yellowish brown gravelly coarse sand.

The nearly level to steep Kosciusko soils are on north- and west-facing slopes and are the dominant soils on the tops of the less prominent ridges. Typically, the surface layer is dark grayish brown sandy loam. The subsoil is yellowish brown sandy loam in the upper part, brown and reddish brown gravelly sandy clay loam in the next part, and dark brown gravelly loamy sand in the lower part. The underlying material is light yellowish brown coarse sand and gravelly coarse sand.

Minor in this association are the Boyer, Brady, Gilford, and Houghton soils. Boyer soils are well drained and are in landscape positions similar to those of the major soils. They are shallower to the underlying material than the Riddles and Ormas soils and contain less clay than the Kosciusko soils. Brady soils are somewhat poorly drained and are on toe slopes and in swales. Gilford and Houghton soils are very poorly drained and are in potholes, drainageways, and swales.

This association is used mainly for cultivated crops, hay, or pasture. Measures that control erosion are needed if cultivated crops are grown on the more sloping soils. Draining some of the deep depressions is difficult. If the amount of precipitation is below normal, droughtiness is a problem in most areas.

Several woodlots are in areas of this association. Many have been grazed. The major soils are well suited to trees. Drought-tolerant tree species should be selected for planting. Measures that improve the timber stand are needed in most of the woodlots.

The major soils are well suited to building site development. The shrink-swell potential of the Riddles and Kosciusko soils is a moderate limitation. Also, the slope is a limitation in some areas. The Riddles soils are moderately limited as sites for septic tank absorption fields because of restricted permeability, and the Ormas and Kosciusko soils are limited because of a poor filtering capacity, which can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at depths of more than 60 inches, only nearby shallow wells are in danger of contamination. The minor soils in drainageways, swales, and potholes are generally unsuited to building site development because of wetness, ponding, and flooding.

8. Riddles-Wawasee Association

Loamy soils that are well drained and formed in glacial till; on uplands

This association is characterized by a nearly level to strongly sloping topography dominated by broad ridges, knobs, and narrow depressions. The surface drainage pattern is moderately well defined. Small lakes or marshes are in the depressions.

This association makes up about 10 percent of the county. It is about 44 percent Riddles soils, 19 percent Wawasee soils, and 37 percent minor soils.

The nearly level to strongly sloping Riddles soils are on broad ridgetops and prominent knobs. Typically, the surface layer is dark brown fine sandy loam. The subsoil

is dark yellowish brown fine sandy loam in the upper part, brown sandy clay loam in the next part, and dark yellowish brown and yellowish brown loam in the lower part. The underlying material is yellowish brown loam.

The gently sloping to strongly sloping Wawasee soils are on the sides of ridges and of prominent knobs. Typically, the surface layer is dark grayish brown fine sandy loam. The subsoil is dark yellowish brown loam in the upper part and brown sandy clay loam in the lower part. The underlying material is brown fine sandy loam.

Minor in this association are the Barry, Griswold, Martinsville, Rensselaer, and Whitaker soils. The poorly drained Barry and very poorly drained Rensselaer soils are in potholes, swales, and broad depressions. The well drained Griswold soils are in nearly level areas. They have a dark surface layer. The well drained Martinsville soils are in landscape positions similar to those of the Riddles and Wawasee soils. They are underlain by stratified material. The somewhat poorly drained Whitaker soils are on toe slopes, in potholes, and in drainageways.

This association is used mainly for cultivated crops. Measures that control erosion are needed if cultivated crops are grown on the more sloping soils. Draining some of the deep depressions is difficult.

Several woodlots are in areas of this association. Many have been grazed. The major soils are well suited to trees. Measures that improve the timber stand are needed in most of the woodlots.

The major soils are well suited to building site development. The shrink-swell potential of the Riddles soils is a moderate limitation. Also, the slope of both the major soils is a limitation in some areas. These soils are moderately limited as sites for septic tank absorption fields because of restricted permeability. In some areas the slope also is a limitation.

Dominantly Nearly Level to Moderately Steep Soils That Are Well Drained and Somewhat Poorly Drained; on Uplands

These soils are on moraines and till plains. They make up about 32 percent of the county. Most areas are used for cultivated crops. Many areas of sloping and moderately steep soils are wooded or pastured. Erosion and wetness are the main management concerns.

9. Wawasee-Crosier-Miami Association

Loamy soils that are well drained and somewhat poorly drained and formed in glacial till; on uplands

This association is characterized by a nearly level to moderately steep topography dominated by low ridges that have broad ridgetops and valleys. The surface drainage pattern is moderately well defined. Small lakes and marshes are in depressions on the lower parts of the landscape.

This association makes up about 28 percent of the county. It is about 30 percent Wawasee soils, 26 percent Crosier soils, 24 percent Miami soils, and 20 percent minor soils.

The well drained, gently sloping to strongly sloping Wawasee soils are on ridgetops and side slopes. Typically, the surface layer is dark grayish brown fine sandy loam. The subsoil is dark yellowish brown loam in the upper part and brown sandy clay loam in the lower part. The underlying material is brown fine sandy loam.

The somewhat poorly drained, nearly level and gently sloping Crosier soils are in broad depressions, on side slopes along drainageways, and on the toe slopes of low ridges. Typically, the surface layer is dark grayish brown loam. The subsoil is grayish brown and brown clay loam. The underlying material is brown loam.

The well drained, gently sloping to moderately steep Miami soils are on knobs, low ridges, and swells. Typically, the surface layer is brown loam. The subsoil is dark brown and dark yellowish brown clay loam. The underlying material is dark yellowish brown, yellowish brown, and brown loam.

Minor in this association are the Aubbeenaubbee, Barry, Metea, Rensselaer, Riddles, and Washtenaw soils. The somewhat poorly drained Aubbeenaubbee soils are in landscape positions similar to those of the Crosier soils. They have a thick surface layer of sandy loam. The poorly drained Barry and Washtenaw soils and the very poorly drained Rensselaer soils are in drainageways and broad depressions. The well drained Metea and Riddles soils are in landscape positions similar to those of the Wawasee soils. Metea soils have a thick, sandy surface layer, and Riddles soils are deeper to the underlying material than the Wawasee soils.

This association is used mainly for cultivated crops. Some areas are used for hay and pasture. Measures that control erosion are needed if cultivated crops are grown on the more sloping soils. Subsurface drains have been installed in most areas of the more poorly drained major and minor soils.

Several woodlots are in areas of this association. The Wawasee soils are well suited to trees. The Crosier soils are fairly well suited to water-tolerant trees. The wetness of these soils limits the use of logging equipment to dry periods or to periods when the ground is frozen.

The major soils are fairly well suited to building site development. The well drained, gently sloping or moderately sloping Wawasee and Miami soils have few limitations if they are used as sites for buildings, but the Crosier soils are severely limited because of wetness. The major soils are limited as sites for septic tank absorption fields because of restricted permeability. The wetness of the Crosier soils and the slope of the steeper Miami and Wawasee soils are additional limitations.

10. Morley-Blount Association

Loamy and silty soils that are well drained and somewhat poorly drained and formed in glacial till; on uplands

This association is characterized by a nearly level to moderately steep topography dominated by prominent ridges and knobs and by broad depressions. The surface drainage pattern is well defined.

This association makes up about 4 percent of the county. It is about 57 percent Morley soils, 15 percent Blount soils, and 28 percent minor soils (fig. 4).

The well drained, nearly level to moderately steep Morley soils are on ridges, knobs, swells, and the side slopes along deeply incised drainageways. Typically, the surface layer is very dark grayish brown loam. The subsoil is yellowish brown clay loam in the upper part, dark yellowish brown clay in the next part, and brown clay loam in the lower part. The underlying material is brown clay loam.

The somewhat poorly drained, nearly level and gently sloping Blount soils are on toe slopes, in poorly defined drainageways and swales, and on the tops of ridges. Typically, the surface layer is dark gray silt loam. The subsurface layer is dark grayish brown silt loam. The subsoil is yellowish brown and grayish brown clay loam. The underlying material is yellowish brown clay loam.

Minor in this association are the Glynwood, Martinsville, Metea, and Pewamo soils. Glynwood soils are moderately well drained and are on the toe slopes of ridges, on side slopes along narrow drainageways, and in shallow swales on ridgetops. Martinsville and Metea soils are well drained and are in landscape positions similar to those of the Morley soils. Martinsville soils have less clay in the subsoil and underlying material than the Morley soils, and Metea soils have a thick, sandy surface layer. Pewamo soils are very poorly drained and are in drainageways and broad depressions.

This association is used mainly for cultivated crops. Some areas are used for hay and pasture. Measures that control erosion are needed if cultivated crops are grown.

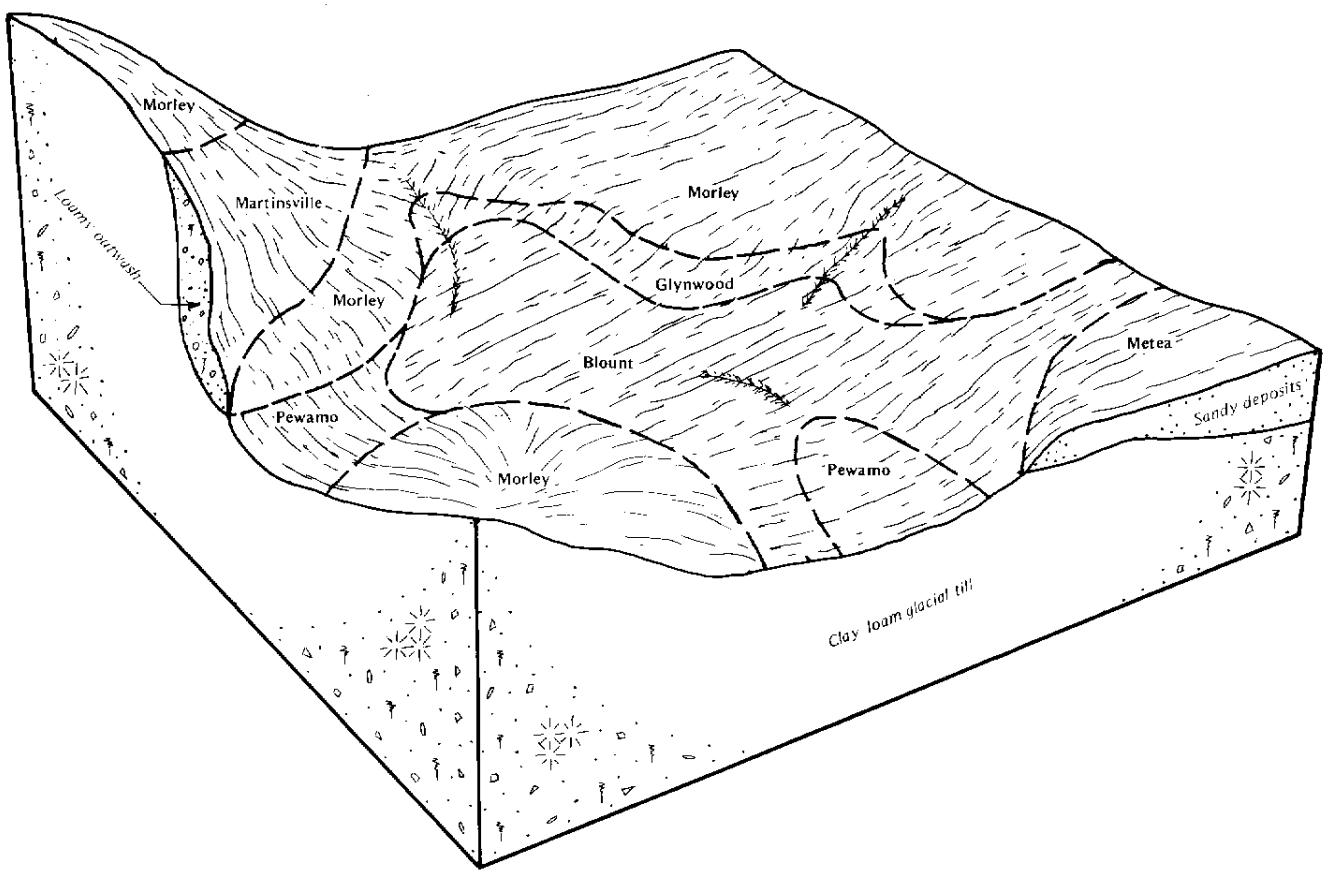


Figure 4.—Pattern of soils and parent material in the Morley-Blount association.

Several woodlots are in areas of this association. The Morley soils are well suited to trees. The Blount soils are fairly well suited to water-tolerant trees. The wetness of these soils limits the use of logging equipment to dry periods or to periods when the ground is frozen.

The major soils generally are poorly suited to building site development. The gently sloping and moderately sloping soils generally are moderately or severely limited as building sites because of wetness and the shrink-swell potential. In most areas the major soils are severely limited as sites for septic tank absorption fields because of wetness, moderately slow or slow permeability, and slope.

Broad Land Use Considerations

Each year land use changes are made in Kosciusko County. More than 20,000 acres, or about 6 percent of the county, is developed for nonfarm uses. As the demand for land to be used for residential, commercial, industrial, agricultural, and recreational purposes increases, planning for orderly growth becomes more important. The soil and water resources of the county should be considered in planning. The general soil map is useful in planning an outline of future changes in land use, but it should not be used as a basis for selecting sites for specific structures. In areas that are well suited to cultivated crops, the suitability for urban development may be poor.

The Riddles-Ormas-Kosciusko and Riddles-Wawasee associations are well suited to most uses. Erosion is a hazard if the more sloping soils are used for cultivated crops. The slope is the main limitation affecting urban and recreational uses. These associations are well suited to woodland. They can produce high-quality hardwoods if they are managed properly.

The Wawasee-Crosier-Miami and Morley-Blount associations are fairly well suited to most uses. Erosion is the main management concern in cultivated areas. The slope is a major limitation affecting urban and recreational uses. Also, restricted permeability commonly is a limitation on sites for septic tank absorption fields. These associations are fairly well suited to woodland. They can produce high-quality hardwoods if they are managed properly.

The Crosier-Barry, Rensselaer-Whitaker, and Sebawa-Gilford associations are well suited to cultivated crops and poorly suited to urban uses. Wetness and ponding are the major management concerns. Surface and subsurface drains are needed. These associations are fairly well suited to woodland. Because of the wetness, windthrow is a hazard. Also, the use of some equipment is restricted during wet periods.

The Ormas-Kosciusko and Shipshe-Carmi associations are fairly well suited to cultivated crops. The major soils have a low or moderate available water capacity and thus are susceptible to drought. Erosion is a hazard if the more sloping soils are used for cultivated crops. These associations are well suited to woodland and to urban and recreational uses.

The Houghton-Palms association is fairly well suited to cultivated crops. Wetness, ponding, and soil blowing are the main management concerns. Extensive drainage systems are needed. This association is poorly suited to woodland and to urban and recreational uses. Wetness, ponding, and the windthrow hazard are the main concerns in managing woodland. Wetness, ponding, and the poor stability of the organic material limit the development of this association for urban and recreational uses.

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, Riddles fine sandy loam, 0 to 2 percent slopes, is a phase of the Riddles series.

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

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Riddles-Ormas-Kosciusko complex, 2 to 6 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquolls is an undifferentiated group in this survey area.

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. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

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

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this county do not always agree or join fully with those of the soils identified on the maps of adjoining counties published at an earlier date. Some differences are the result of changes in concepts of soil series. Other differences result from variations in the extent of the soils. Others are the result of variations in the slope range allowed in the map units.

Table 4 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.

Soil Descriptions

Ab—Abscota fine sandy loam, occasionally flooded. This nearly level, well drained soil is on natural levees and benches along the Eel River and its major tributaries. It is occasionally flooded for brief periods by stream overflow during winter and early spring. Areas are long and narrow and are 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 9 inches thick. The subsoil is dark yellowish brown, very friable sand about 11 inches thick. The underlying material extends to a depth of 60 inches or more. In sequence downward, it is brown, loose and very friable sand; dark brown, loose sand; dark yellowish brown, very friable sand; and dark grayish brown, loose sand. In places the soil is mildly alkaline at the surface.

In some areas the subsoil and underlying material are redder. In other areas they contain more clay, gravel, or both. In places gravelly coarse sand is within a depth of 50 inches. Most areas on riverbanks are strongly sloping to steep.

Included with this soil in mapping are areas of the somewhat poorly drained Shoals and very poorly drained Saranac soils. These soils are in the lower areas directly adjacent to the streams or are in slack-water depressions. They make up about 5 percent of the map unit.

Permeability is rapid in the Abscota soil. The available water capacity is low. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some support a natural cover of mixed hardwoods. A few woodlots have been grazed.

This soil is poorly suited to corn, soybeans, and small grain. Flooding, the low available water capacity, and soil blowing are management concerns. The flooding occasionally results in crop losses. If cultivated crops are grown, measures that conserve moisture and help to control soil blowing are needed. Windblown sand can damage seedlings. A crop rotation that includes grasses and legumes and a system of conservation tillage that leaves all or most of the crop residue on the surface help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, and help to maintain tilth and the organic matter content.

This soil is poorly suited to forage grasses and legumes. It is best suited to deep-rooted species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are seedling mortality and plant competition. Seedlings survive and grow best if competing vegetation is controlled by cutting, spraying, or girdling. Replanting of seedlings may be necessary. Drought-tolerant species should be selected for planting.

Because of the flooding, this soil is generally unsuited to dwellings and septic tank absorption fields. A suitable alternative site should be selected. The soil is severely limited as a site for local roads and streets because of the flooding. Constructing the roads on raised, well compacted fill material above the level of flooding and providing adequate side ditches and culverts help to prevent the damage caused by floodwater.

The land capability classification is IVs. The woodland ordination symbol is 4S.

Ao—Aquents-Urban land complex, rarely flooded. This map unit occurs as nearly level areas on outwash plains, till plains, and moraines. Most areas are on the edges of lakes, where marshes have been filled with soil material. The unit is rarely flooded for brief periods by stream or lake overflow. In many places it is ponded by runoff from the higher adjacent soils. Areas are oval, long and narrow, or irregularly shaped and are 5 to 50 acres in size. They are about 55 percent Aquents and 35 percent Urban land. The Aquents and the Urban land occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the Aquents are a mixture of surface soil, subsoil, and underlying material 2 to 15 feet deep over the original soils. The upper part of the profile is mainly sandy loam and loamy sand. In a few areas it is loam or clay loam. In some areas it is almost exclusively coarse sand and gravel. The lower part of the profile is the original soils, either Histosols or Aquolls, or both.

The Urban land occurs as sites for buildings and other structures, roads, parking lots, and lanes. Open areas support grasses, weeds, and shrubs.

Included in this unit in mapping are small areas of undisturbed soils. These soils make up about 10 percent of the map unit.

The physical characteristics of the Aquents vary. The suitability of these soils for most uses depends on the thickness and texture of the fill, the depth to the seasonal high water table, and the nature of underlying material. Because of the flooding, the soils are generally unsuitable as sites for buildings and septic tank absorption fields. They are severely limited as sites for local roads because of low strength, flooding, and frost action. Additional coarse textured subgrade material and a roadside drainage system that includes culverts minimize the heaving and cracking of roads and driveways.

No land capability classification or woodland ordination symbol is assigned.

ArA—Aubbeenaubbee sandy loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on swells on till plains and in swales, in drainageways, and on toe slopes on moraines. Areas are irregular in shape and are 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 10 inches thick. The subsurface layer is brown sandy loam about 6 inches thick. The subsoil is about 40 inches thick. It is mottled. In sequence downward, it is brown, friable sandy loam; grayish brown, friable fine sandy loam; gray, firm clay loam; and dark gray, firm loam. The underlying material to a depth of 60 inches is brown, mottled loam. In some areas the surface layer is loamy sand, lighter colored, or both. In other areas it contains more silt and less sand. In some places the subsoil is sandy clay loam. In other places the soil is stratified with silt, silt loam, loamy sand, or sand. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Barry soils in shallow

depressions and small drainageways. Also included are the well drained Metea, Miami, and Wawasee soils on swells and low ridges and very poorly drained soils in wooded areas. The very poorly drained soils are wet for long periods during winter and early spring. Included soils make up about 15 percent of the map unit.

Permeability is moderate or moderately rapid in the subsoil of the Aubbeenaubbee soil and moderately slow in the underlying material. The available water capacity is moderate. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and early spring. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture or hay. A very small acreage is used for woodlots.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be intensively row cropped. Wetness is the major limitation. Subsurface drains help to remove excess water. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting, increase the rate of water infiltration and the organic matter content, and help to maintain tilth. The soil is well suited to a till-plant cropping system.

If drained, this soil is well suited to grasses and legumes for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. The buildings should be constructed without basements. Subsurface drains help to lower the water table. The soil is severely limited as a site for local roads and streets because of frost action. An adequate drainage system along the roads helps to prevent the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. Interceptor drains around the outer edges of the absorption field help to remove excess water. Enlarging the absorption field helps to compensate for the restricted permeability.

The land capability classification is IIw. The woodland ordination symbol is 4A.

AtA—Aubbeenaubbee fine sandy loam, moderately permeable, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is on swells on till plains and in swales, in drainageways, and on toe slopes on moraines. Areas are irregular in shape and are 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsurface layer is dark grayish brown sandy loam about 4 inches thick. The subsoil is about 32 inches thick. It is mottled. The upper part is grayish brown, friable sandy loam, and the lower part is yellowish brown, firm loam. The underlying material to a depth of 60 inches is brown, mottled loam. In some areas the surface layer is loamy sand, lighter colored, or both. In other areas it contains more silt and less sand. In some places the subsoil is clay loam. In other places the soil is stratified with silt, silt loam, loamy sand, or sand. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Barry soils in shallow depressions and small drainageways. Also included are the well drained Metea and Wawasee soils on swells and low ridges and very poorly drained soils in wooded areas. The very poorly drained soils are wet for long periods during winter and early spring. Included soils make up about 15 percent of the map unit.

Permeability is moderate or moderately rapid in the subsoil of the Aubbeenaubbee soil and moderate in the underlying material. The available water capacity is moderate. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and early spring. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture or hay. A very small acreage is used for woodlots.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be intensively row cropped. Wetness is the major limitation. Subsurface drains help to remove excess water. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting, increase the rate of water infiltration and the organic matter content, and help to maintain tilth. The soil is well suited to a till-plant cropping system.

If drained, this soil is well suited to grasses and legumes for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. The buildings should be constructed without basements. Subsurface drains help to lower the water table. The soil is severely limited as a site for local roads and streets because of frost action. An adequate drainage system along the roads helps to prevent the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because of the wetness. Interceptor drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Bc—Barry loam. This nearly level, poorly drained soil is on broad flats, in shallow, narrow, meandering depressions, and in drainageways on till plains and moraines. Some of the depressions are frequently ponded by runoff from the higher adjacent soils. Areas are elongated, oval, or irregularly shaped and are 5 to 300 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer also is black loam. It is about 7 inches thick. The subsoil is about 35 inches thick. The upper part is dark gray, mottled, firm fine sandy loam, and the lower part is olive gray, mottled, firm and friable loam. The underlying material to a depth of 60 inches is brown, mottled loam. In some areas the surface layer is lighter colored, less than 10 inches thick, or both. In some of the deeper depressions, the upper part of the subsoil is silty clay loam. In places the subsoil and the underlying material contain more clay. In a few areas the soil has strata of sand directly above the underlying glacial till or is underlain by stratified material.

Included with this soil in mapping are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils on slight rises, in saddles, and at the base of the slopes. These soils make up about 15 percent of the map unit.

The Barry soil is moderately permeable. The available water capacity is high. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled. Clods form, however, if the soil is plowed when wet.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodland. Most woodlots have been grazed.

If drained, this soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. Subsurface drains (fig. 5), surface drains, pumps, or a combination of these can remove excess water. A system of conservation tillage that leaves all or most of the crop residue on the surface minimizes crusting, improves tilth, and helps to maintain the organic matter content. The soil is well suited to fall plowing, fall chiseling, and a till-plant or ridge-plant cropping system.

If drained, this soil is well suited to grasses and legumes for hay and pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality, the windthrow hazard, the equipment limitation, and plant competition are management concerns. Water-tolerant species should be selected for planting. Competing vegetation should be controlled by cutting, girdling, or spraying. Replanting of seedlings is often necessary. Carefully thinning the stand or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of ponding, this soil is generally unsuited to dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of ponding and frost action. Building the roads and streets on well compacted fill material 2 to 3 feet above the original ground level and providing adequate drainage ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

BlA—Blount silt loam, 0 to 2 percent slopes. This nearly level, somewhat poorly drained soil is in depressions, in drainageways, and on ridgetops on till plains and moraines. Areas are irregular in shape and are 5 to 100 acres in size.

Typically, the surface layer is dark gray silt loam about 8 inches thick. The subsurface layer is about 3 inches of dark grayish brown silt loam. The subsoil is mottled, firm clay loam about 19 inches thick. The upper part is yellowish brown, and the lower part is grayish brown. The underlying material to a depth of 60 inches is yellowish brown, mottled clay loam. In a few areas the surface layer is sandy loam. In some places the mottles are lower in the profile. In other places the entire subsoil is gray and grayish brown. In some areas the subsoil has layers of loam or sandy clay loam. In a few places it is underlain by loam till. In some areas the depth to the underlying material is more than 40 inches. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Pewamo soils in the lower positions on the landscape. Also included are areas of the moderately well drained Glynwood and well drained Morley soils on slight rises and in saddles between depressions. Included soils make up about 5 percent of the map unit.

Figure 5.—A subsurface drain installed in an area of Barry loam.

Permeability is moderately slow or slow in the Blount soil. The available water capacity is moderate. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. It restricts the rooting depth. The organic matter content is moderate. Clods form if the soil is plowed when wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay. A few are used as woodland.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be intensively row cropped. Wetness is the main limitation. A drainage system improves crop growth and the timeliness of tillage. Subsurface drains and surface drains help to remove excess water. A system of conservation tillage that leaves all or most of the crop residue on the surface improves or helps to maintain tilth and the organic matter content. The soil is well suited to a ridge-plant cropping system and to fall chiseling.

If drained, this soil is well suited to grasses and legumes for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods minimize surface compaction and help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are seedling mortality and the windthrow hazard. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Carefully thinning the stands or not thinning them at all reduces the windthrow hazard.

Because of the wetness, this soil is severely limited as a site for dwellings. Houses should be constructed without basements. Installing drainage tile around properly designed footings lowers the water table and helps to prevent the damage caused by frost action. The soil is severely limited as a site for local roads and streets because of low strength and frost action. Adequate drainage ditches are needed to lower the water table and thus minimize frost action. Providing coarse textured subgrade or base material helps to prevent the damage caused by low strength and frost action.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability and the wetness. Installing interceptor drains around the absorption field helps to lower the water table. Enlarging the absorption area improves the capacity of the field to absorb the effluent. An enlarged holding tank can increase the capacity of the system during peak periods of use.

The land capability classification is IIw. The woodland ordination symbol is 3C.

BnB—Blount-Glynwood complex, 1 to 3 percent slopes. These nearly level and gently sloping soils are on till plains and moraines. The somewhat poorly drained Blount soil is in swales and potholes, on knolls, and in drainageways. The moderately well drained Glynwood soil is on swells and low ridges, around potholes, and along poorly defined drainageways. Areas are irregular in shape and are 5 to 50 acres in size. They are about 50 percent Blount soil and 35 percent Glynwood soil. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Blount soil is dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 3 inches thick. The subsoil is mottled, firm clay loam about 19 inches thick. The upper part is yellowish brown, and the lower part is grayish brown. The underlying material to a depth of 60 inches is yellowish brown, mottled clay loam. In a few areas the surface layer is sandy loam and has a gravel content of more than 1 percent. In some places the depth to mottles is greater. In other places the entire subsoil is gray and grayish brown. In some areas the subsoil has layers of loam or sandy clay loam. In a few places it is underlain by loam till. In some areas the depth to the underlying material is more than 40 inches.

Typically, the surface layer of the Glynwood soil is dark grayish brown loam about 10 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil is mottled, firm silty clay loam about 20 inches thick. The upper part is yellowish brown, and the lower part is dark yellowish brown. The underlying material to a depth of 60 inches is yellowish brown, mottled clay loam. In some areas the surface layer is sandy loam and has a gravel content of more than 1 percent. In other areas the surface layer is less than 10 inches thick and has been mixed with the upper part of the subsoil by plowing. In some places the subsoil has thin subhorizons of sandy clay loam or silt loam, has fewer mottles, or both. In other places the slope is more than 3 percent.

Included with these soils in mapping are small areas of the very poorly drained Pewamo soils in the lower landscape positions and areas of the well drained Morley soils in the higher positions. Also included are areas where the soil is severely eroded. Included soils make up about 15 percent of the map unit.

Permeability is slow in the Blount and Glynwood soils. The available water capacity is moderate. Runoff is slow or medium. During the winter and spring, the water table is at a depth of about 1.0 to 3.0 feet in the Blount soil and 2.0 to 3.5 feet in the Glynwood soil. It restricts the rooting depth. The organic matter content is moderate in the surface layer of both soils. This layer is friable and can be tilled throughout a moderate range in moisture content, but it tends to crust after heavy rains. Clods form if the soils are plowed when wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of these soils are used for cultivated crops. Some are used for pasture or hay. A few are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Erosion and wetness are management concerns. A crop rotation that includes grasses and legumes, cover crops, water- and sediment-control basins, diversions, grassed waterways, and grade stabilization structures help to control erosion and runoff. Subsurface drains help to remove excess water. A

system of conservation tillage that leaves all or most of the crop residue on the surface improves or helps to maintain tilth and increases the organic matter content. The soils are well suited to fall chiseling.

A cover of grasses and legumes helps to control erosion. If drained, these soils are well suited to grasses and legumes, such as bromegrass, alfalfa, and white clover, for hay or pasture. Unless drained, they are poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing when the soils are wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. Seedling mortality and the windthrow hazard are management concerns on both soils. Plant competition also is a concern on the Glynwood soil. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Some replanting of seedlings may be needed. Carefully thinning the stands or not thinning them at all reduces the windthrow hazard.

Because of the wetness, the Blount soil is severely limited as a site for dwellings. Because of the wetness and the shrink-swell potential, the Glynwood soil is moderately limited as a site for dwellings without basements. It is severely limited as a site for dwellings with basements because of the wetness. Dwellings should be constructed without basements. Installing drain tile around properly designed footings lowers the water table and helps to prevent the damage caused by frost action. Strengthening foundations and footings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling.

Because of low strength and frost action, these soils are severely limited as sites for local roads and streets. An adequate drainage system along the roads helps to prevent the damage caused by frost action. Replacing or strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

These soils are severely limited as sites for septic tank absorption fields because of the wetness and the slow permeability. Overcoming these limitations is very difficult. Enlarging the absorption area improves the capacity of the field to absorb the effluent. Interceptor drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIe. The woodland ordination symbol assigned to the Blount soil is 3C, and that assigned to the Glynwood soil is 4C.

BoB—Boyer loamy sand, 0 to 6 percent slopes. This nearly level and gently sloping, well drained soil is on outwash plains and on knolls and ridges on moraines. Areas are irregularly shaped or are oval. They are 5 to 125 acres in size.

Typically, the surface layer is brown loamy sand about 9 inches thick. The subsoil is about 28 inches thick. The upper part is dark yellowish brown and dark brown, friable sandy loam; the next part is dark brown, very friable loamy sand; and the lower part is dark brown, friable sandy clay loam. The underlying material to a depth of 60 inches is yellowish brown, stratified sand and very gravelly coarse sand. In some areas the surface layer contains more gravel. In other areas the loamy sand is more than 24 inches thick. In some places the soil is moderately eroded. In other places the subsoil, the underlying material, or both are finer textured. In some areas the depth to the underlying material is less than 24 inches or more than 40 inches. In other areas the slope is more than 6 percent.

Included with this soil in mapping are areas of the moderately well drained Bronson and well drained Ormas soils. Ormas soils are more sandy than the Boyer soil. They are in landscape positions similar to those of the Boyer soil. Bronson soils are in the slightly lower areas. Included soils make up about 15 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Boyer soil and very rapid in the underlying material. The available water capacity is low. Runoff is slow in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay. A very few are used for woodlots. Most of the wooded areas have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazard of erosion are the main management concerns. The crops respond well to irrigation. Cover crops, a crop rotation that includes grasses and legumes, water- and sediment-control basins, diversions, grassed waterways, and grade stabilization structures help to control erosion and runoff. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting, reduce the evaporation rate, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. The low available water capacity and the hazard of erosion are management concerns. Drought-tolerant species should be selected for planting. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concern is seedling mortality. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings and for local roads and streets. The sides of shallow excavations can cave in unless they are reinforced. Because of a poor filtering capacity, the soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

BoC—Boyer loamy sand, 6 to 12 percent slopes. This moderately sloping, well drained soil is on breaks on outwash plains and on knolls and ridges on moraines. Areas are elongated or irregularly shaped and range from 5 to 35 acres in size.

Typically, the surface layer is brown loamy sand about 8 inches thick. The subsoil is about 25 inches thick. The upper part is dark yellowish brown and dark brown, friable sandy loam; the next part is dark brown, very friable loamy sand; and the lower part is dark brown, friable sandy clay loam. The underlying material to a depth of 60 inches is yellowish brown, stratified sand and very gravelly coarse sand. In some areas the surface layer contains more gravel. In other areas the loamy sand is more than 24 inches thick. Nearly half of the acreage is moderately eroded. In some places the subsoil, the underlying material, or both are finer textured. Depth to the underlying material varies widely within short distances. It is less than 24 or more than 40 inches in some areas. In places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the moderately well drained Bronson and well drained Ormas soils. Ormas soils are in landscape positions similar to those of the Boyer soil. They are more sandy than the Boyer soil. Bronson soils are in potholes and drainageways. Included soils make up about 15 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Boyer soil and very rapid in the underlying material. The available water capacity is low. Runoff is medium in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Many areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodland. Most woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The hazard of erosion and the low available water capacity are management concerns. Cover crops, a crop rotation that includes grasses and legumes, diversions, water- and sediment-control basins, grassed waterways, and grade stabilization structures help to control erosion and runoff. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting, reduce the evaporation rate, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes for hay and pasture. A cover of grasses and legumes is effective in controlling erosion. The low available water capacity and the hazard of erosion are management concerns. Drought-tolerant species should be selected for planting. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concern is seedling mortality. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings and for local roads and streets. The slope should be modified by land grading or by cutting and filling. The buildings can be designed so that they conform to the natural slope of the land. The local roads and streets should be built on the contour. The sides of shallow excavations can cave in unless they are reinforced.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The slope is a moderate limitation. Installing the distribution lines on the contour helps to ensure even distribution of the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

Bp—Brady sandy loam. This nearly level, somewhat poorly drained soil is on outwash plains. Areas are oblong, elongated, or irregularly shaped and are 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 8 inches thick. The subsurface layer is grayish brown sandy loam about 3 inches thick. The subsoil is about 43 inches thick. The upper part is brown, mottled, friable sandy loam, and the lower part is yellowish brown, mottled, very friable loamy sand. The

underlying material to a depth of 60 inches is gray gravelly coarse sand. In places the surface layer is loam. In a few areas the mottles are lower in the profile. In some areas the entire subsoil is gray and grayish brown. In other areas the subsoil has more sand, gravel, or clay throughout. In a few places it is underlain by neutral or slightly acid sand. In some areas the slope is more than 2 percent.

Included with this soil in mapping are some small areas of the very poorly drained Gilford and Gravelton soils in depressions and poorly defined drainageways. These soils make up about 15 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Brady soil and very rapid in the underlying material. The available water capacity is moderate. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and early spring. The organic matter content is moderate in the surface layer. This layer can be easily tilled throughout a moderately wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or trees. Many woodlots are grazed.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be intensively row cropped. Wetness is the main limitation. Subsurface drains and surface drains help to remove excess water. If the soil is overdrained, however, drought is a hazard. A system of conservation tillage that leaves all or most of the crop residue on the surface improves tilth and helps to maintain the organic matter content. The soil is well suited to a till-plant cropping system.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and clover, for hay and pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing under wet conditions causes surface compaction and poor tilth. Proper stocking rates, timely grazing, and restricted use during wet periods minimize surface compaction and help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is severe. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. Subsurface drains help to lower the water table. Houses should be constructed without basements. Installing drainage tile around properly designed footings helps to prevent the damage caused by frost action. The sides of shallow excavations can cave in unless they are reinforced. The soil is severely limited as a site for local roads and streets because of frost action. Adequate roadside ditches are needed to lower the water table and thus minimize the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because of the wetness. Interceptor drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIw. The woodland ordination symbol is 5A.

BrA—Bronson sandy loam, 0 to 2 percent slopes. This nearly level, moderately well drained soil is on broad outwash plains and on low moraines. Areas are irregular in shape and are 5 to 200 acres in size.

Typically, the surface layer is very dark grayish brown sandy loam about 9 inches thick. The subsoil is about 50 inches thick. In sequence downward, it is yellowish brown, friable sandy loam; dark yellowish brown and dark brown, mottled, friable sandy loam; dark yellowish brown, mottled, very friable loamy sand; and dark brown, mottled, friable sandy clay loam. The underlying material to a depth of 60 inches is brown sand and gravelly coarse sand. In some areas the surface layer contains more gravel or more clay. In other areas the mottles are higher in the profile. In places the entire subsoil is gray or grayish brown. In a few areas the underlying material is dominantly sand or fine sand. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Ormas soils and the very poorly drained Gilford soils. Ormas soils are on slight swells and low knolls. Gilford soils are in depressions and small drainageways. Also included are a few areas where the soil is underlain by loamy lacustrine deposits or till. Included soils make up about 10 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Bronson soil and rapid in the underlying material. The available water capacity is moderate. Runoff is slow. The water table is at a depth of 2.0 to 3.5 feet during winter and early spring. The organic matter content is moderate in the surface layer. This surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture, hay, or woodland. Most wooded areas have been grazed.

This soil is well suited to corn, soybeans, and small grain. The moderate available water capacity is the main limitation. The crops respond well to irrigation. A system of conservation tillage that leaves all or most of the crop residue on the surface, cover crops, crop rotations that include grasses and legumes, and grassed waterways reduce the evaporation rate and help to maintain the organic matter content and tilth. The soil is well suited to a no-till cropping system.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. Deep-rooted legumes and grasses are the best suited forage species. The low available water capacity is the main limitation. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the wetness, this soil is moderately limited as a site for dwellings. Houses should be constructed without basements. Subsurface drains help to lower the water table. Installing drainage tile around properly designed footings helps to prevent the damage caused by frost action. The sides of shallow excavations can cave in unless they are reinforced. The soil is severely limited as a site for local roads and streets because of frost action. Roadside drainage ditches are needed to remove surface water and thus minimize the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because of the wetness. Interceptor drains around the outer edge of the absorption field help to remove excess water.

The land capability classification is IIs. The woodland ordination symbol is 4A.

CaA—Carmi loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad outwash plains. Areas are irregular in shape and are 25 to 500 acres in size.

Typically, the surface layer is black loam about 8 inches thick. The subsurface layer is about 11 inches thick. The upper part is very dark brown loam, and the lower part is very dark grayish brown sandy loam. The subsoil is about 33 inches thick. In sequence downward, it is dark brown, friable sandy loam; brown, very friable gravelly sandy loam; and brown, loose gravelly loamy sand. The underlying material to a depth of 60 inches is brown, stratified sand and very gravelly coarse sand. In some places the surface layer contains more gravel, is thinner, or both. In other places the subsoil contains more silt. In some areas it contains more gravel, extends to a depth of less than 40 inches, or both. In other areas it is mottled at a depth of 30 to 40 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Griswold and Shipshe soils. Griswold soils are more clayey than the Carmi soil, and Shipshe soils are more gravelly. Both of the soils are in landscape positions similar to those of the Carmi soil. They make up about 5 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Carmi soil and rapid in the underlying material. The available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture, hay, or woodlots.

This soil is well suited to corn, soybeans, and small grain. If properly managed, it can be intensively row cropped. The moderate available water capacity is the main limitation. The crops respond well to irrigation. Cover crops and a conservation tillage system that leaves all or most of the crop residue on the surface reduce the evaporation rate, minimize crusting, and increase the rate of water infiltration. The soil is well suited to a no-till cropping system.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Deep-rooted legumes and grasses are the best suited forage species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to dwellings. It is moderately limited as a site for local roads and streets because of frost action. Strengthening the base with better suited material and installing a subsurface drainage system help to prevent the damage caused by frost action. The sides of shallow excavations can cave in unless they are reinforced.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIs. No woodland ordination symbol is assigned.

CIB—Coloma loamy sand, 0 to 6 percent slopes. This nearly level and gently sloping, somewhat excessively drained soil is on outwash plains and terraces and on knolls and ridges on till plains and moraines. Areas are elongated or irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 9 inches thick. The subsoil is about 45 inches of dark yellowish brown and yellowish brown, loose sand. It has bands of dark yellowish brown, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches is yellowish brown sand. In some places the surface layer is darker. In other places the depth to the textural bands in the subsoil is 15 to 24 inches. In some areas the total thickness of the bands is more than 6 inches. In other areas the bands below a depth of 30 inches are continuous. In some places the soil has no textural bands. In other places faint mottles are above the layers of loamy sand at a depth of 36 to 54 inches. In some areas the slope is more than 6 percent.

Included with this soil in mapping are small areas of the well drained Kosciusko, Metea, and Wawasee soils. These soils are in landscape positions similar to those of the Coloma soil. They make up about 10 percent of the map unit.

The Coloma soil is rapidly permeable. The available water capacity is low. Runoff is slow in cultivated areas. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for forage crops. A few support a natural cover of mixed hardwoods.

This soil is poorly suited to corn, soybeans, and small grain. The low available water capacity is the major limitation, and soil blowing is a hazard. Measures that conserve moisture are needed. Windblown sand often damages small seedlings. A crop rotation that includes grasses and legumes, a system of conservation tillage that leaves all or most of the crop residue on the surface, and grassed waterways help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, and improve or maintain tilth and the organic matter content.

This soil is fairly well suited to forage grasses and legumes, such as bromegrass and alfalfa. Deep-rooted grasses and legumes are the best suited forage species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concern is seedling mortality. Replanting of seedlings may be necessary. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is well suited to dwellings and to local roads and streets. The sides of shallow excavations can cave in unless they are reinforced. The soil is severely limited as a site for septic tank absorption fields because it does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IVs. The woodland ordination symbol is 4S.

ClC—Coloma loamy sand, 6 to 12 percent slopes. This moderately sloping, somewhat excessively drained soil is on outwash plains and terraces and on knolls and ridges on till plains and moraines. Areas are elongated and narrow or are irregularly shaped. They are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown loamy sand about 8 inches thick. The subsoil is about 44 inches of dark yellowish brown and yellowish brown, loose sand. It has bands of dark yellowish brown, very friable loamy sand in the lower part. The underlying material to a depth of 60 inches is yellowish brown sand. In some places the surface layer is darker. In other places the depth to the textural bands in the subsoil is 15 to 24 inches. In some areas the total thickness of the bands is more than 6 inches. In other areas the bands below a depth of 30 inches are continuous. In some places the soil has no textural bands. In other places faint mottles are above the layers of loamy sand at a depth of 36 to 52 inches. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the well drained Kosciusko, Metea, and Wawasee soils. These soils are in landscape positions similar to those of the Coloma soil. They make up about 10 percent of the map unit.

The Coloma soil is rapidly permeable. The available water capacity is low. Runoff is medium in cultivated areas. The organic matter content is low in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Many are idle. Some are used for forage crops. A few support a natural cover of mixed hardwoods.

Because of the low available water capacity, the slope, and the hazard of soil blowing, this soil is generally unsuited to corn, soybeans, and small grain. It is fairly well suited to forage grasses and legumes. The low available water capacity is the main limitation. Deep-rooted grasses and legumes are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concern is seedling mortality. Replanting of seedlings may be necessary. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings (fig. 6) and for local roads and streets. The slope can be modified by land grading or by cutting and filling. The dwellings can be designed so that they conform to the natural slope of the land. The roads and streets should be built on the contour. Erosion is a hazard on construction sites. It can be controlled by replacing topsoil and reseeding as soon as possible after construction, by developing random lots on the contour, and by maintaining as much of the existing vegetation as possible during construction. The sides of shallow excavations can cave in unless they are reinforced.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The slope is a moderate limitation. Installing the distribution lines on the contour helps to ensure an even distribution of the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual

Figure 6.—Buildings in an area of Coloma loamy sand, 6 to 12 percent slopes.

geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is VIs. The woodland ordination symbol is 4S.

CrA—Crosier loam, 0 to 1 percent slopes. This nearly level, somewhat poorly drained soil is on swells on till plains and in swales and drainageways on moraines. Areas are irregular in shape and are 20 to 500 acres in size.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The subsoil is mottled, firm clay loam about 27 inches thick. The upper part is grayish brown, and the lower part is brown. The underlying material to a depth of 60 inches is brown, mottled loam. In some areas the subsoil has layers of sandy loam, silt loam, or both. In other areas the depth to the underlying till is more than 40 inches. In a few areas the till is stratified with clay loam, silt loam, sandy loam, or loamy sand. In places the slope is more than 1 percent.

Included with this soil in mapping are small areas of the poorly drained Barry soils in shallow depressions and small drainageways. Also included, in most wooded areas, are very poorly drained soils that are ponded for long periods during winter and early spring. Included soils make up about 10 percent of the map unit.

Permeability is moderately slow in the Crosier soil. The available water capacity is high. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer can be easily tilled, but clods form if the soil is plowed when wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be

intensively row cropped. Wetness is the major limitation. Subsurface drains help to remove excess water. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting, increase the rate of water infiltration and the organic matter content, and help to maintain tilth. The soil is well suited to a till-plant cropping system.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and clover, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and the restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. The buildings should be constructed without basements (fig. 7). Subsurface drains help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. An adequate drainage system along the roads helps to prevent the damage caused by frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. Enlarging the absorption field helps to compensate for the restricted permeability. Interceptor drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIw. The woodland ordination symbol is 4A.

CrB—Crosier loam, 1 to 4 percent slopes. This nearly level and gently sloping, somewhat poorly drained soil is on swells, around potholes, and along poorly defined drainageways on till plains and along well defined drainageways on moraines. Areas are irregular in shape and are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is mottled, firm clay loam about 26 inches thick. The upper part is grayish brown, and the lower part is brown. The underlying material to a depth of 60 inches is brown, mottled loam. In some places the subsoil has fewer mottles and has layers of sandy loam, silt loam, or both. In other places the depth to the underlying till is more than 40 inches. In a few areas the till is stratified clay loam, silt loam, sandy loam, or loamy sand. In some areas the slope is less than 1 or more than 4 percent.

Included with this soil in mapping are small areas of the poorly drained Barry soils in deep depressions and small drainageways and a few small areas of the well drained, gently sloping Miami and Wawasee soils on small knolls and along the sides of drainageways. Also included, in most wooded areas, are very poorly drained soils that are wet for long periods during winter and early spring. Included soils make up about 15 percent of the map unit.

Permeability is moderately slow in the Crosier soil. The available water capacity is high. Runoff is medium. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled, but clods form if the soil is plowed when wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay. A very small acreage is used for woodlots. Most of the woodlots are grazed.

This soil is well suited to corn, soybeans, and small grain. Erosion and wetness are the major management concerns. A crop rotation that includes grasses and legumes, grassed waterways, water- and sediment-control basins, diversions, terraces, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting, increase the rate of water infiltration, and maintain tilth and the organic matter content. The soil is well suited to fall chiseling and to a till-plant cropping system. Subsurface drains can remove excess water.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of wetness, this soil is severely limited as a site for dwellings. The buildings should be constructed without basements. Subsurface drains help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. An adequate drainage system along the roads helps to prevent the damage caused by frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the moderately slow permeability. Enlarging the absorption

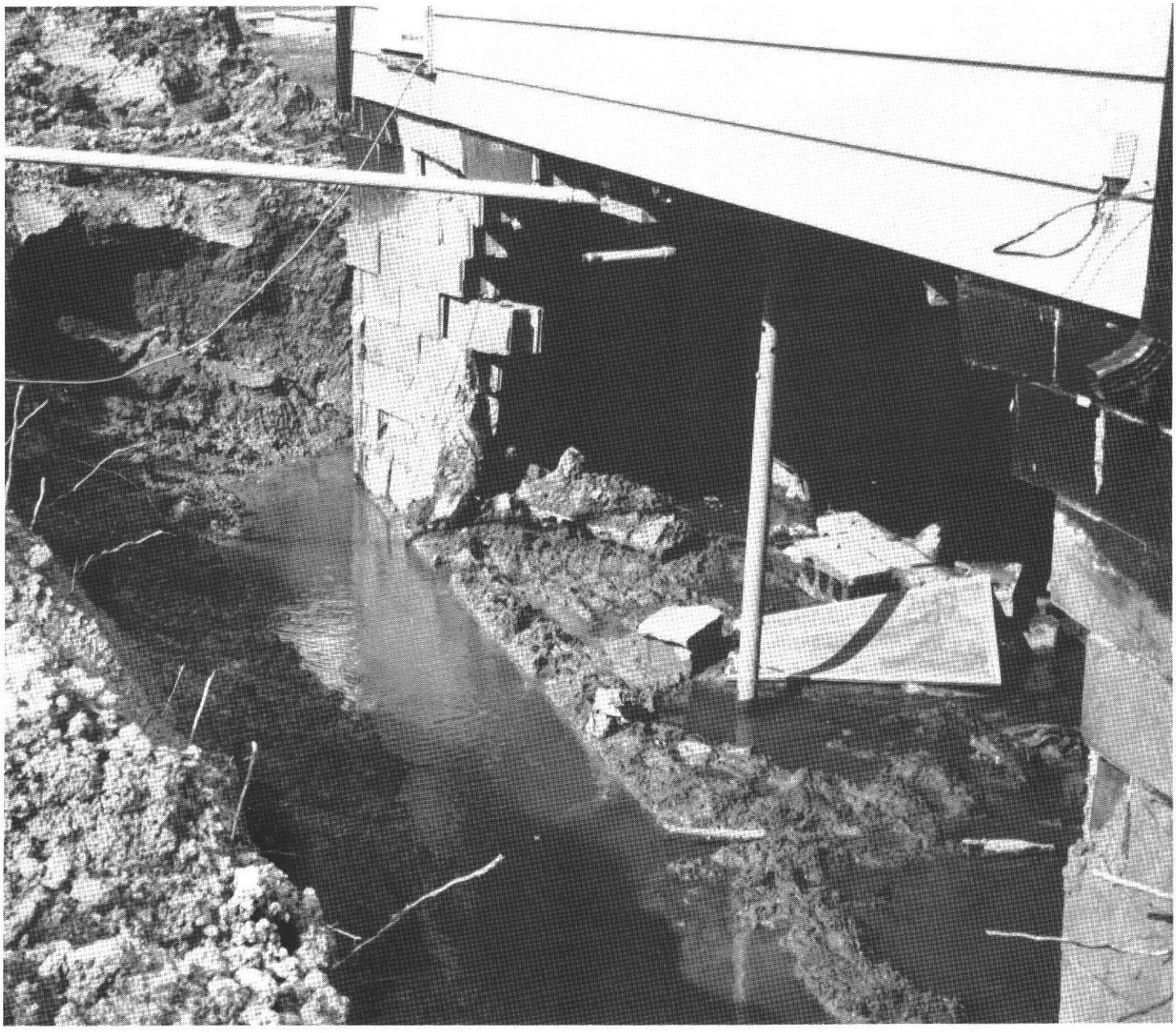


Figure 7.—A collapsed basement wall in an area of Crosier loam, 0 to 1 percent slopes. Inadequate provisions were made for the removal of excess water during periods of spring rainfall.

field helps to compensate for the restricted permeability. Interceptor drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIe. The woodland ordination symbol is 4A.

De—Del Rey silt loam. This nearly level, somewhat poorly drained soil is on slight rises along the outer edges of lake plains in the uplands. Areas are narrow and elongated or are irregularly shaped. They are 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is mottled, firm silty clay loam about 28 inches thick. It is yellowish brown in the upper part, dark yellowish brown and yellowish brown in the next part, and dark yellowish

brown in the lower part. The underlying material to a depth of 60 inches is yellowish brown, mottled silty clay loam. In some places the content of gravel in the surface layer is as much as 15 percent. In other places the subsoil has layers of clay loam, loam, or both. In a few areas the content of clay in the upper part of the subsoil is less than 35 percent. In a few places the underlying material is stratified with thin layers of sandy or loamy material. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained Toledo soils in depressions, on toe slopes, and in small drainageways. Also included, in most wooded areas, are very poorly drained soils that are ponded for long periods during winter and early spring. Included soils make up about 5 percent of the map unit.

Permeability is slow in the Del Rey soil. The available water capacity is high. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and spring. The organic matter content is moderate in the surface layer. This layer becomes very compact and cloddy if it is plowed when wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay. A very small acreage is used for woodlots. Most of the woodlots are grazed.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be intensively row cropped. Wetness is the major limitation. Subsurface drains help to remove excess water. Cover crops and a system of conservation tillage that leaves protective amounts of crop residue on the surface help to control erosion, minimize crusting, increase the rate of water infiltration and the organic matter content, and help to maintain tilth. The soil is well suited to fall chiseling and to a ridge-till cropping system.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and clover, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing when the soil is wet results in severe surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and the windthrow hazard are the main management concerns. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard.

Because of the wetness, this soil is severely limited as a site for dwellings. The buildings should be constructed without basements. Subsurface drains help to lower the water table. The soil is severely limited as a site for local roads and streets because of low strength and frost action. An adequate drainage system along the roads helps to prevent the damage caused by frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the slow permeability. Enlarging the absorption field helps to compensate for the restricted permeability. Interceptor drains around the outer edges of the absorption field help to remove excess water. An enlarged holding tank increases the capacity of the system during peak periods of use.

The land capability classification is IIw. The woodland ordination symbol is 4C.

Ed—Edwards muck, drained. This nearly level, very poorly drained soil is in depressions and along the edges of lakes and streams. In most places it is frequently ponded by runoff from the higher adjacent soils. Areas are irregularly shaped or circular and are 5 to 100 acres in size.

Typically, the surface layer is black muck about 12 inches thick. The upper part has granular structure and is very friable, and the lower part has subangular blocky structure and is firm. The subsurface layer is black, friable muck about 22 inches thick. The underlying material to a depth of 60 inches is olive gray marl. In some places the organic material is less than 16 or more than 50 inches thick. In other places the soil has as much as 24 inches of mineral overwash. In some areas thin strata of mineral material are within the organic layers or between the organic layers and the marl. In other areas all of the underlying material is mineral soil.

Included with this soil in mapping are small areas of the very poorly drained Gravelton soils. These soils are less mucky than the Edwards soil. They are around the edges of the mapped areas or are within the areas. Also included are some undrained areas. Included soils make up about 10 percent of the map unit.

The Edwards soil is moderately slowly permeable to moderately rapidly permeable in the layers of muck. The available water capacity is very high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is very high in the surface layer. This layer can be easily tilled and dries out rapidly in the spring. The soil is subject to late frost.

Most areas of this soil are used for cultivated crops. Most have been drained and thus have a water table 2 or more feet below the surface during the cropping season. In some areas, however, the drainage system has not been maintained and the soil has reverted back to brushy idle land. Some areas are used for pasture or support a natural cover of mixed hardwoods or of

wetland shrubs and grasses. A few areas are planted to specialty crops, such as mint, carrots, and onions.

This soil is poorly suited to corn, soybeans, and specialty crops. Wetness and soil blowing are the main management concerns. Because of poor stability in the organic material and the underlying material, ditchbanks can cave in and the effectiveness of subsurface drains can be impaired. If the soil is drained, the organic material subsides. In many areas it may subside so much that the drainage system is no longer adequate. Locating adequate drainage outlets is difficult in many areas. Windbreaks, a system of conservation tillage that leaves all or most of the crop residue on the surface, and cover crops help to control soil blowing.

If drained, this soil is fairly well suited to grasses and legumes for hay or pasture. Grasses grow better than most legumes. Deep-rooted legumes, such as alfalfa, grow poorly because of the ponding and the high water table. The use of harvesting equipment in areas of hay is restricted to dry periods because of the poor stability of the muck. Overgrazing or grazing when the soil is wet results in surface compaction and pitting, reduced plant density, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is poorly suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Plant competition can be controlled by cutting, spraying, or girdling. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during periods when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, frost action, and low strength. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action. The organic material should be replaced with suitable base material.

The land capability classification is IVw. The woodland ordination symbol is 2W.

Gf—Gilford sandy loam, gravelly substratum. This nearly level, very poorly drained soil is on benches along old drainageways and on broad outwash plains. Some depressional areas are frequently ponded by runoff from the higher adjacent soils. Areas are broad and irregularly shaped and are 5 to 300 acres in size.

Typically, the surface layer is black sandy loam about 9 inches thick. The subsurface layer is very dark gray fine sandy loam about 3 inches thick. The subsoil is about 23 inches thick. It is mottled. The upper part is grayish brown, very friable loamy sand; the next part is dark gray, firm sandy clay loam; and the lower part is dark gray, friable sandy loam. The underlying material to a depth of 60 inches is dark gray and grayish brown loamy sand, sand, and gravelly coarse sand. In some areas the surface soil is less than 10 inches thick. In other areas the upper 2 to 10 inches is mucky mineral soil. In some places the subsoil contains more clay, more gravel, or both. In other places it contains more sand. In a few areas the depth to the underlying material is less than 30 or more than 40 inches. In some areas the underlying material is neutral or slightly acid, stratified fine sand and sand. In other areas the slope is more than 2 percent.

Included with this soil in mapping are areas of the moderately well drained Bronson and somewhat poorly drained Brady soils. These soils are in saddles, on swells, and on the sides of narrow drainageways. They make up about 15 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Gilford soil and very rapid in the underlying material. The available water capacity is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture or hay or support a natural cover of mixed hardwoods. Many of the wooded areas have been grazed.

If drained, this soil is fairly well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. In inadequately drained areas, however, it is poorly suited to most crops. Subsurface drains, surface drains, pumps, or a combination of these can remove excess water. If the soil is overdrained, however, drought is a hazard. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, and help to maintain the organic matter content. The soil is well suited to a till-plant cropping system.

If drained, this soil is well suited to grasses and legumes for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Overgrazing or grazing when the soil is too wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Competing vegetation can be controlled by cutting, spraying, or girdling. Water-tolerant species should be

selected for planting. Replanting of seedlings is often needed. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuited to dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of the ponding and frost action. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

Gm—Gilford mucky sandy loam, gravelly substratum. This nearly level, very poorly drained soil is in depressions on broad outwash plains. In most places it is frequently ponded by runoff from the higher adjacent soils. Areas are elongated or irregularly shaped and are 5 to 100 acres in size.

Typically, the surface layer is black mucky sandy loam about 12 inches thick. The subsoil is about 23 inches thick. The upper part is dark gray, mottled, friable sandy loam, and the lower part is dark gray, mottled, very friable loamy sand. The underlying material to a depth of 60 inches is gray and dark gray sand and gravelly coarse sand. In some areas the surface layer is less than 10 inches thick. In other areas the subsoil contains more clay, more gravel, or both. In places it contains more sand. In a few areas the depth to the underlying material is less than 36 inches. In some areas the underlying material is neutral or slightly acid, stratified fine sand and sand. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the very poorly drained, mucky Palms soils. These soils are in the lower positions on the landscape. They make up about 10 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Gilford soil and very rapid in the underlying material. The available water capacity is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled. It dries out rapidly in the spring. The soil is subject to late frost.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodland. Most of the wooded areas are grazed. A few areas are used for specialty crops, particularly mint.

If drained, this soil is fairly well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. In inadequately drained areas, however, it is poorly suited to most crops. Wetness, ponding, and soil blowing are the major management concerns. Subsurface drains, surface drains, pumps, or a combination of these can remove excess water. If the soil is overdrained, however, drought is a hazard. A system of conservation tillage that leaves all or part of the crop residue on the surface, windbreaks, and cover crops help to control soil blowing and maintain tilth and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and birdsfoot trefoil, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is poorly suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Competing vegetation can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often needed. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and frost action. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding and frost action. The mucky surface layer should be replaced with suitable base material.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

Go—Gravelton loamy sand, occasionally flooded. This nearly level, very poorly drained soil is in low areas adjacent to the major drainageways. It is occasionally flooded for brief periods by stream overflow during winter and early spring. It is frequently ponded by runoff from the higher adjacent soils. Areas are long and narrow and are 5 to 100 acres in size.

Typically, the surface layer is black loamy sand about 6 inches thick. The subsurface layer is very dark brown and dark reddish brown, mottled sandy loam about 10 inches thick. The upper 6 inches of the underlying material is dark brown, mottled, firm sandy loam. The lower part to a depth of 60 inches is grayish brown, brown, very dark gray, dark brown, and very dark grayish brown sand, gravelly coarse sand, and very gravelly coarse sand. In some places the surface layer is thinner, lighter colored, or both. In other places it is sandy loam or is 2 to 10 inches of mucky mineral soil. In some areas the subsurface layer is stratified silt loam, sandy clay

loam, or gravelly sandy loam. In a few areas calcareous sand or gravelly coarse sand is directly below the surface layer.

Included with this soil in mapping are small areas of the somewhat poorly drained Brady and very poorly drained Edwards and Palms soils. Brady soils are in saddles, on swells, and on the side slopes along drainageways. Edwards and Palms soils are mucky. They are in depressions and old oxbows along the major drainageways. Included soils make up about 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the Gravelton soil and rapid or very rapid in the underlying material. The available water capacity is low. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for pasture or hay. Some are wooded, and some are used for row crops. Most of the wooded areas have been grazed.

If drained, this soil is fairly well suited to corn, soybeans, and small grain. If a drainage system is installed, row crops can be grown year after year. The wetness, the ponding, and the flooding are the major management concerns. Subsurface drains, surface drains, or a combination of these can remove excess water. If the soil is overdrained, however, it becomes droughty. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, and help to maintain the organic matter content.

If drained, this soil is well suited to grasses and legumes for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Competing vegetation can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often needed. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding and the flooding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, the flooding, and the potential for frost action. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding, floodwater, and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 3W.

Gr—Gravelton-Palms, gravelly substratum, complex, frequently flooded. These nearly level, very poorly drained soils are on low flood plains along the major drainageways. In most places they are flooded by stream overflow during every winter or early spring (fig. 8). The flooding usually lasts 2 to 8 weeks. The Gravelton soil is on the higher parts of the flood plains. The Palms soil is in depressions, old stream channels, and oxbows on the lowest parts. Areas are elongated and generally are parallel to streams. They are 5 to more than 200 acres in size. They are about 50 percent Gravelton soil and 35 percent Palms soil. The two soils occur as areas so intrically mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Gravelton soil is black loamy sand about 6 inches thick. The subsurface layer is very dark brown and dark reddish brown, mottled sandy loam about 10 inches thick. The upper 6 inches of the underlying material is dark brown, mottled, firm sandy loam. The lower part to a depth of 60 inches is grayish brown, very dark gray, dark brown, and very dark grayish brown sand, gravelly coarse sand, and very gravelly coarse sand. In some places the surface layer is loamy sand, mucky loamy sand, or mucky sandy loam. In other places the subsurface layer is stratified silt loam, sandy clay loam, or gravelly sandy loam. In a few areas calcareous sand or gravelly coarse sand is directly below the surface layer. In places sandy loam, loam, sandy clay loam, silt loam, clay loam, or the gravelly analogs of these textures underlie the sand and gravelly coarse sand.

Typically, the surface layer of the Palms soil is black muck about 9 inches thick. The subsurface layer is black and dark reddish brown muck about 19 inches thick. The upper part of the underlying material is dark olive gray and olive gray sandy clay loam and loam. The lower part to a depth of 60 inches is dark gray gravelly coarse sand. In some places the organic material is less than 16 or more than 50 inches thick. In other places the soil has as much as 24 inches of mineral overwash. In some areas a layer of marl overlies the gravelly coarse sand. In other areas the underlying material is marl or is loamy. In a few places the muck is underlain by sand or loamy sand.

Included with these soils in mapping are areas of the very poorly drained Wallkill soils. These included soils are more silty than the Palms and Gravelton soils. They are in landscape positions similar to those of the Gravelton and Palms soils. Also included are small areas of well drained to somewhat poorly drained, mineral soils

Figure 8.—An inundated area of Gravelton-Palms, gravelly substratum, complex, frequently flooded.

on the higher knobs and knolls. Included soils make up about 15 percent of the map unit.

Permeability is moderately rapid in the upper part of the Gravelton soil and rapid or very rapid in the underlying material. It is moderately rapid to moderately slow in the upper part of the Palms soil and rapid in the lower part of the underlying material. The available water capacity is low in the Gravelton soil and high in the Palms soil. Runoff is very slow or ponded. The water table is near or above the surface most of the year. The organic matter content is high or very high in the surface layer.

Most of the acreage is wooded or is idle land that supports a second growth of small trees, brush, and weeds. A few areas are cleared and are used as pasture.

Because of the ponding and the flooding, these soils are generally unsuited to cultivated crops. They are best suited to wetland wildlife habitat.

These soils are poorly suited to grasses and legumes for pasture. A cover of pasture plants minimizes scouring during periods of flooding. Overgrazing or grazing when the soils are wet depletes the vegetative cover and causes surface compaction and poor tilth. Pasture rotation and timely deferment of grazing help to keep the pasture in good condition.

These soils are poorly suited to trees. Plant competition, seedling mortality, the windthrow hazard,

and the equipment limitation are management concerns. Competing vegetation can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often needed. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or during periods when the ground is frozen.

Because of the ponding and the flooding, these soils are generally unsuitable as sites for dwellings and septic tank absorption fields. They are severely limited as sites for local roads because of the ponding, the flooding, and the potential for frost action. Constructing the roads on raised, well compacted fill material and providing adequate side ditches and culverts help to prevent the damage caused by ponding, floodwater, and frost action.

The land capability classification is Vw. The woodland ordination symbol is 3W.

GtA—Griswold loam, 0 to 2 percent slopes. This nearly level, well drained soil is on a till plain. Areas are oval or irregularly shaped. They range from 20 to nearly 1,500 acres in size.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsurface layer is dark brown loam about 4 inches thick. The subsoil is about 25 inches thick. In sequence downward, it is brown, friable loam; brown, firm sandy clay loam; and dark yellowish brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown sandy loam. In some places the surface layer is fine sandy loam, is less than 10 inches thick, or both. In other places it is lighter colored. In a few areas the surface layer is loamy sand. In some areas the content of gravel in the surface layer is about 5 percent. In some places the depth to the underlying till is more than 40 inches. In other places the slope is 2 to 6 percent.

Included with this soil in mapping are areas of the well drained Carmi and Shipshe soils. These soils are less clayey than the Griswold soil. They are in landscape positions similar to those of the Griswold soil. Also included are small areas of somewhat poorly drained soils in swales and drainageways. Included soils make up about 5 percent of the map unit.

Permeability is moderate in the Griswold soil. Runoff is slow. Organic matter content is high in the surface layer. This layer is friable and can be tilled throughout a wide range in moisture content.

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

This soil is well suited to corn, soybeans, and small grain. If the soil is well managed, row crops can be grown year after year. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting and help to maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to forage grasses and legumes. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to dwellings and septic tank absorption fields. It is moderately limited as a site for local roads and streets because of frost action. Strengthening the base with better suited material helps to prevent the damage caused by frost action.

The land capability classification is I. No woodland ordination symbol is assigned.

He—Histosols and Aquolls. These nearly level, very poorly drained soils are in depressions and potholes and along the border of lakes and streams on outwash plains, river terraces, till plains, and moraines. The soils are frequently ponded by runoff from the higher adjacent soils or by lake or stream overflow. Areas are irregular in shape and are 5 to 100 acres in size. In areas that are 20 acres or less, the soils can be either Histosols or Aquolls. In areas that are larger than 20 acres, the Histosols are on the lowest part of the landscape and are surrounded by the Aquolls. In a few of the larger areas, the Aquolls occur as islands within broad areas of the Histosols. Both soils are covered with water much of the year. Most areas are impassable because of a thick cover of woody vegetation.

Typically, the surface layer of the Histosols is black muck about 12 inches thick. Below this is 6 to 60 inches of black to dark reddish brown, very friable to firm muck. The muck is underlain by glacial drift or lacustrine material.

Typically, the surface layer of the Aquolls is black mineral material 10 to 16 inches thick. The subsoil is gray, mottled, firm and friable, loamy material 10 to 40 inches thick. The underlying material is glacial drift that has various textures. In some areas alluvium is deposited along well defined drainageways.

Included with these soils in mapping are small areas that have been drained; a few isolated knobs of somewhat poorly drained, mineral soils; and some areas where the slope is 2 to 6 percent. Also included, directly adjacent to lakes, are areas of floating bogs, which have layers of water, 2 to 18 inches thick, at a depth of 18 to 60 inches. Included areas make up about 10 percent of the map unit.

Permeability ranges from slow to very rapid in the Histosols and Aquolls. The available water capacity is high or very high. Runoff is very slow or ponded. The water table is near or above the surface most of the year. The organic matter content is high or very high in the surface layer.

Most areas are covered with reeds, sedges, and water-tolerant brush. Some are ponded for such long periods that waterlilies are the major plants.

Because of the ponding, these soils are generally unsuited to cultivated crops, forage grasses and legumes, woodland, dwellings, local roads and streets, and septic tank absorption fields. They are best suited to wetland wildlife habitat (fig. 9). They can be used as sites for ponds. Areas adjacent to lakes or large streams cannot be drained.

The land capability classification is VIIIw. No woodland ordination symbol is assigned.

Ho—Homer sandy loam. This nearly level, somewhat poorly drained soil is on outwash plains and terraces that have many swells and swales. Areas are broad and irregularly shaped and are 5 to 300 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 9 inches thick. The subsoil is about 27 inches thick. In sequence downward, it is brown, mottled,

Figure 9.—An area of Histosols and Aquolls, which provide excellent habitat for wetland wildlife.

friable loam; dark brown, mottled, firm sandy clay loam; and dark brown and very dark gray, firm gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown very gravelly coarse sand. In some areas the mottles are deeper in the profile. In a few areas the lower part of the subsoil is loamy sand. In some places the subsoil contains more sand. In other places it is underlain by neutral or slightly acid sand. In some areas the underlying material is stratified, loamy lacustrine sediments. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Kosciusko and very poorly drained Gravelton and Sebewa soils. Kosciusko soils are on low knolls and ridges. Gravelton soils are along streams. Sebewa soils are in depressions and poorly defined drainageways. Included soils make up 15 percent of the map unit.

Permeability is moderate in the subsoil of the Homer soil and very rapid in the underlying material. The available water capacity is moderate. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and early spring. The organic matter content is moderate in the surface layer. Clods form if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay or support a natural cover of mixed hardwoods. Most of the woodlots have been grazed.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. Wetness is the main management concern. Subsurface drains, surface drains, or a combination of these can remove excess water. If the soil is overdrained, however, drought is a hazard. A system of conservation tillage that leaves all or most of the crop residue on the surface improves tilth and helps to maintain the organic matter content. The soil is well suited to fall chiseling and to a till-plant cropping system.

If drained, this soil is well suited to grasses and legumes for hay and pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, timely grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings. Subsurface drains help to lower the water table. The dwellings should be constructed without basements. Installing drainage tile around properly designed footings helps to prevent the damage caused by frost action. The soil is severely limited as a site for local roads and streets because of low strength and frost action. Installing an adequate drainage system along the roads and providing coarse grained subgrade or base material help to prevent the damage caused by low strength and frost action.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and a poor filtering capacity. Perimeter subsurface drains are needed. Adding suitable filtering material improves the capacity of the field to filter the effluent.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Ht—Houghton muck, undrained. This nearly level, very poorly drained soil is in broad depressions on outwash plains and around lakes. It also is in small depressions on uplands. It is frequently ponded by runoff from the higher adjacent soils, by lake overflow, or both. Areas on outwash plains are irregularly shaped or crescent shaped and are 10 to 200 acres in size. Areas in the upland depressions are irregularly shaped or circular and are 5 to 25 acres in size.

Typically, the soil is black muck to a depth of 60 inches. In a few areas it is primarily peaty material. In a few places the slope is more than 2 percent.

Included with this soil in mapping are small areas where the organic material is less than 50 inches thick and is underlain by marl or by sandy and loamy material. Also included are areas of the very poorly drained Wallkill soils. These soils are more silty than the Houghton soil. They are in positions on the landscape similar to those of the Houghton soil, but they dry out sooner in the spring and are less likely to be covered by water for extended periods. Included soils make up about 5 percent of the map unit.

The Houghton soil is moderately rapidly permeable to moderately slowly permeable. The available water capacity is very high. Runoff is very slow or ponded. The water table is near or above the surface most of the year. The organic matter content is very high in the surface layer.

Most areas of this soil are used as wildlife habitat. Some are used as pasture or woodland. Because of the wetness, this soil is generally unsuited to cultivated crops. It is poorly suited to grasses and legumes for hay or pasture because the water table restricts root growth and frost heave is a serious problem. Because of poor stability in the organic material, operating equipment is very difficult and surface pitting is a hazard.

This soil is poorly suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not

isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings, local roads and streets, and septic tank absorption fields.

The land capability classification is Vw. The woodland ordination symbol is 2W.

Hx—Houghton muck, drained. This nearly level, very poorly drained soil is in broad depressions on outwash plains. It also is in small depressions on uplands. Some of the depressions are frequently ponded by runoff from the higher adjacent soils. Areas on outwash plains are irregular in shape and are 10 to 500 acres in size. Areas in the upland depressions are irregularly shaped or circular and are 5 to 25 acres in size.

Typically, the soil is black muck to a depth of 60 inches. The degree of decomposition and the type of organic material vary. In a few areas the soil is primarily peaty material. In a few places the slope is more than 2 percent.

Included with this soil in mapping are small areas where the organic material is less than 50 inches thick and is underlain by marl or by sandy and loamy material. Also included are areas of the very poorly drained Wallkill soils. These soils are more silty than the Houghton soil. Also, they dry out sooner in the spring and are less likely to be ponded during the growing season. They are primarily around the fringes of the depressions. Included soils make up about 10 percent of the map unit.

The Houghton soil is moderately rapidly permeable to moderately slowly permeable. The available water capacity is very high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is very high in the surface layer. This layer is very friable and can be easily tilled.

Most areas of this soil are used for cultivated crops. Some are used for hay and pasture. A few are used for specialty crops, such as mint, onions, carrots, and potatoes.

If drained, this soil is well suited to corn and soybeans. Wetness and soil blowing are the major management concerns. Fire is a hazard when the organic surface layer is dry. Subsurface drains, surface drains, and pumps are used to reduce the wetness. Because of poor stability in the organic material, ditchbanks can cave in and the effectiveness of drainage tile can be impaired. If drained, the organic material subsides. In many areas it may subside so much that the drainage system is no longer adequate. Locating adequate drainage outlets is difficult in some areas. A system of conservation tillage that leaves all or most of the crop residue on the surface, cover crops, and windbreaks help to control soil blowing.

If drained, this soil is fairly well suited to grasses and legumes, such as reed canarygrass and birdsfoot trefoil, for hay and pasture. A cover of pasture plants or hay is effective in controlling soil blowing. In areas used for hay, the use of harvesting equipment is restricted to dry periods because of the poor stability of the muck. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is poorly suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings, local roads and streets, and septic tank absorption fields.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

KoA—Kosciusko sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad outwash plains and on the tops of knolls and ridges on moraines. Areas range from 5 to 300 acres in size on outwash plains and from 5 to 10 acres on moraines. Most are irregularly shaped, but some are oval or elongated.

Typically, the surface layer is dark grayish brown sandy loam about 9 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is yellowish brown, friable sandy loam; brown and reddish brown, firm gravelly sandy clay loam; and dark brown, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified coarse sand and gravelly coarse sand. In some areas the surface layer is darker, contains more gravel, or both. In other areas it is silt loam or loamy sand. In some places the subsoil contains less sand and gravel, is thicker, or both. In other places the slope is more than 2 percent.

Included with this soil in mapping are areas of the well drained Riddles soils. These soils are less gravelly than the Kosciusko soil. They are in landscape positions similar to those of the Kosciusko soil. Also included are areas of the somewhat poorly drained Homer soils in shallow depressions, on toe slopes, and in small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the subsoil of the Kosciusko soil and very rapid in the underlying material.

The available water capacity is low. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture and hay or support a natural cover of mixed hardwoods. Many of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. If irrigated and properly managed, it is well suited to intensive row cropping. Droughtiness is the main management concern. Cover crops, grassed waterways, a cropping sequence that includes grasses and legumes, and a system of conservation tillage that leaves all or most of the crop residue on the surface conserve moisture and help to maintain the organic matter content and tilth. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes. The low available water capacity is the main limitation. Deep-rooted legumes and grasses, such as bromegrass and alfalfa, are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees (fig. 10). Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings with basements. Because of a moderate shrink-swell potential, it is moderately limited as a site for dwellings without basements. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. The sides of shallow excavations can cave in unless they are reinforced.

Because of the shrink-swell potential and frost action, this soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic. An adequate drainage system along the roads helps to prevent the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

KoB—Kosciusko sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on broad outwash plains and on knolls and ridges on moraines. Areas are 5 to 100 acres in size. Most are irregularly shaped, but some are oval or elongated.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsoil is about 31 inches thick. In sequence downward, it is yellowish brown, friable sandy loam; brown and reddish brown, firm gravelly sandy clay loam; and dark brown, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified coarse sand and gravelly coarse sand. In some places the surface layer is darker, contains more gravel, or both. In other places it is silt loam or loamy sand. In some areas the soil is moderately eroded. In other areas the subsoil contains less sand and gravel, is thicker, or both. In some places it contains more sand. In other places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the well drained Riddles soils. These soils are less gravelly than the Kosciusko soil. They are in landscape positions similar to those of the Kosciusko soil. Also included are areas of the somewhat poorly drained Homer soils in shallow depressions, on toe slopes, and in small drainageways. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the subsoil of the Kosciusko soil and very rapid in the underlying material. The available water capacity is low. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture and hay or support a natural cover of mixed hardwoods. Many of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion and droughtiness are the main management concerns. A crop rotation that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to prevent excessive erosion and reduce the runoff rate. Cover crops and a system of conservation tillage that leaves all or part of the crop residue on the surface help to control erosion, minimize crusting, reduce the evaporation rate, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes. A cover of these plants is effective in controlling erosion. The low available water capacity is the main limitation. Deep-rooted grasses and legumes, such as bromegrass and alfalfa, are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting.

Figure 10.—Second growth of mixed hardwoods in an area of Kosciusko sandy loam, 0 to 2 percent slopes.

Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings with basements. Because of a moderate shrink-swell potential, it is moderately limited as a site for dwellings without basements. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. The sides of shallow excavations can cave in unless they are reinforced.

Because of the shrink-swell potential and frost action, this soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic. An adequate

roadside drainage system minimizes the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

KoC—Kosciusko sandy loam, 6 to 12 percent slopes. This moderately sloping, well drained soil is on outwash plains and on knolls and ridges on moraines. Areas are 5 to 50 acres in size. Most are elongated, but some are irregular in shape.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The subsoil is about 28 inches thick. In sequence downward, it is yellowish brown, friable sandy loam; brown and reddish brown, firm gravelly sandy clay loam; and dark brown, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified coarse sand and gravelly coarse sand. In some areas the surface layer is loam or loamy sand or contains more gravel. In other areas the soil is moderately eroded. In some places the subsoil contains less sand and gravel, is thicker, or both. In other places it contains more sand. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the well drained Riddles soils. These soils are less gravelly than the Kosciusko soil. They are in landscape positions similar to those of the Kosciusko soil. Also included are areas of the somewhat poorly drained Homer soils on toe slopes and in small drainageways. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the subsoil of the Kosciusko soil and very rapid in the underlying material. The available water capacity is low. Runoff is rapid. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture and hay or support a natural cover of mixed hardwoods. Many of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion and droughtiness are the main management concerns. A crop rotation that includes grasses and legumes, grassed waterways, and grade stabilization structures help to prevent excessive erosion and reduce the runoff rate. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface conserve moisture, help to control erosion, minimize crusting, increase the rate of water infiltration, and help to maintain the organic matter content.

This soil is well suited to forage grasses and legumes. A cover of these plants is the most effective means of controlling erosion. The low available water capacity and the hazard of erosion are management concerns. Deep-rooted legumes and grasses, such as bromegrass and alfalfa, are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of a moderate shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings without basements. It is moderately limited as a site for dwellings with basements because of the slope. The slope should be modified by land grading, or the buildings should be designed so that they conform to the natural slope of the land. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard on construction sites. It can be controlled by retaining as much of the existing vegetation as possible during construction and by revegetating disturbed areas as soon as possible. The sides of shallow excavations can cave in unless they are reinforced.

This soil is moderately limited as a site for local roads and streets because of the shrink-swell potential, frost action, and the slope. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by shrinking and swelling and by frost action and improves the ability of the roads and streets to support vehicular traffic. Constructing the roads and streets on the contour and land shaping help to overcome the slope.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination. Installing the absorption fields on the contour results in an even distribution of the effluent.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

KoE—Kosciusko sandy loam, 18 to 30 percent slopes. This moderately steep and steep, well drained soil is on side slopes that border deeply incised drainageways on outwash plains. It also is on knolls and ridges on moraines. Areas are 5 to 25 acres in size. Most are elongated, but a few are irregular in shape.

Typically, the surface layer is dark brown sandy loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable sandy loam; the next part is brown and reddish brown, firm sandy clay loam and gravelly sandy clay loam; and the lower part is dark brown, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified sand and gravelly coarse sand. In some areas the surface layer is silt loam, contains more gravel, or both. In other areas the subsoil contains less sand and gravel, is thicker, or both. In some places it contains more sand. In other places the slope is less than 18 or more than 30 percent.

Permeability is moderate in the subsoil and very rapid in the underlying material. The available water capacity is low. Runoff is very rapid. The organic matter content is moderate in the surface layer.

Most areas are used as wildlife habitat, as woodland, or as unimproved pasture. Very few are farmed. Some wooded areas have been grazed. This soil is generally unsuited to corn, soybeans, and small grain. Erosion and the low available water capacity are management concerns.

A cover of grasses and legumes helps to control erosion. This soil is poorly suited to grasses and legumes for hay or pasture. It is better suited to deep-rooted species than to shallow-rooted ones. The low available water capacity and the slope are the main limitations. Operating most types of haying equipment on these slopes is hazardous. Overgrazing or grazing when the soil is too wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The erosion hazard, the equipment limitation, seedling mortality, and plant competition are management concerns. Trees should be planted on the contour. Logging roads and skid trails should be built across the slope. Operating ordinary crawler tractors and rubber-tired skidders can be hazardous on these slopes. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is generally unsuitable as a site for dwellings and is severely limited as a site for local roads and streets. Building the roads and streets on the contour helps to overcome the slope. Cutting and filling are needed. Replacing the layers of the soil that have a moderate shrink-swell potential with suitable soil material and covering the surface with suitable base material improve the ability of the roads and streets to support vehicular traffic. The soil is generally unsuitable as a site for septic tank absorption fields because of a poor filtering capacity and the slope.

The land capability classification is VIe. The woodland ordination symbol is 4R.

KtA—Kosciusko silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on broad outwash plains. Areas are 5 to 300 acres in size. Most are irregularly shaped, but some are oval or elongated.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 30 inches thick. In sequence downward, it is yellowish brown, friable sandy loam; brown and reddish brown, firm gravelly sandy clay loam; and dark brown, very friable gravelly loamy coarse sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified coarse sand and gravelly coarse sand. In some areas the surface layer is darker, contains more gravel, or both. In other areas it is sandy loam or loam. In some places the subsoil contains less sand and gravel, is thicker, or both. In other places the slope is more than 2 percent.

Included with this soil in mapping are areas of the well drained Riddles soils. These soils are less gravelly than the Kosciusko soil. They are in landscape positions similar to those of the Kosciusko soil. Also included are areas of the somewhat poorly drained Homer soils in shallow depressions, on toe slopes, and in small drainageways. Included soils make up about 5 percent of the map unit.

Permeability is moderate in the subsoil of the Kosciusko soil and very rapid in the underlying material. The available water capacity is low. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture, hay, or woodlots.

This soil is fairly well suited to corn, soybeans, and small grain. If irrigated and well managed, it is well suited to intensive row cropping. Droughtiness is the main management concern. A system of conservation tillage that leaves all or most of the crop residue on the surface, cover crops, crop rotations that include grasses and legumes, and grassed waterways conserve moisture and help to maintain the organic matter content and tilth. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes. The low available water capacity is the main limitation. Deep-rooted legumes and grasses, such as bromegrass and alfalfa, are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings with basements. Because of a moderate shrink-swell potential, it is moderately limited as a site for dwellings

without basements. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. The sides of shallow excavations can cave in unless they are reinforced.

Because of the shrink-swell potential and frost action, this soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic. A drainage system along the roads helps to prevent the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

KxC3—Kosciusko sandy clay loam, 8 to 15 percent slopes, severely eroded. This moderately sloping and strongly sloping, well drained soil is on outwash plains and on knolls and ridges on moraines. Areas are 5 to 50 acres in size. Most are elongated, but some are irregular in shape.

Typically, the surface layer is brown sandy clay loam about 6 inches thick. The subsoil is about 24 inches thick. The upper part is brown and reddish brown, firm gravelly sandy clay loam, and the lower part is dark brown, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified coarse sand and gravelly coarse sand. In some areas the surface layer is sandy loam, contains more gravel, or both. In other areas the soil is only moderately eroded. In some places the subsoil contains less sand and gravel, is thicker, or both. In other places it contains more sand. In some areas the slope is less than 8 or more than 15 percent.

Included with this soil in mapping are areas of the somewhat poorly drained Homer soils on toe slopes and in small drainageways. These soils make up about 10 percent of the map unit.

Permeability is moderate in the subsoil of the Kosciusko soil and very rapid in the underlying material. The available water capacity is low. Runoff is rapid. The organic matter content is low in the surface layer. Plowing this layer is difficult. Clods form if the soil is tilled when it is too wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for pasture and hay. Some have reverted to brushy woodland and are used as wildlife habitat.

This soil is poorly suited to corn, soybeans, and small grain. Erosion and droughtiness are the main management concerns. A crop rotation that includes grasses and legumes, grassed waterways, and grade stabilization structures help to prevent excessive erosion and runoff. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface conserve moisture, help to control erosion, minimize crusting, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to no-till and till-plant cropping systems. A crop rotation that is dominated by forage grasses and legumes is the most effective means of controlling runoff and erosion.

This soil is fairly well suited to forage grasses and legumes. The low available water capacity and the slope are management concerns. Deep-rooted legumes and grasses are the best suited forage species. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of a moderate shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings without basements. It is moderately limited as a site for dwellings with basements because of the slope. The slope should be modified by land grading, or the buildings should be designed so that they conform to the natural slope of the land. Properly designing foundations and footings helps to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard on construction sites. It can be controlled by retaining as much of the existing vegetation as possible during construction and by revegetating disturbed areas as soon as possible. The sides of shallow excavations can cave in unless they are reinforced.

This soil is moderately limited as a site for local roads and streets because of the shrink-swell potential, frost action, and the slope. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by shrinking and swelling and by frost action and improves the ability of the roads and streets to support vehicular traffic. Constructing the roads and streets on the contour and land shaping help to overcome the slope.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger

of contamination. Installing the absorption fields on the contour results in an even distribution of the effluent.

The land capability classification is IVe. The woodland ordination symbol is 4S.

MaA—Martinsville sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on smooth benches along the edges of outwash plains and terraces and on knolls and ridgetops on moraines. Areas are irregular in shape and are 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 9 inches thick. The subsoil is about 41 inches thick. In sequence downward, it is brown, friable sandy loam; dark yellowish brown, friable sandy clay loam; brown, firm sandy clay loam; and yellowish brown, friable loam and sandy loam. The underlying material to a depth of 60 inches is yellowish brown, stratified silt loam, sandy loam, and loamy sand. In some areas the surface layer is darker, has a gravel content of more than 10 percent, or both. In other areas the soil contains more sand and gravel in the subsoil and underlying material, is less than 40 inches deep to stratified material, or both. In some places it is underlain by till. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Whitaker soils in shallow depressions, on toe slopes, and in small drainageways. These soils make up about 10 percent of the map unit.

Permeability is moderate in the Martinsville soil. The available water capacity is high. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture and hay. Only a few are used as woodlots. Some of the woodlots have been grazed.

This soil is well suited to corn, soybeans, and small grain. It can be intensively row cropped. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface conserve moisture, minimize crusting, improve tilth, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings with basements and for septic tank absorption fields. It is moderately limited as a site for dwellings without basements because of the shrink-swell potential. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Because of frost action and the shrink-swell potential, the soil is moderately limited as a site for local roads and streets. Providing an adequate drainage system along the roads reduces the potential for frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

The land capability classification is I. The woodland ordination symbol is 4A.

MaB—Martinsville sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex benches along the edges of outwash plains and terraces and on knolls and ridgetops on moraines (fig. 11). Areas are elongated or irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is brown, friable sandy loam; dark yellowish brown, friable sandy clay loam; brown, firm sandy clay loam; and yellowish brown, friable loam and sandy loam. The underlying material to a depth of 60 inches is yellowish brown, stratified silt loam, sandy loam, and loamy sand. In some areas the surface layer is darker, has a gravel content of more than 10 percent, or both. In other areas the soil is moderately eroded. In some places it contains more sand and gravel in the subsoil and underlying material, is less than 40 inches deep to stratified material, or both. In other places it is underlain by till. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the somewhat poorly drained Whitaker soils in shallow depressions, on toe slopes, and in small drainageways. Also included are areas of the well drained Riddles soils. These soils are more gravelly than the Martinsville soil. They are in landscape positions similar to those of the Martinsville soil. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Martinsville soil. The available water capacity is high. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture and hay. Only a few are used as woodlots. Some of the woodlots have been grazed.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. A crop rotation that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to control erosion and runoff. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface conserve moisture, help

Figure 11.—An area of Martinsville sandy loam, 2 to 6 percent slopes, on the convex bench in the foreground. Rensselaer and Whitaker soils are in the background.

to control erosion, minimize crusting, improve tilth, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings with basements and for septic tank absorption fields. It is moderately limited as a site for dwellings without basements because of the shrink-swell potential. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Because of the shrink-swell potential, the soil is moderately limited as a site for local roads and streets. Providing an adequate drainage system along the roads reduces the potential for frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

The land capability classification is IIe. The woodland ordination symbol is 4A.

MaC—Martinsville sandy loam, 6 to 12 percent slopes. This moderately sloping, well drained soil is on convex benches along the edges of outwash plains and terraces and on knolls and the sides of ridges on moraines. Areas are elongated or irregularly shaped and are 5 to 20 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 8 inches thick. The subsoil is about 38 inches thick. In sequence downward, it is brown, friable sandy loam; dark yellowish brown, friable sandy clay loam; brown, firm sandy clay loam; and yellowish brown, friable loam and sandy loam. The underlying material to a depth of 60 inches is yellowish brown, stratified silt loam, sandy loam, and loamy sand. In some areas the content of gravel in the surface layer is more than 10 percent. In other areas the soil is moderately eroded. In some places it contains more sand and gravel in the subsoil and underlying material, is less than 40 inches deep to the underlying material, or is underlain by till. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the somewhat poorly drained Whitaker soils on toe slopes and in small drainageways. Also included are areas of the well drained Riddles and Morley soils in landscape positions similar to those of the Martinsville soil. Riddles soils are more gravelly than the Martinsville soil, and Morley soils are more clayey. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Martinsville soil. The available water capacity is high. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the main management concern. A crop rotation that includes grasses and legumes, diversions, grassed waterways, and grade stabilization structures help to control erosion and runoff. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface conserve moisture, help to control erosion, minimize crusting, improve tilth, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope and the shrink-swell potential, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard on construction sites. It can be controlled by disturbing the existing vegetation as little as possible during construction and by revegetating the disturbed areas as soon as possible.

Because of the slope, frost action, and the shrink-swell potential, this soil is moderately limited as a site for local roads and streets. Constructing the roads and streets on the contour and land shaping help to overcome the slope. Adequate roadside ditches help to prevent the damage caused by frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

This soil is moderately limited as a site for septic tank absorption fields because of the slope. Installing the absorption field on the contour helps to overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

MbA—Metea loamy sand, 0 to 2 percent slopes. This nearly level, well drained soil is on benches and on the tops of knolls and ridges on till plains and moraines. Areas are 5 to 20 acres in size. Most are irregular in shape, but some are circular or oval.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 24 inches thick. The subsoil is about 22 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is yellowish brown, mottled, firm clay loam. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In some places the surface layer is sandy loam. In other places the sandy part of the soil is less than 20 or more than 40 inches thick. In some areas the lower part of the subsoil is redder. In other areas the lower part of the subsoil and the underlying material have pockets or strata of sand and gravel. In some places, the lower part of the subsoil is sandy clay loam and the underlying material is sandy loam. In other places the slope is more than 2 percent.

Included with this soil in mapping are areas of the well drained Riddles and Wawasee soils. These soils are in landscape positions similar to those of the Metea soil. They are less sandy than the Metea soil. Also included are areas of the somewhat poorly drained Aubbeenaubbee soils in shallow depressions, on toe slopes, and in small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is rapid in the upper part of the Metea soil and moderate in the lower part. The available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The moderate available water capacity and soil blowing are management concerns. A crop rotation that includes grasses and legumes and a system of conservation tillage that leaves all or most of the crop residue on the surface help to prevent excessive soil loss. The soil is well suited to no-till and till-plant cropping systems. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. The moderate available water capacity is a limitation when a stand is becoming established. Deep-rooted legumes and grasses are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. Because of frost action, the soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material and providing adequate roadside ditches help to prevent the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately permeable material underlying the sandy surface soil, however, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

MbB—Metea loamy sand, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex benches and the sides of knolls and ridges on till plains and moraines. Areas are 5 to 25 acres in size. Most are irregular in shape, but some are circular or oval.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 22 inches thick. The subsoil is about 18 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is yellowish brown, mottled, firm clay loam. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In some places the surface layer is sandy loam. In other places the sandy part of the soil is less than 20 or more than 40 inches thick. In some areas the lower part of the subsoil is redder. In other areas the lower part of the subsoil and the underlying material have pockets or strata of sand and gravel. In some places, the lower part of the subsoil is sandy clay loam and the underlying material is sandy loam. In other places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the well drained Riddles and Wawasee soils. These soils are in landscape positions similar to those of the Metea soil. They are less sandy than the Metea soil. Also included are areas of the somewhat poorly drained Aubbeenaubbee soils in shallow depressions, on toe slopes, and in small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is rapid in the upper part of the Metea soil and moderate in the lower part. The available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major management concern. Also, drought is a moderate hazard, and the soil is susceptible to soil blowing. Windblown sand grains can damage seedlings. A crop rotation that includes grasses and legumes, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control soil blowing, reduce the evaporation rate, and increase the rate of water infiltration. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. The moderate available water capacity and the hazard of erosion are management concerns. Deep-rooted legumes and grasses are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. Because of frost action, the soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material and providing adequate roadside ditches help to prevent the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately

permeable material underlying the sandy surface soil, however, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MbC—Metea loamy sand, 6 to 12 percent slopes. This moderately sloping, well drained soil is on convex benches and the sides of knolls and ridges on till plains and moraines. Areas are 5 to 15 acres in size. They generally are irregular in shape, but some are circular or crescent shaped.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsurface layer is yellowish brown, very friable loamy sand about 22 inches thick. The subsoil is about 16 inches thick. The upper part is dark yellowish brown, friable sandy loam, and the lower part is yellowish brown, mottled, firm clay loam. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In some places the surface layer is sandy loam. In other places the sandy part of the soil is less than 20 or more than 40 inches thick. In some areas the lower part of the subsoil is redder. In other areas the lower part of the subsoil and the underlying material have pockets or strata of sand and gravel. In some places, the lower part of the subsoil is sandy clay loam and the underlying material is sandy loam. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the well drained Riddles and Wawasee soils. These soils are in landscape positions similar to those of the Metea soil. They are less sandy than the Metea soil. Also included are areas of the somewhat poorly drained Aubbeenaubbee soils in depressions, on toe slopes, and in small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is rapid in the upper part of the Metea soil and moderate in the lower part. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major management concern. Also, drought is a moderate hazard, and the soil is susceptible to soil blowing. Windblown sand grains can damage seedlings. A crop rotation that includes grasses and legumes, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control soil blowing, reduce the evaporation rate, and increase the rate of water infiltration. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is a hazard. The moderate available water capacity is a limitation when a stand is becoming established. Deep-rooted legumes and grasses are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by disturbing the existing vegetation as little as possible during construction and by revegetating the disturbed areas as soon as possible. The sides of shallow excavations can cave in unless they are reinforced.

Because of the slope and frost action, this soil is moderately limited as a site for local roads and streets. Building the roads on the contour and cutting and filling help to overcome the slope. Providing adequate roadside ditches and culverts and strengthening or replacing the base material help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of a poor filtering capacity. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately permeable material underlying the sandy surface soil, however, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MeA—Metea loamy fine sand, moderately slowly permeable, 0 to 2 percent slopes. This nearly level, well drained soil is on benches and the tops of knolls and ridges on till plains and moraines. Areas are 5 to 10 acres in size. Most are irregular in shape, but many are circular.

Typically, the surface layer is dark grayish brown loamy fine sand about 10 inches thick. The subsurface layer is about 20 inches of dark yellowish brown and yellowish brown, loose loamy sand and sand. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, firm sandy loam, and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 60 inches is brown loam. In some places the surface layer is sandy loam. In other places the sandy part of the soil is less than 20 or more than 40 inches thick. In some areas the lower part of the subsoil is redder. In other areas the lower part of the subsoil or the underlying material has pockets or thin strata of sand and gravel. In some places the underlying

material is clay loam. In other places the slope is more than 2 percent.

Included with this soil in mapping are areas of the well drained Miami and Riddles soils. These soils are in landscape positions similar to those of the Metea soil. They are less sandy than the Metea soil. Also included are areas of the somewhat poorly drained Aubbeenaubbee soils in shallow depressions, on toe slopes, and in small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots.

This soil is fairly well suited to corn, soybeans, and small grain. The moderate available water capacity and the hazard of soil blowing are management concerns. A crop rotation that includes grasses and legumes and a system of conservation tillage that leaves all or most of the crop residue on the surface help to prevent excessive soil loss. The soil is well suited to no-till and till-plant cropping systems. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. The moderate available water capacity is a limitation when a stand is becoming established. Deep-rooted legumes and grasses are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. Because of frost action, the soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material and providing an adequate roadside drainage system help to prevent the damage caused by frost action.

Because of the moderately slow permeability in the lower part of the profile and a poor filtering capacity in the upper part, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field helps to compensate for the moderately slow permeability. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately slowly permeable material underlying the sandy surface soil, however, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

MeB—Metea loamy fine sand, moderately slowly permeable, 2 to 6 percent slopes. This gently sloping, well drained soil is on convex benches and the sides of knolls and ridges on till plains and moraines. Areas are 5 to 25 acres in size. Most are irregular in shape, but some are circular.

Typically, the surface layer is dark grayish brown loamy fine sand about 9 inches thick. The subsurface layer is about 20 inches of dark yellowish brown and yellowish brown, loose loamy sand and sand. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, firm sandy loam, and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 60 inches is brown loam. In some areas the surface layer is sandy loam. In other areas the sandy part of the soil is less than 20 or more than 40 inches thick. In some places the lower part of the subsoil is redder. In other places pockets or strata of sand and gravel are in the lower part of the subsoil or in the underlying material. In some areas the underlying material is clay loam. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the well drained Miami and Riddles soils. These soils are in landscape positions similar to those of the Metea soil. They are less sandy than the Metea soil. Also included are areas of the somewhat poorly drained Aubbeenaubbee soils in shallow depressions, on toe slopes, and in small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Runoff is slow. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major management concern. Also, drought is a moderate hazard, and the soil is susceptible to soil blowing. A crop rotation that includes grasses and legumes, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control soil blowing, reduce the evaporation rate, and increase the rate of water infiltration. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. The

moderate available water capacity is a limitation when a stand is becoming established. Deep-rooted legumes and grasses are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. Because of frost action, the soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material and providing an adequate roadside drainage system help to prevent the damage caused by frost action.

Because of the moderately slow permeability in the lower part of the profile and a poor filtering capacity in the upper part, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption field helps to compensate for the moderately slow permeability. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately slowly permeable material underlying the sandy surface soil, however, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MeC—Metea loamy fine sand, moderately slowly permeable, 6 to 12 percent slopes. This moderately sloping, well drained soil is on convex benches and the sides of knolls and ridges on till plains and moraines. Areas are 5 to 15 acres in size. Most are irregular in shape, but many are circular or crescent shaped.

Typically, the surface layer is brown loamy fine sand about 8 inches thick. The subsurface layer is about 18 inches of dark yellowish brown and yellowish brown, loose loamy sand and sand. The subsoil is about 20 inches thick. The upper part is dark yellowish brown, firm sandy loam, and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 60 inches is brown loam. In some places the surface layer is sandy loam. In other places the sandy part of the soil is less than 20 or more than 40 inches thick. In some areas the lower part of the subsoil is redder. In other areas pockets or strata of sand and gravel are in the lower part of the subsoil or in the underlying material. In some places the underlying material is clay loam. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the well drained Miami and Riddles soils. These soils are in landscape positions similar to those of the Metea soil. They are less sandy than the Metea soil. Also included are areas of the somewhat poorly drained Aubbeenaubbee soils on toe slopes and in small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major management concern. Also, drought is a moderate hazard, and the soil is susceptible to soil blowing. Windblown sand grains often damage seedlings. A crop rotation that includes grasses and legumes, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control soil blowing, reduce the evaporation rate, and increase the rate of water infiltration. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is a hazard. The moderate available water capacity is a limitation when a stand is becoming established. Deep-rooted legumes and grasses are the best suited forage species. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by retaining as much of the existing vegetation as possible during construction and by revegetating disturbed areas as soon as possible. The sides of shallow excavations can cave in unless they are reinforced.

Because of the slope and frost action, this soil is moderately limited as a site for local roads and streets. Building the roads on the contour and cutting and filling help to overcome the slope. Strengthening or replacing the base with better suited material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability in the lower part of the profile and a poor filtering capacity in the upper part. Enlarging the absorption field helps to compensate for the moderately slow permeability. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately slowly permeable material underlying the sandy surface soil, however, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IIIe. The woodland ordination symbol is 4S.

MIB—Miami loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on broad till plains and moraines. Areas are 5 to 200 acres in size. Most are irregular in shape.

Typically, the surface layer is brown loam about 8 inches thick. The subsoil is dark brown and dark yellowish brown, friable and firm clay loam about 28 inches thick. The underlying material to a depth of 60 inches is yellowish brown and brown loam. In some areas the surface layer is sandy loam or sandy clay loam and has a gravel content of as much as 15 percent. In other areas the soil has a thick surface layer of loamy sand. In some places the subsoil has layers of sandy clay loam, sandy loam, or both. In other places it has a clay content of more than 35 percent. In some areas the depth to the underlying till is more than 40 inches. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils in shallow depressions and small drainageways. Also included are small areas where the soil is severely eroded. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the subsoil of the Miami soil and moderately slow in the underlying till. The available water capacity is high. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Many of the woodlots have been grazed.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main management concern. If cultivated crops are grown, measures that control erosion and runoff are needed. Examples are a crop rotation that includes grasses and legumes, cover crops, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures. A system of conservation tillage that leaves all or most of the crop residue on the surface improves or helps to maintain tilth and the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drainage tile help to prevent the structural damage caused by shrinking and swelling. Because of frost action and the shrink-swell potential, the soil is moderately limited as a site for local roads and streets. Installing an adequate roadside drainage system and replacing or covering the upper soil layers with suitable base material help to prevent the damage caused by frost action and by shrinking and swelling.

Because of the moderately slow permeability, this soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area and providing suitable fill material improve the ability of the field to absorb the effluent.

The land capability classification is IIe. The woodland ordination symbol is 5A.

MIC—Miami loam, 6 to 12 percent slopes. This moderately sloping, well drained soil is on broad till plains and moraines and on side slopes along drainageways. Areas are 5 to 35 acres in size. Most are long and narrow or are irregular in shape.

Typically, the surface layer is brown loam about 7 inches thick. The subsoil is dark brown and dark yellowish brown, friable and firm clay loam about 26 inches thick. The underlying material to a depth of 60 inches is yellowish brown and brown loam. In some areas the surface layer is sandy loam or sandy clay loam and has a gravel content of as much as 15 percent. In other areas the soil has a thick surface layer of loamy sand. In some small areas it is moderately eroded. In some places the subsoil has layers of sandy clay loam, sandy loam, or both. In other places it has a clay content of more than 35 percent. In some places the depth to the underlying till is more than 40 inches. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils in shallow depressions and small drainageways. Also included are areas where the soil is severely eroded. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the subsoil of the Miami soil and moderately slow in the underlying till. The available water capacity is high. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the main management concern. A crop rotation that includes grasses and legumes, cover crops, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures help to control erosion and runoff. A system of conservation tillage that leaves all or most of the crop residue on the surface helps to control erosion and improves or helps to maintain tilth and the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope and the shrink-swell potential, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drains help to prevent the structural damage caused by shrinking and swelling.

Because of the slope, frost action, and the shrink-swell potential, this soil is moderately limited as a site for local roads and streets. Cutting and filling and building the roads on the contour help to overcome the slope. Installing an adequate roadside drainage system and replacing or covering the upper soil layers with suitable base material help to prevent the damage caused by shrinking and swelling and by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. Enlarging the absorption area improves the ability of the field to absorb the effluent.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

MrC3—Miami clay loam, 6 to 12 percent slopes, severely eroded. This sloping, well drained soil is on broad till plains and moraines and on side slopes along drainageways. Areas are 5 to 35 acres in size. Most are long and narrow or are irregular in shape.

Typically, the surface layer is dark brown clay loam about 6 inches thick. In most areas, nearly all of the original darkened surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. The subsoil is dark yellowish brown clay loam about 24 inches thick. The upper part is friable, and the lower part is firm. The underlying material to a depth of 60 inches is yellowish brown and brown loam. In some areas the surface layer is loam or sandy loam and has a gravel content of as much as 15 percent. In other areas the soil has a thick surface layer of loamy sand. In some places it is only moderately eroded. In other places the subsoil has layers of sandy clay loam, sandy loam, or both. In some areas the depth to the underlying till is more than 40 inches. In other areas the soil is calcareous within a depth of 26 inches. In some places the underlying material is stratified with sandy and silty material. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils in shallow depressions and small drainageways. These soils make up about 5 percent of the map unit.

Permeability is moderate in the subsoil of the Miami soil and moderately slow in the underlying till. The available water capacity is high. Runoff is rapid. The organic matter content is low in the surface layer. Plowing this layer is difficult. Clods form if the soil is tilled when it is too wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for hay and pasture. A few are used as woodland.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. A crop rotation that is dominated by grasses and legumes is the most effective means of controlling runoff and erosion. Cover crops, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures also help to prevent excessive soil loss. A system of conservation tillage that leaves all or most of the crop residue on the surface helps to control erosion and improves or maintains tilth and the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope and the shrink-swell potential, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drainage tile help to prevent the structural damage caused by shrinking and swelling.

Because of the slope, frost action, and the shrink-swell potential, this soil is moderately limited as a site for local roads and streets. Cutting and filling and building the roads on the contour help to overcome the slope. Installing an adequate roadside drainage system and replacing or covering the upper soil layers with suitable base material help to prevent the damage caused by shrinking and swelling and by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. Enlarging the absorption area improves the ability of the field to absorb the effluent.

The land capability classification is IVe. The woodland ordination symbol is 5A.

MrD3—Miami clay loam, 12 to 18 percent slopes, severely eroded. This strongly sloping, well drained soil is on side slopes along deeply incised drainageways on till plains and moraines. Areas are irregularly shaped or are elongated. They are 5 to 25 acres in size.

Typically, the surface layer is dark brown clay loam about 6 inches thick. In most areas, nearly all of the original darkened surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 24 inches thick. In sequence downward, it is dark brown, firm clay loam; dark brown, friable clay loam; and dark yellowish brown, firm loam. The underlying material to a depth of 60 inches is yellowish brown and brown loam. In some areas the surface layer is loam or sandy loam and has a gravel content of as much as 15 percent. In other areas the soil has a thick surface layer of loamy sand. In some places it is only moderately eroded. In other places the subsoil has layers of sandy clay loam, sandy loam, or both. In some areas it has a clay content of more than 35 percent. In other areas the depth to the underlying till is more than 40 inches. In some places the soil is calcareous within a depth of 26 inches. In other places the underlying material is stratified with sandy and silty material. In some areas the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils in small drainageways. These soils make up about 2 percent of the map unit.

Permeability is moderate in the subsoil of the Miami soil and moderately slow in the underlying till. The available water capacity is high. Runoff is very rapid. The organic matter content is low in the surface layer.

Most areas of this soil are used for forage grasses and legumes. Some are used for cultivated crops. A few have reverted to brushy woodland and are used as wildlife habitat.

This soil is generally unsuited to corn, soybeans, and small grain. Erosion is the major hazard. Some areas have gullies that cannot be easily crossed by farm machinery.

This soil is poorly suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is a severe hazard. Operating some types of haying equipment is hazardous on these slopes. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is severely limited as a site for dwellings and for local roads and streets. The buildings should be designed so that they conform to the natural slope of the land. The roads and streets should be built on the contour. Cutting and filling are needed. Because of the slope and the moderately slow permeability, the soil is severely limited as a site for septic tank absorption fields. Enlarging the absorption area improves the ability of the field to absorb the effluent. The distribution lines should be installed across the slope.

The land capability classification is VIe. The woodland ordination symbol is 5A.

MsB—Miami-Owosso-Metea complex, 2 to 8 percent slopes. These gently sloping and moderately sloping, well drained soils are on moraines. The Miami soil is on ridgetops and on the highest knobs on the landscape. The Owosso soil is on the lower ridges and on north- and west-facing side slopes. The Metea soil is on south- and east-facing side slopes and on the less prominent ridges and foot slopes. Areas are irregular in shape and are 10 to more than 150 acres in size. They are about 40 percent Miami soil, 25 percent Owosso soil, and 20 percent Metea soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Miami soil is brown loam about 8 inches thick. The subsoil is dark brown and dark yellowish brown, friable and firm clay loam about 30 inches thick. The underlying material to a depth of 60 inches is yellowish brown and brown loam. In some areas the surface layer is sandy loam or loamy sand. In

other areas it is darker. In some places the soil is moderately eroded. In other places the subsoil, the underlying material, or both have layers of sandy clay loam or contain more gravel. In some areas the depth to the underlying till is more than 40 inches. In other areas the underlying material is stratified with silt loam, loamy sand, or sandy loam. In places the slope is less than 2 or more than 8 percent.

Typically, the surface layer of the Owosso soil is dark grayish brown sandy loam about 9 inches thick. The subsoil is about 35 inches thick. In sequence downward, it is brown, friable sandy loam; brown, firm loam; and yellowish brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some places the surface layer is loam, contains more gravel, or both. In other places the soil has a thick, sandy surface layer. In some areas it is moderately eroded. In a few areas the depth to the underlying material is less than 30 inches. In some places the subsoil is sandy clay loam, contains more gravel, or both. In other places the lower part of the subsoil has mottles with low chroma. In some areas the underlying material is silty clay or loam. In other areas the slope is less than 2 or more than 8 percent.

Typically, the surface layer of the Metea soil is dark grayish brown loamy fine sand about 9 inches thick. The subsurface layer is about 23 inches of dark yellowish brown and yellowish brown, loose loamy sand and sand. The subsoil is about 18 inches thick. The upper part is dark yellowish brown, firm sandy loam, and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some areas the surface layer is sandy loam. In other areas the sandy part of the soil is less than 20 or more than 40 inches thick. In some places the soil is moderately eroded. In other places the subsoil and the underlying material are loam or silty clay loam. In some areas the lower part of the subsoil is redder. In other areas the underlying material has pockets or strata of sand and gravel. In places the slope is less than 2 or more than 8 percent.

Included with these soils in mapping are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils in swales, on toe slopes, and in small drainageways. Also included are areas where the soil is severely eroded. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the upper part of the Miami soil and moderately slow in the lower part. It is moderately rapid in the upper part of the Owosso soil and moderately slow in the lower part. It is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is high in the Miami and Owosso soils and moderate in the Metea soil. Runoff is medium on the Miami and Owosso soils and slow on the Metea soil. The organic matter content is moderate in the surface layer of all three soils. This layer can be easily tilled throughout a wide range in moisture content.

Most areas of these soils are used for cultivated crops. Some that are in the Tri-County Fish and Wildlife Area are used as wildlife habitat or are occasionally farmed. Some areas are used for hay or pasture. A few support a natural cover of mixed hardwoods.

These soils are well suited to corn, soybeans, and small grain. Erosion is the major hazard. A drainage system is needed in some of the included depressional areas. Cover crops, a system of conservation tillage that leaves all or most of the crop residue on the surface, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures help to control erosion. The soil is well suited to no-till and till-plant cropping systems. A crop rotation that is dominated by grasses or legumes is the most effective means of controlling runoff and erosion.

These soils are well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is a hazard. Overgrazing or grazing when the soils are wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are well suited to trees. The main management concerns are seedling mortality and plant competition. Replanting of seedlings is sometimes necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the shrink-swell potential, the Miami soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drainage tile help to prevent the structural damage caused by shrinking and swelling. The Owosso and Metea soils are suitable as sites for dwellings.

Because of frost action, the Miami and Metea soils are moderately limited as sites for local roads and streets. Also, the Miami soil is moderately limited because of the shrink-swell potential, and the Owosso soil is severely limited because of low strength. Adequate roadside ditches and culverts help to prevent the damage caused by frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

These soils are severely limited as sites for septic tank absorption fields because of the moderately slow permeability. Enlarging the absorption area improves the ability of the field to absorb the effluent. The Metea soil has a poor filtering capacity, which can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately slowly permeable material underlying the sandy surface soil, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IIe. The woodland ordination symbol assigned to the Miami soil is 5A, that assigned to the Owosso soil is 4A, and that assigned to the Metea soil is 4S.

MsD—Miami-Owosso-Metea complex, 10 to 25 percent slopes. These moderately sloping to moderately steep, well drained soils are on moraines. The Miami soil is on ridgetops and on the highest knobs on the landscape. The Owosso soil is on the lower ridges and on north- and west-facing side slopes. The Metea soil is on south- and east-facing side slopes and on the less prominent ridges and foot slopes. Areas are irregularly shaped or elongated and are 10 to more than 300 acres in size. They are about 40 percent Miami soil, 25 percent Owosso soil, and 20 percent Metea soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Miami soil is brown loam about 6 inches thick. The subsoil is dark yellowish brown and dark brown, friable and firm clay loam about 28 inches thick. The underlying material to a depth of 60 inches is yellowish brown and brown loam. In some areas the surface layer is sandy loam or loamy sand. In other areas it is darker. In some places the soil is moderately eroded. In other places the subsoil, the underlying material, or both have layers of sandy clay loam or contain more gravel. In some areas the depth to the underlying till is more than 40 inches. In other areas the underlying material is stratified with silt loam, loamy sand, or sandy loam. In places the slope is less than 10 or more than 25 percent.

Typically, the surface layer of the Owosso soil is dark grayish brown sandy loam about 7 inches thick. The subsoil is about 27 inches thick. In sequence downward, it is brown, friable sandy loam; brown, firm loam; and yellowish brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some places the surface layer is loam, contains more gravel, or both. In other places the soil has a thick, sandy surface layer. In some areas it is moderately eroded. In a few areas the depth to the underlying material is less than 30 inches. In places the subsoil is sandy clay loam, contains more gravel, or both. In a few areas the lower part of the subsoil has mottles with low chroma. In some places the underlying material is silty clay or loam. In other places the slope is less than 10 or more than 25 percent.

Typically, the surface layer of the Metea soil is dark grayish brown loamy fine sand about 8 inches thick. The subsurface layer is about 18 inches of dark yellowish brown and yellowish brown, loose loamy sand and sand. The subsoil is about 38 inches thick. The upper part is dark yellowish brown, firm sandy loam, and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some places the surface layer is sandy loam. In other places the sandy part of the soil is less than 20 or more than 40 inches thick. On about 20 percent of the acreage, the soil is moderately eroded. In some areas the subsoil and the underlying material are loam or silty clay loam. In other areas the lower part of the subsoil is redder. In some places pockets or strata of sand and gravel are in the underlying material. In other places the slope is less than 10 or more than 25 percent.

Included with these soils in mapping are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils in swales, on toe slopes, and in small drainageways. Also included are some areas where the soil is severely eroded. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the upper part of the Miami soil and moderately slow in the lower part. It is moderately rapid in the upper part of the Owosso soil and moderately slow in the lower part. It is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is high in the Miami and Owosso soils and moderate in the Metea soil. Runoff is rapid on Miami and Owosso soils and medium on the Metea soil. The organic matter content is moderate in the surface layer of all three soils. This layer can be easily tilled throughout a wide range in moisture content.

Many areas of these soils support a natural cover of mixed hardwoods. Some that have a slope of less than 15 percent are used for cultivated crops. Areas in the Tri-County Fish and Wildlife Area are used as wildlife habitat or are occasionally farmed. Some cleared areas are used for hay or pasture.

These soils are poorly suited to corn, soybeans, and small grain. Erosion is the major hazard. Because of the slope, operating some types of farm machinery is hazardous. Cover crops, a system of conservation tillage that leaves all or most of the crop residue on the surface, diversions, terraces, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. A crop rotation that is dominated by grasses or legumes is the most effective means of controlling runoff and erosion.

These soils are fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is a severe hazard. Operating some types of haying equipment is hazardous on these slopes. Overgrazing or grazing when the soils are wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

These soils are fairly well suited to trees. Seedling mortality, plant competition, the erosion hazard, and the equipment limitation are management concerns. Replanting of seedlings is sometimes necessary. Seedlings survive and grow well if competing vegetation

is controlled by cutting, spraying, or girdling. The type of equipment that can be used on these slopes is limited. The trees should be planted on the contour.

Because of the slope, these soils are severely limited as sites for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Land shaping and retaining walls may be needed. Erosion is a hazard on construction sites. It can be controlled by retaining as much of the existing vegetation as possible during construction and by revegetating disturbed areas as soon as possible.

Because of the slope, these soils are severely limited as sites for local roads and streets. The steeper areas are unsuitable for this use. Cutting and filling and building the roads on the contour help to overcome the slope. Road culverts should be installed at strategic locations.

These soils are severely limited as sites for septic tank absorption fields because of the slope and the moderately slow permeability. The steeper areas are unsuited to this use. Enlarging the absorption area improves the ability of the field to absorb the effluent. Installing the distribution lines on the contour helps to overcome the slope. The Metea soil has a poor filtering capacity, which can result in the pollution of ground water. Because of the common practice of installing deep wells and the moderately slowly permeable material underlying the sandy surface soil, the risk of contamination by septic tank effluent is minimal.

The land capability classification is IVe. The woodland ordination symbol assigned to the Miami soil is 5A, that assigned to the Owosso soil is 4A, and that assigned to the Metea soil is 4R.

MvC—Morley loam, 6 to 12 percent slopes. This moderately sloping, well drained soil is on broad uplands and on side slopes along drainageways on till plains and moraines. Areas are 5 to 20 acres in size. Most are irregularly shaped, but some are elongated.

Typically, the surface layer is dark grayish brown loam about 7 inches thick. The subsoil is about 27 inches thick. The upper part is yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown and brown, firm clay and clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some areas the surface layer is sandy loam and contains more gravel. In a few areas the soil has a thick surface layer of loamy sand. In some places it is moderately eroded. In other places the subsoil has thin layers of sandy clay loam or silt loam. In a few areas the depth to the underlying material is less than 24 inches. In places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the well drained Martinsville soils and a few severely eroded areas. Martinsville soils are less clayey than the Morley soil. They are in landscape positions similar to those of the Morley soil. Also included, along the major drainageways, are some areas of soils that are underlain by sand and gravelly coarse sand. Included soils make up about 15 percent of the map unit.

Permeability is moderately slow in the Morley soil. The available water capacity is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is friable and can be tilled throughout a fairly wide range in moisture content, but it tends to crust after heavy rains, especially in plowed areas where it contains subsoil material.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture or are wooded. Many of the wooded areas are grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the main hazard. It can be controlled by a crop rotation that includes grasses and legumes and by water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures. A system of conservation tillage that leaves all or most of the crop residue on the surface helps to control erosion and improves or maintains tilth and the organic matter content. In seepy areas in some waterways and swales, a subsurface drainage system is needed.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by retaining as much of the existing vegetation as possible during construction and by revegetating disturbed areas as soon as possible.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. Enlarging the absorption area and providing suitable fill material improve the ability of the field to absorb the effluent.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

MxC3—Morley silty clay loam, 5 to 15 percent slopes, severely eroded. This gently sloping to strongly sloping, well drained soil is on broad uplands and on side slopes along drainageways on till plains and moraines. Areas are 5 to 100 acres in size. Most are irregularly shaped, but some are elongated.

Typically, the surface layer is dark yellowish brown silty clay loam about 7 inches thick. In most areas, nearly all of the original darkened surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 21 inches thick. The upper part is dark yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some areas the surface layer is silt loam or loam. In other areas it contains more gravel. In some places the soil is less eroded. In other places the subsoil has thin layers of sandy clay loam or silt loam. In a few places the solum is less than 20 inches thick. In a few areas the lower part of the subsoil has faint mottles. In some areas the slope is less than 5 or more than 15 percent.

Included with this soil in mapping are areas of the well drained Martinsville soils. These soils are less clayey than the Morley soil. They are on the slightly lower slopes. Also included, along the major drainageways, are some areas of soils that are underlain by sand and gravelly coarse sand. Included soils make up about 10 percent of the map unit.

Permeability is moderately slow in the Morley soil. The available water capacity is moderate. Runoff is rapid. The organic matter content is moderate in the surface layer. Plowing this layer is difficult. Clods form if the soil is tilled when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for hay or pasture. A few have reverted to brushy woodland and are used as wildlife habitat.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the main hazard. A crop rotation that is dominated by grasses and legumes is the most effective means of preventing excessive soil loss. Water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures also help to prevent excessive soil loss. A system of conservation tillage that leaves all or most of the crop residue on the surface helps to control erosion and improves or maintains tilth and the organic matter content.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the shrink-swell potential and the slope, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by disturbing as little of the existing vegetation as possible during construction and by revegetating disturbed areas as soon as possible.

Because of low strength, this soil is severely limited as a site for local roads and streets. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. The slope also is a limitation. Enlarging the absorption area improves the capacity of the field to absorb the effluent. Installing the absorption field on the contour helps to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 4A.

MxD3—Morley silty clay loam, 15 to 25 percent slopes, severely eroded. This strongly sloping and moderately steep, well drained soil is on uplands and on side slopes that border deeply incised drainageways on till plains and moraines. Areas are irregularly shaped or elongated and are 5 to 30 acres in size.

Typically, the surface layer is dark yellowish brown silty clay loam about 7 inches thick. In most areas, nearly all of the original darkened surface layer has been removed by erosion and tillage has mixed the rest with the upper part of the subsoil. The subsoil is about 18 inches thick. The upper part is dark yellowish brown, firm silty clay loam, and the lower part is dark yellowish brown and brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some areas the surface layer is silt loam or loam or contains more gravel. In other areas the soil is less eroded. In places the subsoil has thin layers of sandy clay loam or silt loam. In a few places the solum is less than 20 inches thick. In a few areas the lower part of the subsoil has faint mottles. In places the slope is less than 15 or more than 25 percent.

Included with this soil in mapping are areas of the well drained Martinsville soils. These soils are less clayey than the Morley soil. They are on the slightly lower slopes. Also included, along the major drainageways, are some areas of soils that are underlain by sand and gravelly coarse sand. Included soils make up about 15 percent of the map unit.

Permeability is moderately slow in the Morley soil. The available water capacity is moderate. Runoff is very rapid. The organic matter content is moderate in the surface layer. Plowing this layer is difficult. Clods form if the soil is tilled when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used as wildlife habitat. Some are used for pasture or hay. A few are used for cultivated crops. Some have reverted to brushy woodland. Most of the wooded areas have been grazed.

Because of a very severe hazard of erosion, this soil is generally unsuited to corn and soybeans. Small grain can be grown occasionally to help establish grasses and legumes.

This soil is poorly suited to grasses and legumes, such as bromegrass and alfalfa, for hay. It is fairly well suited to pasture. Erosion is a severe hazard. Operating some types of haying equipment is hazardous on these slopes. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition, the erosion hazard, and the equipment limitation are the main management concerns. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. The use of heavy equipment should be restricted because roads tend to be slippery and ruts form easily during wet periods. The type of equipment that can be safely used on these slopes is limited. The trees should be planted on the contour.

Because of the slope, this soil is generally unsuitable as a site for dwellings and for septic tank absorption fields. It is severely limited as a site for local roads because of the slope and low strength. Building the roads and streets on the contour and cutting and filling help to overcome the slope. Road culverts should be installed at strategic locations. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

The land capability classification is VIe. The woodland ordination symbol is 4R.

MzB—Morley-Glynwood complex, 1 to 4 percent slopes. These nearly level and gently sloping soils are on till plains and moraines. The well drained Morley soil is on swells and low ridges, around potholes, and along drainageways. The moderately well drained Glynwood soil is in swales and potholes, on the tops of low ridges, and in drainageways. Areas are irregular in shape and are 5 to 75 acres in size. The two soils occur as areas so intricately mixed that mapping them separately is not practical.

Typically, the surface layer of the Morley soil is very dark grayish brown loam about 9 inches thick. The subsoil is about 33 inches thick. In sequence downward, it is yellowish brown, firm clay loam; dark yellowish brown, firm clay; and brown, firm clay loam. The underlying material to a depth of 60 inches is brown clay loam. In some areas the surface layer is sandy loam and has a gravel content of more than 1 percent. In other areas the soil is moderately eroded. In some places the subsoil has layers of silt loam, loam, or sandy clay loam. In other places the slope is more than 4 percent.

Typically, the surface layer of the Glynwood soil is dark grayish brown silt loam about 9 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil is about 24 inches thick. It is mottled and firm. The upper part is yellowish brown clay, and the lower part is brown clay loam. The underlying material to a depth of 60 inches is brown, mottled clay loam. In some areas the surface layer is sandy loam and has a gravel content of more than 1 percent. In some places the soil is moderately eroded. In other places the subsoil has thin layers of sandy clay loam, silty clay loam, loam, or silt loam.

Included with these soils in mapping are areas of the somewhat poorly drained Blount and well drained Martinsville soils. Blount soils are in landscape positions similar to those of the Glynwood soil. Martinsville soils are less clayey than the Morley soil. They are in landscape positions similar to those of the Morley soil. Also included are some areas of severely eroded soils. Included soils make up about 6 percent of the map unit.

Permeability is moderately slow in the Morley soil and slow in the Glynwood soil. The available water capacity is moderate in both soils. Runoff is medium. The Glynwood soil has a water table at a depth of 2.0 to 3.5 feet during winter and early spring. The organic matter content is moderate in the surface layer of both soils. This layer is friable and can be tilled throughout a moderate range in moisture content, but it tends to crust after heavy rains. Clods form if the soils are plowed when wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of these soils are used for cultivated crops. Some are used for pasture or hay. A few are used as woodland.

These soils are well suited to corn, soybeans, and small grain. Erosion and wetness are management concerns. A crop rotation that includes grasses and legumes, cover crops, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures help to control erosion and runoff. A system of conservation tillage that leaves all or most of the crop residue on the surface improves or helps to maintain tilth and increases the organic matter content. In seepy areas in waterways and swales, a subsurface drainage system is needed.

These soils are well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Erosion is the main hazard. Overgrazing or grazing when

the soils are wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate on the Morley soil. In areas of the Glynwood soil, seedling mortality, the windthrow hazard, and plant competition are the main management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Some replanting of seedlings may be needed. Carefully thinning the stands or not thinning them at all reduces the windthrow hazard.

The shrink-swell potential of both soils and the wetness of the Glynwood soil are limitations on sites for dwellings. Subsurface drains help to lower the water table. Strengthening foundations, footings, and basement walls and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling.

Because of low strength, these soils are severely limited as sites for local roads and streets. Frost action also is a severe limitation in areas of the Glynwood soil. Adequate roadside drainage ditches and culverts help to prevent the damage caused by frost action. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic.

Because of the moderately slow or slow permeability, these soils are severely limited as sites for septic tank absorption fields. The wetness of the Glynwood soil also is a severe limitation. Enlarging the absorption field helps to compensate for the restricted permeability. Interceptor drains around the outer edges of the absorption field help to remove excess water.

The land capability classification is IIe. The woodland ordination symbol assigned to the Morley soil is 4A, and that assigned to the Glynwood soil is 4C.

OrA—Ormas loamy sand, 0 to 2 percent slopes. This nearly level, well drained soil is on broad outwash plains and terraces and on the tops of knolls and ridges in the uplands. Areas are broad and irregular in shape and are 5 to 200 acres in size.

Typically, the surface layer is brown loamy sand about 10 inches thick. The subsurface layer is about 24 inches thick. It is yellowish brown. The upper part is very friable loamy sand, and the lower part is loose sand. The subsoil is about 14 inches thick. It is brown and friable. The upper part is sandy loam, and the lower part is gravelly sandy loam. The underlying material to a depth of 60 inches is brown and dark yellowish brown gravelly coarse sand. In some areas the surface layer is darker or is sandy loam, or both. In a few places it has a gravel content of 5 to 15 percent. In a few areas it is less than 10 inches thick. In some areas the subsoil, the underlying material, or both are finer textured. In other areas the subsoil has thin textural bands. In some places the soil has a thinner solum, less clay and gravel in the subsoil, or both. In other places the depth to the underlying material is less than 40 inches. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Riddles soils. These soils are more clayey than the Ormas soil. They are in landscape positions similar to those of the Ormas soil. Also included are areas of the moderately well drained Bronson soils in the slightly lower landscape positions. Included soils make up about 10 percent of the map unit.

The Ormas soil is rapidly permeable and moderately rapidly permeable in the subsoil and very rapidly permeable in the underlying material. The available water capacity is low. Runoff is slow in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for forage grasses and legumes or as woodland. Many of the wooded areas have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazard of soil blowing are management concerns. A crop rotation that includes grasses and legumes, a system of conservation tillage that leaves all or most of the crop residue on the surface, and grassed waterways help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and plant competition are the main management concerns. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. The soil is moderately limited as a site for local roads and streets because of frost action. Providing adequate roadside ditches and culverts helps to prevent the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because it does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OrB—Ormas loamy sand, 2 to 6 percent slopes. This gently sloping, well drained soil is on outwash plains and terraces and on knolls and ridges in the uplands. Areas are broad and irregular in shape and are 5 to 50 acres in size.

Typically, the surface layer is brown loamy sand about 10 inches thick. The subsurface layer is about 24 inches thick. The upper part is yellowish brown, very friable loamy sand, and the lower part is yellowish brown, loose sand. The subsoil is about 18 inches of brown, friable sandy loam and gravelly sandy loam. The underlying material to a depth of 60 inches is brown and dark yellowish brown gravelly coarse sand. In some areas the surface layer is sandy loam, contains more gravel, or both. In other areas the soil is moderately eroded. In some places the subsoil, the underlying material, or both are finer textured. In other places the subsoil has thin textural bands. In some areas it has less clay and gravel. In other areas the depth to the underlying material is less than 40 inches. In places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the moderately well drained Bronson and well drained Riddles soils. Bronson soils are in the slightly lower landscape positions. Riddles soils are more clayey than the Ormas soil. They are in landscape positions similar to those of the Ormas soil. Also included are a few small areas where the soil is severely eroded. Included soils make up about 15 percent of the map unit.

The Ormas soil is rapidly permeable and moderately rapidly permeable in the subsoil and very rapidly permeable in the underlying material. The available water capacity is low. Runoff is slow in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for forage grasses and legumes or for woodlots. Many of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazards of soil blowing and erosion are management concerns. A crop rotation that includes grasses and legumes, a system of conservation tillage that leaves all or most of the crop residue on the surface, and grassed waterways help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. The soil is moderately limited as a site for local roads and streets because of frost action. Providing adequate roadside ditches and culverts helps to prevent the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because it does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination. Installing the absorption field on the contour results in an even distribution of the effluent.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OrC—Ormas loamy sand, 6 to 12 percent slopes. This moderately sloping, well drained soil is on outwash plains and terraces and on knolls and ridges in the uplands. Areas are long and narrow or are irregular in shape. They are 5 to 40 acres in size.

Typically, the surface layer is brown loamy sand about 8 inches thick. The subsurface layer is about 22 inches thick. The upper part is yellowish brown, very friable loamy sand, and the lower part is yellowish brown, loose sand. The subsoil is brown, friable gravelly sandy loam about 14 inches thick. The underlying material to a depth of 60 inches is brown and dark yellowish brown gravelly coarse sand. In some places the surface layer is sandy loam, contains more gravel, or both. In other places the soil is moderately eroded. In some areas the subsoil, the underlying material, or both are finer textured. In other areas the subsoil has thin textural bands or contains less clay and gravel. In some places the depth to the underlying material is less than 40 inches. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the moderately well drained Bronson and well drained Riddles soils. Bronson soils are in the slightly lower landscape positions. Riddles soils are more clayey than the Ormas soil. They are in landscape positions similar to those of the Ormas soil. Also included are a few areas where the soil is severely eroded. Included soils make up about 15 percent of the map unit.

The Ormas soil is rapidly permeable and moderately rapidly permeable in the subsoil and very rapidly permeable in the underlying material. The available water

capacity is low. Runoff is medium in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for forage grasses and legumes or for woodlots. Some of the woodlots are grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazards of soil blowing and erosion are management concerns. A crop rotation that includes grasses and legumes, a system of conservation tillage that leaves all or most of the crop residue on the surface, and grassed waterways help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by returning topsoil and seeding as soon as possible after construction, by retaining as much of the existing vegetation as possible during construction, and by revegetating disturbed areas as soon as possible. The sides of shallow excavations can cave in unless they are reinforced.

Because of the slope and the potential for frost action, this soil is moderately limited as a site for local roads and streets. Cutting and filling and building the roads and streets on the contour help to overcome the slope. Providing adequate roadside ditches and culverts helps to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because it does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination. Installing the absorption field on the contour results in an even distribution of the effluent.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OtA—Ormas loamy sand, sandy substratum, 0 to 2 percent slopes. This nearly level, well drained soil is on high terraces, in areas of valley fill, and on moraines. Areas are broad and irregular in shape and are 5 to 200 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsurface layer is about 22 inches thick. The upper part is yellowish brown, very friable loamy sand, and the lower part is yellowish brown, loose sand. The subsoil is dark brown, firm sandy loam about 14 inches thick. The underlying material to a depth of 60 inches is brown sand. In some areas the surface layer is darker, is sandy loam, or both. In a few places it has a gravel content of 5 to 15 percent. In some areas the subsoil has thin textural bands. In other areas the depth to the underlying material is less than 40 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Riddles soils. These soils are more clayey than the Ormas soil. They are in landscape positions similar to those of the Ormas soil. Also included are areas of the moderately well drained Bronson soils in the slightly lower landscape positions. Included soils make up about 10 percent of the map unit.

The Ormas soil is rapidly permeable and moderately rapidly permeable in the subsoil and rapidly permeable in the underlying material. The available water capacity is low. Runoff is slow in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for forage grasses and legumes or for woodlots. Many of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazard of soil blowing are management concerns. A crop rotation that includes grasses and legumes, a system of conservation tillage that leaves all or most of the crop residue on the surface, and grassed waterways help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. The soil is moderately limited as a site for local roads and streets because of the potential for frost action. Providing adequate roadside ditches and culverts helps to prevent the damage caused by frost action. Because of a poor filtering capacity, the soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OtB—Ormas loamy sand, sandy substratum, 2 to 6 percent slopes. This gently sloping, well drained soil is on high terraces, in areas of valley fill, and on moraines. Areas are broad and irregular in shape and are 5 to 50 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsurface layer is about 22 inches thick. The upper part is yellowish brown, very friable loamy sand, and the lower part is yellowish brown, loose sand. The subsoil is dark brown, firm sandy loam about 14 inches thick. The underlying material to a depth of 60 inches is brown sand. In some areas the surface layer is sandy loam, contains more gravel, or both. In other areas the soil is moderately eroded. In some places the subsoil has thin textural bands. In other places it has more clay and gravel. In some areas the depth to the underlying material is less than 40 inches. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the moderately well drained Bronson and well drained Riddles soils. Bronson soils are in the slightly lower landscape positions. Riddles soils are more clayey than the Ormas soil. They are in landscape positions similar to those of the Ormas soil. Also included are a few areas where the soil is severely eroded. Included soils make up about 15 percent of the map unit.

The Ormas soil is rapidly permeable and moderately rapidly permeable in the subsoil and rapidly permeable in the underlying material. The available water capacity is low. Runoff is slow in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for forage grasses and legumes or for woodlots. Many of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazards of soil blowing and erosion are management concerns. A crop rotation that includes grasses and legumes, a system of conservation tillage that leaves all or most of the crop residue on the surface, and grassed waterways help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. Because of the potential for frost action, the soil is moderately limited as a site for local roads and streets. Providing adequate roadside ditches and culverts helps to prevent the damage caused by frost action. The soil is severely limited as a site for septic tank absorption fields because it does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

OtC—Ormas loamy sand, sandy substratum, 6 to 12 percent slopes. This moderately sloping, well drained soil is on high terraces, in areas of valley fill, and on moraines. Areas are long and narrow or are irregular in shape. They are 5 to 40 acres in size.

Typically, the surface layer is dark brown loamy sand about 8 inches thick. The subsurface layer is about 22 inches thick. The upper part is yellowish brown, very friable loamy sand, and the lower part is yellowish brown, loose sand. The subsoil is dark brown, firm sandy loam about 14 inches thick. The underlying material to a depth of 60 inches is brown sand. In some places the surface layer is sandy loam, contains more gravel, or both. In other places the soil is moderately eroded. In some areas the subsoil has thin textural bands. In other areas it has more clay and gravel. In some places the depth to the underlying material is less than 40 inches. In other places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the well drained Riddles soils. These soils are more clayey than the Ormas soil. They are in landscape positions similar to those of the Ormas soil. Also included are a few areas of severely eroded soils. Included soils make up about 15 percent of the map unit.

The Ormas soil is rapidly permeable and moderately rapidly permeable in the subsoil and rapidly permeable in the underlying material. The available water capacity is low. Runoff is medium in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for forage grasses and legumes or for woodlots. Some of the woodlots are grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazards of soil blowing and erosion are management concerns. A crop rotation that includes grasses and legumes, a system of conservation tillage that leaves all or most of the crop residue on the surface, and grassed waterways help to prevent excessive soil loss. The soil is well suited to a no-till cropping system. Cover crops help to control soil blowing, conserve moisture, improve or help to maintain tilth, and increase the organic matter content.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. It is best suited to deep-rooted species. The low available water capacity is the main limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is fairly well suited to trees. Seedling mortality and plant competition are the main management concerns. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by returning topsoil and seeding as soon as possible after construction, by retaining as much of the existing vegetation as possible during construction, and by revegetating disturbed areas as soon as possible. The sides of shallow excavations can cave in unless they are reinforced.

Because of the slope and the potential for frost action, this soil is moderately limited as a site for local roads and streets. Cutting and filling and building the roads and streets on the contour help to overcome the slope. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because it does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination. Installing the absorption field on the contour results in an even distribution of the effluent.

The land capability classification is IIIs. The woodland ordination symbol is 4S.

Pa—Palms muck, drained. This nearly level, very poorly drained soil is in depressions on moraines, till plains, and outwash plains. In most places it is frequently ponded by runoff from the higher adjacent soils. Areas are irregularly shaped or circular and are 5 to 100 acres in size.

Typically, the surface layer is black muck about 10 inches thick. The upper part has granular structure and is very friable, and the lower part has subangular blocky structure and is friable. The subsurface layer is black, very friable muck about 23 inches thick. The upper part of the underlying material is very dark gray silty clay loam. The lower part to a depth of 60 inches is grayish brown loam. In places the organic material is less than 16 or more than 50 inches thick. In some areas loamy sand, sand, or gravelly sand is at a depth of 40 to 60 inches. In other areas the underlying material includes marl.

Included with this soil in mapping are small areas of the poorly drained Barry and very poorly drained Gilford and Sebewa soils. These soils are less mucky than the Palms soil. They are around the edges of the depressions or within the depressions. They are slightly higher on the landscape than the Palms soil and are less likely to be ponded during the growing season. Also included are areas where the soil is undrained. Included soils make up about 10 percent of the map unit.

The Palms soil is moderately rapidly permeable to moderately slowly permeable in the upper part and moderately permeable or moderately slowly permeable in the underlying material. The available water capacity is very high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is very high in the surface layer. This layer is very friable and can be easily tilled. It dries out rapidly in the spring.

Most areas of this soil are used for cultivated crops. Some are used for specialty crops, such as mint, carrots, and onions. Some are used for pasture or hay or support a natural cover of mixed hardwoods or of wetland shrubs and grasses.

If drained, this soil is fairly well suited to corn, soybeans, and small grain. Wetness and soil blowing are management concerns. Because of poor stability in the organic material, ditchbanks can cave in and the

effectiveness of subsurface drains can be impaired. The organic material subsides when it is drained. In many areas it has subsided so much that the drainage system is no longer adequate. Drainage outlets are not readily available in many areas. Windbreaks, a system of conservation tillage that leaves all or most of the crop residue on the surface, and cover crops help to control soil blowing.

If drained, this soil is well suited to grasses and legumes for hay or pasture. It is better suited to grasses than to most legumes. Deep-rooted legumes, such as alfalfa, grow poorly because of the ponding and the high water table. Soil blowing is a hazard. In areas of hayland, the use of harvesting equipment is restricted to dry periods because of poor stability in the muck. Overgrazing or grazing when the soil is wet results in surface compaction and pitting, reduced plant density, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is poorly suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only when the ground is frozen.

Because of subsidence, the ponding, and low strength, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, subsidence, and frost action. Replacing the organic material with better suited material improves the ability of the roads to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Pb—Palms muck, gravelly substratum, drained. This nearly level, very poorly drained soil is in shallow depressions on outwash plains and along drainageways. It also is on moraines. It is frequently ponded by runoff from the higher adjacent soils. The areas on outwash plains are broad and irregularly shaped and are 15 to several hundred acres in size. The areas on moraines are oval or oblong and are 5 to 25 acres in size.

Typically, the surface layer is black muck about 9 inches thick. The subsurface layer is black and dark reddish brown muck about 19 inches thick. The upper part of the underlying material is dark olive gray and olive gray sandy clay loam and loam. The lower part to a depth of 60 inches is dark gray gravelly coarse sand. In some areas the organic material is less than 16 or more than 50 inches thick. In other areas the soil has as much as 24 inches of mineral overwash. In places a layer of marl overlies the gravelly coarse sand. In a few areas the muck is underlain by sand or loamy sand. In some areas the underlying material is entirely marl or loam.

Included with this soil in mapping are small areas of the very poorly drained Gilford, Gravelton, and Sebewa soils. These soils are less mucky than the Palms soil. They are near the edges of the mapped areas or are on slight rises. Also included are some areas where the soil is undrained. Included soils make up about 15 percent of the map unit.

The Palms soil is moderately rapidly permeable to moderately slowly permeable in the organic material. The underlying material is moderately permeable in the upper part and rapidly permeable in the lower part. The available water capacity is very high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is very high in the surface layer. This layer dries out rapidly and can be easily tilled. The soil is subject to late frost.

Most areas of this soil are used for cultivated crops. Some are used for specialty crops, such as mint, carrots, and onions. Some are used for pasture or hay or support a natural cover of mixed hardwoods or of wetland shrubs and grasses.

If drained, this soil is fairly well suited to corn, soybeans, and small grain. Wetness and soil blowing are management concerns. Because of poor stability in the organic material and in the underlying material, ditchbanks can cave in and the effectiveness of subsurface drains can be impaired. Drains installed below a depth of 3 feet can be plugged by fine sand. The organic material subsides when it is drained. In many areas it has subsided so much that the drainage system is no longer adequate. Drainage outlets are not readily available in many areas. Windbreaks, a system of conservation tillage that leaves all or most of the crop residue on the surface, and cover crops help to control soil blowing.

If drained, this soil is well suited to grasses and legumes for hay or pasture. It is better suited to grasses than to most legumes. Deep-rooted legumes, such as alfalfa, grow poorly because of the ponding and the high water table. Soil blowing is a hazard. In areas of hayland, the use of harvesting equipment is restricted to dry periods because of poor stability in the muck. Overgrazing or grazing when the soil is wet results in surface compaction and pitting, reduced plant density, and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is poorly suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the

equipment limitation are management concerns. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of subsidence, the ponding, and frost action. Replacing the organic material with better suited material improves the ability of the roads to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 2W.

Pe—Pewamo silty clay loam. This nearly level, very poorly drained soil is on broad flats and in the shallow depressions and drainageways on moraines and till plains. In the concave areas it is frequently ponded by runoff from the higher adjacent soils. Areas are irregularly shaped or elongated and are 5 to 30 acres in size.

Typically, the surface layer is black silty clay loam about 10 inches thick. The subsurface layer is very dark gray silty clay loam about 4 inches thick. The subsoil is about 23 inches thick. It is mottled and firm. The upper part is gray silty clay, and the lower part is dark gray silty clay loam. The underlying material to a depth of 60 inches is dark grayish brown, mottled clay loam. In some places the dark surface soil is less than 10 inches thick. In other places the subsoil and the underlying material have layers of loam or sandy clay loam or are stratified with thin layers of loamy sand, sandy loam, or silt loam. In some areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the poorly drained Washtenaw soils in drainageways and depressions. These soils are less clayey than the Pewamo soil. Also included are small areas of the moderately well drained Glynwood and somewhat poorly drained Blount soils on slight rises, along the sides of small drainageways, and in saddles. These soils dry out more rapidly in the spring than the Pewamo soil and are less likely to be ponded. Included soils make up about 15 percent of the map unit.

The Pewamo soil is moderately slowly permeable. The available water capacity is high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. This layer dries out slowly in the spring. Clods form if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodlots. Most of the woodlots have been grazed.

This soil is well suited to corn and soybeans. If drained and otherwise properly managed, it is well suited to intensive row cropping. Wetness and ponding are management concerns. Excess water can be removed by subsurface drains, surface drains, or a combination of these. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to fall plowing, fall chiseling, and a ridge-plant cropping system.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and white clover, for hay and pasture. Unless drained, it is poorly suited to deep-rooted species because of the ponding and the high water table. Overgrazing or grazing under wet conditions results in surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to maintain tilth and plant density.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of low strength, the ponding, and frost action. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by low strength and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Pg—Pits, gravel. This nearly level to steep map unit is on moraines, terraces, and outwash plains. Areas are oval or elongated and are 3 to 160 acres in size.

Typically, the upper soil material has been removed and the sand and gravel exposed. In some areas soil material has been washed into the pits. These areas support a sparse cover of vegetation.

Included in this unit in mapping are small areas of Kosciusko and Boyer soils and areas where the water table is near the surface and the pit contains water. Kosciusko and Boyer soils generally are between spoil piles or around the perimeter of the pits. Also included, in the uplands, are small pits where all of the gravel has been removed and glacial till is exposed.

Most of the pits are abandoned or are only occasionally used as a source of fill. Many areas support a very limited amount of vegetation. The pits have little or no value for farming. Some of those that are filled with water are suitable for some recreational uses. They can be stocked with fish. The dry pits could be reclaimed and used as habitat for upland wildlife.

No land capability classification or woodland ordination symbol is assigned.

Re—Rensselaer loam. This nearly level, very poorly drained soil is in slight depressions on broad outwash plains and terraces. It also is along small drainageways and in depressions on till plains, terraces, and outwash plains. In the concave areas it is frequently ponded by runoff from the higher adjacent soils. Areas are irregularly shaped or elongated and are 5 to 100 acres in size.

Typically, the surface layer is very dark brown loam about 9 inches thick. The subsurface layer is black, firm silty clay loam about 6 inches thick. The subsoil is about 27 inches thick. It is gray and mottled. The upper part is firm sandy clay loam, and the lower part is friable sandy loam. The underlying material to a depth of 60 inches is gray, light olive brown, and olive brown, stratified sandy loam, silt loam, and loamy sand. In some places the dark surface soil is less than 10 inches thick. In other places the subsoil has thin layers of loam, loamy sand, or silt loam. In some areas the content of gravel is 5 to 10 percent in the underlying material. In other areas the texture of the strata in the underlying material varies widely within short distances. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the poorly drained Washtenaw and somewhat poorly drained Whitaker soils. Washtenaw soils are more silty than the Rensselaer soil. They are in drainageways and depressions. Whitaker soils are along the sides of narrow drainageways and on small swells. Included soils make up about 10 percent of the map unit.

The Rensselaer soil is moderately permeable. The available water capacity is high. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled. Clods form if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. A few are used for hay, pasture, or woodlots. Many of the woodlots have been grazed.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is well suited to intensive row cropping. Excess water can be removed by subsurface drains, surface drains, pumps, or a combination of these. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to fall plowing, fall chiseling, and till-plant and ridge-plant cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and white clover, for hay or pasture. Unless drained, it is poorly suited to deep-rooted species because of the high water table and the ponding. Overgrazing or grazing under wet conditions results in surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, timely grazing, and restricted use during wet periods help to maintain tilth and plant density.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding, low strength, and the potential for frost action. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by low strength and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

RlA—Riddles fine sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on dissected till plains and on smooth benches and the tops of ridges on moraines. Areas are elongated or irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The subsoil is about 42 inches thick. In sequence downward, it is dark yellowish brown, friable fine sandy loam; brown, firm sandy clay

loam; dark yellowish brown, friable loam; and yellowish brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some areas the surface layer is loamy sand. In other areas the subsoil contains less sand, less gravel, or both. In places the depth to the underlying material is less than 40 inches. In a few areas the underlying material is stratified silt, silt loam, or sand and gravelly coarse sand. In some areas the slope is more than 2 percent.

Included with this soil in mapping are areas of the well drained Kosciusko and Ormas soils. These soils are more sandy than the Riddles soil. They are in landscape positions similar to those of the Riddles soil. Also included are areas of the somewhat poorly drained Crosier soils in shallow depressions and small drainageways. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Riddles soil. The available water capacity is high. Runoff is slow in cultivated areas. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Some of the woodlots have been grazed.

This soil is well suited to corn, soybeans, and small grain. If good management is applied, row crops can be grown year after year. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting and help to maintain tilth and the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely grazing help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drainage tile help to prevent the structural damage caused by shrinking and swelling. Because of frost action and low strength, the soil is moderately limited as a site for local roads and streets. Strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. The soil is moderately limited as a site for septic tank absorption fields because of the moderate permeability. Enlarging the absorption area improves the capacity of the field to absorb the effluent.

The land capability classification is I. The woodland ordination symbol is 5A.

RIB—Riddles fine sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on dissected till plains and on benches and the tops of ridges on moraines. Areas are elongated or irregularly shaped and are 5 to 100 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is about 40 inches thick. In sequence downward, it is dark yellowish brown, friable fine sandy loam; brown, firm sandy clay loam; dark yellowish brown, friable loam; and yellowish brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the surface layer is loamy sand, has a gravel content of as much as 15 percent, or both. In other places the soil is moderately eroded. In some areas the subsoil contains less sand, less gravel, or both. In other areas the depth to the underlying material is less than 40 inches. In a few areas the underlying material is stratified silt, silt loam, or sand and gravelly coarse sand. In places the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the well drained Kosciusko and Ormas soils. These soils are more sandy than the Riddles soil. They are in landscape positions similar to those of the Riddles soil. Also included are areas of the somewhat poorly drained Crosier soils. These soils are in shallow depressions and small drainageways. Also included are a few areas of severely eroded soils. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Riddles soil. The available water capacity is high. Runoff is medium in cultivated areas. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Many of the woodlots have been grazed.

This soil is well suited to corn, soybeans, and small grain. Erosion is the main hazard. A crop rotation that includes grasses and legumes, cover crops, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. A system of conservation tillage that leaves all or most of the crop residue on the surface improves tilth and helps to maintain the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings. Strengthening foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drainage tile help to prevent the structural damage caused by shrinking and swelling. The soil is moderately limited as a site for local roads and streets because of low strength and frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by frost action. Strengthening the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Because of the moderate permeability, the soil is moderately limited as a site for septic tank absorption fields. Enlarging the absorption area improves the capacity of the field to absorb the effluent.

The land capability classification is IIe. The woodland ordination symbol is 5A.

RIC—Riddles fine sandy loam, 6 to 12 percent slopes. This moderately sloping, well drained soil is on benches, broad uplands, till plains, and moraines. Areas are elongated or irregularly shaped and are 5 to 40 acres in size.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The subsoil is about 36 inches thick. In sequence downward, it is dark yellowish brown, friable fine sandy loam; brown, firm sandy clay loam; dark yellowish brown, friable loam; and yellowish brown, friable loam. The underlying material to a depth of 60 inches is dark yellowish brown loam. In some areas the surface layer is loamy sand, has a gravel content of as much as 15 percent, or both. In other areas the soil is moderately eroded. In some places the subsoil contains less sand, less gravel, or both. In other places the depth to the underlying material is less than 40 inches. In a few areas the underlying material is stratified silt, silt loam, or sand and gravelly coarse sand. In places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are areas of the well drained Kosciusko and Ormas soils. These soils are more sandy than the Riddles soil. They are in landscape positions similar to those of the Riddles soil. Also included are areas of the somewhat poorly drained Crosier soils in shallow depressions and small drainageways and a few areas of severely eroded soils. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Riddles soil. The available water capacity is high. Runoff is medium in cultivated areas. The organic matter is moderate in the surface layer. This layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture, hay, or woodlots. Some of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the main management concern. A crop rotation that includes grasses and legumes, cover crops, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. A system of conservation tillage that leaves all or most of the crop residue on the surface helps to maintain tilth and the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope and the shrink-swell potential, this soil is moderately limited as a site for dwellings. The buildings should be designed so that they conform to the natural slope of the land. Strengthening foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drainage tile help to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard on construction sites. It can be controlled by retaining as much of the existing vegetation as possible during construction and by revegetating disturbed areas as soon as possible.

Because of low strength, frost action, and the slope, this soil is moderately limited as a site for local roads and streets. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by frost action. The base should be strengthened with better suited material. Constructing the roads and streets on the contour and land shaping help to overcome the slope.

This soil is moderately limited as a site for septic tank absorption fields because of the slope and the moderate permeability. The absorption field should be installed on the contour. Enlarging the absorption area improves the ability of the field to absorb the effluent.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

RID—Riddles fine sandy loam, 12 to 18 percent slopes. This strongly sloping, well drained soil is on side slopes, between ridges, and along drainageways in the uplands. Areas are elongated or irregularly shaped and are 5 to 25 acres in size.

Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil is about 36 inches thick. In sequence downward, it is dark yellowish brown, friable fine sandy loam; brown, firm sandy clay loam; dark yellowish brown, firm loam; and brown, friable loam. The underlying material to a depth of 60 inches is brown

loam. In some areas the surface layer is loamy sand. In other areas the soil has a thick surface layer of sand in which the content of gravel is as much as 15 percent. In some places the soil is moderately eroded. In other places the subsoil contains less sand, less gravel, or both. In some areas the depth to the underlying material is less than 40 inches. In a few areas the underlying material is stratified silt, silt loam, or sand and gravelly coarse sand. In places the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are areas of the well drained Kosciusko and Ormas soils. These soils are more sandy than the Riddles soil. They are in landscape positions similar to those of the Riddles soil. Also included are areas of the somewhat poorly drained Crosier soils on toe slopes and in small drainageways and a few areas of severely eroded soils. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Riddles soil. The available water capacity is high. Runoff is rapid in cultivated areas. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Many are used for hay and pasture (fig. 12). A few support a natural cover of mixed hardwoods.

Figure 12.—A pastured area of Riddles fine sandy loam, 12 to 18 percent slopes, in the background. Rensselaer soils are in the ponded area in the foreground.

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major management concern. It cannot be easily controlled if this strongly sloping soil is cropped along with the less sloping surrounding soils. Crop rotations that are dominated by grasses and legumes are the most effective means of controlling runoff and erosion. Cover crops, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. A system of conservation tillage that leaves all or most of the crop residue on the surface improves tilth and helps to maintain the organic matter content. The soil is well suited to a no-till cropping system.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is a severe hazard. If hay is harvested, operating some types of equipment is hazardous on these slopes. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition.

This is fairly well suited to trees. The main management concerns are plant competition, the erosion hazard, and the equipment limitation. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Trees should be planted on the contour, and logging roads, skid trails, and landings should be established on the gentler slopes. The use of equipment is limited by the slope.

Because of the slope, this soil is severely limited as a site for dwellings, local roads and streets, and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Local roads and streets should be built on the contour. Cutting and filling are needed. Septic tank absorption fields should be installed on the contour.

The land capability classification is IVe. The woodland ordination symbol is 5R.

RxB—Riddles-Ormas-Kosciusko complex, 2 to 6 percent slopes. These gently sloping, well drained soils are on moraines. The Riddles soil is on ridgetops and on the highest knobs on the landscape. The Ormas soil is at the lower elevations and on east- and south-facing slopes. The Kosciusko soil is on north- and west-facing slopes and on the tops of the less prominent ridges. Areas are irregular in shape or elongated and are 5 to 150 acres in size. They are about 30 percent Riddles soil, 30 percent Ormas soil, and 25 percent Kosciusko soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Riddles soil is brown fine sandy loam about 8 inches thick. The subsoil is about 40 inches thick. In sequence downward, it is dark yellowish brown, friable fine sandy loam; brown, firm sandy clay loam; dark yellowish brown, friable loam; and yellowish brown, friable loam. The underlying material to a depth of 60 inches is yellowish brown loam. In some places the surface layer is loamy sand and has a gravel content of as much as 15 percent. In other places the soil is moderately eroded. In some areas the subsoil contains less sand, less gravel, or both. In other areas the underlying material is within a depth of 40 inches. In a few areas it is stratified silt, silt loam, or sand and gravelly coarse sand. In places the slope is less than 2 or more than 6 percent.

Typically, the surface layer of the Ormas soil is brown loamy sand about 10 inches thick. The subsurface layer is about 24 inches thick. It is yellowish brown. The upper part is very friable loamy sand, and the lower part is loose sand. The subsoil is brown, friable gravelly sandy loam about 14 inches thick. The underlying material to a depth of 60 inches is brown and dark yellowish brown gravelly coarse sand. In some areas the surface layer is sandy loam, contains more gravel, or both. In other areas it is thinner. In some places the soil is eroded. In other places the subsoil, the underlying material, or both are finer textured. In some areas the subsoil has thin textural bands. In other areas it has less clay and gravel. In places the underlying material is within a depth of 40 inches. In some areas, particularly at the base of the slopes, faint mottles are at a depth of 30 to 42 inches. In other areas the slope is less than 2 or more than 6 percent.

Typically, the surface layer of the Kosciusko soil is dark grayish brown sandy loam about 8 inches thick. The subsoil is about 31 inches thick. The upper part is yellowish brown, friable sandy loam; the next part is brown and reddish brown, firm gravelly sandy clay loam; and the lower part is reddish brown, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified coarse sand and gravelly coarse sand. In places the surface layer is loam or loamy sand. In a few areas the soil contains more gravel. In some places it is eroded. In other places the subsoil contains less sand and gravel, extends to a greater depth, or both. In some areas the soil contains more sand. In other areas the slope is less than 2 or more than 6 percent.

Included with these soils in mapping are areas of the somewhat poorly drained Crosier and moderately well drained Bronson soils. These included soils are in saddles, shallow depressions, potholes, and small drainageways and on toe slopes. Also included are a few areas of severely eroded soils. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Riddles soil. It is rapid and moderately rapid in the upper part of the Ormas soil and very rapid in the lower part. It is moderate in the upper part of the Kosciusko soil and very rapid in the lower part. The available water capacity is high in the Riddles soil and low in the Kosciusko and Ormas soils.

Runoff is medium on the Riddles and Kosciusko soils and slow on the Ormas soil. The organic matter content is moderate in the surface layer of all three soils. This layer is friable or very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of these soils are used for cultivated crops. Some are used for hay or pasture. A few are wooded. Many of the wooded areas have been grazed.

These soils are well suited to corn, soybeans, and small grain. The slope of all three soils and the low available water capacity of the Kosciusko and Ormas soils are the main management concerns if corn or soybeans are grown. Spot drainage of some of the included depressional areas is needed. Cover crops, a crop rotation that includes grasses and legumes, water- and sediment-control basins, grassed waterways, and grade stabilization structures help to control erosion and runoff. Cover crops and a conservation tillage system that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting and evaporation, increase the rate of water infiltration, and help to maintain the organic matter content. The soils are well suited to no-till and till-plant cropping systems.

A cover of grasses and legumes helps to control erosion. These soils are well suited to forage grasses and legumes, such as bromegrass and alfalfa. They are best suited to deep-rooted species. Erosion is the main hazard, and the low available water capacity of the Kosciusko and Ormas soils is a limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate on the Riddles soil. Seedling mortality and plant competition are the main management concerns on the Kosciusko and Ormas soils. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary.

The Ormas soil is suitable as a site for dwellings, but the Kosciusko and Riddles soils are moderately limited because of the moderate shrink-swell potential. Properly designing foundations, footings, and basement walls and installing foundation drainage tile help to prevent the structural damage caused by shrinking and swelling. Erosion is a hazard on construction sites. It can be controlled by returning topsoil and reseeding as soon as possible after construction.

These soils are moderately limited as sites for local roads and streets because of frost action in all three soils, low strength in the Riddles soil, and the shrink-swell potential of the Kosciusko soil. Providing adequate roadside ditches and culverts helps to prevent the damage caused by frost action. The layers of the Kosciusko soil that have a moderate shrink-swell potential should be replaced with suitable soil material. Covering the surface of the Riddles soil with suitable coarse textured base material improves the ability of the roads and streets to support vehicular traffic.

The Riddles soil is moderately limited as a site for septic tank absorption fields because of the moderate permeability. Enlarging the absorption area improves the capacity of the field to absorb the effluent. The Kosciusko and Ormas soils are severely limited as sites for absorption fields because they do not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination. Onsite investigation is needed to determine the suitability of individual sites.

The land capability classification is IIe. The woodland ordination symbol assigned to the Riddles soil is 5A, and that assigned to the Ormas and Kosciusko soils is 4S.

RxC—Riddles-Ormas-Kosciusko complex, 6 to 12 percent slopes. These moderately sloping, well drained soils are on moraines. The Riddles soil is on ridgetops and on the highest knobs on the landscape. The Ormas soil is at the lower elevations and on east- and south-facing slopes. The Kosciusko soil is on north- and west-facing slopes and on the tops of the less prominent ridges. Areas are irregular in shape or elongated and are 5 to 50 acres in size. They are about 30 percent Riddles soil, 30 percent Ormas soil, and 25 percent Kosciusko soil. The three soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the surface layer of the Riddles soil is brown fine sandy loam about 8 inches thick. The subsoil is about 36 inches thick. In sequence downward, it is dark yellowish brown, friable fine sandy loam; brown, firm sandy clay loam; dark yellowish brown, friable loam; and yellowish brown, friable loam. The underlying material to a depth of 60 inches is dark yellowish brown loam. In some areas the surface layer is loamy sand and has a gravel content of as much as 15 percent. In other areas the soil is moderately eroded. In some places the subsoil contains less sand, less gravel, or both. In other places the underlying material is within a depth of 40 inches. In a few areas it is stratified silt, silt loam, or sand and gravelly coarse sand. In places the slope is less than 6 or more than 12 percent.

Typically, the surface layer of the Ormas soil is brown loamy sand about 8 inches thick. The subsurface layer is about 20 inches thick. It is yellowish brown. The upper part is very friable loamy sand, and the lower part is loose sand. The subsoil is brown, friable gravelly sandy loam about 16 inches thick. The underlying material to a depth of 60 inches is brown and dark yellowish brown gravelly coarse sand. In some areas the surface layer is sandy loam, contains more gravel, or both. In other areas it is thinner. In some places the soil is eroded. In

other places the subsoil, the underlying material, or both are finer textured. In some areas the subsoil has thin textural bands. In other areas it has less clay and gravel. In places the underlying material is within a depth of 40 inches. In some areas, particularly at the base of the slopes, faint mottles are at a depth of 30 to 42 inches. In other areas the slope is less than 6 or more than 12 percent.

Typically, the surface layer of the Kosciusko soil is dark brown sandy loam about 7 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish brown, friable sandy loam; the next part is brown and reddish brown, firm gravelly sandy clay loam; and the lower part is reddish brown, very friable gravelly loamy sand. The underlying material to a depth of 60 inches is light yellowish brown, stratified coarse sand and gravelly coarse sand. In places the surface layer is loam or loamy sand. In a few areas the soil contains more gravel. In some places it is eroded. In other places the subsoil contains less sand and gravel, extends to a greater depth, or both. In some areas the soil contains more sand. In other areas the slope is less than 6 or more than 12 percent.

Included with these soils in mapping are areas of the somewhat poorly drained Crosier and moderately well drained Bronson soils. These included soils are in saddles, shallow depressions, potholes, and small drainageways and on toe slopes. Also included are a few small areas of severely eroded soils. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Riddles soil. It is rapid and moderately rapid in the upper part of the Ormas soil and very rapid in the lower part. It is moderate in the upper part of the Kosciusko soil and very rapid in the lower part. The available water capacity is high in the Riddles soil and low in the Kosciusko and Ormas soils. Runoff is medium on all three soils. The organic matter content is moderate in the surface layer. This layer is friable or very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of these soils are used for cultivated crops. Some are used for hay or pasture. A few are wooded. Many of the wooded areas have been grazed.

These soils are fairly well suited to corn, soybeans, and small grain. The slope of all three soils and the low available water capacity of the Kosciusko and Ormas soils are the main management concerns if corn or soybeans are grown. Spot drainage of some of the included depressional areas is needed. Cover crops, a crop rotation that includes grasses and legumes, water- and sediment-control basins, grassed waterways, and grade stabilization structures help to control erosion and runoff. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control erosion, minimize crusting and evaporation, increase the rate of water infiltration, and help to maintain the organic matter content.

These soils are well suited to forage grasses and legumes, such as bromegrass and alfalfa. They are best suited to deep-rooted species. Erosion is the main hazard, and the low available water capacity of the Kosciusko and Ormas soils is a limitation. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

These soils are well suited to trees. Plant competition is moderate on the Riddles soil. Seedling mortality and plant competition are the main management concerns on the Kosciusko and Ormas soils. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Drought-tolerant species should be selected for planting. Replanting of seedlings is often necessary.

Because of the slope, these soils are moderately limited as sites for dwellings. The shrink-swell potential of the Kosciusko and Riddles soils also is a moderate limitation. Properly designing foundations, footings, and basement walls, backfilling with coarse textured material, and installing foundation drains help to prevent the structural damage caused by shrinking and swelling. The buildings should be designed so that they conform to the natural slope of the land. Erosion is a hazard on construction sites. It can be controlled by returning topsoil and reseeding as soon as possible after construction.

These soils are moderately limited as sites for local roads and streets because of the potential for frost action and the slope of all three soils, the shrink-swell potential of the Kosciusko soil, and low strength in the Riddles soil. Constructing the roads and streets on the contour and land shaping help to overcome the slope. Culverts should be installed at strategic locations. Providing adequate roadside ditches and culverts help to prevent the damage caused by frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by frost action and low strength.

Because of the slope, these soils are moderately limited as sites for septic tank absorption fields. Also, the Riddles soil is moderately limited because of the moderate permeability, and the Kosciusko and Ormas soils are severely limited because they do not adequately filter the effluent. Cutting and filling and installing the absorption field on the contour help to overcome the slope. Enlarging the absorption field improves the ability of the Riddles soil to absorb the effluent. The poor filtering capacity of the Kosciusko and Ormas soils can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination. Onsite investigation is needed to determine the suitability of individual sites.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Riddles soil is 5A, and that assigned to the Ormas and Kosciusko soils is 4S.

Sa—Saranac clay loam, gravelly substratum, occasionally flooded. This nearly level, very poorly drained soil is on flood plains along the major streams and along creeks. It is occasionally flooded for brief periods during winter and early spring. It is frequently ponded by runoff from the higher adjacent soils. Areas are long and narrow and are 5 to 20 acres in size.

Typically, the surface layer is very dark gray clay loam about 7 inches thick. The subsurface layer is very dark grayish brown and black silty clay loam about 16 inches thick. The subsoil is about 30 inches thick. It is dark gray and gray, mottled, firm silty clay and silty clay loam in the upper part and gray, mottled, friable loam in the lower part. The underlying material to a depth of 60 inches is grayish brown gravelly loamy coarse sand. In some areas the surface layer is loam. In other areas the subsoil contains less clay and more silt or sand. In a few areas the content of gravel is less than 10 percent in the underlying material.

Included with this soil in mapping are areas of the somewhat poorly drained Shoals soils. These soils are in the higher areas on benches and along streambanks. They make up about 5 percent of the map unit.

Permeability is moderately slow in the upper part of the Saranac soil and rapid in the sandy and gravelly underlying material. The available water capacity is high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. Clods form if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil support a natural cover of mixed hardwoods. Many woodlots have been grazed. Some areas are used for cultivated crops. A few are used as pasture.

This soil is fairly well suited to corn and soybeans. If drained and otherwise well managed, it is well suited to intensive row cropping. Late planting or replanting is frequently necessary because of the wetness, the flooding, or both. Subsurface drains, surface drains, or a combination of these can help to overcome the wetness. A system of conservation tillage that leaves all or most of the crop residue on the surface improves tilth and helps to maintain the organic matter content. The soil is well suited to a ridge-plant cropping system if the rows follow the direction of natural drainage or streamflow and the ridges are prepared in the spring.

This soil is well suited to grasses and some legumes, such as reed canarygrass and white clover, for hay and pasture. It is poorly suited to deep-rooted legumes because of the high water table. The wetness and the flooding are the main management concerns. Grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the flooding and the ponding, this soil is generally unsuitable as a site for dwellings, septic tank absorption fields, and local roads and streets. The sides of shallow excavations can cave in unless they are reinforced.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

Se—Sebewa loam. This nearly level, poorly drained soil is on outwash plains and terraces. In some concave areas it is frequently ponded by runoff from the higher adjacent soils (fig. 13). Areas are 5 to 500 acres in size. Most are oblong or irregularly shaped.

Typically, the surface layer is black loam about 11 inches thick. The subsoil is about 19 inches thick. The upper part is gray, mottled, firm clay loam; the next part is gray, mottled, friable sandy clay loam; and the lower part is dark gray, mottled, friable loam. The underlying material to a depth of 60 inches is grayish brown gravelly coarse sand and sand. In some areas the surface layer is less than 11 inches thick. In other areas the upper 2 to 10 inches is mucky mineral material. In some places the subsoil has less clay. In other places the subsoil and the underlying material are stratified with silt loam, loamy sand, and loam. In a few areas the depth to the underlying material is more than 40 inches. In some places the underlying material is neutral or slightly acid fine sand and sand to a depth of 60 inches or more. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Homer soils on swells, on narrow ridges, and in saddles. These soils make up about 10 percent of the map unit.

Permeability is moderate in the subsoil of the Sebewa soil and rapid in the underlying material. The available water capacity is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled. Clods form, however, if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Figure 13.—Ponding in a depressional area of Sebewa loam.

Most areas of this soil are used for cultivated crops. A few are used for pasture, hay, or woodlots. Many of the woodlots have been grazed.

If drained, this soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. In inadequately drained areas, however, it is poorly suited to most crops. Subsurface drains, surface drains, pumps, or a combination of these can remove excess water. If the soil is overdrained, however, drought is a hazard. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, and help to maintain the organic matter content. The soil is well suited to fall plowing, fall chiseling, and till-plant and ridge-plant cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and white clover, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Competing vegetation can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often

needed. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and the potential for frost action. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

Sf—Sebewa mucky loam. This nearly level, very poorly drained soil is in depressions on outwash plains and terraces. In most places it is frequently ponded by runoff from the higher adjacent soils. Areas are oblong or irregularly shaped and are 5 to 200 acres in size.

Typically, the surface layer is black mucky loam about 13 inches thick. The subsoil is about 25 inches thick. The upper part is dark gray, mottled, firm sandy loam; the next part is gray, mottled, firm gravelly clay loam; and the lower part is gray, mottled, friable gravelly loam. The underlying material to a depth of 60 inches is grayish brown very gravelly coarse sand. In some areas the mucky mineral surface layer is less than 10 inches thick. In other areas the subsoil has less clay or gravel. In some places the subsoil and the underlying material are stratified with silt loam, loamy sand, and loam. In a few places the depth to the underlying material is more than 40 inches. In some areas the underlying material is neutral or slightly acid fine sand and sand to a depth of 60 inches or more. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Homer soils on swells, on narrow ridges, and in saddles. Also included, in potholes, depressions, and swales, are areas of the very poorly drained Palms soils, which are more mucky than the Sebewa soil. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the subsoil of the Sebewa soil and rapid in the underlying material. The available water capacity is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is very high in the surface layer. This layer can be easily tilled and dries out rapidly in the spring. The soil is subject to late frost.

Most areas of this soil are used for cultivated crops. A few are used for specialty crops, particularly mint. The rest are used for pasture, hay, or woodland.

If drained, this soil is fairly well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is suited to intensive row cropping. In inadequately drained areas, however, it is poorly suited to most crops. Subsurface drains, surface drains, pumps, or a combination of these can remove excess water. If the soil is overdrained, however, drought is a hazard. Windbreaks, cover crops, and a system of conservation tillage that leaves all or most of the crop residue on the surface help to control soil blowing and maintain tilth and the organic matter content.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and white clover, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Competing vegetation can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often needed. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and the potential for frost action. The mucky surface layer should be removed when the roads are constructed. Building the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 5W.

ShA—Shipshe sandy loam, 0 to 2 percent slopes. This nearly level, well drained soil is on an outwash plain. Areas are broad and irregular in shape and are 5 to 1,000 acres in size.

Typically, the surface layer is very dark brown sandy loam about 12 inches thick. The subsurface layer is very dark grayish brown very gravelly sandy loam about 6 inches thick. The subsoil is about 21 inches thick. It is dark reddish brown and firm. The upper part is very gravelly sandy loam, and the lower part is very gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown, stratified sand and very gravelly coarse sand. In some areas the surface layer contains more gravel. In other areas the subsoil contains less sand, less gravel, or both. In a few areas the depth to

the underlying material is less than 30 or more than 40 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are areas of the well drained Griswold soils. These soils are more clayey than the Shipshe soil. They are in landscape positions similar to those of the Shipshe soil. Also included are areas of the somewhat poorly drained Homer and moderately well drained Bronson soils in shallow depressions and small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Shipshe soil and very rapid in the underlying material. The available water capacity is low. Runoff is slow. The organic matter content is high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. If irrigated and well managed, it is well suited to intensive row cropping. The low available water capacity is the main management concern. A system of conservation tillage that leaves all or most of the crop residue on the surface, crop rotations that include grasses and legumes, and grassed waterways conserve moisture and help to maintain the organic matter content and tilth. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. The low available water capacity is the main limitation. Deep-rooted species are the best suited forage plants. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. The soil is moderately limited as a site for local roads and streets because of frost action. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIs. No woodland ordination symbol is assigned.

ShB—Shipshe sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on a broad outwash plain. Areas are elongated, oval, or crescent shaped and are 5 to 25 acres in size.

Typically, the surface layer is very dark brown sandy loam about 10 inches thick. The subsurface layer is very dark grayish brown very gravelly sandy loam about 6 inches thick. The subsoil is about 19 inches thick. It is dark reddish brown and firm. The upper part is very gravelly sandy loam, and the lower part is very gravelly sandy clay loam. The underlying material to a depth of 60 inches is brown, stratified sand and very gravelly coarse sand. In some areas the surface layer contains more gravel, is lighter colored, or is thinner. In other areas the soil is moderately eroded. In places the subsoil contains less sand, less gravel, or both. In a few areas the depth to the underlying material is less than 30 or more than 40 inches. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are areas of the well drained Griswold soils. These soils are more clayey than the Shipshe soil. They are in landscape positions similar to those of the Shipshe soil. They make up about 5 percent of the map unit.

Permeability is moderately rapid in the subsoil of the Shipshe soil and very rapid in the underlying material. The available water capacity is low. Runoff is medium. The organic matter content is high in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. A few are used for pasture, hay, or woodlots. Most of the woodlots have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. The low available water capacity and the hazard of erosion are management concerns. The crops respond well to irrigation. Winter cover crops and crop rotations that include grasses and legumes help to control runoff and erosion. A system of conservation tillage that leaves all or most of the crop residue on the surface helps to control erosion, conserves moisture, and helps to maintain tilth and the organic matter content. The soil is well suited to no-till and till-plant cropping systems.

This soil is well suited to forage grasses and legumes, such as bromegrass and alfalfa. The low available water capacity is the main limitation. Deep-rooted species are the best suited forage plants. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is suitable as a site for dwellings. The sides of shallow excavations can cave in unless they are reinforced. Because of frost action, the soil is moderately limited as a site for local roads and streets. Replacing or covering the upper soil layers with suitable base material helps to prevent the damage caused by frost action.

Because of a poor filtering capacity, this soil is severely limited as a site for septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Because of the common practice of installing deep wells and the usual geologic

stratification of the material at a depth of more than 60 inches, however, only nearby shallow wells are in danger of contamination.

The land capability classification is IIIe. No woodland ordination symbol is assigned.

Sn—Shoals loam, gravelly substratum, occasionally flooded. This nearly level, somewhat poorly drained soil is on flood plains along the major streams and along narrow creeks. It is occasionally flooded for brief periods during winter and early spring. Areas are long and narrow and are 5 to 80 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The upper part of the underlying material is yellowish brown and dark grayish brown, mottled, friable and firm loam. The next part is brown and grayish brown, mottled, firm clay loam and loam. The lower part to a depth of 60 inches is gray, loose gravelly loamy sand. In some areas the surface layer is sandy loam. In other areas the underlying material contains more clay or more sand and less gravel. In places the soil is gently sloping.

Included with this soil in mapping are areas of the very poorly drained Saranac soils. These soils are in the lower areas in depressions and at the base of upland slopes. They make up about 10 percent of the map unit.

Permeability is moderate in the loamy part of the Shoals soil and rapid or very rapid in the gravelly loamy sand. The available water capacity is high. Runoff is very slow. The water table is at a depth of 1 to 3 feet during winter and early spring. The organic matter content is moderate in the surface layer. This layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

Most areas of this soil are used for cultivated crops. Many support a natural cover of mixed hardwoods. Many woodlots have been grazed. A few areas are pastured.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is well suited to intensive row cropping. Because of the wetness, the flooding, or both, late planting or replanting is sometimes necessary. Subsurface drains, surface drains, or a combination of these can help to overcome the wetness. A system of conservation tillage that leaves all or most of the crop residue on the surface improves or helps to maintain tilth and the organic matter content. The soil is well suited to a ridge-plant cropping system.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and birdsfoot trefoil, for hay and pasture. Unless drained, it is poorly suited to deep-rooted legumes because of the high water table. The wetness and the flooding are the main problems. Grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. The main management concerns are the equipment limitation and plant competition. The seasonal high water table hinders harvesting activities. Equipment should be used only during dry periods or when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the flooding, this soil is generally unsuitable as a site for dwellings, septic tank absorption fields, and local roads and streets.

The land capability classification is IIw. The woodland ordination symbol is 5W.

To—Toledo silty clay. This nearly level, very poorly drained soil is in depressions and small glacial lakebeds on uplands and terraces. It is often ponded by runoff from the higher adjacent soils. Areas are elongated or irregularly shaped and are 5 to 100 acres in size.

Typically, the surface layer is very dark gray silty clay about 6 inches thick. The subsurface layer also is very dark gray silty clay. It is about 3 inches thick. The subsoil is mottled, firm silty clay about 33 inches thick. The upper part is dark gray, and the lower part is gray. The underlying material to a depth of 60 inches is gray, mottled silty clay. In some places the surface layer is silt loam, is more than 9 inches thick, or both. In other places the subsoil and the underlying material contain more sand, more gravel, or both. In some areas they contain less clay and more silt. In a few areas the underlying material is glacial till within a depth of 48 inches. In places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the poorly drained Washtenaw soils in upland drainageways and depressions. These soils are more silty than the Toledo soil. Also included are small areas of the somewhat poorly drained Del Rey soils on slight rises, along the sides of small drainageways, and in saddles. Included soils make up about 5 percent of the map unit.

Permeability is slow in the Toledo soil. The available water capacity is moderate. Runoff is very slow or ponded. The water table is near or above the surface during winter and spring. The organic matter content is high in the surface layer. This layer dries out slowly in the spring. Clods form if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is very difficult.

Most areas of this soil are used for row crops. A few are used for small grain, hay, pasture, or woodland.

If drained, this soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is well suited to intensive row cropping. Subsurface drains, surface drains, or a combination of these can remove excess water. Adequate drainage outlets are not readily available in some areas. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting,

improve tilth, increase the rate of water infiltration, and help to maintain the organic matter content. The soil is well suited to fall plowing, fall chiseling, and a ridge-plant cropping system.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and birdsfoot trefoil, for hay and pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Even if subsurface drains are installed, the legumes can be damaged during periods of ponding. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Overgrazing also reduces plant density and plant hardiness. Proper stocking rates, timely grazing, and restricted use during wet periods help to maintain good tilth and plant density.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of low strength, the ponding, and frost action. Strengthening or replacing the base with better suited material improves the ability of the roads to support vehicular traffic. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

Ud—Udorthents, loamy. These nearly level to moderately steep soils are on outwash plains, till plains, and moraines. Areas are rectangular or oval and are 5 to 40 acres in size.

These soils consist of dominantly loamy material 12 to 60 inches deep over solid waste. The soil material is a mixture of sandy loam, loamy sand, sandy clay loam, loam, and clay loam. The solid waste is metal, wood, plastics, and various kinds of decomposing organic solids.

Included with these soils in mapping are small areas of undisturbed soils. These included soils make up about 10 percent of the map unit.

The physical characteristics of the Udorthents vary. The slope, the depth to solid waste, and the stage of decomposition in the waste determine the suitability of these soils for selected uses. Most of the acreage is idle land covered with weeds and brush. Recently disturbed areas support no vegetation.

Special management is needed if these soils are farmed. An intensified fertility program that includes the incorporation of organic residue or manure into the soils is needed if cultivated crops are grown. In the gently sloping to moderately steep areas, measures that control erosion are needed. Examples are diversions, terraces, and grassed waterways. Exposed areas should be revegetated as soon as possible after the conversion to an agricultural use.

Growing grasses and legumes for pasture or hay is the best means of controlling erosion. An intensive fertility program is necessary if a vigorous plant cover is to be established.

Reforestation is another means of controlling runoff and erosion. Seedling mortality is the main management concern. An intensive fertility program helps to establish the seedlings. Drought-tolerant species should be selected for planting. Replanting is often necessary.

Because of instability, hazardous gases, and the possibility of poisonous residues, these soils are generally unsuitable as sites for dwellings. An alternative site should be selected.

No land capability classification or woodland ordination symbol is assigned.

Uf—Udorthents-Urban land complex. This map unit occurs as nearly level to moderately steep, well drained soils intermingled with areas of Urban land. The unit is on outwash plains, till plains, and moraines. The Udorthents have been mixed by cutting, leveling, or filling. The Urban land is covered with buildings, roads, and parking lots. Areas are irregular in shape and are 5 to 75 acres in size. They are about 70 percent Udorthents and 20 percent Urban land. The Udorthents and the Urban land occur as areas so intricately mixed that mapping them separately is not practical.

In most areas of the Udorthents, the soil material is a mixture of loamy sand, sandy loam, sandy clay loam, loam, and clay loam. The content of coarse fragments is 5 to 35 percent.

Included with the Udorthents and Urban land in mapping are small areas of undisturbed soils. Also included are some sandy and gravelly areas. Included soils make up about 10 percent of the map unit.

The physical characteristics of the Udorthents vary. The suitability of these soils for most uses depends on the slope, the texture of the disturbed layers, and the composition of the underlying material. Most of the acreage is idle land. Most of the steeper areas are abandoned gravel pits. Many areas have a permanent cover of vegetation. Some are farmed.

Special management is needed if the Udorthents are farmed. An intensified fertility program that includes the incorporation of organic residue or manure into the soils is needed if cultivated crops are grown. In the gently

sloping to moderately steep areas, measures that control erosion are needed. Examples are diversions, grade stabilization structures, and grassed waterways. A drainage system may be needed in the nearly level areas.

Onsite investigation is needed if this map unit is to be used for additional building site development. Because soil properties vary from one area to another, engineering test data are needed. Erosion is a hazard on construction sites. As little vegetation as possible should be removed before construction, and a protective plant cover should be established as soon as possible after construction. A subsurface drainage system may be needed in the nearly level areas. The limitations that can affect septic tank absorption fields vary. They include restricted permeability in all areas, wetness in nearly level areas, and the slope in gently sloping to moderately steep areas.

No land capability classification or woodland ordination symbol is assigned.

Wa—Wallkill silt loam. This nearly level, very poorly drained soil is in depressional areas on moraines, till plains, and outwash plains. It also is at the outer edges of large marshes and along streams draining the marshes. It is frequently ponded by runoff from the higher adjacent soils. Areas are round, oval, or long and narrow and are 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is very dark gray and dark gray silt loam about 16 inches thick. Below this is muck about 36 inches thick. The upper part of the muck is black and firm, and the lower part is dark reddish brown and friable. In some areas the overwash has thin layers of sandy loam or loamy sand. In a few places it is as thin as 10 inches or as thick as 48 inches. In places loamy, sandy, or marly material is within a depth of 60 inches.

Included with this soil in mapping are a few areas of the very poorly drained Edwards, Houghton, and Palms soils. These soils are less silty than the Wallkill soil. They are mainly near the middle of the depressions. They make up about 15 percent of the map unit.

Permeability is moderate in the mineral layers of the Wallkill soil and moderately rapid in the organic material. The available water capacity is high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled. Clods form, however, if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some of the wetter areas support weeds and brush. A few areas are used for pasture or support a natural cover of water-tolerant hardwoods. Some of the wooded areas are grazed.

If drained, this soil is fairly well suited to corn and soybeans. If drained and otherwise well managed, it can be intensively row cropped. Excess water can be removed by subsurface drains, surface drains, pumps, or a combination of these. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, and increase the rate of water infiltration. The soil is well suited to spring plowing.

This soil is poorly suited to most of the grasses and legumes grown for hay and pasture because the water table restricts root growth and frost heave is a problem. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Proper stocking rates, pasture rotation, and timely deferment of grazing help to keep the pasture in good condition.

This soil is poorly suited to trees. Seedling mortality, the windthrow hazard, plant competition, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings, local roads and streets, and septic tank absorption fields.

The land capability classification is IIIw. The woodland ordination symbol is 3W.

Wc—Washtenaw silt loam. This nearly level, poorly drained soil is in depressions and drainageways on till plains and moraines. It is often ponded by runoff from the higher adjacent soils. Areas are oval or elongated and are 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The next 22 inches is dark grayish brown, friable and firm silt loam and loam. Below this is a buried surface layer of very dark brown silt loam about 8 inches thick. The buried subsoil is about 16 inches of dark gray and gray, mottled, firm silty clay loam and clay loam. The underlying material to a depth of 60 inches is brown, mottled loam. In some areas, the surface layer is sandy loam and the next layer has thin strata of sandy loam, loamy sand, or sand. In a few places the depth to the buried surface layer is less than 20 or more than 40 inches. In some areas the subsoil and underlying material contain more sand, more gravel, or both. In a few places the underlying material is organic or is sandy loam.

Included with this soil in mapping are areas of the very poorly drained Pewamo, Rensselaer, and Toledo soils. These soils are less silty than the Washtenaw soil. They are in landscape positions similar to those of the

Washtenaw soil. They make up about 15 percent of the map unit.

Permeability is moderate in the upper part of the Washtenaw soil and slow in the subsoil and underlying material. The available water capacity is high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled. Clods form, however, if the soil is plowed when it is wet.

Most areas of this soil have been drained and are used for cultivated crops. Some support weeds and brush. A few are used for pasture or support a natural cover of water-tolerant brush and hardwoods.

If drained, this soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be intensively row cropped. Subsurface drains, surface drains, pumps, or a combination of these can remove excess water. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, and increase the rate of water infiltration. The soil is well suited to fall plowing, fall chiseling, and till-plant and ridge-plant cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and white clover, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Even if subsurface drains are installed, the legumes are damaged during periods of ponding. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and the potential for frost action. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

We—Washtenaw loam, gravelly substratum. This nearly level, poorly drained and very poorly drained soil is in depressions and drainageways on outwash plains and at the base of low moraines. It is often ponded by runoff from the higher adjacent soils. Areas are oval or elongated and are 5 to 25 acres in size.

Typically, the surface layer is very dark grayish brown loam about 11 inches thick. The next layer is dark grayish brown, friable silt loam about 12 inches thick. Below this is a buried surface layer of very dark gray sandy loam about 7 inches thick. The buried subsoil is about 26 inches of dark gray and very dark gray, mottled, firm and friable sandy clay loam and sandy loam. The underlying material to a depth of 60 inches is dark gray gravelly loamy coarse sand. In some areas, the surface layer is sandy loam and the next layer has strata of loamy sand or sand. In a few places the depth to the buried surface layer is less than 20 or more than 40 inches. In some areas the subsoil and underlying material contain less sand, less gravel, or both. In places the underlying material is organic.

Included with this soil in mapping are areas of the very poorly drained Rensselaer soils in the slightly higher landscape positions. These soils are less silty than the Washtenaw soil. They make up about 15 percent of the map unit.

Permeability is moderate or moderately slow in the subsoil of the Washtenaw soil and very rapid in the underlying material. The available water capacity is high. Runoff is very slow or ponded. The water table is near or above the surface during winter and early spring. The organic matter content is high in the surface layer. This layer is friable and can be easily tilled. Clods form, however, if the soil is plowed when it is wet.

Most areas of this soil have been drained and are used for cultivated crops. Some support weeds and brush. A few are used for pasture or support a natural cover of water-tolerant brush and hardwoods.

If drained, this soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it can be intensively row cropped. Subsurface drains, surface drains, pumps, or a combination of these can remove excess water. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface minimize crusting, improve tilth, and increase the rate of water infiltration. The soil is well suited to fall plowing, fall chiseling, and till-plant and ridge-plant cropping systems.

If drained, this soil is well suited to grasses and legumes, such as reed canarygrass and white clover, for hay or pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the ponding and the high water table. Even if subsurface drains are installed, the legumes are damaged during periods of ponding. Overgrazing or grazing when the soil is wet results in surface compaction and poor tilth. Pasture rotation, timely deferment of grazing, and

restricted use during wet periods help to keep the pasture in good condition.

This soil is fairly well suited to trees. Plant competition, seedling mortality, the windthrow hazard, and the equipment limitation are management concerns. Unwanted trees and shrubs can be controlled by cutting, spraying, or girdling. Water-tolerant species should be selected for planting. Replanting of seedlings is often necessary. Carefully thinning the stands or not thinning them at all and applying harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Equipment should be used only during dry periods or when the ground is frozen.

Because of the ponding, this soil is generally unsuitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads because of the ponding and the potential for frost action. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by ponding and frost action.

The land capability classification is IIw. The woodland ordination symbol is 5W.

WIB—Wawasee fine sandy loam, 2 to 6 percent slopes. This gently sloping, well drained soil is on till plains and moraines. Areas are 5 to 200 acres in size. Most are broad and irregular in shape, but some are elongated.

Typically, the surface layer is dark grayish brown fine sandy loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is dark yellowish brown, friable loam; the next part is brown, firm sandy clay loam; and the lower part is brown, friable sandy clay loam. The underlying material to a depth of 60 inches is brown fine sandy loam. In some areas the surface layer is loamy sand. In other areas it is darker. In places the soil is moderately eroded. In a few areas the subsoil, the underlying material, or both have more clay and less sand. In some places the depth to the underlying till is more than 40 inches. In other places the underlying material is stratified with silt loam, loamy sand, or loam. In some areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are small areas of the well drained Metea soils on knolls and side slopes and small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils at the base of slopes, on flats, and in depressions and small drainageways. Metea soils are more sandy than the Wawasee soil. Also included are a few areas where the soil is severely eroded. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Wawasee soil. The available water capacity also is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay. A few support a natural cover of mixed hardwoods. Many of the wooded areas have been grazed.

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. If cultivated crops are grown, measures that control erosion and runoff are needed. Examples are a crop rotation that includes grasses and legumes, water- and sediment-control basins, grassed waterways, diversions, terraces, and grade stabilization structures. Cover crops and a system of conservation tillage that leaves all or most of the crop residue on the surface improve or help to maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

This soil is suitable as a site for dwellings. Because of frost action, it is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic. The soil is moderately limited as a site for septic tank absorption fields because of the moderate permeability. Enlarging the absorption area improves the ability of the field to absorb the effluent.

The land capability classification is IIe. The woodland ordination symbol is 5A.

WIC2—Wawasee fine sandy loam, 6 to 12 percent slopes, eroded. This moderately sloping, well drained soil is on broad uplands and on side slopes along drainageways. Areas are long and narrow or irregularly shaped and are 5 to 50 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. It is mixed with some dark yellowish brown subsoil material. The subsoil is about 28 inches thick. The upper part is dark yellowish brown, friable loam; the next part is brown, firm sandy clay loam; and the lower part is brown, friable sandy clay loam. The underlying material to a depth of 60 inches is brown fine sandy loam. In some areas the surface layer is loamy sand. In other areas it is darker. In some places the soil is slightly eroded or severely eroded. In other places the subsoil, the underlying material, or both have more clay and less sand. In some areas the depth to the underlying till is more than 40 inches. In other areas the underlying

material is stratified with silt loam, loamy sand, or loam. In places the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are some areas of the well drained Metea soils on knolls and side slopes. These soils are more sandy than the Wawasee soil. Also included are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils at the base of slopes, in depressions, and along small drainageways. Included soils make up about 10 percent of the map unit.

Permeability is moderate in the Wawasee soil. The available water capacity also is moderate. Runoff is medium. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay. A few support a natural cover of mixed hardwoods. Most of the wooded areas have been grazed.

This soil is fairly well suited to corn, soybeans, and small grain. Erosion is the major hazard. A crop rotation that includes grasses and legumes, cover crops, water- and sediment-control basins, diversions, terraces, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. A system of conservation tillage that leaves all or most of the crop residue on the surface improves or helps to maintain tilth and the organic matter content. The soil is well suited to till-plant and no-till cropping systems.

This soil is well suited to grasses and legumes, such as bromegrass and alfalfa, for hay or pasture. Erosion is the main hazard. Overgrazing or grazing when the soil is wet results in surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the slope, this soil is moderately limited as a site for dwellings. The slope should be modified by land grading, or the buildings should be designed so that they conform to the natural slope of the land. Because of the potential for frost action and the slope, the soil is moderately limited as a site for local roads and streets. Strengthening or replacing the base with better suited material improves the ability of the roads and streets to support vehicular traffic. Cutting and filling and constructing the roads on the contour help to overcome the slope. Installing road culverts at strategic locations helps to prevent water damage.

Because of the moderate permeability and the slope, this soil is moderately limited as a site for septic tank absorption fields. Enlarging the absorption area improves the ability of the field to absorb the effluent. Installing the absorption field on the contour helps to overcome the slope. Cutting and filling may be needed.

The land capability classification is IIIe. The woodland ordination symbol is 5A.

WID2—Wawasee fine sandy loam, 12 to 18 percent slopes, eroded. This strongly sloping, well drained soil is on the sides of ridges and along drainageways in the uplands. Areas are elongated or irregularly shaped and are 5 to 25 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 6 inches thick. It is mixed with some dark yellowish brown subsoil material. The subsoil is about 27 inches thick. The upper part is dark yellowish brown, friable loam; the next part is brown, firm sandy clay loam; and the lower part is brown, friable sandy clay loam. The underlying material to a depth of 60 inches is brown fine sandy loam. In some areas the surface layer is loamy sand. In other areas it is darker. In some places the soil is slightly eroded or severely eroded. In other places the subsoil, the underlying material, or both have more clay and less sand. In some areas the depth to the underlying till is more than 40 inches. In other areas the underlying material is stratified with silt loam, loamy sand, or loam. In places the slope is less than 12 or more than 18 percent.

Included with this soil in mapping are some areas of the well drained Metea soils on knolls and side slopes. These soils are more sandy than the Wawasee soil. Also included are small areas of the somewhat poorly drained Aubbeenaubbee and Crosier soils at the base of slopes and along small drainageways. Included soils make up about 5 percent of the map unit.

Permeability is moderate in the Wawasee soil. The available water capacity also is moderate. Runoff is rapid in cultivated areas. The organic matter content is moderate in the surface layer. This layer is very friable and can be easily tilled throughout a wide range in moisture content.

Many areas of this soil are used for pasture or hay. Some are used for cultivated crops. A few support a natural cover of mixed hardwoods. A few are used as wildlife habitat.

This soil is poorly suited to corn, soybeans, and small grain. The slope and the hazard of erosion are management concerns. Cover crops, diversions, grassed waterways, and grade stabilization structures help to prevent excessive soil loss. A system of conservation tillage that leaves all or most of the crop residue on the surface improves tilth and helps to maintain the organic matter content. The soil is well suited to a no-till cropping system. A crop rotation that is dominated by grasses and legumes is the most effective means of controlling runoff and erosion.

This soil is fairly well suited to grasses and legumes, such as bromegrass and alfalfa, for hay and pasture. Erosion is a severe hazard. Operating some types of haying equipment is hazardous on these slopes. Overgrazing or grazing when the soil is wet results in

surface compaction, excessive runoff, and poor tilth. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. The main management concerns are plant competition, the erosion hazard, and the equipment limitation. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling. Trees should be planted on the contour, and logging roads, skid trails, and landings should be established on the gentler slopes. The use of some equipment is limited because of the slope.

Because of the slope, this soil is severely limited as a site for dwellings, local roads and streets, and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land, local roads and streets should be built on the contour, and septic tank absorption fields should be installed on the contour. Cutting and filling and land shaping may be needed. Installing road culverts at strategic locations helps to prevent water damage.

The land capability classification is IVe. The woodland ordination symbol is 5R.

Wt—Whitaker loam. This nearly level, somewhat poorly drained soil is on outwash plains and terraces. Areas are irregularly shaped, oblong, or elongated and are 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown loam about 9 inches thick. The subsurface layer is grayish brown loam about 6 inches thick. The subsoil is mottled, firm clay loam about 29 inches thick. The upper part is yellowish brown, the next part is dark grayish brown, and the lower part is yellowish brown. The underlying material to a depth of 60 inches is multicolored, stratified loamy sand, sandy loam, loam, and silt loam. In places the surface layer is very dark grayish brown. In some areas the depth to mottles is greater. In other areas the subsoil is grayish brown. In a few places the lower part of the subsoil is loamy sand. In some places it has a gravel content of 5 to more than 15 percent. In other places the subsoil is underlain by till or by strata of clay loam or silty clay loam. In some areas the depth to the underlying material is less than 36 inches. In other areas the slope is more than 2 percent.

Included with this soil in mapping are small areas of the well drained Martinsville and very poorly drained Rensselaer soils. Martinsville soils are on low knolls and ridges. Rensselaer soils are in depressions and poorly defined drainageways. Included soils make up about 15 percent of the map unit.

Permeability is moderate in the Whitaker soil. The available water capacity is high. Runoff is slow. The water table is at a depth of 1 to 3 feet during winter and early spring. The organic matter content is moderate in the surface layer. Clods form if the soil is plowed when it is wet. Because of the cloddiness, preparing a friable seedbed is difficult.

Most areas of this soil are used for cultivated crops. Some are used for pasture or hay or support a natural cover of mixed hardwoods (fig. 14). Some of the wooded areas are grazed.

This soil is well suited to corn, soybeans, and small grain. If drained and otherwise well managed, it is well suited to intensive row cropping. Subsurface drains, surface drains, or a combination of these can remove excess water. A system of conservation tillage that leaves all or most of the crop residue on the surface improves tilth and helps to maintain the organic matter content. The soil is well suited to fall chiseling and to a till-plant cropping system.

If drained, this soil is well suited to grasses and legumes, such as bromegrass and birdsfoot trefoil, for hay and pasture. Unless drained, it is poorly suited to deep-rooted legumes, such as alfalfa, because of the seasonal high water table. Overgrazing or grazing under wet conditions results in surface compaction and poor tilth. Proper stocking rates, timely grazing, and restricted use during wet periods help to keep the pasture in good condition.

This soil is well suited to trees. Plant competition is moderate. Seedlings survive and grow well if competing vegetation is controlled by cutting, spraying, or girdling.

Because of the wetness, this soil is severely limited as a site for dwellings and septic tank absorption fields. The water table can be lowered by a drainage system. Interceptor drains are needed around the outer edges of the absorption fields. Dwellings should be constructed without basements, and subsurface drains should be installed around properly designed footings. Because of frost action, the soil is severely limited as a site for local roads and streets. An adequate drainage system along the roads helps to prevent the damage caused by frost action.

The land capability classification is IIw. The woodland ordination symbol is 4A.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban

Figure 14.—An excellent stand of native hardwoods in an area of Whitaker loam.

and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 232,000 acres in the survey area, or about 65 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in associations 4, 5, 6, 8, and 9, which are described under the heading "General Soil Map Units."

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

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

Stephen A. Boeder, district conservationist, Soil Conservation Service, helped prepare 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.

About 244,000 acres in the county is used as cropland. Of this total, about 125,000 acres is used for corn, 70,000 acres for soybeans, 15,000 acres for wheat, 2,000 acres for oats, 30,000 acres for rotation hay and pasture, and 2,000 acres for specialty crops, such as fruits, vegetables, sunflowers, and mint.

In 1968, about 21,000 acres of potentially good cropland was used as pasture and 18,000 acres as woodland (*9*). In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly aid in the application of such technology.

The paragraphs that follow describe the major management concerns in the areas of the county used for crops and pasture. These concerns are water erosion, soil blowing, wetness, fertility, and tilth.

Water erosion and *soil blowing* affect all of the cropland in the county to some extent. In 1981, about 49 percent of the cropland was eroding at or below the tolerable level (T), 46 percent was eroding above T but at a rate of less than 10 tons per acre per year, and 5 percent was eroding at a rate of more than 10 tons per acre per year. About 71 percent of the pasture was eroding at a rate of less than T, 23 percent between T and 10 tons per acre per year, and 6 percent at a rate of more than 10 tons per acre per year.

About 50 percent of the soils in the county are susceptible to soil blowing. These soils have a surface layer of sandy loam, loamy sand, or a similar texture. Examples are Boyer, Kosciusko, and Ormas soils.

Water erosion is caused by the impact of raindrops on the surface and by runoff. As raindrops impact on an unprotected surface, soil particles are dislodged and moved into voids on the surface. As a result, the rate of water infiltration into the soil is reduced and the runoff rate increases. As water flows off the landscape, loose soil particles are picked up and carried downslope. Soils

that have a surface layer of silt loam, loam, silty clay loam, or clay loam are the most susceptible to erosion. Morley, Glynwood, Blount, and Miami are examples of soils that are highly susceptible to erosion.

Soil blowing occurs through the processes of saltation, surface creep, and suspension. Saltation occurs when soil particles are moved through alternate lifting and filling motions. Through suspension, the soil particles are lifted into the air and carried away. Through surface creep, they are not lifted but are pushed along the surface.

Water erosion and soil blowing remove topsoil and thus reduce the productivity of the soil. The eroding soil material is deposited within a short distance or is carried into streams or lakes, where it lowers water quality, stimulates the growth of weeds, and destroys the habitat for small animals and plants.

Soil conservation measures slow the rate of runoff, protect the surface, or both. Grassed waterways, terraces, and diversions are examples of measures that slow the rate of runoff. Crop rotations that include grasses and legumes, no-till farming or another system of conservation tillage, and a permanent cover of grasses help to protect the surface.

Soil blowing can be minimized by windbreaks of trees or tall grasses, which break the windflow pattern. A system of conservation tillage that leaves crop residue on the surface, crop rotations that include grasses and legumes, a permanent cover of vegetation, and cover crops also help to control soil blowing.

Soil blowing in Kosciusko County is especially critical in May. Measures that protect small seedlings are needed. The appropriate level of protection depends on the susceptibility of the soil to soil blowing. It also depends on the type of crop grown. Specialty crops, for example, cannot withstand any bombardment by windblown soil particles. Consequently, they require a much higher level of protection than corn.

Wetness is a limitation on about 72,000 acres of the cropland in the county and on a significant acreage of pasture. A combination of surface and subsurface drains is needed in some soils, such as Washtenaw, Toledo, and Rensselaer soils. Where adequate outlets are not available, a pump drainage system is needed.

In areas of organic soils, such as Houghton, Edwards, and Palms, a special drainage system is needed. Drainage aerates the soils. Aeration increases oxidation. As a result, the soils subside. A drainage system that keeps the water table at the level required by the crops during the growing season and raises it to the surface during the rest of the year minimizes the oxidation and subsidence of these soils. Because of variations in the degree of decomposition and in the origin of the parent material, internal water movement may not be uniform. As a result, achieving uniform drainage throughout a field may be difficult.

Further information about the design of drainage systems for each kind of soil is available in local offices of the Soil Conservation Service.

Soil fertility is determined by the amount of nutrients available to plants. The natural fertility of soils varies, depending on their physical and chemical properties. Natural fertility is low in most of the soils on uplands and terraces because the nutrients have been leached away and reaction is medium acid. Natural fertility is high in the soils in upland depressions and on bottom land. These soils receive runoff from adjacent soils, are neutral, and have not been leached of nutrients so extensively as other soils.

The natural fertility of soils can be changed. Additions of fertilizer and lime increase the supply of available nutrients and raise the pH of the soil. On the other hand, if crops are harvested year after year and no fertilizer is added, the supply of available nutrients decreases and the pH is lowered. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts to be applied.

Tilth is an important factor affecting the preparation of a seedbed, the germination of seeds, and the infiltration of water into the soil. Soils in which tilth is good have granular structure and are friable and porous. Soils in which tilth is poor cannot be easily worked into a good seedbed. They are cloddy and tend to dry out more slowly than other soils. When they do dry out, they become hard. Heavy rainfall on soils that have poor soil structure causes surface sealing, which reduces the rate of water infiltration and increases the runoff rate. The sealed surface becomes a hard crust when it dries. Germinating seeds cannot easily break through the crusted surface.

Tilth can be maintained or improved by adding crop residue, manure, or other organic material to the soil. Applying a system of conservation tillage and working the soil when moisture conditions are favorable minimize the damage to soil structure. Fall plowing does not improve the tilth of most of the soils in Kosciusko County. The hazard of erosion increases if the surface is bare throughout winter and early spring. The dark, nearly level, loamy or clayey soils in depressions are the only soils that should be plowed in the fall. Freezing and thawing can improve the tilth of these soils and allow them to warm up earlier in the spring.

Forage crops are well suited to the soils and climate in Kosciusko County. Alfalfa and red clover are the most commonly grown legumes in the county. They are well suited to the well drained soils and can be grown on the very poorly drained soils if surface and subsurface drains are installed to remove excess water. Timothy, bromegrass, and orchardgrass are the most commonly grown grasses on the well drained soils. Reed

canarygrass can be grown on the poorly drained and very poorly drained soils.

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 land capability classification of each map unit also is shown in the table.

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 ensures the smallest possible loss.

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 for those crops.

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 criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include 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 rangeland, 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.

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 few limitations that restrict their use.

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

Class III soils have severe limitations that reduce the choice of plants 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, rangeland, woodland, wildlife habitat, or recreation.

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" and in the yields table.

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 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 an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site 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.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for 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, help to keep 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 ensure 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 commercial nursery.

Recreation

Kosciusko County has numerous facilities for outdoor recreational activities. These activities include hunting, fishing, boating, swimming, camping, and horseback riding. The Tri-County Fish and Game Area makes up about 3,000 acres of rolling to hilly land in the northeastern part of the county. It includes many lakes, marshes, and wooded areas interrupted by cultivated fields. It offers excellent opportunities for outdoor recreation (*5*).

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 and horseback riding 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

James D. McCall, biologist, Soil Conservation Service, helped prepare this section.

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 soybeans.

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 bluegrass, bromegrass, orchardgrass, clover, timothy, 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 ragweed, goldenrod, wild carrot, foxtail, and dock.

Hardwood trees and woody understory produce nuts or other fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are maple, oak, poplar, cherry, beech, apple, black walnut, hawthorn, dogwood, hickory, blackberry, and raspberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, and dogwood.

Coniferous plants furnish browse and seeds. 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, and cedar.

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, cattail, arrowhead, 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, mourning dove, pheasant, meadowlark, killdeer, field sparrow, cottontail rabbit, woodchuck, and red fox.

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 blue jay, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Edge habitat consists of areas where major land uses or cover types adjoin. A good example is the border between dense woodland and a field of no-till corn. Although not rated in the table, edge habitat is of primary importance to animals from the smallest songbirds to

white-tailed deer. Most of the animals that inhabit openland or woodland also frequent edge habitat, and desirable edge areas are consistently used by 10 times as many wildlife as are the centers of large areas of woodland or cropland.

Engineering

Max L. Evans, state conservation engineer, Soil Conservation Service, helped prepare this section.

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, slope, 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 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 filter the effluent effectively. 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 and for aquifer-fed excavated 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, irrigation, 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.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table (fig. 15). 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.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

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 soil blowing 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 soil blowing, 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.

Figure 15.—An aquifer-fed excavated pond in an area of Sebewa loam.

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.

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.

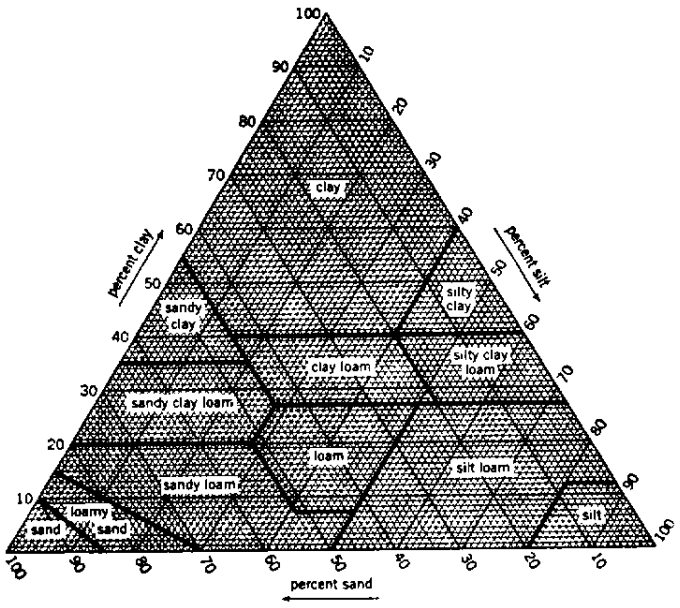


Figure 16.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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 (fig. 16). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, 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, CL-ML.

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 ovendry 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 generally 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 earthmoving 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.

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 soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. 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 soil blowing 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 soil blowing 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 soil blowing 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 soil blowing are used.
5. Loamy soils that are less than 20 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 soil blowing are used.
6. Loamy soils that are 20 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 soil blowing.

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 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.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

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 is not considered flooding, nor is water in swamps and marshes.

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, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 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 are 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.

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 the 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.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Indiana State Highway Research and Training Center, Purdue University.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—

D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Moisture density, Method A—T 99 (AASHTO), D 698 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). 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. Table 20 shows the classification of the soils in the survey area. 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 Alfisol.

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 Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

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 has 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 underlying material 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* (*8*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*10*). 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."

Abscota Series

The Abscota series consists of well drained, rapidly permeable soils on flood plains. These soils formed in sandy alluvial deposits. Slopes range from 0 to 2 percent.

Abscota soils are adjacent to Shoals and Saranac soils. The adjacent soils have a mottled subsoil and contain more clay than the Abscota soils. They are in the lower positions on the landscape.

A typical pedon of Abscota fine sandy loam, occasionally flooded, in a cultivated field; 700 feet south

and 2,200 feet east of the northwest corner of sec. 14, T. 30 N., R. 7 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.
Bw—9 to 20 inches; dark yellowish brown (10YR 3/4) sand; weak medium granular structure; very friable; common fine roots; mildly alkaline; clear smooth boundary.
C1—20 to 30 inches; brown (10YR 4/3) sand; single grain; loose; few fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.
C2—30 to 38 inches; brown (10YR 4/3) sand; single grain; very friable; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.
C3—38 to 50 inches; dark brown (10YR 3/3) sand; single grain; loose; few fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.
C4—50 to 56 inches; dark yellowish brown (10YR 3/4) sand; massive; very friable; about 1 percent gravel; strong effervescence; moderately alkaline; abrupt smooth boundary.
C5—56 to 60 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; about 12 percent gravel; strong effervescence; moderately alkaline.

The control section is neutral or mildly alkaline. Below a depth of 40 inches, reaction ranges to moderately alkaline. The content of coarse fragments is 0 to 3 percent to a depth of 50 inches.

The A horizon has chroma of 1 to 3. It is fine sandy loam, sandy loam, or loamy sand. The B horizon has value of 3 or 4 and chroma of 2 to 4. It is loamy sand, sand, or loamy fine sand. The C horizon has value of 3 to 5 and chroma of 2 to 4. It is dominantly sand or coarse sand, but gravelly coarse sand is below a depth of 50 inches in some pedons.

Aubbeenaubbee Series

The Aubbeenaubbee series consists of somewhat poorly drained soils on till plains and moraines. These soils formed in loamy outwash and the underlying glacial till. Permeability is moderate or moderately rapid in the upper part of the subsoil and moderate or moderately slow in the lower part and in the underlying material. Slopes range from 0 to 2 percent.

Aubbeenaubbee soils are similar to Crosier soils and are adjacent to Barry, Metea, Miami, and Wawasee soils. Crosier soils do not have a texture of sandy loam in the surface soil or the upper part of the subsoil. Barry soils have a surface layer that is thicker and darker than that of the Aubbeenaubbee soils and have a dominantly grayish subsoil. They are in the lower positions on the landscape. Metea, Miami, and Wawasee soils do not have mottles in the upper part of the subsoil. They are in the higher positions on the landscape.

A typical pedon of Aubbeenaubbee fine sandy loam, moderately permeable, 0 to 2 percent slopes, in a cultivated field; 1,550 feet east and 175 feet north of the center of sec. 17, T. 34 N., R. 5 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; about 2 percent gravel; medium acid; abrupt smooth boundary.
EB—8 to 12 inches; dark grayish brown (10YR 4/2) sandy loam; many fine faint light brownish gray (10YR 6/2) mottles; weak medium and fine granular structure; friable; common fine roots; dark grayish brown (10YR 4/2) material from the Ap horizon in voids and old root channels; strongly acid; abrupt wavy boundary.
Bg—12 to 22 inches; grayish brown (10YR 5/2) sandy loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak fine and very fine subangular blocky structure; friable; few fine roots; strongly acid; abrupt wavy boundary.
2Bt1—22 to 32 inches; yellowish brown (10YR 5/4) loam; many medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds and in pores; about 5 percent gravel; medium acid; gradual wavy boundary.
2Bt2—32 to 44 inches; yellowish brown (10YR 5/4) loam; many medium distinct gray (10YR 5/1) mottles; weak coarse subangular blocky structure; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds and in pores; about 10 percent gravel; slightly acid; abrupt wavy boundary.
2C—44 to 60 inches; brown (10YR 5/3) loam; few fine faint grayish brown (10YR 5/2) and few fine distinct light gray (N 7/0) mottles; massive; firm; about 3 percent gravel; strong effervescence; mildly alkaline.

The solum is 40 to 50 inches thick. The loamy outwash ranges from 18 to 38 inches in thickness.

The Ap horizon has value of 3 or 4 and chroma of 2 or 3. It is fine sandy loam or sandy loam. Some pedons have an E horizon. The A and E horizons are medium acid to neutral. The EB and Bg horizons have value of 4 or 5 and chroma of 2 or 3. They are strongly acid to slightly acid. Some pedons have a Bt horizon, which is fine sandy loam or sandy clay loam. The 2Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is loam or clay loam. It is medium acid to neutral. The 2C horizon has value of 5 or 6 and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Barry Series

The Barry series consists of poorly drained, moderately permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 0 to 2 percent.

The Barry soils in this county do not have an argillic horizon, which is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Barry soils are similar to Pewamo and Rensselaer soils and are adjacent to Aubbeenaubbee and Crosier soils. Pewamo soils have more clay in the subsoil and underlying material than the Barry soils. Rensselaer soils are more stratified in the lower part of the subsoil and in the underlying material than the Barry soils. Aubbeenaubbee and Crosier soils have a surface layer that is thinner and lighter colored than that of the Barry soils. They are in the higher positions on the landscape.

A typical pedon of Barry loam, in a cultivated field; 300 feet west and 1,500 feet north of the southeast corner of sec. 18, T. 34 N., R. 5 E.

Ap—0 to 8 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; many fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

A—8 to 15 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; about 4 percent gravel; slightly acid; abrupt smooth boundary.

Bg1—15 to 28 inches; dark gray (5Y 4/1) fine sandy loam; many fine distinct olive (5Y 5/3) and prominent yellowish red (5YR 4/8) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous very dark gray (10YR 3/1) clay films on faces of peds and lining pores; common fine distinct yellowish red (5YR 4/8) iron stains; about 5 percent gravel; slightly acid; clear wavy boundary.

Bg2—28 to 42 inches; olive gray (5Y 5/2) loam; many medium faint olive (5Y 5/3) and prominent yellowish red (5YR 4/8) mottles; moderate medium subangular blocky structure; firm; few fine roots in the upper part; thin discontinuous dark gray (10YR 4/1) clay films on faces of peds and lining pores; few fine prominent yellowish red (5YR 4/8) iron stains; about 6 percent gravel; slightly acid; clear wavy boundary.

Bg3—42 to 50 inches; olive gray (5Y 5/2) loam; many medium faint olive (5Y 5/3) and prominent yellowish red (5YR 4/8) mottles; moderate fine subangular blocky structure; friable; thin discontinuous dark gray (10YR 4/1) clay films lining pores; few fine prominent yellowish red (5YR 4/8) iron stains; about 8 percent gravel; neutral; clear wavy boundary.

C—50 to 60 inches; brown (10YR 5/3) loam; common fine prominent gray (5Y 5/1) and yellowish red (5YR 5/6) mottles; massive; friable; about 12 percent gravel; few light gray (10YR 7/1) accumulations of lime; strong effervescence; mildly alkaline.

The thickness of the solum is 36 to 50 inches. It generally coincides with the depth to effervescent material. The content of coarse fragments ranges from 0 to 12 percent throughout the profile. The solum is slightly acid to mildly alkaline.

The Ap and A horizons have hue of 10YR, value of 2 or 3, and chroma of 1 or 2, or they are black (N 2/0) or very dark gray (N 3/0). They are loam, silt loam, or sandy loam. Some pedons have an AB horizon. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It is loam, fine sandy loam, sandy clay loam, or clay loam. The content of clay in the upper 20 inches of this horizon is 18 to 25 percent. Some pedons do not have a Bg3 horizon. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 3, or it is gray (N 5/0 or N 6/0). It is sandy loam or loam. It is mildly alkaline or moderately alkaline. The content of gravel in this horizon is 5 to 12 percent.

Blount Series

The Blount series consists of somewhat poorly drained, moderately slowly permeable and slowly permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 0 to 3 percent.

Blount soils are similar to Crosier and Del Rey soils and are adjacent to Glynwood, Morley, and Pewamo soils. Crosier soils have less clay in the subsoil and underlying till than the Blount soils. Del Rey soils have less sand and fewer coarse fragments in the lower part of the subsoil than the Blount soils. Glynwood and Morley soils have fewer mottles in the upper part of the subsoil than the Blount soils. They are in the higher positions on the landscape. Pewamo soils have a surface layer that is thicker, darker, and finer textured than that of the Blount soils and have a dominantly grayish subsoil. They are in the lower positions on the landscape.

A typical pedon of Blount silt loam, 0 to 2 percent slopes, in a cultivated field; 50 feet east and 1,300 feet south of the northwest corner of sec. 10, T. 30 N., R. 6 E.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; many fine roots; about 2 percent gravel; slightly acid; abrupt smooth boundary.

E—8 to 11 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium platy structure parting to moderate medium granular;

friable; common fine roots; about 1 percent gravel; medium acid; abrupt smooth boundary.

Bt—11 to 20 inches; yellowish brown (10YR 5/4) clay loam; common medium faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; thin continuous grayish brown (2.5Y 5/2) clay films on faces of peds; about 2 percent gravel; slightly acid; clear wavy boundary.

Btg—20 to 30 inches; grayish brown (10YR 5/2) clay loam; many medium faint gray (10YR 5/1) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; thin continuous grayish brown (2.5Y 5/2) clay films on faces of peds; about 3 percent gravel; neutral; abrupt wavy boundary.

C—30 to 60 inches; yellowish brown (10YR 5/4) clay loam; many medium faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 25 to 40 inches thick. The Ap horizon has chroma of 1 or 2. It is loam or silt loam. Some pedons do not have an E horizon. The Bt horizon has value of 4 or 5 and chroma of 2 to 4. It is silty clay loam, clay loam, or silty clay. It is slightly acid to very strongly acid in the upper part and neutral or mildly alkaline in the lower part. Some pedons have a BC horizon, which is neutral to moderately alkaline. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is mildly alkaline or moderately alkaline. It is clay loam or silty clay loam.

Boyer Series

The Boyer series consists of well drained soils on outwash plains and on knolls and ridges on moraines. These soils formed in loamy outwash overlying stratified sand and very gravelly or gravelly coarse sand. They are moderately rapidly permeable in the solum and very rapidly permeable in the underlying material. Slopes range from 0 to 12 percent.

Boyer soils are similar to Kosciusko and Ormas soils and are adjacent to Bronson and Ormas soils. Kosciusko soils have more clay in the subsoil than the Boyer soils. Ormas soils have a solum that is thicker than that of the Boyer soils. Bronson soils have a mottled subsoil. They are in the lower positions on the landscape.

A typical pedon of Boyer loamy sand, 0 to 6 percent slopes, in a cultivated field; 2,150 feet west and 75 feet north of the center of sec. 26, T. 33 N., R. 5 E.

Ap—0 to 9 inches; brown (10YR 4/3) loamy sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

BA—9 to 14 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; friable; few fine roots; medium acid; abrupt wavy boundary.

Bt1—14 to 24 inches; dark brown (10YR 4/3) sandy loam; weak fine and medium subangular blocky structure; friable; few fine roots; clay bridges between sand grains; about 5 percent gravel; medium acid; clear wavy boundary.

Bt2—24 to 34 inches; dark brown (7.5YR 4/4) loamy sand; weak fine subangular blocky structure; very friable; few fine roots; clay bridges between sand grains; neutral; abrupt irregular boundary.

Bt3—34 to 37 inches; dark brown (10YR 3/3) sandy clay loam; weak fine and medium subangular blocky structure; friable; few fine roots; clay bridges between sand grains; about 10 percent gravel; neutral; abrupt irregular boundary.

2C—37 to 60 inches; yellowish brown (10YR 5/4) stratified sand and very gravelly coarse sand; single grain; loose; about 50 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum is 24 to 40 inches. It generally is the same as the depth to carbonates. The content of coarse fragments ranges from 5 to 25 percent in the solum and from 10 to 55 percent in the 2C horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is loamy sand or sandy loam. The BA horizon also is loamy sand or sandy loam. Some pedons do not have a BA horizon. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is loamy sand, sandy loam, loam, sandy clay loam, or the gravelly analogs of these textures. Some pedons do not have a Bt3 horizon. The composition and thickness of the sand and very gravelly or gravelly coarse sand layers in the 2C horizon vary widely. Tongues of the Bt3 horizon extend more than 2 feet into this horizon in some pedons.

Brady Series

The Brady series consists of somewhat poorly drained soils on outwash plains. These soils formed in glacial outwash over sand and gravelly coarse sand. They are moderately rapidly permeable in the subsoil and very rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Brady soils are similar to Bronson and Homer soils and are adjacent to Gilford and Gravelton soils. Bronson soils have a surface layer that is lighter colored than that of the Brady soils and do not have grayish mottles in the upper part of the subsoil. Homer soils contain more clay in the subsoil than the Brady soils and have a thinner solum. Gilford and Gravelton soils have a surface layer that is thicker and darker than that of the Brady soils. They are in the lower positions on the landscape.

A typical pedon of Brady sandy loam, in a cultivated field; 300 feet south and 600 feet west of the center of sec. 5, T. 34 N., R. 6 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium and coarse granular structure; friable; many fine roots; about 5 percent gravel; slightly acid; abrupt smooth boundary.
E—8 to 11 inches; grayish brown (10YR 5/2) sandy loam, pale brown (10YR 6/3) dry; weak medium platy structure; firm; common fine roots; about 3 percent gravel; slightly acid; abrupt smooth boundary.
BE—11 to 30 inches; brown (10YR 5/3) sandy loam; many medium faint grayish brown (10YR 5/2) and prominent yellowish red (5YR 4/8) mottles; weak medium and coarse subangular blocky structure; friable; few fine roots; few soft accumulations of iron and manganese oxide; about 5 percent gravel; slightly acid; abrupt wavy boundary.
Bt—30 to 40 inches; brown (7.5YR 4/4) sandy loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds and lining pores; about 5 percent gravel; medium acid; abrupt wavy boundary.
2BC—40 to 54 inches; yellowish brown (10YR 5/4) loamy sand; many medium faint grayish brown (10YR 5/2) mottles; very weak coarse subangular blocky structure; very friable; about 10 percent gravel; mildly alkaline; abrupt irregular boundary.
2Cg—54 to 60 inches; gray (10YR 5/1) gravelly coarse sand; common fine distinct dark yellowish brown (10YR 3/4) mottles; single grain; loose; about 35 percent gravel; strong effervescence; moderately alkaline.

The solum ranges 40 to 60 inches in thickness. The content of gravel ranges from 0 to 15 percent throughout the solum.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is sandy loam or loamy sand. Some pedons do not have an E horizon. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam, sandy clay loam, or the gravelly analogs of these textures. The 2BC horizon has chroma of 2 to 4. It is sandy loam or loamy sand. The 2Cg horizon is sand, gravelly coarse sand, or stratified coarse sand and gravel.

Bronson Series

The Bronson series consists of moderately well drained soils on outwash plains and low moraines. These soils formed in glacial outwash over sand and gravelly coarse sand. They are moderately rapidly permeable in the subsoil and rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Bronson soils are similar to Brady soils and are adjacent to Gilford and Ormas soils. Brady soils have grayish mottles in the upper part of the subsoil. Gilford soils have a surface layer that is thicker and darker than that of the Bronson soils. They are in the lower positions on the landscape. Ormas soils are browner than the Bronson soils. They are in the higher positions on the landscape.

A typical pedon of Bronson sandy loam, 0 to 2 percent slopes, in a cultivated field; 300 feet south and 1,180 feet west of the northeast corner of sec. 11, T. 32 N., R. 5 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, light brownish gray (2.5Y 6/2) dry; weak medium granular structure; friable; many fine roots; about 5 percent gravel; neutral; abrupt smooth boundary.
BE—9 to 17 inches; yellowish brown (10YR 5/4) sandy loam; weak medium subangular blocky structure; friable; common fine roots; about 3 percent gravel; slightly acid; clear wavy boundary.
Bt1—17 to 24 inches; dark yellowish brown (10YR 4/4) sandy loam; few fine faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; few fine roots; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; about 5 percent gravel; strongly acid; clear wavy boundary.
Bt2—24 to 32 inches; dark brown (7.5YR 4/4) sandy loam; many medium faint brown (7.5YR 5/2) mottles; weak medium subangular blocky structure; friable; thin discontinuous reddish brown (5YR 4/4) clay films lining pores; about 5 percent gravel; strongly acid; clear wavy boundary.
Bt3—32 to 55 inches; dark yellowish brown (10YR 4/4) loamy sand; many coarse distinct light gray (10YR 7/2), yellowish brown (10YR 5/4), and very dark grayish brown (10YR 3/2) mottles; massive; very friable; clay bridges between sand grains; about 5 percent gravel; medium acid; abrupt irregular boundary.
Bt4—55 to 59 inches; dark brown (10YR 3/3) sandy clay loam; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure; friable; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds and lining pores; about 10 percent gravel; slightly acid; abrupt irregular boundary.
2C—59 to 70 inches; brown (10YR 5/3) stratified sand and gravelly coarse sand; single grain; loose; about 25 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum is generally 44 to 60 inches, but it ranges from 42 to 70 inches. The Ap

horizon has value of 3 to 5 and chroma of 2 to 4. It is sandy loam or loamy sand. The BE horizon also is sandy loam or loamy sand. It has chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5Y, value of 3 to 5, and chroma of 3 or 4. It is sandy loam, sandy clay loam, loamy sand, or the gravelly analogs of these textures. The 2C horizon has chroma of 2 or 3.

Carmi Series

The Carmi series consists of well drained soils on outwash plains. These soils formed in loamy outwash over stratified sand and gravelly or very gravelly coarse sand. They are moderately rapidly permeable in the subsoil and rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Carmi soils are similar to Shipshe soils and are adjacent to Griswold and Shipshe soils. Shipshe soils have a higher content of coarse fragments than the Carmi soils. Also, they have a thinner solum. Griswold soils have more clay in the subsoil than the Carmi soils and are underlain by till. They are in the higher positions on the landscape.

A typical pedon of Carmi loam, 0 to 2 percent slopes, in a cultivated field; 85 feet north and 875 feet west of the center of sec. 4, T. 33 N., R. 6 E.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

A1—8 to 12 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt wavy boundary.

A2—12 to 19 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; friable; few fine roots; about 5 percent gravel; slightly acid; clear wavy boundary.

Bw1—19 to 24 inches; dark brown (7.5YR 3/4) sandy loam; moderate medium subangular blocky structure; friable; few fine roots; about 8 percent gravel; slightly acid; clear wavy boundary.

2Bw2—24 to 35 inches; brown (7.5YR 4/4) gravelly sandy loam; weak fine subangular blocky structure; very friable; about 20 percent gravel; medium acid; clear wavy boundary.

2BC—35 to 52 inches; brown (7.5YR 4/4) gravelly loamy sand; single grain; loose; about 20 percent gravel; neutral; abrupt irregular boundary.

2C—52 to 60 inches; brown (10YR 5/3) stratified sand and very gravelly coarse sand; single grain; loose; about 35 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum is dominantly 44 to 55 inches, but it ranges from 40 to 60 inches. The depth to material in which the content of gravel is more than 15 percent ranges from 20 to 40 inches.

The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. They are loam or sandy loam. Some pedons do not have an A2 horizon. Some have a BE horizon. The Bw and 2Bw horizons have hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. They are sandy loam, sandy clay loam, or the gravelly analogs of these textures. The 2BC horizon has hue of 5YR, 10YR, or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy loam, loamy sand, sand, or the gravelly analogs of these textures. The 2C horizon is sand, coarse sand, loamy coarse sand, or the gravelly or very gravelly analogs of these textures.

Coloma Series

The Coloma series consists of somewhat excessively drained, rapidly permeable soils on outwash plains and terraces, till plains, and moraines. These soils formed in water-washed sand reworked by the wind. Slopes range from 0 to 12 percent.

Coloma soils are similar to Ormas soils and are adjacent to Kosciusko, Metea, and Wawasee soils. The similar and adjacent soils have more clay in the subsoil than the Coloma soils. They are in landscape positions similar to those of the Coloma soils.

A typical pedon of Coloma loamy sand, 6 to 12 percent slopes, in a cultivated field; 1,170 feet west and 875 feet south of the center of sec. 1, T. 33 N., R. 6 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loamy sand, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; medium acid; abrupt smooth boundary.

Bw1—8 to 16 inches; dark yellowish brown (10YR 4/4) sand, very pale brown (10YR 7/3) dry; single grain; loose; few fine roots; medium acid; clear wavy boundary.

Bw2—16 to 28 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; medium acid; clear wavy boundary.

E&Bt—28 to 52 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; lamellae of dark yellowish brown (10YR 4/4) loamy sand (Bt); weak medium subangular blocky structure; very friable; lamellae are 0.5 to 1.0 inch thick, are 2 to 8 inches apart, and have a cumulative thickness of 5 inches; few fine roots; slightly acid; abrupt wavy boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) sand; single grain; loose; slightly acid.

The lamellae are at a depth of 24 to 60 inches. They are 1/16 to 1 inch thick. The total thickness of all the lamellae in the solum is less than 6 inches. The content of gravel is 0 to 5 percent throughout the profile.

The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is loamy sand or sand. The Bw horizon also is loamy sand or sand. It has hue of 7.5YR or 10YR and value and chroma of 4 or 5. The Bt part of the E&Bt horizon has hue of 7.5YR or 10YR and value and chroma of 4 or 5. It is sandy loam or loamy sand. The E part has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 or 5. It is sand or loamy sand. The C horizon has value of 5 or 6 and chroma of 4 to 6. It is medium acid or slightly acid.

Crosier Series

The Crosier series consists of somewhat poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 0 to 4 percent.

Crosier soils are similar to Aubbeenaubbee, Blount, and Whitaker soils and are adjacent to Barry, Miami, and Wawasee soils. Aubbeenaubbee soils have more sand in the surface soil and in the upper part of the subsoil than the Crosier soils. Blount soils have more clay in the subsoil than the Crosier soils. Whitaker soils are stratified in the lower part of the subsoil and in the underlying material. Barry soils have a surface layer that is thicker and darker than that of the Crosier soils and have a dominantly grayish subsoil. They are in the lower positions on the landscape. Miami and Wawasee soils are browner than the Crosier soils. They are in the higher positions on the landscape.

A typical pedon of Crosier loam, 0 to 1 percent slopes, in a cultivated field; 1,285 feet west and 30 feet south of the northeast corner of sec. 26, T. 34 N., R. 5 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate fine granular structure; friable; common medium and fine roots; slightly acid; abrupt smooth boundary.

Btg—9 to 20 inches; grayish brown (10YR 5/2) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains; about 2 percent gravel; neutral; clear smooth boundary.

Bt—20 to 36 inches; brown (10YR 5/3) clay loam; many medium faint light brownish gray (10YR 6/2) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; thin continuous dark gray (10YR 4/1) clay films on faces of peds; few black (10YR 2/1) iron and manganese oxide stains; about 4 percent gravel; neutral; clear wavy boundary.

C—36 to 60 inches; brown (10YR 5/3) loam; common medium distinct gray (10YR 6/1) mottles; massive; friable; few light gray (10YR 7/2) streaks; about 7 percent gravel; strong effervescence; moderately alkaline.

The solum is 26 to 40 inches thick. The content of coarse fragments ranges from 1 to 10 percent throughout the profile.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. Some pedons have an E horizon, which is loam, fine sandy loam, silt loam, or sandy loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is loam, sandy clay loam, or clay loam. Some pedons have a BC horizon, which is neutral to moderately alkaline loam or sandy loam. The C horizon has hue of 10YR or 2.5Y and chroma of 2 to 4. It is loam or sandy loam.

Del Rey Series

The Del Rey series consists of somewhat poorly drained, slowly permeable soils on lake plains. These soils formed in lacustrine sediments. Slopes range from 0 to 2 percent.

Del Rey soils are similar to Blount soils and are adjacent to Toledo soils. Blount soils formed in glacial till and have a higher content of coarse fragments in the lower part of the subsoil and in the underlying material than the Del Rey soils. Toledo soils have a surface layer that is thicker and darker than that of the Del Rey soils. They are in the lower positions on the landscape.

A typical pedon of Del Rey silt loam, in a cultivated field; 35 feet west and 1,300 feet north of the southeast corner of sec. 1, T. 34 N., R. 5 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many fine roots; about 4 percent gravel; slightly acid; abrupt smooth boundary.

BE—8 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint grayish brown (10YR 5/2) mottles; moderate medium and thick platy structure parting to moderate fine subangular blocky; firm; common fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—12 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium faint yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; firm; common fine roots; thick continuous dark grayish brown (10YR 4/2) clay films on faces of peds and lining pores; about 1 percent gravel; slightly acid; clear wavy boundary.

Bt2—26 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; many coarse faint grayish brown (10YR 5/2) mottles; strong medium subangular blocky structure; firm; few fine roots; thick continuous dark grayish brown (10YR 4/2) clay films on faces of

peds; about 1 percent gravel; mildly alkaline; clear wavy boundary.

Bt3—30 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; many fine faint yellowish brown (10YR 5/6) mottles; strong medium subangular blocky structure; firm; thick continuous very dark grayish brown (10YR 3/2) clay films on faces of peds; mildly alkaline; abrupt smooth boundary.

C—36 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint grayish brown (10YR 5/2) mottles; massive; firm; strong effervescence; moderately alkaline.

The solum is 30 to 44 inches thick. The Ap horizon has chroma of 1 or 2. It is silt loam or loam. Some pedons have an E horizon. The BE horizon has value of 5 or 6 and chroma of 3 or 4. The Bt1 and Bt2 horizons have hue of 10YR or 2.5Y and value and chroma of 4 to 6. The Bt3 horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6. It is stratified with silty clay in some pedons. It is neutral to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 6. It is dominantly silt loam or silty clay loam. In some pedons, however, it is stratified with clay loam or sandy loam or with thin layers of fine sand.

Edwards Series

The Edwards series consists of very poorly drained soils in depressions, in potholes, and around lakes on outwash plains, till plains, and moraines. These soils formed in organic material over marl. Permeability is moderately slow to moderately rapid in the organic material. Slopes range from 0 to 2 percent.

Edwards soils are similar to Palms soils and are adjacent to Gravelton, Houghton, and Wallkill soils. Palms soils are underlain by sandy or loamy material within a depth of 50 inches. Gravelton soils do not have a mucky surface layer. They are in the slightly higher positions on the landscape. Houghton soils formed in more than 51 inches of organic material. They are slightly lower on the landscape than the Edwards soils. Wallkill soils have a mineral surface layer. They are in the slightly higher positions on the landscape.

A typical pedon of Edwards muck, drained, in an idle area; 1,320 feet south and 160 feet east of the center of sec. 36, T. 33 N., R. 5 E.

Oa1—0 to 6 inches; sapric material, black (N 2/0) broken face and rubbed, black (N 2/0) dry; less than 5 percent fiber, less than 1 percent rubbed; moderate fine and medium granular structure; very friable; many fine and medium roots; neutral; abrupt smooth boundary.

Oa2—6 to 12 inches; sapric material, black (N 2/0) broken face and rubbed; less than 5 percent fiber, less than 1 percent rubbed; weak medium and coarse subangular blocky structure; firm; few fine and medium roots; neutral; abrupt smooth boundary.

Oa3—12 to 18 inches; sapric material, black (N 2/0) broken face and rubbed; less than 5 percent fiber, less than 1 percent rubbed; moderate fine and very fine subangular blocky structure; friable; few fine roots; neutral; clear smooth boundary.

Oa4—18 to 34 inches; sapric material, black (5YR 2/1) broken face and rubbed; about 10 percent fiber, less than 1 percent rubbed; moderate fine and very fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

2C—34 to 60 inches; olive gray (5Y 5/2) marl; massive; friable; violent effervescence; moderately alkaline.

The organic material is 16 to 48 inches thick. It is derived primarily from herbaceous plants, but it has woody fragments in some pedons. It ranges from medium acid to mildly alkaline.

The surface tier has hue of 10YR, value of 2, and chroma of 1 or 2 or is black (N 2/0). The subsurface and bottom tiers have hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 1 or 2, or they are black (N 2/0). Some pedons have layers of hemic material less than 10 inches thick. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 8, and chroma of 1 or 2. In some pedons the marl has layers of sandy material within a depth of 51 inches. The total thickness of these layers is less than 8 inches.

Gilford Series

The Gilford series consists of very poorly drained soils on outwash plains. These soils formed in glacial outwash over sand and gravelly coarse sand. They are moderately rapidly permeable in the subsoil and very rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Gilford soils are similar to Gravelton and Sebewa soils and are adjacent to Brady, Bronson, and Palms soils. Gravelton soils have a solum that is thinner than that of the Gilford soils. Sebewa soils have more clay in the subsoil than the Gilford soils. Brady and Bronson soils do not have a thick, dark surface layer and are browner throughout than the Gilford soils. They are in the higher positions on the landscape. Palms soils are organic to a depth of more than 16 inches. They are in the lower positions on the landscape.

A typical pedon of Gilford sandy loam, gravelly substratum, in a cultivated field; 1,850 feet west and 770 feet south of the northeast corner of sec. 12, T. 34 N., R. 5 E.

Ap—0 to 9 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine roots; about 1

percent gravel; slightly acid; abrupt smooth boundary.

A—9 to 12 inches; very dark gray (10YR 3/1) fine sandy loam, gray (10YR 5/1) dry; weak medium granular structure; very friable; common fine roots; medium acid; abrupt wavy boundary.

Bg1—12 to 18 inches; grayish brown (10YR 5/2) loamy sand; common medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) mottles; weak medium granular structure; very friable; few fine roots; medium acid; abrupt wavy boundary.

Bg2—18 to 24 inches; dark gray (10YR 4/1) sandy clay loam; common medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; firm; few fine roots; about 1 percent gravel; medium acid; abrupt wavy boundary.

Bg3—24 to 35 inches; dark gray (10YR 4/1) sandy loam; common medium prominent strong brown (7.5YR 5/8) and dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; few fine roots; medium acid; abrupt wavy boundary.

2Cg1—35 to 44 inches; dark gray (10YR 4/1) loamy sand; few fine prominent dark brown (7.5YR 4/4) and grayish brown (10YR 5/2) mottles; single grain; very friable; about 1 percent gravel; slightly acid; abrupt irregular boundary.

3Cg2—44 to 55 inches; grayish brown (10YR 5/2) sand; few fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; about 1 percent gravel; neutral; abrupt irregular boundary.

4Cg3—55 to 60 inches; grayish brown (10YR 5/2) gravelly coarse sand; single grain; loose; about 25 percent gravel; strong effervescence; mildly alkaline.

The solum is 30 to 40 inches thick. It is medium acid to neutral. The depth to sandy material is less than 40 inches. The content of gravel is 0 to 8 percent in the upper part of the solum and 0 to 15 percent in the lower part. It is 15 to 50 percent in the gravelly substratum.

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 sandy loam, fine sandy loam, loamy sand, or mucky sandy loam. Some pedons have an E horizon, a BE horizon, or both. The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 6, and chroma of 1 or 2. It is fine sandy loam, sandy loam, loamy sand, loam, or sandy clay loam. Some pedons have a BC horizon. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 to 3. It is slightly acid to moderately alkaline.

Glynwood Series

The Glynwood series consists of moderately well drained, slowly permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 1 to 4 percent.

Glynwood soils are adjacent to Blount, Morley, and Pewamo soils. Blount soils are more gray in the upper part of the subsoil than the Glynwood soils. They are in shallow depressions and poorly defined drainageways. Morley soils are browner than the Glynwood soils. They are in the higher positions on the landscape. Pewamo soils have a surface layer that is thicker and darker than that of the Glynwood soils and are grayer throughout. They are in deep depressions and along well defined drainageways.

A typical pedon of Glynwood silt loam, in a cultivated area of Morley-Glynwood complex, 1 to 4 percent slopes; 2,315 feet north and 550 feet east of the southwest corner of sec. 11, T. 30 N., R. 6 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; about 2 percent gravel; slightly acid; abrupt smooth boundary.

E—9 to 14 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) dry; many fine distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure; friable; few fine roots; strongly acid; abrupt wavy boundary.

2Bt1—14 to 24 inches; yellowish brown (10YR 5/4) clay; common fine faint yellowish brown (10YR 5/8) and few fine faint grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds and lining pores; few black (10YR 2/1) iron and manganese stains; about 3 percent gravel; medium acid; clear wavy boundary.

2Bt2—24 to 33 inches; yellowish brown (10YR 5/4) clay; many medium faint dark grayish brown (10YR 4/2) and common medium faint yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds and lining pores; few black (10YR 2/1) iron and manganese stains; about 5 percent gravel; mildly alkaline; clear wavy boundary.

2BC—33 to 38 inches; brown (10YR 5/3) clay loam; many medium faint grayish brown (10YR 5/2) and common medium faint dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds and lining pores; about 2 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

2C1—38 to 50 inches; brown (10YR 5/3) clay loam; many coarse distinct grayish brown (2.5Y 5/2) and common coarse faint dark grayish brown (10YR 4/2) mottles; massive; firm; about 5 percent gravel;

strong effervescence; mildly alkaline; gradual wavy boundary.
2C2—50 to 60 inches; brown (10YR 5/3) clay loam; many coarse distinct gray (10YR 6/1) mottles; massive; firm; about 2 percent gravel; strong effervescence; mildly alkaline.

The solum is 25 to 40 inches thick. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. The E horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons do not have an E horizon. The A and E horizons are silt loam or loam. They are neutral to strongly acid. The 2Bt horizon has value of 4 or 5 and chroma of 2 to 6. It is clay, silty clay, or clay loam. The content of clay is 35 to 45 percent in the particle-size control section. Some pedons do not have a 2BC horizon. The 2C horizon has value of 4 or 5 and chroma of 3 or 4. It is clay loam or silty clay loam.

Gravelton Series

The Gravelton series consists of very poorly drained soils on flood plains. These soils formed in sandy and loamy alluvium underlain by stratified sand and gravel. They are moderately rapidly permeable in the upper part and rapidly permeable or very rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Gravelton soils are similar to Gilford soils and are adjacent to Brady, Edwards, Palms, and Wallkill soils. Gilford soils have a solum that is thicker than that of the Gravelton soils. Brady soils do not have a thick, dark surface layer and are browner than the Gravelton soils. They are in the higher positions on the landscape. Edwards, Palms, and Wallkill soils are in the lower positions on the landscape. Edwards and Palms soils are organic to a depth of more than 16 inches. Wallkill soils have buried deposits of muck.

A typical pedon of Gravelton loamy sand, occasionally flooded, in a pasture; 2,525 feet south and 125 feet east of the northwest corner of sec. 10, T. 34 N., R. 6 E.

A1—0 to 6 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine and medium roots; about 3 percent gravel; neutral; abrupt smooth boundary.
A2—6 to 12 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) dry; few fine distinct dark reddish brown (2.5YR 3/4) mottles; weak medium subangular blocky structure parting to moderate coarse granular; friable; many fine and medium roots; neutral; abrupt wavy boundary.
A3—12 to 16 inches; dark reddish brown (5YR 2/2) sandy loam, dark brown (7.5YR 3/2) dry; many fine distinct dark reddish brown (2.5YR 3/4) mottles; weak medium subangular blocky structure; friable; many fine roots; about 1 percent gravel; neutral; abrupt wavy boundary.
C—16 to 22 inches; dark brown (10YR 3/3) sandy loam, pale brown (10YR 6/3) dry; many fine distinct reddish brown (5YR 4/4) and yellowish brown (10YR 5/6) mottles; massive; firm; common fine roots; about 4 percent gravel; neutral; abrupt wavy boundary.
2Cg1—22 to 28 inches; grayish brown (2.5Y 5/2) gravelly coarse sand; single grain; loose; few fine roots; about 25 percent gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.
2Cg2—28 to 34 inches; brown (10YR 5/3) gravelly coarse sand; single grain; loose; about 20 percent gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.
2Cg3—34 to 40 inches; very dark gray (5Y 3/1) and dark olive (5Y 3/3) sand; common coarse distinct dark brown (7.5YR 4/4) mottles; massive; friable; about 10 percent gravel; mildly alkaline; abrupt wavy boundary.
2Cg4—40 to 50 inches; dark brown (10YR 4/3) very gravelly coarse sand; single grain; very friable; about 40 percent gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.
2Cg5—50 to 60 inches; very dark grayish brown (2.5Y 3/2) very gravelly coarse sand; single grain; loose; about 45 percent gravel; strong effervescence; moderately alkaline.

The depth to the 2C horizon is 16 to 24 inches. The A horizon has hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 1 or 2, or it is black (N 2/0). In some pedons it does not have mottles in the lower part. This horizon has a gravel content of 0 to 8 percent. It is slightly acid to mildly alkaline. The C and 2Cg horizons have hue of 10YR, 2.5Y, or 5Y, value of 3 to 6, and chroma of 1 to 3. The C horizon is dominantly sandy loam, but thin subhorizons of loam are common. The content of gravel in this horizon ranges from 0 to 10 percent. The 2Cg horizon is loamy coarse sand, coarse sand, sand, or the gravelly or very gravelly analogs of these textures. The content of gravel in this horizon ranges from 10 to 50 percent. It generally increases with increasing depth.

Griswold Series

The Griswold series consists of well drained, moderately permeable soils on till plains. These soils formed in loamy glacial till. Slopes range from 0 to 2 percent.

Griswold soils are similar to Wawasee soils and are adjacent to Carmi, Shipshe, and Wawasee soils. Wawasee soils have a surface soil that is thinner and lighter colored than that of the Griswold soils. They are in the slightly higher positions on the landscape. Carmi and Shipshe soils have more sand and gravel throughout than the Griswold soils. Also, they are on lower plains.

A typical pedon of Griswold loam, 0 to 2 percent slopes, in a cultivated field; 800 feet north and 1,040 feet east of the southwest corner of sec. 2, T. 33 N., R. 6 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak medium and coarse granular structure; friable; many medium and fine roots; medium acid; abrupt smooth boundary.
A—10 to 14 inches; dark brown (10YR 3/3) loam, grayish brown (10YR 5/2) dry; moderate medium and coarse granular structure; friable; many fine roots; black (10YR 2/1) loam in root channels, in voids, and on faces of peds; medium acid; clear wavy boundary.
Bt1—14 to 22 inches; brown (10YR 4/3) loam; moderate fine and medium subangular blocky structure; friable; few fine roots; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds and lining pores; about 5 percent gravel; medium acid; clear wavy boundary.
Bt2—22 to 34 inches; brown (10YR 4/3) sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thick discontinuous dark brown (10YR 4/3) clay films on faces of peds and lining pores; about 5 percent gravel; slightly acid; abrupt wavy boundary.
BC—34 to 39 inches; dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; friable; few fine roots; common fine black (10YR 2/1) iron and manganese stains; about 7 percent gravel; slightly acid; abrupt irregular boundary.
C—39 to 60 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable; about 10 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The A horizon has value of 2 or 3 and chroma of 1 to 3. It is medium acid to mildly alkaline. Some pedons have an AB horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 5. It is loam, sandy clay loam, or sandy loam. The BC horizon has colors similar to those of the Bt horizon. It is loam or sandy loam. It is medium acid to mildly alkaline. Some pedons do not have a BC horizon. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Homer Series

The Homer series consists of somewhat poorly drained soils on broad outwash plains and terraces. These soils formed in glacial outwash over very gravelly coarse sand. They are moderately permeable in the subsoil and very rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Homer soils are similar to Brady and Whitaker soils and are adjacent to Gravelton, Kosciusko, and Sebewa soils. Brady soils have less clay in the subsoil than the Homer soils. Whitaker soils contain less gravel than the Homer soils and formed in lacustrine sediments. Gravelton and Sebewa soils have a surface layer that is thicker and darker than that of the Homer soils and have a dominantly grayish subsoil. They are in the lower positions on the landscape. Kosciusko soils are browner than the Homer soils. They are in the higher positions on the landscape.

A typical pedon of Homer sandy loam, in a cultivated field; 1,185 feet west and 175 feet north of the southeast corner of sec. 36, T. 34 N., R. 5 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, pale brown (10YR 6/3) dry; weak medium and coarse granular structure; friable; common fine roots; about 5 percent gravel; medium acid; abrupt smooth boundary.
Bt—9 to 16 inches; brown (7.5YR 4/4) loam; common fine distinct grayish brown (10YR 5/2) and yellowish red (5YR 4/8) mottles; weak thick platy structure parting to weak fine subangular blocky; friable; common fine roots; thin continuous grayish brown (10YR 5/2) clay films lining pores; about 5 percent gravel; slightly acid; clear wavy boundary.
Btg1—16 to 26 inches; dark brown (10YR 4/3) sandy clay loam; many medium prominent yellowish red (5YR 4/8) and gray (5YR 5/1) mottles; moderate medium subangular blocky structure; firm; few fine roots; thick continuous dark grayish brown (10YR 4/2) clay films lining pores and on vertical faces of peds; about 10 percent gravel; slightly acid; abrupt wavy boundary.
2Btg2—26 to 30 inches; dark brown (7.5YR 3/2) gravelly sandy clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; thin continuous very dark gray (10YR 3/1) clay films and organic coatings on faces of peds and lining pores; about 25 percent gravel; medium acid; abrupt wavy boundary.
2Btg3—30 to 36 inches; very dark gray (10YR 3/1) gravelly sandy clay loam; common medium distinct dark gray (10YR 4/1) and yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; firm; thin to thick discontinuous very dark gray (10YR 3/1) clay films and organic coatings on faces of peds; about 15 percent gravel; neutral, abrupt smooth boundary.
3C—36 to 60 inches; brown (10YR 5/3) very gravelly coarse sand; single grain; loose; about 45 percent gravel; strong effervescence; moderately alkaline.

The solum is 28 to 40 inches thick. The Ap horizon has value of 3 or 4 and chroma of 1 to 3. It is sandy loam, fine sandy loam, or loam. The content of gravel in this horizon is 5 to 10 percent. Some pedons have an E horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 4. It is loam, sandy clay

loam, or clay loam. The content of clay in the upper 20 inches of this horizon is 20 to 27 percent. The content of gravel is 5 to 14 percent throughout this horizon. The 2Bt horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 1 to 3. It is the gravelly analogs of sandy clay loam or sandy loam. Some pedons have a 2BCg horizon. The 3C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3. It is the gravelly or very gravelly analogs of coarse sand or loamy coarse sand. The content of gravel in this horizon ranges from 15 to 60 percent.

Houghton Series

The Houghton series consists of very poorly drained, moderately rapidly permeable to moderately slowly permeable soils on broad flats on outwash plains, around the edges of lakes, and in depressions throughout the uplands. These soils formed in organic material that has not completely decomposed. Slopes range from 0 to 2 percent.

Houghton soils are adjacent to Edwards, Palms, and Wallkill soils. Edwards and Palms soils are underlain by loamy or marly material. Wallkill soils are in the slightly higher positions on the landscape. They formed in alluvial deposits over organic material.

A typical pedon of Houghton muck, drained, in a pasture; 280 feet west and 100 feet north of the southeast corner of sec. 34, T. 33 N., R. 7 E.

Op—0 to 9 inches; sapric material, black (N 2/0) broken face and rubbed; less than 5 percent fiber, none rubbed; moderate medium granular structure; very friable; many fine and medium roots; medium acid; clear smooth boundary.

Oa1—9 to 28 inches; sapric material, black (5YR 2/1) broken face and rubbed; about 15 percent fiber, less than 5 percent rubbed; moderate coarse subangular blocky structure; very friable; many fine roots; neutral; clear smooth boundary.

Oa2—28 to 38 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, less than 5 percent rubbed; massive; very friable; few fine roots; neutral; clear smooth boundary.

Oa3—38 to 60 inches; sapric material, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, 5 percent rubbed; massive; very friable; some woody fragments; neutral.

The organic material is more than 51 inches thick. It is primarily sapric material. In some pedons, however, it has thin layers of hemic material. The hemic layers have a combined thickness of less than 10 inches. They are in areas where woody material is most common. The content of coarse fragments ranges from 0 to 10 percent throughout the profile. The 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 black (N 2/0). Reaction ranges from medium acid to mildly alkaline throughout the profile.

Kosciusko Series

The Kosciusko series consists of well drained soils on outwash plains and on knolls and ridges on moraines. These soils formed in loamy outwash and the underlying coarse sand and gravelly coarse sand. They are moderately permeable in the solum and very rapidly permeable in the underlying material. Slopes range from 0 to 30 percent.

The Kosciusko soils in this county have contrasting textures in the control section, which are not definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Kosciusko soils are similar to Boyer and Ormas soils and are adjacent to Homer, Ormas, and Riddles soils. Boyer and Ormas soils have more sand in the subsoil than the Kosciusko soils. Homer soils have a mottled subsoil. They are in the lower positions on the landscape. Riddles soils have less gravel in the subsoil than the Kosciusko soils and are underlain by till. They are in landscape positions similar to those of the Kosciusko soils.

A typical pedon of Kosciusko sandy loam, 2 to 6 percent slopes, in an idle area; 500 feet east and 675 feet south of the northwest corner of sec. 26, T. 33 N., R. 7 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; many fine roots; about 8 percent gravel; medium acid; abrupt smooth boundary.

Bt1—8 to 13 inches; yellowish brown (10YR 5/4) sandy loam; weak thin and medium platy structure; friable; many fine roots; thin discontinuous dark yellowish brown (10YR 4/4) clay films lining pores; about 11 percent gravel; medium acid; clear wavy boundary.

Bt2—13 to 22 inches; brown (7.5YR 4/4) gravelly sandy clay loam; weak fine and medium subangular blocky structure; firm; common fine roots; thin discontinuous dark brown (7.5YR 3/2) clay films on faces of peds and lining pores; about 17 percent gravel; strongly acid; clear wavy boundary.

Bt3—22 to 34 inches; reddish brown (5YR 4/4) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thick continuous dark reddish brown (5YR 3/3) clay films on faces of peds and lining pores; about 22 percent gravel; strongly acid; abrupt wavy boundary.

2BC—34 to 39 inches; dark brown (7.5YR 4/4) gravelly loamy sand; weak fine and medium subangular blocky structure; very friable; few very fine roots; about 20 percent gravel; medium acid; abrupt irregular boundary.

2C—39 to 60 inches; light yellowish brown (10YR 6/4) stratified coarse sand and gravelly coarse sand; single grain; loose; about 35 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The content of gravel is 5 to 20 percent in the A horizon, 15 to 35 percent in the Bt horizon, and 20 to 35 percent in the 2BC horizon.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is silt loam, sandy loam, or sandy clay loam. Some pedons have an A horizon, an E horizon, or both. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 5. It is sandy loam, sandy clay loam, or the gravelly analogs of these textures. The 2BC horizon has the same colors as the Bt horizon. It is gravelly sandy loam, gravelly loamy coarse sand, or gravelly loamy sand. In some pedons tongues of material from the lower part of the Bt horizon extend into the 2C horizon for several feet. Some pedons have a dark horizon of gravelly sandy clay loam rather than or in addition to the 2BC horizon. The coarse sand and gravelly coarse sand layers in the 2C horizon vary widely in composition and thickness.

Martinsville Series

The Martinsville series consists of well drained, moderately permeable soils on outwash plains, terraces, and moraines. These soils formed in loamy outwash and in the underlying stratified material. Slopes range from 0 to 12 percent.

Martinsville soils are similar to Riddles soils and are adjacent to Morley, Riddles, and Whitaker soils. Morley and Riddles soils are in landscape positions similar to those of the Martinsville soils. They are underlain by till. Morley soils have more clay throughout than the Martinsville soils, and Riddles soils have more gravel in the subsoil. Whitaker soils have a mottled subsoil. They are in the lower positions on the landscape.

A typical pedon of Martinsville sandy loam, 0 to 2 percent slopes, in a cultivated field; 1,500 feet south and 150 feet east of the northwest corner of sec. 24, T. 33 N., R. 5 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

BE—9 to 18 inches; brown (10YR 4/3) sandy loam; moderate medium platy structure parting to moderate fine subangular blocky; friable; common fine roots; thin discontinuous very dark grayish brown (10YR 3/2) clay films lining pores; dark grayish brown (10YR 4/2) material from the Ap horizon in old root channels and wormholes; medium acid; clear smooth boundary.

Bt1—18 to 24 inches; dark yellowish brown (10YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; common fine roots; common distinct light brownish gray (10YR 6/2) clean sand grains on faces of peds; thin discontinuous dark brown (7.5YR 3/2) clay films on faces of some peds and lining pores; medium acid; clear wavy boundary.

Bt2—24 to 40 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium angular and subangular blocky structure; firm; few fine roots; thin continuous dark brown (7.5YR 3/2) clay films on faces of peds and lining pores; slightly acid; abrupt wavy boundary.

BC—40 to 50 inches; yellowish brown (10YR 5/4) stratified sandy loam and loam; weak coarse subangular blocky structure; friable; about 5 percent gravel; neutral; gradual wavy boundary.

2C—50 to 60 inches; yellowish brown (10YR 5/4) stratified silt loam, sandy loam, and loamy sand; massive; very friable; about 10 percent fine pebbles in the strata of loamy sand; strong effervescence; mildly alkaline.

The thickness of the solum is dominantly 40 to 52 inches, but it ranges from 40 to more than 60 inches. The content of coarse fragments ranges from 0 to 10 percent throughout the profile.

The Ap horizon has chroma of 2 or 3. It is sandy loam, loam, or silt loam. Some pedons have an AB or E horizon. Some do not have a BE horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is sandy loam, loam, or sandy clay loam. The BC horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is loam or sandy loam and is not stratified in some pedons. The 2C horizon has value of 4 or 5 and chroma of 2 to 4. It is silt loam, loam, sandy loam, or loamy sand.

Metea Series

The Metea series consists of well drained soils on knolls and ridges on till plains and moraines. These soils formed in sandy material and the underlying glacial till. They are rapidly permeable in the upper part and moderately permeable or moderately slowly permeable in the lower part. Slopes range from 0 to 25 percent.

Metea soils are similar to Owosso soils and are adjacent to Aubbeenaubbee, Miami, Owosso, Riddles, and Wawasee soils. Owosso soils have more clay and less sand in the surface layer and in the upper part of the subsoil than the Metea soils. Aubbeenaubbee soils are mottled. They are in the lower positions on the landscape. Miami, Riddles, and Wawasee soils have more clay and less sand in the upper part of the subsoil than the Metea soils. They are on side slopes or knolls.

A typical pedon of Metea loamy sand, 2 to 6 percent slopes, in a cultivated field; 545 feet south and 100 feet west of the northeast corner of sec. 25, T. 32 N., R. 5 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) loamy sand, light brownish gray (10YR 6/2) dry; weak medium granular structure; very friable; many fine roots; medium acid; abrupt wavy boundary.
E1—10 to 20 inches; yellowish brown (10YR 5/6) loamy sand; weak fine granular structure; very friable; few fine roots; slightly acid; clear wavy boundary.
E2—20 to 32 inches; yellowish brown (10YR 5/6) loamy sand; weak medium granular structure; very friable; few fine roots; slightly acid; abrupt wavy boundary.
Bt1—32 to 40 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; few fine roots; thin discontinuous dark brown (10YR 4/3) clay films lining pores; neutral; abrupt wavy boundary.
2Bt2—40 to 50 inches; yellowish brown (10YR 5/6) clay loam; many medium faint yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark brown (10YR 4/3) clay films on faces of peds and lining pores; few fine pebbles; neutral; abrupt wavy boundary.
2C—50 to 60 inches; yellowish brown (10YR 5/6) loam; common medium faint light brownish gray (10YR 6/2) mottles; massive; firm; about 3 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges 40 to 60 inches. The thickness of the sandy material ranges 20 to 40 inches.

The Ap horizon has value of 3 or 4 and chroma of 2 to 4. It is loamy fine sand or loamy sand. It is medium acid to neutral. Some pedons have a BE horizon. The E 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, sand, or fine sand. The Bt horizon has value and chroma of 4 or 5. It is sandy loam, fine sandy loam, or sandy clay loam. The 2Bt horizon has value of 4 or 5 and chroma of 3 to 6. In some pedons it has no mottles. It is clay loam or loam. Some pedons have a 2BC horizon. The 2C horizon has value of 5 or 6 and chroma of 3 to 6.

Miami Series

The Miami series consists of well drained soils on till plains and moraines. These soils formed in glacial till. They are moderately permeable in the subsoil and moderately slowly permeable in the underlying material. Slopes range from 2 to 25 percent.

Miami soils are similar to Morley and Wawasee soils and are adjacent to Aubbeenaubbee, Crosier, Metea, and Owosso soils. Morley soils have more clay in the lower part of the subsoil and in the underlying material than the Miami soils. Wawasee soils have more sand in the subsoil than the Miami soils. Aubbeenaubbee and Crosier soils are mottled in the upper part of the subsoil. They are in the lower positions on the landscape. Metea and Owosso soils have more sand in the surface layer and in the upper part of the subsoil than the Miami soils. They are in landscape positions similar to those of the Miami soils.

A typical pedon of Miami loam, 2 to 6 percent slopes, in a cultivated field; 875 feet west and 1,100 feet north of the center of sec. 13, T. 31 N., R. 7 E.

Ap—0 to 8 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; many medium roots; about 2 percent gravel; medium acid; abrupt smooth boundary.
Bt1—8 to 18 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; friable; common medium roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds and lining pores; about 1 percent gravel; medium acid; clear wavy boundary.
Bt2—18 to 26 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium angular blocky structure; firm; few fine roots; medium discontinuous brown (10YR 5/3) clay films on faces of peds and lining pores; about 2 percent gravel; slightly acid; clear wavy boundary.
Bt3—26 to 30 inches; dark brown (10YR 4/3) clay loam; weak medium subangular blocky structure; friable; medium discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; about 3 percent gravel; slightly acid; clear wavy boundary.
BC—30 to 36 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium subangular blocky structure; firm; about 3 percent gravel; neutral; abrupt wavy boundary.
C1—36 to 48 inches; yellowish brown (10YR 5/4) loam; massive; firm; common light brownish gray (10YR 6/2) streaks; about 5 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.
C2—48 to 60 inches; brown (10YR 5/3) loam; massive; firm; few gray (10YR 6/1) streaks; about 5 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum typically is 34 to 40 inches, but it ranges from 24 to 40 inches. The Ap horizon has value of 3 to 5 and chroma of 2 or 3. It is loam, fine sandy loam, sandy loam, or clay loam. Some pedons have a thin E or BA horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is clay loam or silty clay loam. It is slightly acid to strongly acid. The BC horizon has colors similar to those of the Bt horizon. It is neutral or mildly alkaline and has free carbonates in some pedons. Some pedons do not

have a BC horizon. The C horizon has value of 5 or 6 and chroma of 3 or 4.

Morley Series

The Morley series consists of well drained, moderately slowly permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 1 to 25 percent.

Morley soils are similar to Miami soils and are adjacent to Blount, Glynwood, and Martinsville soils. Miami soils have less clay and more sand in the upper part of the solum than the Morley soils. Blount and Glynwood soils have mottles in the upper part of the subsoil. They are on foot slopes and in swales. Martinsville soils have less clay in the subsoil than the Morley soils and are underlain by stratified material. They are in landscape positions similar to those of the Morley soils.

A typical pedon of Morley loam, in a cultivated area of Morley-Glynwood complex, 1 to 4 percent slopes; 2,690 feet west and 1,150 feet north of the southeast corner of sec. 18, T. 30 N., R. 6 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; about 1 percent gravel; medium acid; abrupt smooth boundary.

Bt1—9 to 18 inches; yellowish brown (10YR 5/4) clay loam; strong medium angular blocky structure; firm; common fine roots; thin continuous brown (10YR 5/3) silt coatings on faces of peds; strongly acid; abrupt wavy boundary.

2Bt2—18 to 32 inches; dark yellowish brown (10YR 4/4) clay; strong medium angular blocky structure; firm; few fine roots; thin continuous dark brown (10YR 3/3) clay films on faces of peds and lining pores; medium acid; clear wavy boundary.

2BC—32 to 42 inches; brown (10YR 4/3) clay loam; few fine distinct gray (10YR 6/1) mottles; weak medium angular blocky structure; firm; about 1 percent gravel; strong effervescence; mildly alkaline; gradual wavy boundary.

2C—42 to 60 inches; brown (10YR 5/3) clay loam; common fine distinct gray (10YR 6/1) mottles; massive; firm; about 1 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 44 inches thick. It has a gravel content of 0 to 8 percent.

The Ap horizon has value of 3 or 4. It is dominantly loam or silt loam, but in severely eroded areas it is silty clay loam. It is strongly acid to slightly acid. Some pedons have an E horizon. Some have a BA horizon. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. In some pedons it is mottled in the lower part. It is clay loam, silty clay loam, or clay. It is strongly acid to slightly acid. The 2BC horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 3 or 4. It is silty clay loam or clay loam. It is slightly acid to moderately alkaline. The 2C horizon has chroma of 3 or 4. It is clay loam or silty clay loam. It is mildly alkaline or moderately alkaline.

Ormas Series

The Ormas series consists of well drained soils on outwash plains and terraces and on knolls and ridges in the uplands. These soils formed in sandy outwash reworked by the wind. They are rapidly permeable in the upper part of the solum, moderately rapidly permeable in the lower part, and rapidly permeable or very rapidly permeable in the underlying material. Slopes range from 0 to 12 percent.

Ormas soils are similar to Boyer, Coloma, and Kosciusko soils and are adjacent to Bronson, Kosciusko, and Riddles soils. Boyer and Kosciusko soils have a solum that is thinner than that of the Ormas soils. Coloma soils have less clay in the lower part of the subsoil than the Ormas soils. Also, they contain less gravel. Bronson soils have a mottled subsoil. They are in the lower positions on the landscape. Riddles soils have more clay in the surface layer and in the underlying material than the Ormas soils. They are in landscape positions similar to those of the Ormas soils.

A typical pedon of Ormas loamy sand, 2 to 6 percent slopes, in a cultivated field; 2,125 feet west and 875 feet north of the southeast corner of sec. 17, T. 30 N., R. 5 E.

Ap—0 to 10 inches; brown (10YR 4/3) loamy sand, brown (10YR 5/3) dry; weak medium granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

E1—10 to 22 inches; yellowish brown (10YR 5/6) loamy sand; weak medium granular structure; very friable; common fine roots; slightly acid; clear wavy boundary.

E2—22 to 34 inches; yellowish brown (10YR 5/4) sand; single grain; loose; slightly acid; abrupt smooth boundary.

Bt1—34 to 39 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 3/2) clay films lining pores; about 5 percent gravel; neutral; abrupt wavy boundary.

2Bt2—39 to 48 inches; brown (7.5YR 4/4) gravelly sandy loam; weak medium subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 3/2) clay films lining pores; about 15 percent gravel; neutral; abrupt wavy boundary.

2C1—48 to 52 inches; brown (7.5YR 4/4) gravelly coarse sand; single grain; loose; about 30 percent gravel; strong effervescence; moderately alkaline, clear wavy boundary.

2C2—52 to 60 inches; dark yellowish brown (10YR 4/4) gravelly coarse sand; single grain; loose; about 25 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum typically is 45 to 55 inches, but it ranges from 45 to 65 inches. The A horizon has value of 3 to 5 and chroma of 2 or 3. The E horizon has value of 4 to 6 and chroma of 3 to 6. The A and E horizons are loamy sand, loamy fine sand, or sand. Some pedons do not have an E2 horizon. The Bt and 2Bt horizons have hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 to 6. They are sandy loam, gravelly sandy loam, sandy clay loam, or gravelly sandy clay loam. Some pedons have a B't horizon or a BC horizon. These horizons have colors similar to those of the Bt horizon. They are sandy loam, loamy sand, sandy clay loam, or the gravelly analogs of these textures. The 2C horizon is gravelly coarse sand, sand, or coarse sand. It is mildly alkaline or moderately alkaline.

Owosso Series

The Owosso series consists of well drained soils on till plains and moraines. These soils formed in glacial outwash and the underlying glacial till. They are moderately rapidly permeable in the upper part of the solum and moderately slowly permeable in the lower part and in the underlying material. Slopes range from 2 to 25 percent.

Owosso soils are similar to Metea soils and are adjacent to Metea, Miami, and Morley soils. The adjacent soils are in landscape positions similar to those of the Owosso soils. Metea soils have a thick, sandy surface layer and have less clay in the upper part of the subsoil than the Owosso soils. Miami soils have more clay in the upper part of the subsoil than the Owosso soils and have less clay in the underlying material. Morley soils have less sand and more clay in the upper part of the subsoil than the Owosso soils.

A typical pedon of Owosso sandy loam, in a cultivated area of Miami-Owosso-Metea complex, 2 to 8 percent slopes; 1,600 feet east and 650 feet south of the northwest corner of sec. 34, T. 34 N., R. 7 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine roots; about 5 percent gravel; neutral; abrupt smooth boundary.

BA—9 to 15 inches; brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; friable; few fine roots; about 7 percent gravel; neutral; gradual wavy boundary.

Bt1—15 to 28 inches; brown (7.5YR 4/4) loam; weak medium subangular blocky structure; firm; few fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 7 percent gravel; slightly acid; abrupt wavy boundary.

Bt2—28 to 36 inches; brown (7.5YR 4/4) loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 14 percent gravel; neutral; abrupt wavy boundary.

2Bt3—36 to 44 inches; yellowish brown (10YR 5/4) clay loam; few fine faint grayish brown (10YR 5/2) mottles; moderate medium angular blocky structure; firm; thin continuous dark brown (10YR 4/3) clay films on faces of peds and lining pores; about 5 percent gravel; neutral; clear wavy boundary.

2C—44 to 60 inches; brown (10YR 5/3) clay loam; few fine faint gray (10YR 5/1) mottles; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 48 inches thick. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. It is sandy loam or fine sandy loam. Some pedons have an E horizon, which has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The A, E, BA, and Bt horizons are strongly acid to neutral. The BA and Bt horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The Bt horizon is sandy loam or loam. The 2Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is clay loam or silty clay loam. It is strongly acid to mildly alkaline. The 2C horizon has value of 4 or 5 and chroma of 3 or 4. It is clay loam or silty clay loam.

Palms Series

The Palms series consists of very poorly drained soils in depressions on outwash plains, lake plains, till plains, and moraines. These soils formed in organic material over loamy and sandy material. They are moderately rapidly permeable to moderately slowly permeable in the organic material and moderately slowly permeable to rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Palms soils are similar to Edwards soils and are adjacent to Barry, Gilford, Gravelton, Sebewa, and Wallkill soils. Edwards soils are underlain by marl. Barry, Gilford, Gravelton, and Sebewa are mineral soils. They are in the slightly higher positions on the landscape. Wallkill soils formed in alluvial deposits over organic material. They are in the slightly higher positions on the landscape.

A typical pedon of Palms muck, gravelly substratum, drained, in a pasture; 1,330 feet east and 75 feet north of the center of sec. 11, T. 34 N., R. 7 E.

Op—0 to 9 inches; sapric material, black (N 2/0) broken face and rubbed; about 1 percent fiber, a trace rubbed; moderate medium granular structure; very friable; many fine roots; about 10 percent mineral material; slightly acid; abrupt smooth boundary.

Oa1—9 to 14 inches; sapric material, black (N 2/0) broken face and rubbed; about 5 percent fiber, a trace rubbed; moderate fine subangular blocky structure; friable; many fine roots; about 5 percent mineral material; neutral; clear smooth boundary.
Oa2—14 to 22 inches; sapric material, black (5YR 2/1) broken face, black (10YR 2/1) rubbed; about 8 percent fiber, 1 percent rubbed; weak medium subangular blocky structure; friable; common fine roots; neutral; clear wavy boundary.
Oa3—22 to 28 inches; sapric material, dark reddish brown (5YR 2/2) broken face, black (10YR 2/1) rubbed; about 15 percent fiber, 1 percent rubbed; weak medium subangular blocky structure; friable; common fine roots; slightly acid; abrupt smooth boundary.
2Cg1—28 to 36 inches; dark olive gray (5Y 3/2) sandy clay loam; massive; firm; about 2 percent gravel; neutral; clear wavy boundary.
2Cg2—36 to 42 inches; olive gray (5Y 4/2) loam; massive; very friable; about 8 percent gravel; mildly alkaline; abrupt wavy boundary.
3Cg3—42 to 52 inches; dark gray (5Y 4/1) gravelly coarse sand; single grain; loose; about 28 percent gravel; mildly alkaline; gradual wavy boundary.
3Cg4—52 to 60 inches; dark gray (5Y 4/1) gravelly coarse sand; single grain; loose; about 22 percent gravel; strong effervescence; mildly alkaline.

The organic material is 16 to 48 inches thick. It is derived primarily from herbaceous plants. In some pedons, however, it has woody fragments.

The Op and Oa horizons have hue of 10YR, 7.5YR, or 5YR, value of 2 or 3, and chroma of 1 to 3, or they are black (N 2/0). They are strongly acid to moderately alkaline. The 2Cg horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 6, and chroma of 1 or 2. It is silty clay loam, clay loam, sandy clay loam, loam, silt loam, or sandy loam. It is slightly acid to mildly alkaline. The content of coarse fragments in this horizon ranges from 0 to 10 percent. The 3Cg horizon, if it occurs, has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 3. It is gravelly loamy coarse sand or gravelly coarse sand. The content of coarse fragments in this horizon ranges from 20 to 50 percent.

Pewamo Series

The Pewamo series consists of very poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 0 to 2 percent.

Pewamo soils are similar to Barry soils and are adjacent to Blount, Glynwood, and Washtenaw soils. Barry soils have less clay in the subsoil and underlying material than the Pewamo soils. Blount and Glynwood soils do not have a thick, dark surface layer. They are in the higher positions on the landscape. Washtenaw soils formed in recent alluvium and in the underlying glacial material. They are in the slightly higher positions on the landscape.

A typical pedon of Pewamo silty clay loam, in a cultivated field; 325 feet east and 1,650 feet south of the northwest corner of sec. 34, T. 31 N., R. 7 E.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (N 4/0) dry; weak medium granular structure; friable; many fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.
AB—10 to 14 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium angular blocky structure; firm; common fine roots; about 5 percent gravel; neutral; clear wavy boundary.
Btg1—14 to 26 inches; gray (10YR 5/1) silty clay; many medium distinct yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; firm; few fine roots; medium continuous dark gray (10YR 4/1) clay films on faces of peds; very dark gray (10YR 3/1) channel fillings; about 3 percent gravel; neutral; clear wavy boundary.
Btg2—26 to 37 inches; dark gray (10YR 4/1) silty clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; medium continuous very dark gray (10YR 3/1) clay films on faces of peds; very dark gray (10YR 3/1) channel fillings; about 8 percent gravel; neutral; abrupt wavy boundary.
Cg—37 to 60 inches; dark grayish brown (10YR 4/2) clay loam; common medium faint dark gray (10YR 4/1) mottles; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 50 inches. It coincides with the depth to effervescent material. The content of coarse fragments in the solum is 2 to 10 percent.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam, silt loam, or clay loam. The Btg horizon has hue of 10YR or 5Y, value of 4 to 6, and chroma of 1 to 3. It is silty clay loam, silty clay, or clay loam. The C horizon has hue of 10YR or 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam or silty clay loam.

Rensselaer Series

The Rensselaer series consists of very poorly drained, moderately permeable soils in lacustrine basins on till plains, terraces, and outwash plains. These soils formed in stratified lacustrine sediments. Slopes range from 0 to 2 percent.

Rensselaer soils are similar to Barry and Sebewa soils and are adjacent to Washtenaw and Whitaker soils.

Barry soils are not stratified in the lower part of the subsoil or in the underlying material. Sebewa soils are underlain by sand and gravelly coarse sand. Washtenaw soils formed in recent alluvium and the underlying glacial material. They are in depressions. Whitaker soils do not have a thick, dark surface layer. They are in the higher positions on the landscape.

A typical pedon of Rensselaer loam, in a cultivated field; 1,650 feet east and 550 feet north of the southwest corner of sec. 14, T. 31 N., R. 7 E.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; many fine roots; about 4 percent gravel; slightly acid; abrupt smooth boundary.

AB—9 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; firm; few fine roots; about 1 percent gravel; neutral; clear wavy boundary.

2Btg—15 to 30 inches; gray (10YR 5/1) sandy clay loam; common medium faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

2BCg—30 to 42 inches; gray (10YR 5/1) sandy loam; common medium distinct yellowish brown (10YR 5/8) and common medium prominent grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; friable; thin discontinuous gray (10YR 6/1) clay films lining pores; mildly alkaline; abrupt wavy boundary.

3Cg—42 to 60 inches; gray (10YR 5/1), light olive brown (2.5Y 5/4), and olive brown (2.5Y 4/4) stratified sandy loam, silt loam, and loamy sand; many medium distinct gray (10YR 5/1), light gray (10YR 6/1), and light olive brown (2.5Y 5/4) mottles; massive; firm and friable; about 5 percent gravel in the strata of loamy sand; strong effervescence; moderately alkaline.

The thickness of the solum commonly is 40 to 48 inches, but it ranges from 40 to 54 inches. The content of coarse fragments is 0 to 5 percent throughout the solum.

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 silt loam, loam, silty clay loam, or sandy loam. The 2Btg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or less. It is dominantly sandy clay loam, sandy loam, or loam, but strata of clay loam or silty clay loam are common. Some pedons do not have a 2BCg horizon. The 3Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly sandy loam, loam, or silt loam but has thin layers of fine sand or loamy sand.

Riddles Series

The Riddles series consists of well drained, moderately permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 0 to 18 percent.

Riddles soils are similar to Martinsville and Wawasee soils and are adjacent to Crosier, Kosciusko, and Ormas soils. Martinsville soils have more sand and are more stratified in the lower part of the solum and in the underlying material than the Riddles soils. Wawasee soils have a solum that is thinner than that of the Riddles soils. Crosier soils have mottles in the upper part of the subsoil. They are in the lower positions on the landscape. Kosciusko and Ormas soils are in landscape positions similar to those of the Riddles soils. Kosciusko soils have more sand and gravel in the subsoil and underlying material than the Riddles soils. Also, they have a thinner solum. Ormas soils have a thick surface layer of loamy sand and are underlain by sandy outwash.

A typical pedon of Riddles fine sandy loam, 2 to 6 percent slopes, in a cultivated field; 1,480 feet west and 1,175 feet south of the northeast corner of sec. 6, T. 33 N., R. 7 E.

Ap—0 to 8 inches; dark brown (10YR 3/3) fine sandy loam, pale brown (10YR 6/3) dry; weak medium granular structure; friable; many medium roots; about 6 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—8 to 20 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak medium subangular blocky structure; friable; common medium roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 10 percent gravel; slightly acid; clear wavy boundary.

Bt2—20 to 32 inches; brown (10YR 4/3) sandy clay loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; about 4 percent gravel; neutral; gradual wavy boundary.

Bt3—32 to 43 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds; about 7 percent gravel; neutral; gradual wavy boundary.

BC—43 to 48 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; friable; about 6 percent gravel; neutral; abrupt wavy boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; about 10 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum is typically 42 to 55 inches, but it ranges from 40 to 65 inches. The content of

coarse fragments ranges from 1 to 14 percent throughout the solum.

The Ap horizon has value of 3 to 5 and chroma of 1 to 4. It is loam, sandy loam, or fine sandy loam. Some pedons have an AB horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is generally sandy clay loam or sandy loam, but it has subhorizons of loam or clay loam. The BC horizon is loam or sandy loam. It is neutral or mildly alkaline and has free carbonates in some pedons. The C horizon has value of 5 or 6 and chroma of 3 or 4. It is loam, sandy loam, or stratified loam and sandy loam.

Saranac Series

The Saranac series consists of very poorly drained soils on flood plains. These soils formed in loamy, silty, and clayey alluvium over sandy and gravelly outwash. They are moderately slowly permeable in the upper part and rapidly permeable in the sandy and gravelly underlying material. Slopes range from 0 to 2 percent.

Saranac soils are similar to Toledo soils and are adjacent to Shoals soils. Toledo soils have a dark surface layer that is thinner than that of the Saranac soils. They decrease regularly in content of organic carbon with increasing depth. Shoals soils are somewhat poorly drained and are in the higher positions on the landscape. They are browner than the Saranac soils.

A typical pedon of Saranac clay loam, gravelly substratum, occasionally flooded, in a cultivated field; 1,700 feet west and 100 feet north of the center of sec. 13, T. 30 N., R. 7 E.

Ap—0 to 7 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; weak very coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

A1—7 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate coarse granular structure; friable; many fine roots; neutral; clear smooth boundary.

A2—16 to 23 inches; black (10YR 2/1) silty clay loam; moderate medium granular structure; firm; common fine roots; neutral; clear smooth boundary.

Bg1—23 to 35 inches; dark gray (N 4/0) silty clay; many coarse prominent brown (10YR 5/3) and yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to strong medium subangular blocky; firm; few fine roots; neutral; clear smooth boundary.

Bg2—35 to 45 inches; gray (N 5/0) silty clay loam; many coarse prominent brown (10YR 5/3) and yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few fine pebbles; neutral; abrupt smooth boundary.

BCg—45 to 53 inches; gray (10YR 5/1) loam; few fine faint brown (10YR 5/3) mottles; massive; friable; few fine pebbles; strong effervescence; mildly alkaline; abrupt smooth boundary.

2Cg—53 to 60 inches; grayish brown (10YR 5/2) gravelly loamy coarse sand; many fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; about 25 percent gravel; strong effervescence; mildly alkaline.

The solum ranges from 30 to 55 inches in thickness. The depth to free carbonates ranges from 30 to 60 inches. The mollic epipedon is 10 to 24 inches thick. It includes the upper part of the B horizon in most pedons.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is clay loam, silty clay loam, or silt loam. It is slightly acid to mildly alkaline. The B horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2, or it is neutral in hue and has value of 4 or 5. It is silty clay loam, silty clay, or clay loam and has thin lenses of silt loam or loam. It is neutral in the upper part and neutral or mildly alkaline in the lower part. Some pedons have a C horizon. This horizon is clay loam or silty clay loam and has thin strata of silt loam, sandy loam, or loamy sand. Gravelly coarse sand or gravelly loamy coarse sand is below a depth of 40 to 55 inches.

Sebewa Series

The Sebewa series consists of poorly drained and very poorly drained soils on outwash plains and terraces. These soils formed in glacial outwash over sand and gravelly coarse sand. They are moderately permeable in the subsoil and rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Sebewa soils are similar to Gilford and Rensselaer soils and are adjacent to Homer and Palms soils. Gilford soils have more sand in the subsoil than the Sebewa soils. Rensselaer soils have less gravel in the lower part of the subsoil than the Sebewa soils and are underlain by finer textured stratified material. Homer soils have a dark surface layer that is thinner than that of the Sebewa soils. They are in depressions and potholes on the higher parts of the landscape. Palms soils are organic to a depth of more than 16 inches. They are in depressions and potholes.

A typical pedon of Sebewa loam, in a cultivated field; 1,280 feet south and 1,220 feet east of the center of sec. 32, T. 34 N., R. 5 E.

Ap—0 to 11 inches; black (10YR 2/1) loam, gray (10YR 5/1) dry; weak fine granular structure; friable; common fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.

Btg1—11 to 20 inches; gray (10YR 5/1) clay loam; many coarse distinct brown (10YR 4/3) and yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few fine roots; thick

discontinuous very dark gray (10YR 3/1) clay films on faces of peds; few black (N 2/0) iron and manganese stains; about 5 percent gravel; slightly acid; clear wavy boundary.

Btg2—20 to 26 inches; gray (10YR 5/1) sandy clay loam; many coarse distinct brown (10YR 4/3) and yellowish brown (10YR 5/8) mottles; weak fine and medium subangular blocky structure; friable; few fine roots; thick discontinuous dark gray (10YR 4/1) clay films on faces of peds and lining pores; many black (N 2/0) iron and manganese stains; about 8 percent gravel; slightly acid; abrupt wavy boundary.

Btg3—26 to 30 inches; dark gray (10YR 4/1) loam; few fine distinct dark reddish brown (5YR 3/3) mottles; weak fine subangular blocky structure; friable; few fine roots; thin very dark gray (10YR 3/1) clay bridges between sand grains; few black (N 2/0) iron and manganese stains; about 10 percent gravel; neutral; abrupt irregular boundary.

2Cg1—30 to 36 inches; grayish brown (10YR 5/2) gravelly coarse sand; single grain; loose; about 20 percent gravel; mildly alkaline; clear irregular boundary.

2Cg2—36 to 60 inches; grayish brown (10YR 5/2) stratified sand and gravelly coarse sand; single grain; loose; about 35 percent gravel; strong effervescence; moderately alkaline.

The solum is 24 to 40 inches thick. The Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is loam, sandy loam, or silt loam. In some pedons an A horizon underlies the Ap horizon, particularly where the Ap horizon is less than 10 inches thick. The Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It is clay loam, loam, sandy clay loam, or the gravelly analogs of these textures. The Btg3 horizon is neutral or mildly alkaline. The 2Cg horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6, and chroma of 1 or 2. The content of coarse fragments in this horizon ranges from 15 to 60 percent.

Shipshe Series

The Shipshe series consists of well drained soils on outwash plains. These soils formed in loamy outwash over stratified sand and very gravelly coarse sand. They are moderately rapidly permeable in the subsoil and very rapidly permeable in the underlying material. Slopes range from 0 to 6 percent.

Shipshe soils are similar to Boyer and Carmi soils and are adjacent to Bronson, Griswold, and Homer soils. Boyer and Carmi soils contain less gravel in the subsoil than the Shipshe soils. Also, Boyer soils have a lighter colored surface layer, and Carmi soils are deeper to the underlying sandy and gravelly sediments. Bronson and Homer soils have mottles in the subsoil. They are in the lower positions on the landscape. Griswold soils have more clay and less gravel in the subsoil than the Shipshe soils and are underlain by till. They are on the higher plains.

A typical pedon of Shipshe sandy loam, 0 to 2 percent slopes, in a cultivated field; 750 feet north and 700 feet east of the center of sec. 29, T. 34 N., R. 6 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; common fine roots; about 7 percent gravel; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; very dark brown (10YR 2/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; common fine roots; about 7 percent gravel; slightly acid; clear wavy boundary.

AB—12 to 18 inches; very dark grayish brown (10YR 3/2) very gravelly sandy loam, dark brown (10YR 3/3) dry; weak fine subangular blocky structure; friable; few fine roots; about 43 percent gravel; neutral; gradual wavy boundary.

Bt1—18 to 34 inches; dark reddish brown (5YR 3/3) very gravelly sandy loam; moderate medium subangular blocky structure; firm; few fine roots; thin discontinuous very dark grayish brown (10YR 3/2) clay films on sand grains and lining some voids; about 44 percent gravel; slightly acid; abrupt wavy boundary.

Bt2—34 to 39 inches; dark reddish brown (5YR 2/2) very gravelly sandy clay loam; weak medium subangular blocky structure; firm; medium discontinuous black (5YR 2/1) clay films bridging sand grains and lining some voids; about 35 percent gravel; neutral; abrupt irregular boundary.

2C—39 to 60 inches; brown (10YR 5/3) stratified sand and very gravelly coarse sand; single grain; loose; about 45 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 40 inches thick. The sand fraction is dominantly medium sand.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is sandy loam or loam. The content of coarse fragments in this horizon is 2 to 10 percent. The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 or 4, and chroma of 2 to 4. It is gravelly sandy loam or gravelly sandy clay loam. The content of coarse fragments in this horizon is 35 to 45 percent. Some pedons do not have a Bt2 horizon. Many have a BC horizon, which is loose gravelly loamy sand. Tongues of the Bt2 or BC horizon extend as much as 2 feet into the 2C horizon in some pedons. The composition and thickness of the sand and gravel layers in the 2C horizon vary widely.

Shoals Series

The Shoals series consists of somewhat poorly drained soils on flood plains. These soils formed in loamy alluvial deposits underlain by sandy and gravelly outwash. They are moderately permeable in the loamy sediments and rapidly permeable or very rapidly permeable in the sandy and gravelly material. Slopes range from 0 to 2 percent.

Shoals soils are similar to Whitaker soils and are adjacent to Abscota and Saranac soils. Whitaker soils regularly decrease in content of organic carbon with increasing depth and contain less gravel in the underlying material than the Shoals soils. They are on outwash plains and terraces. Abscota soils are well drained and are in the higher positions on the landscape. Saranac soils have a thick, dark surface layer and are grayer throughout than the Shoals soils. They are in the lower positions on the landscape.

A typical pedon of Shoals loam, gravelly substratum, occasionally flooded, in a cultivated field; 2,230 feet north and 300 feet west of the southeast corner of sec. 5, T. 30 N., R. 7 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (2.5Y 5/2) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

C1—9 to 18 inches; yellowish brown (10YR 5/4) loam; common medium distinct dark gray (5Y 4/1) and gray (10YR 5/1) mottles; weak medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

C2—18 to 30 inches; dark grayish brown (2.5Y 4/2) loam; many fine distinct dark yellowish brown (10YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate coarse granular structure; firm; common fine roots in the upper 4 inches and few fine roots in the lower 8 inches; neutral; abrupt smooth boundary.

C3—30 to 42 inches; brown (10YR 4/3) clay loam; common coarse prominent gray (N 5/0) and strong brown (7.5YR 5/8) mottles; massive; firm; few fine roots; neutral; abrupt smooth boundary.

C4—42 to 48 inches; grayish brown (10YR 5/2) loam; common coarse prominent brown (10YR 5/3) and strong brown (7.5YR 5/8) mottles; massive; firm; neutral; abrupt smooth boundary.

C5—48 to 60 inches; gray (10YR 5/1) gravelly loamy sand; single grain; loose; about 18 percent gravel; strong effervescence; moderately alkaline.

Reaction is slightly acid to mildly alkaline in the control section and ranges to moderately alkaline below a depth of 40 inches. The A horizon has value of 3 or 4. It is silt loam or loam. The part of the C horizon within a depth of 40 inches has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. It is loam, silt loam, clay loam, or sandy loam. The part below a depth of 40 inches has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4. It is silt loam, loam, sandy loam, loamy sand, coarse sand, gravelly loamy sand, or gravelly coarse sand.

Toledo Series

The Toledo series consists of very poorly drained, slowly permeable soils in depressions and small glacial lakebeds on uplands and terraces. These soils formed in lacustrine deposits. Slopes range from 0 to 2 percent.

Toledo soils are similar to Saranac soils and are adjacent to Del Rey and Washtenaw soils. Del Rey soils have a surface layer that is lighter colored than that of the Toledo soils. They are in the higher positions on the landscape. Saranac soils are underlain by sandy outwash. They are on flood plains. Washtenaw soils formed in recent alluvium over a buried surface layer. They are in the slightly higher positions on the landscape.

A typical pedon of Toledo silty clay, in a cultivated field; 1,850 feet east and 1,525 north of the southwest corner of sec. 17, T. 30 N., R. 6 E.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.

A—6 to 9 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; few medium distinct yellowish brown (10YR 5/8) mottles; moderate medium angular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg1—9 to 15 inches; dark gray (10YR 4/1) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; strong coarse subangular blocky structure; firm; few fine roots; neutral; clear wavy boundary.

Bg2—15 to 25 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; firm; few fine roots; thin continuous black (10YR 2/1) organic coatings in pores and root channels; neutral; clear wavy boundary.

BCg1—25 to 30 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; firm; thin discontinuous black (10YR 2/1) organic coatings in pores; weak effervescence; mildly alkaline; clear wavy boundary.

BCg2—30 to 36 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; firm; thin discontinuous black (10YR 2/1) organic coatings in pores; strong effervescence; mildly alkaline; clear smooth boundary.

BCg3—36 to 42 inches; gray (10YR 5/1) silty clay; common medium distinct yellowish brown (10YR

5/6) mottles; moderate medium platy structure; firm; strong effervescence; mildly alkaline; clear smooth boundary.
Cg—42 to 60 inches; gray (10YR 5/1) silty clay; common medium distinct yellowish brown (10YR 5/4) mottles; massive; firm; strong effervescence; mildly alkaline.

The solum is 36 to 50 inches thick. 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 silty clay or silty clay loam. It is medium acid to neutral. The B horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It is slightly acid to mildly alkaline. The BC horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6. It is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. It is dominantly silty clay or silty clay loam, but thin strata of silt loam, clay loam, fine sandy loam, or loam are common in some pedons.

Wallkill Series

The Wallkill series consists of very poorly drained soils along streams, around the outer fringes of marshes and lakes, and in upland potholes. These soils formed in alluvial deposits over organic material. They are moderately permeable in the mineral layers and moderately rapidly permeable in the organic material. Slopes range from 0 to 2 percent.

Wallkill soils are similar to Washtenaw soils and are adjacent to Edwards, Houghton, and Palms soils. Washtenaw soils formed in alluvial deposits and the underlying glacial material. Edwards, Houghton, and Palms soils formed in organic material in the slightly lower positions on the landscape.

A typical pedon of Wallkill silt loam, in an area of marsh; 450 feet east and 800 feet south of the northwest corner of sec. 34, T. 34 N., R. 7 E.

A—0 to 8 inches; very dark grayish brown (2.5Y 3/2) silt loam, light brownish gray (10YR 6/2) dry; moderate coarse granular structure; friable; many fine roots; neutral; abrupt smooth boundary.
ACg—8 to 18 inches; very dark gray (10YR 3/1) silt loam; weak medium granular structure; friable; common fine roots; neutral; abrupt wavy boundary.
Cg—18 to 24 inches; dark gray (10YR 4/1) silt loam; weak medium subangular blocky structure; friable; common fine roots; neutral; abrupt smooth boundary.
2Oa1—24 to 34 inches; sapric material, black (5YR 2/1) broken face and rubbed; about 12 percent fiber, 1 percent rubbed; massive; firm; few fine roots; neutral; abrupt smooth boundary.
2Oa2—34 to 48 inches; sapric material, dark reddish brown (5YR 3/2) broken face and rubbed; about 15 percent fiber, 1 percent rubbed; weak medium platy structure; friable; neutral; abrupt smooth boundary.
2Oa3—48 to 60 inches; sapric material, dark reddish brown (5YR 3/2) broken face and rubbed; about 20 percent fiber, 5 percent rubbed; weak thick platy structure; friable; strong effervescence; mildly alkaline.

The thickness of the alluvium is dominantly 20 to 36 inches, but it ranges from 16 to 40 inches. The Ap horizon has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 or 2. It is silt loam or loam. The AC and C horizons have hue of 10YR to 5Y, value of 3 to 5, and chroma of 1 or 2. They are dominantly silt loam, but some pedons have subhorizons of fine sandy loam. The 2Oa horizon has hue of 5YR to 2.5Y, value of 2 or 3, and chroma of 1 or 2, or it is black (N 2/0). In most pedons it is sapric material to a depth of 5 feet, but some pedons have thin layers of hemic material.

Washtenaw Series

The Washtenaw series consists of poorly drained soils in depressions and drainageways on outwash plains, till plains, and moraines. These soils formed in recent alluvium and the underlying glacial material. They have a buried surface layer and subsoil. They are moderately permeable in the alluvial deposits and in the upper part of the buried soil, slowly permeable to moderately permeable in the buried subsoil, and slowly permeable to very rapidly permeable in the underlying material. Slopes range from 0 to 2 percent.

Washtenaw soils are similar to Wallkill soils and are adjacent to Pewamo, Rensselaer, and Toledo soils. Wallkill soils formed in alluvium over organic material. Pewamo, Rensselaer, and Toledo soils do not have alluvial deposits in the upper part. They are in the slightly higher positions on the landscape.

A typical pedon of Washtenaw silt loam, in an idle area; 320 feet north and 100 feet west of the center of sec. 1, T. 32 N., R. 6 E.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; common fine and medium roots; neutral; clear smooth boundary.
C1—8 to 18 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable; few fine and medium roots; neutral; clear smooth boundary.
C2—18 to 30 inches; dark grayish brown (10YR 4/2) loam; few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; few fine roots; neutral; abrupt smooth boundary.
2Ab—30 to 38 inches; very dark brown (10YR 2/2) silt loam; weak medium subangular blocky structure; firm; few fine roots; thin discontinuous dark grayish

brown (10YR 4/2) silt coatings on faces of peds; neutral; abrupt smooth boundary.

2Btgb1—38 to 44 inches; dark gray (5Y 4/1) silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; about 2 percent gravel; neutral; clear wavy boundary.

2Btgb2—44 to 54 inches; gray (5Y 5/1) clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) coatings on faces of peds; about 10 percent gravel; neutral; abrupt wavy boundary.

2C—54 to 60 inches; brown (10YR 5/3) loam; common fine faint gray (10YR 6/1) and grayish brown (10YR 5/2) mottles; massive; friable; about 5 percent gravel; strong effervescence; moderately alkaline.

The alluvial deposits are 20 to 40 inches deep over the buried soil. The A horizon has value of 3 to 5 and chroma of 2 or 3. It is loam or silt loam. The C horizon has value of 4 or 5 and chroma of 1 or 2. It is silt loam, sandy loam, or loam. The 2Ab horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam, sandy loam, loam, or silty clay loam. The 2Btgb horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 2 or less. It is clay loam, sandy clay loam, silty clay loam, sandy loam, loam, or the gravelly analogs of these textures. The 2C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 2 to 4. It is loam, sandy clay loam, or clay loam. In some pedons the depth to this horizon is more than 60 inches. In the gravelly substratum phase, the texture is gravelly coarse sand, coarse sand, gravelly loamy coarse sand, or gravelly loamy sand. The gravelly substratum commonly is stratified.

Wawasee Series

The Wawasee series consists of well drained, moderately permeable soils on till plains and moraines. These soils formed in glacial till. Slopes range from 2 to 18 percent.

Wawasee soils are similar to Griswold, Miami, and Riddles soils and are adjacent to Aubbeenaubbee, Crosier, and Metea soils. Griswold soils have a surface layer that is thicker and darker than that of the Wawasee soils. Miami soils have more clay in the lower part of the subsoil and in the underlying glacial till than the Wawasee soils. Riddles soils have a solum that is thicker than that of the Wawasee soils. Aubbeenaubbee and Crosier soils have mottles in the upper part of the subsoil. They are in the lower positions on the landscape. Metea soils have a thick, sandy surface layer. They are on knolls and side slopes.

A typical pedon of Wawasee fine sandy loam, 2 to 6 percent slopes, in a cultivated field; 1,660 feet north and 75 feet east of the southwest corner of sec. 25, T. 32 N., R. 5 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine roots; about 6 percent gravel; slightly acid; abrupt smooth boundary.

BA—8 to 14 inches; dark yellowish brown (10YR 4/4) loam; moderate medium granular structure; friable; common fine roots; about 2 percent gravel; slightly acid; abrupt wavy boundary.

Bt1—14 to 28 inches; brown (10YR 4/3) sandy clay loam; moderate medium subangular blocky structure; firm; common fine roots; thin discontinuous dark brown (10YR 3/3) clay films on faces of peds and lining pores; about 5 percent gravel; medium acid; clear wavy boundary.

Bt2—28 to 38 inches; brown (10YR 4/3) sandy clay loam; weak fine subangular blocky structure; friable; few fine roots; thin continuous dark brown (10YR 3/3) clay films lining pores; about 4 percent gravel; slightly acid; abrupt wavy boundary.

C—38 to 60 inches; brown (10YR 5/3) fine sandy loam; massive; friable; about 6 percent gravel; strong effervescence; moderately alkaline.

The solum is 28 to 40 inches thick. The content of coarse fragments is less than 2 percent to about 10 percent in the solum.

The A horizon has value of 4 or 5 and chroma of 2 or 3. It is loam, fine sandy loam, or sandy loam. Some pedons have a thin E horizon. Some do not have a BA horizon. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is loam or sandy clay loam. Some pedons have a BC horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 6. It is loam, fine sandy loam, or sandy loam. The content of coarse fragments in this horizon is 5 to 14 percent.

Whitaker Series

The Whitaker series consists of somewhat poorly drained, moderately permeable soils on outwash plains and terraces. These soils formed in medium textured and moderately coarse textured lacustrine sediments. Slopes range from 0 to 2 percent.

Whitaker soils are similar to Crosier, Homer, and Shoals soils and are adjacent to Martinsville and Rensselaer soils. Crosier and Homer soils contain more gravel throughout than the Whitaker soils and are not stratified with silty sediments in the underlying material. Shoals soils are underlain by sandy sediments. They are on flood plains. Martinsville soils have no mottles. They are in the higher positions on the landscape. Rensselaer soils have a surface soil that is thicker and darker than

that of the Whitaker soils. They are in the lower positions on the landscape.

A typical pedon of Whitaker loam, in a cultivated field; 1,600 feet west and 525 feet south of the center of sec. 20, T. 33 N., R. 6 E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak medium granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

E—9 to 15 inches; grayish brown (10YR 5/2) loam; common medium distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/6) mottles; weak coarse granular structure; friable; few fine roots; few black (10YR 2/1) iron and manganese stains; medium acid; clear smooth boundary.

Bt1—15 to 22 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) and gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; thin discontinuous brown (10YR 5/3) clay films lining pores; medium acid; clear smooth boundary.

Bt2—22 to 34 inches; dark grayish brown (10YR 4/2) clay loam; many coarse distinct gray (10YR 6/1) and yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; firm; thin discontinuous grayish brown (10YR 5/2) clay films on faces of peds and lining pores; common black (10YR 2/1) iron and manganese stains; medium acid; clear smooth boundary.

Bt3—34 to 44 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct gray (10YR 5/1) and yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds and lining pores; few black (10YR 2/1) iron and manganese stains; slightly acid; clear smooth boundary.

2C1—44 to 52 inches; mottled dark grayish brown (10YR 4/2), yellowish brown (10YR 5/4), very dark grayish brown (10YR 3/2), and gray (10YR 5/1) stratified sandy loam, loamy sand, and loam; massive and single grain; friable; slight effervescence; mildly alkaline; abrupt wavy boundary.

2C2—52 to 60 inches; mottled dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and light gray (10YR 6/1) stratified loam, sandy loam, and silt loam; massive; friable and firm; slight effervescence; mildly alkaline.

The thickness of the solum typically is 40 to 44 inches, but it ranges from 40 to 55 inches. The A horizon has value of 4 or 5 and chroma of 2 or 3. It is loam or fine sandy loam. It is medium acid to neutral. Some pedons do not have an E horizon. Some have a BE horizon. This horizon is loam or fine sandy loam. The Bt horizon has value of 4 to 6 and chroma of 1 to 4. It is clay loam, sandy clay loam, or loam. The 2C horizon has value of 4 to 6 and chroma of 1 to 6. It is dominantly sandy loam, fine sandy loam, loam, or silt loam but has thin strata of sandy material. It is slightly acid to moderately alkaline.

Formation of the Soils

This section relates the major factors of soil formation to the soils in the county. It also describes the processes of soil formation.

Factors of Soil Formation

Soils form through the physical and chemical weathering of geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that 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 into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is always required for the differentiation of soil 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.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The parent materials in Kosciusko County were deposited by glaciers or by meltwater from the glaciers. Some of these materials were reworked and redeposited by the subsequent actions of water and wind. The most recent glaciers covered the county about 12,000 to 15,000 years ago. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Kosciusko County are 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. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Kosciusko County is calcareous, friable or firm fine sandy loam, sandy loam, loam, or clay loam. Miami soils are an example of soils that formed in glacial till. These soils typically are medium textured and have well developed structure.

Outwash material was deposited by running water from melting glaciers. The size of the particles that make up outwash varies, depending on the velocity of the water that carried the material. When the water slowed down, the coarser particles were deposited. Finer particles, such as very fine sand, silt, and clay, were carried farther by the more slowly moving water. Outwash deposits generally occur as layers of similar-size particles, such as sandy loam, sand, gravel, and other coarse particles. Kosciusko soils are an example of soils that formed in outwash material.

Lacustrine material was deposited by still, or ponded, glacial meltwater. 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. The soils in Kosciusko County that formed in these deposits are medium textured to fine textured. Toledo soils are an example of soils that formed in lacustrine material.

Alluvium was recently deposited by floodwater along present streams. This material varies in texture, depending on the speed of the water from which it was deposited. Shoals and Saranac are examples of soils that formed in alluvium.

Organic material occurs as deposits of plant remains. After the glaciers withdrew from the survey area, water was left standing in depressions on outwash plains, lake plains, and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains fell to the bottom. Because of wetness, the plant remains did not decompose but remained around the edge of the lakes. Later, white-cedar and other water-tolerant trees grew in the areas. As these trees died, their remains became part of the organic accumulation. The lakes were eventually filled with organic material, which developed into peat. In some areas the plant

remains subsequently decomposed into muck. In other areas the material has changed little since deposition. Houghton soils are an example of soils that formed in organic material.

Plant and Animal Life

Plants have been the principal organisms influencing the soils in Kosciusko County. Bacteria, fungi, and earthworms also have affected the formation of soils in the county. The chief contribution of plant and animal life to soil formation is the addition of organic matter and nitrogen to the soil. The kind of organic material on and in the soil depends on the kinds of native plants that grew on the soil. The remains of these plants accumulated on the surface, decayed, and eventually became humus. The roots of the plants provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria helped to break down the organic matter into plant nutrients.

The native vegetation in Kosciusko County was mainly deciduous trees, but a few areas supported prairie grasses. Differences in natural soil drainage and minor variations in the kind of parent material affected the composition of the vegetative cover. Some well drained upland soils, such as Griswold and Shipshe soils, formed under prairie grasses. Other well drained upland soils, such as Miami, Morley, and Wawasee soils, mainly supported sugar maple, beech, walnut, and hickory. The somewhat excessively drained Coloma soils supported black oak and scrub oak. Wet soils, such as Barry, Rensselaer, and Sebewa soils, primarily supported maple, oak, and willow. The well drained soils that formed dominantly under forest vegetation generally have less organic matter than the well drained soils that formed dominantly under grasses.

Climate

Climate helps to determine the kind of plant and animal life on and in the soil, the amount of water available for the weathering of minerals and the translocation of soil material, and the rate of chemical reaction in the soil. These influences are important, but they affect large areas rather than a relatively small area, such as a county.

The climate in Kosciusko County is cool and humid. It is presumably similar to the climate under which the soils formed. The soils in the county differ from soils that formed under a dry, warm climate and from those that formed under a hot, moist climate. The climate is uniform throughout the county. No major differences among the soils result from differences in climate. More detailed information about the climate is available under the heading "General Nature of the County."

Relief

Relief has markedly affected the soils in Kosciusko County through its effect on natural drainage, runoff, erosion, plant cover, and soil temperature. Slopes range from nearly level to steep. Runoff is most rapid on the steeper slopes. Water is temporarily ponded in the lower areas.

Natural drainage in the county ranges from somewhat excessively drained on ridgetops to very poorly drained in depressions. Through its affect on soil aeration, drainage determines the color of the soil. Water and air move freely through well drained soils but slowly through very poorly drained soils. In well aerated soils, the iron and aluminum compounds that give most soils their color are brightly colored and oxidized. The somewhat excessively drained Coloma soils are an example. Rensselaer and other poorly aerated, very poorly drained soils are dull gray and mottled.

Time

Time, usually a long time, is required for the processes of soil formation to form distinct horizons. Differences in the length of time that the parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in the county range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming processes long enough for the development of distinct horizons. Soils that formed in recent alluvial sediments, however, have not been in place long enough for distinct horizons to develop.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in Kosciusko County. These processes are the accumulation of organic matter; the dissolution, transfer, and removal of calcium carbonates and bases; the liberation and translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils more than one of these processes have helped to differentiate horizons.

Some organic matter has accumulated in the surface layer of all the soils in the county. The organic matter content of some soils is moderate, but that of others is high. Generally, the soils that have the most organic matter, such as Barry and Rensselaer soils, have a thick, dark surface soil.

Carbonates and bases have been leached from the upper horizons of nearly all the soils in the county. Leaching probably preceded the translocation of silicate clay minerals. Most of the carbonates and some of the bases have been leached from the 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 of a high water table or the slow movement of water through the profile.

Clay accumulates in pores and on the faces of the structural units along which water moves. The leaching of bases and the translocation of silicate clays are among the more important processes of horizon differentiation in the county. Miami soils are an example of soils in which translocated silicate clay in the form of clay films has accumulated in the Bt horizon.

Gleying, or the reduction and transfer of iron, has occurred in all of the very poorly drained to somewhat poorly drained soils in the county. In these naturally wet soils, this process has significantly affected horizon differentiation. A gray color in the subsoil indicates the reduction and redistribution of iron oxide. Reduction is commonly accompanied by some transfer of the iron, either from upper horizons to lower ones or completely out of the profile. Mottles, which are 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.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

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.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

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 shatter or loosen hard compacted layers to a depth below normal plow depth.

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 to 38 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.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of 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.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

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 resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

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, subsurface. The removal of excess ground water through buried drains installed within the soil profile. The drains collect the water and convey it to a gravity or pump outlet.

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 is not 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.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

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 meltwater.

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 meltwater. 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 7.6 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 (7.6 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.

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 uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:
O horizon.—An organic layer of fresh and decaying plant residue.

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, any plowed or disturbed surface layer.
E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.
B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon 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) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.
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 overlying 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, an Arabic numeral, commonly a 2, precedes the letter C.
Cr horizon.—Soft, consolidated bedrock beneath the soil.
R layer.—Hard, consolidated bedrock beneath the soil. The bedrock 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.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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 capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

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.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, 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.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

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.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

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 0.2 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.)

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

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 filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

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.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

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.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

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.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of 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 millimeters 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, E, 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.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

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.

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.

Underlying material. The part of the soil below the solum.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

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.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-76 at Warsaw, Indiana)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	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*	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	31.7	14.1	22.9	57	-14	7	1.74	0.66	2.61	5	4.5
February	35.8	17.0	26.4	62	-12	10	1.71	.87	2.38	5	8.3
March	44.3	24.8	34.6	77	4	54	2.28	1.13	3.20	6	4.8
April	59.0	37.1	48.1	84	18	255	3.97	2.40	5.37	9	.7
May	70.7	47.4	59.1	90	28	592	3.22	2.09	4.23	7	.0
June	80.7	56.4	68.6	97	37	858	4.18	2.49	5.68	7	.0
July	84.1	60.3	72.2	97	44	998	4.16	2.22	5.73	7	.0
August	82.3	57.3	69.8	94	41	924	3.21	1.58	4.54	6	.0
September	76.6	50.1	63.3	94	30	699	2.96	1.53	4.11	6	.0
October	64.9	39.3	52.1	85	20	387	3.14	1.04	4.82	6	.0
November	48.3	29.3	38.8	73	8	91	2.60	1.45	3.54	6	1.6
December	35.9	19.1	27.6	64	-8	30	2.35	.68	3.68	6	5.9
Yearly:											
Average	59.5	37.7	48.6	---	---	---	---	---	---	---	---
Extreme	---	---	---	99	-14	---	---	---	---	---	---
Total	---	---	---	---	---	4,905	35.52	29.40	41.16	76	25.8

* 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 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-76 at Warsaw, Indiana)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 24	May 10	May 19
2 years in 10 later than--	Apr. 19	May 4	May 14
5 years in 10 later than--	Apr. 9	Apr. 21	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 12	Oct. 3	Sept. 18
2 years in 10 earlier than--	Oct. 18	Oct. 8	Sept. 23
5 years in 10 earlier than--	Oct. 29	Oct. 20	Oct. 4

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-76 at Warsaw, Indiana)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	178	158	129
8 years in 10	187	166	137
5 years in 10	203	181	152
2 years in 10	219	195	167
1 year in 10	228	203	175

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ab	Abscota fine sandy loam, occasionally flooded	120	*
Ao	Aquents-Urban land complex, rarely flooded	1,830	0.5
ArA	Aubbeenaubbee sandy loam, 0 to 2 percent slopes	555	0.2
AtA	Aubbeenaubbee fine sandy loam, moderately permeable, 0 to 2 percent slopes	3,790	1.1
Bc	Barry loam	18,265	5.2
BlA	Blount silt loam, 0 to 2 percent slopes	1,100	0.3
BnB	Blount-Glynwood complex, 1 to 3 percent slopes	2,240	0.6
BoB	Boyer loamy sand, 0 to 6 percent slopes	6,880	1.9
BoC	Boyer loamy sand, 6 to 12 percent slopes	2,405	0.7
Bp	Brady sandy loam	4,195	1.2
BrA	Bronson sandy loam, 0 to 2 percent slopes	4,755	1.3
CaA	Carmi loam, 0 to 2 percent slopes	2,980	0.8
ClB	Coloma loamy sand, 0 to 6 percent slopes	3,415	1.0
ClC	Coloma loamy sand, 6 to 12 percent slopes	930	0.3
CrA	Crosier loam, 0 to 1 percent slopes	21,385	6.0
CrB	Crosier loam, 1 to 4 percent slopes	14,980	4.2
De	Del Rey silt loam	455	0.1
Ed	Edwards muck, drained	2,020	0.6
Gf	Gilford sandy loam, gravelly substratum	4,990	1.4
Gm	Gilford mucky sandy loam, gravelly substratum	2,045	0.6
Go	Gravelton loamy sand, occasionally flooded	1,755	0.5
Gr	Gravelton-Palms, gravelly substratum, complex, frequently flooded	2,255	0.6
GtA	Griswold loam, 0 to 2 percent slopes	1,585	0.5
He	Histosols and Aquolls	5,305	1.5
Ho	Homer sandy loam	4,050	1.1
Ht	Houghton muck, undrained	6,275	1.8
Hx	Houghton muck, drained	8,885	2.5
KoA	Kosciusko sandy loam, 0 to 2 percent slopes	7,040	2.0
KoB	Kosciusko sandy loam, 2 to 6 percent slopes	8,360	2.4
KoC	Kosciusko sandy loam, 6 to 12 percent slopes	1,670	0.5
KoE	Kosciusko sandy loam, 18 to 30 percent slopes	445	0.1
KtA	Kosciusko silt loam, 0 to 2 percent slopes	1,530	0.4
KxC3	Kosciusko sandy clay loam, 8 to 15 percent slopes, severely eroded	2,680	0.8
MaA	Martinsville sandy loam, 0 to 2 percent slopes	2,265	0.6
MaB	Martinsville sandy loam, 2 to 6 percent slopes	4,040	1.1
MaC	Martinsville sandy loam, 6 to 12 percent slopes	500	0.1
MbA	Metea loamy sand, 0 to 2 percent slopes	910	0.3
MbB	Metea loamy sand, 2 to 6 percent slopes	4,410	1.2
MbC	Metea loamy sand, 6 to 12 percent slopes	840	0.2
MeA	Metea loamy fine sand, moderately slowly permeable, 0 to 2 percent slopes	230	0.1
MeB	Metea loamy fine sand, moderately slowly permeable, 2 to 6 percent slopes	825	0.2
MeC	Metea loamy fine sand, moderately slowly permeable, 6 to 12 percent slopes	200	0.1
MlB	Miami loam, 2 to 6 percent slopes	9,335	2.6
MlC	Miami loam, 6 to 12 percent slopes	1,360	0.4
MrC3	Miami clay loam, 6 to 12 percent slopes, severely eroded	1,455	0.4
MrD3	Miami clay loam, 12 to 18 percent slopes, severely eroded	475	0.1
MsB	Miami-Owosso-Metea complex, 2 to 8 percent slopes	2,840	0.8
MsD	Miami-Owosso-Metea complex, 10 to 25 percent slopes	1,525	0.4
MvC	Morley loam, 6 to 12 percent slopes	565	0.2
MxC3	Morley silty clay loam, 5 to 15 percent slopes, severely eroded	3,845	1.1
MxD3	Morley silty clay loam, 15 to 25 percent slopes, severely eroded	225	0.1
MzB	Morley-Glynwood complex, 1 to 4 percent slopes	4,725	1.3
OrA	Ormas loamy sand, 0 to 2 percent slopes	9,230	2.6
OrB	Ormas loamy sand, 2 to 6 percent slopes	7,790	2.2
OrC	Ormas loamy sand, 6 to 12 percent slopes	1,725	0.5
OtA	Ormas loamy sand, sandy substratum, 0 to 2 percent slopes	3,585	1.0
OtB	Ormas loamy sand, sandy substratum, 2 to 6 percent slopes	2,880	0.8
OtC	Ormas loamy sand, sandy substratum, 6 to 12 percent slopes	490	0.1
Pa	Palms muck, drained	1,220	0.4
Pb	Palms muck, gravelly substratum, drained	4,580	1.3
Pe	Pewamo silty clay loam	1,825	0.5
Pg	Pits, gravel	225	0.1
Re	Rensselaer loam	15,055	4.2

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
RlA	Riddles fine sandy loam, 0 to 2 percent slopes	6,705	1.9
RlB	Riddles fine sandy loam, 2 to 6 percent slopes	16,375	4.6
RlC	Riddles fine sandy loam, 6 to 12 percent slopes	2,615	0.7
RlD	Riddles fine sandy loam, 12 to 18 percent slopes	650	0.2
RxB	Riddles-Ormas-Kosciusko complex, 2 to 6 percent slopes	5,585	1.6
RxC	Riddles-Ormas-Kosciusko complex, 6 to 12 percent slopes	1,970	0.6
Sa	Saranac clay loam, gravelly substratum, occasionally flooded	560	0.2
Se	Sebewa loam	12,535	3.5
Sf	Sebewa mucky loam	4,255	1.2
ShA	Shipshe sandy loam, 0 to 2 percent slopes	6,045	1.7
ShB	Shipshe sandy loam, 2 to 6 percent slopes	505	0.1
Sn	Shoals loam, gravelly substratum, occasionally flooded	1,185	0.3
To	Toledo silty clay	1,430	0.4
Ud	Udorthents, loamy	175	0.1
Uf	Udorthents-Urban land complex	1,665	0.5
Wa	Wallkill silt loam	840	0.2
Wc	Washtenaw silt loam	2,010	0.6
We	Washtenaw loam, gravelly substratum	735	0.2
WlB	Wawasee fine sandy loam, 2 to 6 percent slopes	23,375	6.6
WlC2	Wawasee fine sandy loam, 6 to 12 percent slopes, eroded	5,965	1.7
WlD2	Wawasee fine sandy loam, 12 to 18 percent slopes, eroded	475	0.1
Wt	Whitaker loam	6,760	1.9
	Water areas less than 40 acres in size	2,494	0.7
	Water areas more than 40 acres in size	9,600	2.7
	Total	354,854	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
ArA	Aubbeenaubbee sandy loam, 0 to 2 percent slopes (where drained)
AtA	Aubbeenaubbee fine sandy loam, moderately permeable, 0 to 2 percent slopes (where drained)
Bc	Barry loam (where drained)
BlA	Blount silt loam, 0 to 2 percent slopes (where drained)
BnB	Blount-Glynwood complex, 1 to 3 percent slopes (where drained)
Bp	Brady sandy loam
BrA	Bronson sandy loam, 0 to 2 percent slopes
CaA	Carmi loam, 0 to 2 percent slopes
CrA	Crosier loam, 0 to 1 percent slopes (where drained)
CrB	Crosier loam, 1 to 4 percent slopes (where drained)
De	Del Rey silt loam (where drained)
Gf	Gilford sandy loam, gravelly substratum (where drained)
Gm	Gilford mucky sandy loam, gravelly substratum (where drained)
GtA	Griswold loam, 0 to 2 percent slopes
Ho	Homer sandy loam (where drained)
KoA	Kosciusko sandy loam, 0 to 2 percent slopes
KoB	Kosciusko sandy loam, 2 to 6 percent slopes
KtA	Kosciusko silt loam, 0 to 2 percent slopes
MaA	Martinsville sandy loam, 0 to 2 percent slopes
MaB	Martinsville sandy loam, 2 to 6 percent slopes
MbA	Metea loamy sand, 0 to 2 percent slopes
MbB	Metea loamy sand, 2 to 6 percent slopes
MeA	Metea loamy fine sand, moderately slowly permeable, 0 to 2 percent slopes
MeB	Metea loamy fine sand, moderately slowly permeable, 2 to 6 percent slopes
MlB	Miami loam, 2 to 6 percent slopes
MsB	Miami-Owosso-Metea complex, 2 to 8 percent slopes
MzB	Morley-Glynwood complex, 1 to 4 percent slopes
Pe	Pewamo silty clay loam (where drained)
Re	Rensselaer loam (where drained)
RlA	Riddles fine sandy loam, 0 to 2 percent slopes
RlB	Riddles fine sandy loam, 2 to 6 percent slopes
RxB	Riddles-Ormas-Kosciusko complex, 2 to 6 percent slopes
Sa	Saranac clay loam, gravelly substratum, occasionally flooded (where drained)
Se	Sebewa loam (where drained)
Sf	Sebewa mucky loam (where drained)
Sn	Shoals loam, gravelly substratum, occasionally flooded (where drained)
To	Toledo silty clay (where drained)
Wc	Washtenaw silt loam (where drained)
We	Washtenaw loam, gravelly substratum (where drained)
WlB	Wawasee fine sandy loam, 2 to 6 percent slopes
Wt	Whitaker loam (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND 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)

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Alfalfa-bromegrass hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Ab Abscota	IVs	65	25	28	2.5	5.0
Ao**. Aquents-Urban land						
ArA, AtA Aubbeenaubbee	IIw	110	38	50	3.6	7.2
Bc Barry	IIw	125	42	56	4.8	9.6
BlA Blount	IIw	106	35	48	4.3	7.2
BnB Blount-Glynwood	IIe	102	33	43	4.2	8.4
BoB Boyer	IIIs	65	25	28	2.3	4.6
BoC Boyer	IIIe	60	22	26	2.3	4.6
Bp Brady	IIw	95	28	45	3.6	7.2
BrA Bronson	IIs	80	30	35	3.0	6.0
CaA Carmi	IIs	100	33	48	4.0	8.0
ClB Coloma	IVs	45	18	25	2.5	5.0
ClC Coloma	VIs	---	---	---	---	---
CrA Crosier	IIw	120	42	54	4.0	8.0
CrB Crosier	IIe	120	42	54	4.0	8.0
De Del Rey	IIw	115	37	49	4.5	9.0
Ed Edwards	IVw	90	34	---	---	---
Gf Gilford	IIIw	100	33	50	3.8	7.6
Gm Gilford	IIIw	90	30	40	3.8	7.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Alfalfa-bromegrass hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Go---------- Gravelton	IIIw	110	38	44	3.6	7.2
Gr---------- Gravelton-Palms	Vw	---	---	---	---	---
GtA---------- Griswold	I	120	42	56	4.8	9.6
He---------- Histosols and Aquolls	VIIIw	---	---	---	---	---
Ho---------- Homer	IIw	105	33	48	3.5	7.0
Ht---------- Houghton	Vw	---	---	---	---	---
Hx---------- Houghton	IIIw	115	34	---	---	---
KoA---------- Kosciusko	IIIs	80	28	38	2.6	5.2
KoB---------- Kosciusko	IIIe	75	26	38	2.5	5.0
KoC---------- Kosciusko	IIIe	70	24	32	2.4	4.8
KoE---------- Kosciusko	VIe	---	---	---	2.2	4.5
KtA---------- Kosciusko	IIIs	90	30	40	3.0	6.0
KxC3---------- Kosciusko	IVe	60	20	30	2.2	4.4
MaA---------- Martinsville	I	115	40	46	3.8	7.6
MaB---------- Martinsville	IIe	110	38	44	3.6	7.2
MaC---------- Martinsville	IIIe	100	35	40	3.3	6.6
MbA---------- Metea	IIIs	85	30	42	2.8	5.6
MbB---------- Metea	IIIe	81	29	39	2.6	5.2
MbC---------- Metea	IIIe	75	26	35	2.5	5.0
MeA---------- Metea	IIIs	85	30	42	2.8	5.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Alfalfa-bromegrass hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
MeB---- Metea	IIIe	80	28	40	2.7	5.4
MeC---- Metea	IIIe	75	26	38	2.5	5.0
MlB---- Miami	IIe	110	38	50	3.6	7.2
MlC---- Miami	IIIe	95	33	43	3.1	6.2
MrC3---- Miami	IVe	90	32	40	3.0	6.0
MrD3---- Miami	VIe	---	---	---	2.5	5.0
MsB---- Miami-Owosso-Metea	IIe	102	36	50	3.7	7.4
MsD---- Miami-Owosso-Metea	IVe	79	28	38	2.9	5.8
MvC---- Morley	IIIe	100	34	46	4.2	8.4
MxC3---- Morley	IVe	65	20	30	3.5	7.0
MxD3---- Morley	VIe	---	---	---	3.3	6.6
MzB---- Morley-Glynwood	IIe	103	35	45	4.3	8.6
OrA---- Ormas	IIIs	70	27	32	2.3	4.6
OrB---- Ormas	IIIs	65	23	30	2.2	4.4
OrC---- Ormas	IIIs	60	22	28	2.0	4.0
OtA---- Ormas	IIIs	75	30	35	2.5	5.0
OtB---- Ormas	IIIs	70	25	32	2.3	4.6
OtC---- Ormas	IIIs	65	22	30	2.2	4.4
Pa---- Palms	IIIw	105	42	---	---	---
Pb---- Palms	IIIw	80	35	---	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Alfalfa-bromegrass hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
Pe Pewamo	IIw	120	40	54	4.5	9.0
Pg**. Pits						
Re Rensselaer	IIw	135	48	58	4.9	9.8
R1A Riddles	I	120	42	48	4.0	8.0
R1B Riddles	IIe	115	40	46	3.8	7.6
R1C Riddles	IIIe	105	37	42	3.4	6.8
R1D Riddles	IVe	90	32	36	3.0	6.0
RxB Riddles-Ormas-Kosciusko	IIe	83	29	38	2.8	5.5
RxC Riddles-Ormas-Kosciusko	IIIe	76	27	34	2.5	5.1
Sa Saranac	IIIw	100	33	---	3.5	6.7
Se Sebewa	IIw	105	36	50	4.6	9.2
Sf Sebewa	IIIw	95	33	45	4.0	8.0
ShA Shipshe	IIIs	85	32	40	3.0	6.0
ShB Shipshe	IIIe	83	30	38	2.9	5.8
Sn Shoals	IIw	115	35	45	3.5	7.0
To Toledo	IIIw	120	42	47	4.5	9.0
Ud. Udorthents						
Uf**. Udorthents-Urban land						
Wa Wallkill	IIIw	120	40	50	4.0	8.0
Wc Washtenaw	IIw	130	46	52	4.3	8.6
We Washtenaw	IIw	115	40	45	4.0	8.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Alfalfa-bromegrass hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
W1B---------- Wawasee	IIe	105	37	47	3.4	6.8
W1C2---------- Wawasee	IIIe	90	30	40	3.1	6.0
W1D2---------- Wawasee	IVe	85	28	38	3.1	6.0
Wt---------- Whitaker	IIw	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.

** See description of the map unit for composition and behavior characteristics of the map unit.

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)	Climate (c)
		Acres	Acres	Acres	Acres
I	10,555	---	---	---	---
II	185,130	83,495	93,900	7,735	---
III	111,085	32,190	30,560	48,335	---
IV	16,185	10,630	2,020	3,535	---
V	8,530	---	8,530	---	---
VI	2,075	1,145	---	930	---
VII	---	---	---	---	---
VIII	5,305	---	5,305	---	---

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				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
Ab Abscota	4S	Slight	Slight	Moderate	Slight	Northern red oak White ash Silver maple Eastern cottonwood American sycamore	83 80 --- --- ---	65 80 --- --- ---	Eastern white pine, yellow-poplar.
ArA, AtA Aubbeenaubbee	4A	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Northern red oak	75 85 85 75	57 67 81 57	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore, green ash, white ash.
Bc Barry	5W	Slight	Severe	Severe	Severe	Pin oak White oak Northern red oak Red maple	86 75 78 56	68 57 60 36	Eastern white pine, red maple, white ash, American sycamore.
BlA Blount	3C	Slight	Slight	Severe	Severe	White oak Northern red oak Green ash Bur oak Pin oak	65 65 --- --- ---	48 48 --- --- ---	Eastern white pine, red pine, yellow-poplar.
BnB**: Blount	3C	Slight	Slight	Severe	Severe	White oak Northern red oak Green ash Bur oak Pin oak	65 65 --- --- ---	48 48 --- --- ---	Eastern white pine, red pine, yellow-poplar.
Glynwood	4C	Slight	Slight	Moderate	Moderate	Northern red oak Black oak White oak Red maple Slippery elm Black cherry White ash	80 80 80 --- --- --- ---	62 62 62 --- --- --- ---	Austrian pine, yellow-poplar, green ash, pin oak, red maple, black oak, American sycamore.
BoB, BoC Boyer	4S	Slight	Slight	Moderate	Slight	White oak Red pine Eastern white pine Jack pine Northern red oak	70 75 65 68 75	52 142 136 100 57	Eastern white pine, red pine, jack pine.
Bp Brady	5A	Slight	Slight	Slight	Slight	Black oak Bur oak Red maple Quaking aspen Green ash Slippery elm	90 --- --- --- --- ---	72 --- --- --- --- ---	Red pine, green ash, eastern white pine.

See footnotes 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	Volume*	
BrA--------- Bronson	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	52	Eastern white pine, red pine, jack pine.
						Red pine----------	72	134	
						Eastern white pine--	85	196	
						Jack pine----------	70	103	
ClB, ClC-------- Coloma	4S	Slight	Slight	Moderate	Slight	Northern red oak----	70	52	Eastern white pine, red pine, jack pine.
						White oak----------	70	52	
CrA, CrB-------- Crosier	4A	Slight	Slight	Slight	Slight	White oak----------	75	57	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak----------	85	67	
						Yellow-poplar-------	85	81	
						Northern red oak----	75	57	
De--------- Del Rey	4C	Slight	Slight	Severe	Severe	White oak----------	70	52	Austrian pine, green ash, pin oak, red maple.
						Northern red oak----	70	52	
						Green ash----------	---	---	
						Bur oak----------	---	---	
Ed--------- Edwards	2W	Slight	Severe	Severe	Severe	White ash----------	51	35	Red maple, silver maple, white ash.
						Red maple----------	51	33	
						Quaking aspen-------	56	56	
						Black willow--------	---	---	
						Silver maple--------	76	30	
Gf, Gm---------- Gilford	4W	Slight	Severe	Severe	Severe	Pin oak----------	70	52	Eastern white pine, European larch, white spruce, white ash.
						Eastern white pine--	---	---	
						Bigtooth aspen------	---	---	
						Red maple----------	---	---	
Go--------- Gravelton	3W	Slight	Severe	Severe	Severe	Red maple----------	72	44	Green ash, red maple, American sycamore, pin oak, silver maple, swamp white oak.
						Silver maple--------	95	46	
						White ash----------	72	69	
						American elm--------	70	---	
						Eastern cottonwood--	100	---	
						American sycamore---	90	---	
						Pin oak----------	90	72	
Gr**: Gravelton------	3W	Slight	Severe	Severe	Severe	Red maple----------	72	44	Green ash, red maple, American sycamore, pin oak, silver maple, swamp white oak.
						Silver maple--------	95	46	
						White ash----------	72	69	
						American elm--------	70	---	
						Eastern cottonwood--	100	---	
						American sycamore---	90	---	
						Pin oak----------	90	72	
Palms----------	3W	Slight	Severe	Severe	Severe	Red maple----------	60	38	Red maple, silver maple, white ash.
						Silver maple--------	76	30	
						White ash----------	51	35	
						Quaking aspen-------	56	56	
Ho--------- Homer	4A	Slight	Slight	Slight	Slight	White oak----------	70	52	Eastern white pine, American sycamore, white ash, red maple, yellow-poplar.
						Pin oak----------	85	67	
						Yellow-poplar-------	85	81	

See footnotes 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	Volume*	
Ht, Hx---------- Houghton	2W	Slight	Severe	Severe	Severe	White ash----------	51	35	---
						Red maple----------	51	33	
						Black willow--------	---	---	
						Quaking aspen-------	56	56	
						Silver maple--------	76	30	
KoA, KoB, KoC--- Kosciusko	4S	Slight	Slight	Moderate	Slight	Northern red oak----	78	60	Eastern white pine, red pine, jack pine.
						White oak----------	76	58	
						Eastern white pine--	70	151	
						Black oak----------	---	---	
						Jack pine----------	---	---	
KoE---------- Kosciusko	4R	Moderate	Moderate	Moderate	Slight	Northern red oak----	78	60	Eastern white pine, red pine, jack pine.
						White oak----------	76	58	
						Eastern white pine--	70	151	
						Black oak----------	---	---	
						Jack pine----------	---	---	
KtA, KxC3------- Kosciusko	4S	Slight	Slight	Moderate	Slight	Northern red oak----	78	60	Eastern white pine, red pine, jack pine.
						White oak----------	76	58	
						Eastern white pine--	70	151	
						Black oak----------	---	---	
						Jack pine----------	---	---	
MaA, MaB, MaC--- Martinsville	4A	Slight	Slight	Slight	Slight	White oak----------	80	62	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	104	
MbA, MbB, MbC, MeA, MeB, MeC-- Metea	4S	Slight	Slight	Moderate	Slight	White oak----------	80	62	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar-------	86	82	
						Eastern white pine--	75	166	
						Red pine-----------	75	142	
MlB, MlC, MrC3, MrD3---------- Miami	5A	Slight	Slight	Slight	Slight	White oak----------	90	72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	104	
MsB**: Miami----------	5A	Slight	Slight	Slight	Slight	White oak----------	90	72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	104	
Owosso---------	4A	Slight	Slight	Slight	Slight	White oak----------	90	72	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar-------	98	104	

See footnotes 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	Volume*	
MsB**:									
Metea	4S	Slight	Slight	Moderate	Slight	White oak	80	62	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar	86	82	
						Eastern white pine	75	166	
						Red pine	75	142	
MsD**:									
Miami	5A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar	98	104	
Owosso	4A	Slight	Slight	Slight	Slight	White oak	90	72	Eastern white pine, red pine, black walnut, yellow-poplar, white ash.
						Yellow-poplar	98	104	
Metea	4R	Moderate	Moderate	Moderate	Slight	White oak	80	62	Eastern white pine, red pine, yellow-poplar, black walnut.
						Yellow-poplar	86	82	
						Eastern white pine	75	166	
						Red pine	75	142	
MvC, MxC3----- Morley	4A	Slight	Slight	Slight	Slight	White oak	80	62	White oak, black walnut, green ash, eastern white pine, red pine, white spruce.
						Northern red oak	80	62	
						Yellow-poplar	90	90	
						Black walnut	---	---	
						Bur oak	---	---	
						Shagbark hickory	---	---	
MxD3----- Morley	4R	Moderate	Moderate	Slight	Slight	White oak	80	62	White oak, black walnut, green ash, eastern white pine, red pine, white spruce.
						Northern red oak	80	62	
						Yellow-poplar	90	90	
						Black walnut	---	---	
						Bur oak	---	---	
						Shagbark hickory	---	---	
MzB**:									
Morley	4A	Slight	Slight	Slight	Slight	White oak	80	62	White oak, black walnut, green ash, eastern white pine, red pine, white spruce.
						Northern red oak	80	62	
						Yellow-poplar	90	90	
						Black walnut	---	---	
						Bur oak	---	---	
						Shagbark hickory	---	---	
Glynwood	4C	Slight	Slight	Moderate	Moderate	Northern red oak	80	62	Austrian pine, yellow-poplar, green ash, pin oak, red maple, black oak, American sycamore.
						Black oak	80	62	
						White oak	80	62	
						Red maple	---	---	
						Slippery elm	---	---	
						Black cherry	---	---	
						White ash	---	---	

See footnotes 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	Volume*	
OrA, OrB, OrC--- Ormas	4S	Slight	Slight	Moderate	Slight	White oak---------- Yellow-poplar------- Eastern white pine-- Red pine----------	70 --- --- 78	52 --- --- 146	Eastern white pine, red pine, yellow-poplar, black walnut, European alder.
OtA, OtB, OtC--- Ormas	4S	Slight	Slight	Moderate	Slight	White oak---------- Yellow-poplar------- Eastern white pine-- Red pine----------	70 --- --- 78	52 --- --- 150	Eastern white pine, red pine, yellow-poplar, black walnut, European alder.
Pa, Pb---------- Palms	2W	Slight	Severe	Severe	Severe	White ash---------- Red maple---------- Quaking aspen------- Black willow-------- Silver maple--------	51 51 56 --- 76	35 33 56 --- 30	---
Pe-------------- Pewamo	5W	Slight	Severe	Moderate	Moderate	Pin oak---------- Swamp white oak----- Red maple---------- White ash---------- Eastern cottonwood-- Green ash----------	90 --- 71 71 98 ---	72 --- 44 67 --- ---	White ash, eastern white pine, red maple, green ash.
Re-------------- Rensselaer	5W	Slight	Severe	Severe	Severe	Pin oak---------- White oak---------- Northern red oak----	86 75 76	68 57 58	Eastern white pine, red maple, white ash.
R1A, R1B, R1C--- Riddles	5A	Slight	Slight	Slight	Slight	White oak---------- Yellow-poplar------- Northern red oak----	90 98 90	72 104 72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
R1D------------- Riddles	5R	Moderate	Moderate	Slight	Slight	White oak---------- Yellow-poplar------- Northern red oak----	90 98 76	72 104 72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
RxB**, RxC**: Riddles---------	5A	Slight	Slight	Slight	Slight	White oak---------- Yellow-poplar------- Northern red oak----	90 98 90	72 104 72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.

See footnotes 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	Volume*	
RxB**, RxC**: Ormas	4S	Slight	Slight	Moderate	Slight	White oak	70	52	Eastern white pine, red pine, yellow-poplar, black walnut, European alder.
						Yellow-poplar	---	---	
						Eastern white pine	---	---	
						Red pine	78	150	
Kosciusko	4S	Slight	Slight	Moderate	Slight	Northern red oak	78	60	Eastern white pine, red pine, jack pine.
						White oak	76	58	
						Eastern white pine	70	151	
						Black oak	---	---	
						Jack pine	---	---	
Sa Saranac	5W	Slight	Severe	Severe	Severe	Pin oak	85	67	Eastern white pine, red maple, white ash.
						Red maple	---	---	
						Bur oak	---	---	
						White ash	---	---	
Se, Sf Sebewa	5W	Slight	Severe	Severe	Severe	Pin oak	88	70	Eastern white pine, white ash, green ash.
						White ash	75	78	
						White oak	72	54	
						Red maple	---	---	
						American basswood	---	---	
Sn Shoals	5W	Slight	Moderate	Slight	Slight	Pin oak	90	72	Red maple, swamp chestnut oak, pin oak, eastern white pine.
						American sycamore	---	---	
						Eastern cottonwood	---	---	
						Red maple	---	---	
To Toledo	4W	Slight	Severe	Severe	Severe	Pin oak	80	62	Pin oak, green ash, American sycamore, red maple, silver maple, swamp white oak.
						Swamp white oak	80	62	
						Red maple	---	---	
						Green ash	---	---	
						Eastern cottonwood	---	---	
Wa Wallkill	3W	Slight	Severe	Severe	Severe	---	---	---	---
Wc Washtenaw	5W	Slight	Severe	Severe	Moderate	Pin oak	86	68	Eastern white pine, black spruce, red maple, white ash, white spruce.
						Northern red oak	75	57	
						Red maple	70	43	
						Silver maple	---	---	
						White ash	---	---	
						American basswood	---	---	
						White oak	---	---	
We Washtenaw	5W	Slight	Severe	Severe	Severe	Pin oak	86	68	Eastern white pine, American sycamore, red maple, green ash, white spruce.
						Northern red oak	75	57	
						Red maple	70	43	
						Silver maple	---	---	
						White ash	---	---	
						American sycamore	---	---	
						American basswood	---	---	

See footnotes 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	Volume*	
W1B, W1C2---------- Wawasee	5A	Slight	Slight	Slight	Slight	White oak----------	90	72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	104	
						Sugar maple---------	---	---	
						White ash----------	---	---	
W1D2---------- Wawasee	5R	Moderate	Moderate	Slight	Slight	White oak----------	90	72	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.
						Yellow-poplar-------	98	104	
						Sugar maple---------	---	---	
						White ash----------	---	---	
Wt---------- Whitaker	4A	Slight	Slight	Slight	Slight	White oak----------	70	52	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.
						Pin oak------------	85	67	
						Yellow-poplar-------	85	81	
						Northern red oak----	75	57	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** 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 height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ab---------- Abscota	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Ao*: Aquents.					
Urban land.					
ArA, AtA---------- Aubbeenaubbee	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Bc---------- Barry	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, white fir, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
BlA---------- Blount	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
BnB*: Blount----------	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white 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 height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BnB*: Glynwood	---	Amur honeysuckle, Washington hawthorn, Amur privet, arrowwood, eastern redcedar, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
BoB, BoC Boyer	Siberian peashrub	Tatarian honeysuckle, Amur honeysuckle, lilac, Washington hawthorn, radiant crabapple, autumn-olive, eastern redcedar.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
Bp Brady	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
BrA Bronson	---	Silky dogwood, American cranberrybush, Amur privet, Amur honeysuckle.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
CaA Carmi	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
ClB, ClC Coloma	Siberian peashrub	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Austrian pine, jack pine, red pine.	Eastern white pine	---
CrA, CrB Crosier	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, blue spruce, northern white-cedar, Washington hawthorn, white fir.	Norway spruce	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
De---------- Del Rey	---	Amur privet, arrowwood, eastern redcedar, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Ed---------- Edwards	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Gf, Gm---------- Gilford	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Northern white-cedar, Norway spruce, Washington hawthorn, white fir, blue spruce, Austrian pine.	Eastern white pine	Pin oak.
Go---------- Gravelton	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Gr*: Gravelton-------- Palms.	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
GtA---------- Griswold	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
He*: Histosols. Aquolls.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ho---------- Homer	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Ht. Houghton					
Hx---------- Houghton	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
KoA, KoB, KoC, KoE, KtA, KxC3--- Kosciusko	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Amur honeysuckle, Tatarian honeysuckle, Washington hawthorn.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
MaA, MaB, MaC----- Martinsville	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
MbA, MbB, MbC, MeA, MeB, MeC---- Metea	---	Washington hawthorn, Amur honeysuckle, Amur privet, Tatarian honeysuckle, American cranberrybush.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Red pine, eastern white pine, Norway spruce.	---
MlB, MlC, MrC3, MrD3---------- Miami	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
MsB*: Miami----------	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MsB*:					
Owosso	---	Amur honeysuckle, Amur privet, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Metea	---	Washington hawthorn, Amur honeysuckle, Amur privet, Tatarian honeysuckle, American cranberrybush.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Red pine, eastern white pine, Norway spruce.	---
MsD*:					
Miami	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Owosso	---	Amur honeysuckle, Amur privet, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Metea	---	Washington hawthorn, Amur honeysuckle, Amur privet, Tatarian honeysuckle, American cranberrybush.	Austrian pine, eastern redcedar, northern white-cedar, osageorange.	Red pine, eastern white pine, Norway spruce.	---
MvC, MxC3, MxD3--- Morley	---	Amur honeysuckle, Washington hawthorn, eastern redcedar, Amur privet, arrowwood, American cranberrybush, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MzB*: Morley	---	Amur honeysuckle, Washington hawthorn, eastern redcedar, Amur privet, arrowwood, American cranberrybush, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Glynwood	---	Amur honeysuckle, Washington hawthorn, Amur privet, arrowwood, eastern redcedar, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
OrA, OrB, OrC, OtA, OtB, OtC---- Ormas	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
Pa---------- Palms	Common ninebark, whitebelle honeysuckle.	Amur honeysuckle, Amur privet, silky dogwood, nannyberry viburnum, Tatarian honeysuckle.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
Pb---------- Palms	Whitebelle honeysuckle, common ninebark.	Silky dogwood, Tatarian honeysuckle, Amur honeysuckle, Amur privet, tall purple willow.	---	Black willow, golden willow.	Imperial Carolina poplar.
Pe---------- Pewamo	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Pg*. Pits					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Re---------- Rensselaer	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
R1A, R1B, R1C, R1D---------- Riddles	---	Amur privet, Amur honeysuckle, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
RxB*, RxC*: Riddles----------	---	Amur privet, Amur honeysuckle, American cranberrybush, Washington hawthorn, Tatarian honeysuckle.	Eastern redcedar, Austrian pine, northern white-cedar, osageorange.	Eastern white pine, Norway spruce, red pine.	---
Ormas----------	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Washington hawthorn, Amur honeysuckle, Tatarian honeysuckle.	Red pine, Austrian pine, jack pine.	Eastern white pine	---
Kosciusko--------	Siberian peashrub	Eastern redcedar, lilac, radiant crabapple, autumn-olive, Amur honeysuckle, Tatarian honeysuckle, Washington hawthorn.	Eastern white pine, red pine, Austrian pine, jack pine.	---	---
Sa---------- Saranac	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, northern white-cedar, Washington hawthorn, Norway spruce, blue spruce.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Se, Sf---------- Sebewa	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
ShA, ShB---------- Shipshe	Siberian peashrub	Amur honeysuckle, lilac, Tatarian honeysuckle, eastern redcedar, radiant crabapple, Washington hawthorn, autumn-olive.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
Sn---------- Shoals	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Northern white-cedar, blue spruce, Austrian pine, white fir, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
To---------- Toledo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Ud*. Udorthents					
Uf*: Udorthents.					
Urban land.					
Wa---------- Wallkill	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Wc---------- Washtenaw	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
We---------- Washtenaw	---	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Blue spruce, Norway spruce, white fir, Austrian pine, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
W1B, W1C2, W1D2--- Wawasee	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Wt---------- Whitaker	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, northern white-cedar, white fir, Austrian pine.	Norway spruce-----	Pin oak, 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
Ab Abscota	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: droughty, flooding.
Ao*: Aquents.					
Urban land.					
ArA Aubbeenaubbee	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
AtA Aubbeenaubbee	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Bc Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
BlA Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BnB*: Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Glynwood	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Slight.
BoB Boyer	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight	Moderate: small stones.
BoC Boyer	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight	Moderate: small stones, slope.
Bp Brady	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BrA Bronson	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
CaA Carmi	Slight	Slight	Slight	Slight	Slight.
ClB Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
ClC Coloma	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, 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
CrA, CrB Crosier	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
De Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ed Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
Gf, Gm Gilford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Go Gravelton	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Gr*: Gravelton	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding, flooding.	Severe: ponding.	Severe: ponding, flooding.
Palms	Severe: flooding, ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding, flooding.	Severe: ponding, excess humus.	Severe: ponding, flooding, excess humus.
GtA Griswold	Slight	Slight	Slight	Slight	Slight.
He*: Histosols.					
Aquolls.					
Ho Homer	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Ht, Hx Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
KoA Kosciusko	Slight	Slight	Slight	Slight	Moderate: droughty.
KoB Kosciusko	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
KoC Kosciusko	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
KoE Kosciusko	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
KtA Kosciusko	Slight	Slight	Slight	Severe: erodes easily.	Moderate: 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
KxC3---------- Kosciusko	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: droughty, slope.
MaA---------- Martinsville	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Slight.
MaB---------- Martinsville	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
MaC---------- Martinsville	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
MbA---------- Metea	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
MbB---------- Metea	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
MbC---------- Metea	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
MeA---------- Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: too sandy, percs slowly.	Moderate: too sandy.	Moderate: droughty.
MeB---------- Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
MeC---------- Metea	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
MlB---------- Miami	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
MlC, MrC3---------- Miami	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
MrD3---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
MsB*: Miami----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
Owosso----------	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight----------	Slight.
Metea----------	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: 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
MsD*:					
Miami	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Owosso	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Metea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.	Severe: slope.
MvC	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
Morley					
MxC3	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Morley					
MxD3	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Morley					
MzB*:					
Morley	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
Glynwood	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Slight.
OrA	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
Ormas					
OrB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Ormas					
OrC	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Ormas					
OtA	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
Ormas					
OtB	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Ormas					
OtC	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
Ormas					
Pa	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Palms					
Pb	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Palms					

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
Pe---------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pg*. Pits					
Re---------- Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
RlA---------- Riddles	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Slight.
RlB, RlC---------- Riddles	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
RlD---------- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
RxB*: Riddles----------	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
Ormas----------	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Kosciusko----------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
RxC*: Riddles----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
Ormas----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: droughty, slope.
Kosciusko----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: droughty, slope.
Sa---------- Saranac	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Se, Sf---------- Sebewa	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
ShA---------- Shipshe	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: droughty.
ShB---------- Shipshe	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: droughty.
Sn---------- Shoals	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Severe: erodes easily.	Moderate: wetness, flooding.
To---------- Toledo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

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
Ud*. Udorthents					
Uf*: Udorthents.					
Urban land.					
Wa---------- Wallkill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Wc, We---------- Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
W1B---------- Wawasee	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
W1C2---------- Wawasee	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
W1D2---------- Wawasee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Wt---------- Whitaker	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	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
Ab---------- Abscota	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Ao*: Aquents.										
Urban land.										
ArA---------- Aubbeenaubbee	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AtA---------- Aubbeenaubbee	Fair	Good	Good	Good	Good	Fair	Fair	Fair	Good	Fair.
Bc---------- Barry	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
BlA---------- Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BnB*:										
Blount----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Glynwood----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BoB, BoC---------- Boyer	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bp---------- Brady	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BrA---------- Bronson	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Very poor.
CaA---------- Carmi	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ClB---------- Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
ClC---------- Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
CrA---------- Crosier	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CrB---------- Crosier	Fair	Good	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
De---------- Del Rey	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

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
Ed---------- Edwards	Very poor.	Poor	Poor	Fair	Poor	Good	Good	Poor	Fair	Good.
Gf, Gm---------- Gilford	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Go---------- Gravelton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Gr*:										
Gravelton---------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Palms----------	Poor	Fair	Poor	Fair	Fair	Good	Good	Fair	Fair	Good.
GtA---------- Griswold	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
He*:										
Histosols.										
Aquolls.										
Ho---------- Homer	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Ht, Hx---------- Houghton	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
KoA, KoB---------- Kosciusko	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
KoC---------- Kosciusko	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
KoE---------- Kosciusko	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
KtA---------- Kosciusko	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
KxC3---------- Kosciusko	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
MaA, MaB---------- Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MaC---------- Martinsville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MbA, MbB---------- Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
MbC---------- Metea	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MeA, MeB---------- Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
MeC---------- Metea	Fair	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							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
MlB---- Miami	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MlC, MrC3---- Miami	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MrD3---- Miami	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MsB*:										
Miami----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Owosso----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Metea----	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
MsD*:										
Miami----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Owosso----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Metea----	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MvC, MxC3---- Morley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MxD3---- Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MzB*:										
Morley----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Glynwood----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OrA, OrB---- Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
OrC---- Ormas	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
OtA, OtB---- Ormas	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
OtC---- Ormas	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Pa---- Palms	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Pb---- Palms	Very poor.	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.

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
Pe---------- Pewamo	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
Pg*. Pits										
Re---------- Rensselaer	Good	Fair	Good	Fair	Fair	Good	Good	Good	Good	Good.
R1A, R1B, R1C------ Riddles	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
R1D---------- Riddles	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
RxB*: Riddles----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ormas----------	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Kosciusko---------	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
RxC*: Riddles----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ormas----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Kosciusko---------	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Sa---------- Saranac	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Se, Sf---------- Sebewa	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
ShA, ShB---------- Shipshe	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Sn---------- Shoals	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
To---------- Toledo	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Ud*. Udorthents										
Uf*: Udorthents.										
Urban land.										

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
Wa---------- Wallkill	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wc---------- Washtenaw	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
We---------- Washtenaw	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
W1B---------- Wawasee	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
W1C2---------- Wawasee	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
W1D2---------- Wawasee	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ab---------- Abscota	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
Ao*: Aquents.						
Urban land.						
ArA, AtA---------- Aubbeenaubbee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
Bc---------- Barry	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
BlA---------- Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
BnB*: Blount----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Glynwood---------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
BoB---------- Boyer	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: small stones.
BoC---------- Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
Bp---------- Brady	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
BrA---------- Bronson	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: frost action.	Slight.
CaA---------- Carmi	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
ClB---------- Coloma	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: large stones, 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
ClC---------- Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
CrA, CrB---------- Crosier	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
De---------- Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ed---------- Edwards	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.
Gf, Gm---------- Gilford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Go---------- Gravelton	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding.
Gr*: Gravelton--------	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding, flooding, frost action.	Severe: ponding, flooding.
Palms----------	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, flooding, ponding.	Severe: subsides, ponding, flooding.	Severe: ponding, flooding, excess humus.
GtA---------- Griswold	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
He*: Histosols. Aquolls.						
Ho---------- Homer	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Ht, Hx---------- Houghton	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.
KoA---------- Kosciusko	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: 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
KoB---------- Kosciusko	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Moderate: droughty.
KoC---------- Kosciusko	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: droughty, slope.
KoE---------- Kosciusko	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
KtA---------- Kosciusko	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: droughty.
KxC3--------- Kosciusko	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: droughty, slope.
MaA---------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
MaB---------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
MaC---------- Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
MbA---------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
MbB---------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
MbC---------- Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
MeA---------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
MeB---------- Metea	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
MeC---------- Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
MlB---------- Miami	Moderate: dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: frost action, shrink-swell.	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
MlC, MrC3--------- Miami	Moderate: slope, dense layer.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
MrD3---------- Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MsB*: Miami-----------	Moderate: dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
Owosso-----------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
Metea-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
MsD*: Miami-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Owosso-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Metea-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MvC---------- Morley	Moderate: too clayey.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
MxC3---------- Morley	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
MxD3---------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
MzB*: Morley-----------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Glynwood---------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
OrA---------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
OrB---------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
OrC---------- Ormas	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.

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
OtA---------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
OtB---------- Ormas	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
OtC---------- Ormas	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Pa---------- Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
Pb---------- Palms	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
Pe---------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
Pg*. Pits						
Re---------- Rensselaer	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
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.
RlC---------- Riddles	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Moderate: low strength, frost action, slope.	Moderate: slope.
RlD---------- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RxB*: Riddles----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, frost action.	Slight.
Ormas----------	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Kosciusko--------	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.	Moderate: 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
RxC*: Riddles	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
Ormas	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Kosciusko	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Moderate: shrink-swell, slope, frost action.	Moderate: droughty, slope.
Sa Saranac	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: low strength, ponding, flooding.	Severe: ponding.
Se, Sf Sebewa	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
ShA Shipshe	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
ShB Shipshe	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Sn Shoals	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
To Toledo	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
Ud*. Udorthents						
Uf*: Udorthents. Urban land.						
Wa Wallkill	Severe: ponding, excess humus.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Wc Washtenaw	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
We Washtenaw	Severe: cutbanks cave, 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
W1B---------- Wawasee	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
W1C2---------- Wawasee	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
W1D2---------- Wawasee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wt---------- Whitaker	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: 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," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ab Abscota	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.
Ao*: Aquents.					
Urban land.					
ArA Aubbeenaubbee	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
AtA Aubbeenaubbee	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
Bc Barry	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
BlA Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BnB*: Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Glynwood	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
BoB Boyer	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
BoC Boyer	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Bp Brady	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: wetness.
BrA Bronson	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage.

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
CaA---------- Carmi	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ClB---------- Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
ClC---------- Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
CrA, CrB---------- Crosier	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
De---------- Del Rey	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Ed---------- Edwards	Severe: ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: ponding, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Gf, Gm---------- Gilford	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, small stones.
Go---------- Gravelton	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, small stones.
Gr*: Gravelton----------	Severe: flooding, ponding, poor filter.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: seepage, too sandy, small stones.
Palms----------	Severe: subsides, flooding, ponding.	Severe: seepage, flooding, excess humus.	Severe: flooding, seepage, ponding.	Severe: flooding, seepage, ponding.	Poor: ponding, excess humus.
GtA---------- Griswold	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Fair: small stones.
He*: Histosols. Aquolls.					
Ho---------- Homer	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.

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
Ht, Hx Houghton	Severe: subsides, ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
KoA, KoB Kosciusko	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
KoC Kosciusko	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
KoE Kosciusko	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
KtA Kosciusko	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
KxC3 Kosciusko	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
MaA, MaB Martinsville	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
MaC Martinsville	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope, thin layer.
MbA, MbB Metea	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MbC Metea	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MeA, MeB Metea	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MeC Metea	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MlB Miami	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
MlC, MrC3 Miami	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: 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
MrD3---------- Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MsB*: Miami----------	Severe: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
Owosso----------	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Severe: seepage.	Fair: too clayey.
Metea----------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
MsD*: Miami----------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Owosso----------	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
Metea----------	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
MvC---------- Morley	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
MxC3---------- Morley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MxD3---------- Morley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
MzB*: Morley----------	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Glynwood----------	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
OrA, OrB---------- Ormas	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
OrC---------- Ormas	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
OtA, OtB---------- Ormas	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.

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
OtC---------- Ormas	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Pa---------- Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Pb---------- Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	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.
Pg*. Pits					
Re---------- Rensselaer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
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.
RlC---------- Riddles	Moderate: percs slowly, slope.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
RlD---------- Riddles	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
RxB*: Riddles----------	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Ormas----------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Kosciusko----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
RxC*: Riddles----------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
Ormas----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer, seepage.

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
RxC*: Kosciusko	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Sa---- Saranac	Severe: flooding, ponding, percs slowly.	Severe: seepage, flooding, ponding.	Severe: flooding, seepage, ponding.	Severe: flooding, ponding.	Poor: too clayey, ponding.
Se, Sf---- Sebewa	Severe: poor filter, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: small stones, seepage, too sandy.
ShA, ShB---- Shipshe	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Sn---- Shoals	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
To---- Toledo	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Ud*. Udorthents					
Uf*: Udorthents. Urban land.					
Wa---- Wallkill	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding.
Wc---- Washtenaw	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
We---- Washtenaw	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: ponding.	Poor: ponding.
WlB---- Wawasee	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----	Slight----	Good.
WlC2---- Wawasee	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
WlD2---- Wawasee	Severe: slope.	Severe: slope.	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
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," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ab Abscota	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Ao*: Aquents.				
Urban land.				
ArA, AtA Aubbeenaubbee	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bc Barry	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
BlA Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
EnB*: Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Glynwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
BoB, BoC Boyer	Good	Probable	Probable	Poor: small stones, area reclaim.
Bp Brady	Fair: wetness.	Probable	Probable	Poor: small stones.
BrA Bronson	Fair: wetness.	Probable	Probable	Poor: small stones.
CaA Carmi	Good	Probable	Probable	Poor: small stones, area reclaim.
ClB, ClC Coloma	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
CrA, CrB Crosier	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
De Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ed Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Gf, Gm---------- Gilford	Poor: wetness.	Probable----------	Probable----------	Poor: wetness, area reclaim.
Go---------- Gravelton	Poor: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim, wetness.
Gr*: Gravelton----------	Poor: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim, wetness.
Palms----------	Poor: wetness.	Probable----------	Probable----------	Poor: excess humus, wetness.
GtA---------- Griswold	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
He*: Histosols. Aquolls.				
Ho---------- Homer	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.
Ht, Hx---------- Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
KoA, KoB, KoC---------- Kosciusko	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
KoE---------- Kosciusko	Fair: slope.	Probable----------	Probable----------	Poor: small stones, area reclaim, slope.
KtA, KxC3---------- Kosciusko	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
MaA, MaB---------- Martinsville	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MaC---------- Martinsville	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
MbA, MbB, MbC, MeA, MeB, MeC---------- Metea	Good----------	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
MlB---------- Miami	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MlC, MrC3---------- Miami	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
MrD3---------- Miami	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
MsB*:				
Miami----------	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Owosso----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Metea----------	Good----------	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
MsD*:				
Miami----------	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Owosso----------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Metea----------	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
MvC, MxC3---------- Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
MxD3---------- Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
MzB*:				
Morley----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Glynwood----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
OrA, OrB---------- Ormas	Good----------	Probable----------	Probable----------	Fair: too sandy, small stones.
OrC---------- Ormas	Good----------	Probable----------	Probable----------	Fair: too sandy, small stones.
OtA, OtB, OtC--------- Ormas	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
Pa---------- Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pb Palms	Poor: wetness.	Probable	Probable	Poor: excess humus, wetness.
Pe Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pg*. Pits				
Re Rensselaer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
RlA, RlB Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
RlC Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
RlD Riddles	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
RxB*: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
Kosciusko	Good	Probable	Probable	Poor: small stones, area reclaim.
RxC*: Riddles	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, small stones.
Ormas	Good	Probable	Probable	Fair: too sandy, small stones.
Kosciusko	Good	Probable	Probable	Poor: small stones, area reclaim.
Sa Saranac	Poor: wetness.	Probable	Probable	Poor: too clayey, wetness.
Se, Sf Sebewa	Poor: wetness.	Probable	Probable	Poor: wetness, small stones, area reclaim.
ShA, ShB Shipshe	Good	Probable	Probable	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Sn---------- Shoals	Fair: wetness.	Probable----------	Probable----------	Fair: area reclaim.
To---------- Toledo	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ud*. Udorthents				
Uf*: Udorthents.				
Urban land.				
Wa---------- Wallkill	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wc---------- Washtenaw	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
We---------- Washtenaw	Poor: wetness.	Probable----------	Probable----------	Poor: wetness.
W1B---------- Wawasee	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
W1C2---------- Wawasee	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
W1D2---------- Wawasee	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
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. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ab---------- Abscota	Severe: seepage.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Ao*: Aquents.						
Urban land.						
ArA---------- Aubbeenaubbee	Severe: seepage.	Severe: slow refill.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
AtA---------- Aubbeenaubbee	Severe: seepage.	Moderate: slow refill.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
Bc---------- Barry	Severe: seepage.	Moderate: slow refill.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
BlA---------- Blount	Slight---------	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
BnB*: Blount----------	Moderate: slope.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Glynwood---------	Moderate: slope.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily, rooting depth.
BoB---------- Boyer	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
BoC---------- Boyer	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Bp---------- Brady	Severe: seepage.	Severe: cutbanks cave.	Frost action---	Wetness, soil blowing.	Wetness, soil blowing.	Wetness.
BrA---------- Bronson	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Favorable.
CaA---------- Carmi	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, rooting depth.	Too sandy, soil blowing.	Rooting depth.
ClB---------- Coloma	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ClC---------- Coloma	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
CrA, CrB---------- Crosier	Slight---------	Severe: slow refill.	Frost action---	Wetness--------	Wetness--------	Wetness.
De---------- Del Rey	Slight---------	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Ed---------- Edwards	Severe: seepage.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Gf, Gm---------- Gilford	Severe: seepage.	Severe: cutbanks cave.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
Go---------- Gravelton	Severe: seepage.	Severe: cutbanks cave.	Ponding, flooding, frost action.	Ponding, fast intake, flooding.	Ponding, too sandy, soil blowing.	Wetness.
Gr*: Gravelton--------	Severe: seepage.	Severe: cutbanks cave.	Ponding, flooding, frost action.	Ponding, fast intake, flooding.	Ponding, too sandy, soil blowing.	Wetness.
Palms----------	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, flooding, subsides.	Ponding, soil blowing, flooding.	Ponding, soil blowing.	Wetness.
GtA---------- Griswold	Moderate: seepage.	Severe: no water.	Deep to water	Favorable------	Favorable------	Favorable.
He*: Histosols. Aquolls.						
Hc---------- Homer	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, soil blowing.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily.
Ht, Hx---------- Houghton	Severe: seepage.	Severe: slow refill.	Frost action, subsides, ponding.	Soil blowing, ponding.	Ponding, soil blowing.	Wetness.
KoA---------- Kosciusko	Severe: seepage.	Severe: no water.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
KoB---------- Kosciusko	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
KoC, KoE---------- Kosciusko	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
KtA---------- Kosciusko	Severe: seepage.	Severe: no water.	Deep to water	Droughty-------	Erodes easily, too sandy.	Erodes easily, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
KxC3---------- Kosciusko	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
MaA---------- Martinsville	Moderate: seepage.	Severe: no water.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
MaB---------- Martinsville	Moderate: seepage, slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
MaC---------- Martinsville	Severe: slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
MbA---------- Metea	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
MbB---------- Metea	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
MbC---------- Metea	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
MeA---------- Metea	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
MeB---------- Metea	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
MeC---------- Metea	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
MlB---------- Miami	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
MlC, MrC3, MrD3--- Miami	Severe: slope.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
MsB*:						
Miami----------	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
Owosso----------	Severe: seepage.	Severe: no water.	Deep to water	Soil blowing, rooting depth, slope.	Soil blowing---	Rooting depth.
Metea----------	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MsD*:						
Miami	Severe: slope.	Severe: no water.	Deep to water	Soil blowing, slope, rooting depth.	Slope, erodes easily, soil blowing.	Slope, erodes easily, rooting depth.
Owosso	Severe: seepage, slope.	Severe: no water.	Deep to water	Soil blowing, rooting depth, slope.	Slope, soil blowing.	Slope, rooting depth.
Metea	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
MvC Morley	Severe: slope.	Severe: no water.	Deep to water	Percs slowly, slope, rooting depth.	Erodes easily, percs slowly, slope.	Erodes easily, rooting depth, slope.
MxC3, MxD3 Morley	Severe: slope.	Severe: no water.	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
MzB*:						
Morley	Moderate: slope.	Severe: no water.	Deep to water	Percs slowly, slope, rooting depth.	Erodes easily, percs slowly.	Erodes easily, rooting depth.
Glynwood	Moderate: slope.	Severe: no water.	Percs slowly, frost action, slope.	Slope, wetness.	Erodes easily, wetness.	Erodes easily, rooting depth.
OrA Ormas	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake.	Soil blowing	Droughty.
OrB Ormas	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing	Droughty.
OrC Ormas	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty.
OtA Ormas	Severe: seepage.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.
OtB Ormas	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
OtC Ormas	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Pa Palms	Severe: seepage.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.
Pb Palms	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing.	Ponding, soil blowing.	Wetness.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Pe---------- Pewamo	Slight---------	Severe: slow refill.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
Pg*. Pits						
Re---------- Rensselaer	Moderate: seepage.	Severe: cutbanks cave.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
RlA---------- Riddles	Moderate: seepage.	Severe: no water.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
RlB---------- Riddles	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
RlC---------- Riddles	Severe: slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
RlD---------- Riddles	Severe: slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
RxB*: Riddles----------	Moderate: seepage, slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
Ormas----------	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing---	Droughty.
Kosciusko--------	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy------	Droughty.
RxC*: Riddles----------	Severe: slope.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, soil blowing.	Slope.
Ormas----------	Severe: seepage, slope.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, soil blowing.	Slope, droughty.
Kosciusko--------	Severe: seepage, slope.	Severe: no water.	Deep to water	Droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Sa---------- Saranac	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, flooding, frost action.	Ponding, flooding.	Erodes easily, ponding.	Wetness, erodes easily.
Se, Sf---------- Sebewa	Severe: seepage.	Severe: cutbanks cave.	Frost action, cutbanks cave, ponding.	Ponding--------	Too sandy, ponding.	Wetness.
ShA, ShB---------- Shipshe	Severe: seepage.	Severe: no water.	Deep to water	Droughty, soil blowing, rooting depth.	Too sandy, soil blowing.	Droughty, rooting depth.
Sn---------- Shoals	Severe: seepage.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Wetness, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
To---------- Toledo	Slight---------	Severe: no water.	Ponding, percs slowly, frost action.	Ponding--------	Ponding, percs slowly.	Wetness, percs slowly.
Ud*. Udorthents						
Uf*: Udorthents.						
Urban land.						
Wa---------- Wallkill	Severe: seepage.	Moderate: slow refill.	Ponding, frost action.	Ponding, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily.
Wc---------- Washtenaw	Moderate: seepage.	Severe: slow refill.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding.	Wetness, erodes easily, percs slowly.
We---------- Washtenaw	Severe: seepage.	Severe: slow refill, cutbanks cave.	Ponding, frost action.	Ponding--------	Erodes easily, ponding.	Wetness, erodes easily.
W1B---------- Wawasee	Moderate: seepage, slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
W1C2, W1D2-------- Wawasee	Severe: slope.	Severe: no water.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
Wt---------- Whitaker	Moderate: seepage.	Moderate: slow refill, cutbanks cave.	Frost action---	Wetness--------	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		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ab---------- Abscota	0-9	Fine sandy loam	SM, SM-SC, SC	A-2-4, A-4	0	95-100	95-100	60-70	30-40	<25	NP-10
	9-60	Loamy sand, sand, loamy fine sand.	SP, SM, SP-SM	A-2-4, A-1, A-3	0	95-100	80-100	45-75	3-20	---	NP
Ao*: Aquents.											
Urban land.											
ArA---------- Aubbeenaubbee	0-16	Sandy loam-------	SM, SM-SC	A-2-4, A-4	0	100	90-100	50-85	30-50	<25	NP-6
	16-38	Sandy loam, sandy clay loam, fine sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	100	90-100	50-90	25-55	15-30	3-10
	38-56	Clay loam, loam	CL	A-6, A-4	0	95-100	85-100	75-100	55-80	25-35	9-14
	56-60	Loam----------	CL, CL-ML	A-4	0-3	90-100	85-100	75-100	55-80	20-30	5-10
AtA---------- Aubbeenaubbee	0-8	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	100	90-100	50-85	30-50	<21	NP-6
	8-22	Fine sandy loam, sandy clay loam, sandy loam.	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	100	90-100	50-90	25-55	16-30	3-10
	22-44	Clay loam, loam	CL, CL-ML	A-4, A-6	0	95-100	85-100	75-100	55-80	25-35	5-15
	44-60	Loam----------	ML, CL-ML, CL	A-4	0-3	90-100	85-100	75-100	55-80	15-25	2-10
Bc---------- Barry	0-15	Loam----------	ML, CL, CL-ML	A-4	0-3	90-100	80-100	80-100	55-90	20-30	NP-8
	15-50	Loam, sandy clay loam, fine sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0-3	90-100	80-100	80-90	45-75	18-28	4-14
	50-60	Sandy loam, fine sandy loam, loam.	SM, SM-SC	A-2, A-4	0-3	90-100	80-100	35-70	30-40	<20	NP-5
BlA---------- Blount	0-11	Silt loam--------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	11-30	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	30-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
BnB*: Blount----------	0-11	Silt loam--------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	11-30	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	30-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
Glynwood--------	0-14	Loam----------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-100	55-90	23-40	4-15
	14-33	Clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	85-100	75-100	65-95	35-55	15-30
	33-60	Clay loam, silty clay loam.	CL	A-6, A-4	0-5	95-100	80-100	75-95	65-90	25-40	7-18

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	
BoB, BoC--------- Boyer	0-9	Loamy sand--------	SM, SM-SC	A-2, A-1	0-5	95-100	65-95	45-75	15-30	<20	NP-6
	9-37	Sandy loam, sandy clay loam, loamy sand.	SM, SC, SM-SC, SP-SM	A-2, A-4, A-6, A-1	0-5	80-100	65-95	55-85	10-45	10-35	NP-16
	37-60	Gravelly sand, coarse sand, gravel.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-10	40-100	35-100	30-70	0-10	---	NP
Bp--------------- Brady	0-11	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	75-100	60-70	25-40	<25	NP-7
	11-40	Sandy loam, sandy clay loam, gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	75-95	60-80	25-45	15-35	NP-16
	40-54	Loamy sand, sandy loam.	SM	A-2	0-5	95-100	75-95	55-70	15-35	---	NP
	54-60	Gravelly sand, coarse sand, gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2-4	0-5	40-75	35-70	20-55	0-10	---	NP
BrA-------------- Bronson	0-17	Sandy loam--------	SM, SM-SC	A-2, A-4	0-5	95-100	90-100	65-75	20-40	<25	NP-5
	17-32	Sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2, A-4, A-6	0-5	95-100	60-95	60-85	25-45	<30	NP-15
	32-59	Loamy sand, gravelly loamy sand, sandy clay loam.	SM, SP-SM, SC	A-2, A-4	0-5	85-95	60-95	55-70	10-15	---	NP
	59-70	Sand and gravel	SP, GP, SP-SM, GP-GM	A-1, A-2, A-3	0-10	40-90	35-85	20-60	0-10	---	NP
CaA-------------- Carmi	0-19	Loam--------------	SM-SC, SC	A-6, A-4	0-5	90-100	90-100	55-70	35-45	15-35	5-15
	19-35	Gravelly sandy loam, sandy loam.	SM-SC, SC, GC, GM-GC	A-2, A-4, A-6	0-5	65-95	60-90	50-65	20-40	15-35	5-15
	35-60	Stratified gravelly loamy sand to coarse sand and gravel.	SP-SM, GP-GM, SM, GM	A-1	0-15	40-65	35-65	20-50	5-25	<20	NP-5
ClB, ClC--------- Coloma	0-8	Loamy sand--------	SM	A-2, A-4	0	75-100	75-100	50-90	15-50	---	NP
	8-28	Sand, loamy sand	SP, SM, SP-SM	A-2, A-3	0	75-100	75-100	50-75	2-30	---	NP
	28-60	Stratified sand and loamy sand.	SP, SM, SP-SM	A-2, A-3	0-8	75-100	75-100	50-75	2-30	---	NP
CrA, CrB--------- Crosier	0-9	Loam--------------	CL	A-4, A-6	0	100	95-100	85-95	60-80	22-33	8-15
	9-36	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-95	85-95	75-90	60-70	33-47	15-26
	36-60	Loam, sandy loam	CL, ML	A-4, A-6	0-3	85-90	80-90	70-85	50-60	25-35	2-12
De--------------- Del Rey	0-8	Silt loam---------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	25-45	10-25
	8-36	Silty clay loam, silty clay.	CH, CL	A-7	0	95-100	95-100	90-100	85-95	40-55	20-30
	36-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	10-25
Ed--------------- Edwards	0-34	Sapric material	PT	A-8	0	---	---	---	---	---	---
	34-60	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		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Gf---------- Gilford	0-12	Sandy loam, fine sandy loam.	SC, SM-SC, SM	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	2-10
	12-35	Sandy loam, sandy clay loam, loamy sand.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	15-35	20-30	NP-8
	35-55	Coarse sand, sand, loamy sand.	SM, SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	18-60	3-18	---	NP
	55-60	Gravelly coarse sand, very gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0-15	40-85	35-75	20-50	3-10	---	NP
Gm---------- Gilford	0-12	Mucky sandy loam	SC, SM-SC, SM	A-4, A-2-4	0	95-100	90-100	60-70	30-40	20-30	2-10
	12-35	Sandy loam, loamy sand, fine sandy loam.	SM, SC, SM-SC	A-2-4	0	90-100	90-100	55-70	15-35	20-30	NP-8
	35-55	Coarse sand, sand, loamy sand.	SM, SP, SP-SM	A-3, A-1-b, A-2-4	0	90-100	85-100	18-60	3-18	---	NP
	55-60	Gravelly coarse sand, very gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0-15	40-85	35-75	20-50	3-10	---	NP
Go---------- Gravelton	0-6	Loamy sand-------	SM	A-2-4	0	95-100	90-100	50-75	15-30	---	NP
	6-22	Sandy loam, loam	SM, SC, ML, CL	A-4, A-6	0	90-100	85-100	45-95	35-85	<30	NP-11
	22-40	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM, GP, GP-GM	A-1-b, A-1-a	0-3	60-90	65-85	35-50	3-10	<20	NP-3
	40-60	Very gravelly coarse sand.	GP, GP-GM, SP, SP-SM	A-1-b, A-1-a	0-3	40-60	35-50	20-35	3-10	---	NP
Gr*: Gravelton-------	0-6	Loamy sand-------	SM	A-2-4	0	95-100	90-100	50-75	15-30	---	NP
	6-22	Sandy loam, loam	SM, SC, ML, CL	A-4, A-6	0	90-100	85-100	45-95	35-85	<30	NP-11
	22-40	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM, GP, GP-GM	A-1-b, A-1-a	0-3	60-90	65-85	35-50	3-10	<20	NP-3
	40-60	Very gravelly coarse sand.	GP, GP-GM, SP, SP-SM	A-1-b, A-1-a	0-3	40-60	35-50	20-35	3-10	---	NP
Palms----------	0-28	Sapric material	PT	A-8	0	---	---	---	---	---	---
	28-46	Loam, sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	100	65-100	40-80	20-35	5-15
	46-60	Sand, gravelly coarse sand.	SP, SM, GP, GM	A-1, A-2, A-3	0-5	45-95	35-90	20-70	2-30	---	NP
GtA---------- Griswold	0-14	Loam----------	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	70-90	20-30	5-15
	14-34	Loam, sandy clay loam, clay loam.	CL-ML, CL, SM-SC, SC	A-6, A-4	0-5	95-100	90-100	80-90	45-80	20-35	5-15
	34-39	Sandy loam, loam, sandy clay loam.	SC, SM-SC, CL-ML, CL	A-2, A-4, A-6	0-10	85-95	75-90	60-85	30-55	20-30	5-15
	39-60	Sandy loam-------	SM, SC, SM-SC	A-2, A-4	0-10	85-95	65-85	50-75	20-45	<25	3-10
He*: Histosols.											

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	
He*: Aquolls.											
Ho---------- Homer	0-9	Sandy loam-------	SM-SC, SM	A-2-4, A-4	0	95-100	85-100	60-70	30-40	<20	NP-5
	9-26	Sandy clay loam, clay loam, loam.	ML, CL	A-6, A-7, A-4	0	90-100	80-100	80-100	70-95	30-50	8-20
	26-36	Gravelly sandy clay loam, gravelly loam, gravelly sandy loam.	SC	A-2-6, A-6, A-4, A-2-4	0-3	90-100	60-75	45-60	30-50	25-30	8-11
	36-60	Stratified sand to very gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	1-5	30-70	25-55	7-20	2-10	<20	NP-3
Ht, Hx---------- Houghton	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---
KoA, KoB, KoC, KoE---------- Kosciusko	0-13	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	85-100	80-100	50-90	30-70	<30	NP-10
	13-34	Gravelly sandy clay loam, gravelly sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2, A-1	0-3	55-80	55-75	35-65	15-40	20-40	5-20
	34-39	Gravelly loamy sand, very gravelly sandy loam, gravelly sandy loam.	SM, GM, GP-GM, SP-SM	A-1, A-2-4	0-5	45-75	40-70	20-50	10-30	<20	NP
	39-60	Stratified very gravelly coarse sand to coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-8	30-60	30-55	15-40	2-10	<20	NP
KtA---------- Kosciusko	0-9	Silt loam--------	ML, CL-ML, CL	A-4	0	100	95-100	90-100	80-100	20-35	2-10
	9-34	Gravelly sandy clay loam, sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2, A-1	0-3	55-80	55-75	35-65	15-40	20-40	5-20
	34-39	Gravelly loamy coarse sand, very gravelly sandy loam, gravelly sandy loam.	SM, GM, GP-GM, SP-SM	A-1, A-2-4	0-5	45-75	40-70	20-50	10-30	<20	NP
	39-60	Stratified very gravelly coarse sand to coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-8	30-60	30-55	15-40	2-10	<20	NP

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	
KxC3---------- Kosciusko	0-6	Sandy clay loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	85-100	80-100	50-90	30-70	<30	NP-10
	6-27	Gravelly sandy clay loam, gravelly sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2, A-1	0-3	55-80	55-75	35-65	15-40	20-40	5-20
	27-30	Gravelly loamy sand, very gravelly sandy loam, gravelly sandy loam.	SM, GM, GP-GM, SP-SM	A-1, A-2-4	0-5	45-75	40-70	20-50	10-30	<20	NP
	30-60	Stratified very gravelly coarse sand to coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-8	30-60	30-55	15-40	2-10	<20	NP
MaA, MaB, MaC---- Martinsville	0-18	Sandy loam-------	SM, SM-SC	A-4, A-2-4	0	100	85-100	55-85	30-50	<20	NP-6
	18-40	Clay loam, silty clay loam, sandy clay loam.	CL, SC	A-4, A-6, A-2	0	95-100	85-100	70-100	30-95	25-40	7-15
	40-50	Sandy loam, loam, sandy clay loam.	SM-SC, CL-ML, CL, SC	A-2, A-4, A-6	0	95-100	85-100	55-95	30-75	20-30	5-11
	50-60	Stratified sand to silt loam.	SM, SM-SC, CL-ML	A-4, A-2-4, A-1	0	95-100	85-100	45-95	10-75	<25	NP-8
MbA, MbB, MbC---- Metea	0-10	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	10-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-80	5-35	---	NP
	32-40	Sandy clay loam, fine sandy loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-75	<27	4-9
	40-50	Loam, clay loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	10-15
	50-60	Loam-------------	CL, CL-ML	A-4	0-3	85-95	75-95	65-90	50-75	<25	5-10
MeA, MeB, MeC---- Metea	0-9	Loamy fine sand	SM	A-2-4	0	100	100	50-80	15-35	---	---
	9-29	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	29-36	Sandy loam, sandy clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-55	18-27	4-9
	36-50	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	50-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
MlB, MlC--------- Miami	0-8	Loam-------------	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	8-30	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	30-36	Loam, clay loam	CL, SC	A-4, A-6	0-3	90-100	85-100	70-95	40-95	25-35	8-15
	36-60	Loam-------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
MrC3, MrD3------- Miami	0-6	Clay loam--------	CL	A-6	0	100	90-100	75-95	65-95	30-40	15-20
	6-25	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	25-30	Loam, clay loam	CL, SC	A-4, A-6	0-3	90-100	85-100	70-95	40-95	25-35	8-15
	30-60	Loam-------------	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20

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	
MsB*, MsD*:											
Miami	0-8	Loam	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	8-30	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	30-36	Loam, clay loam	CL, SC	A-4, A-6	0-3	90-100	85-100	70-95	40-95	25-35	8-15
	36-60	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
Owosso	0-9	Sandy loam	SM, SM-SC, SC	A-2, A-4	0-5	95-100	75-100	50-70	20-45	12-29	NP-10
	9-36	Sandy loam, loam, fine sandy loam.	SM, SC, SM-SC	A-2, A-4	0-5	95-100	75-100	60-90	25-45	15-30	NP-10
	36-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	90-95	85-95	60-90	25-40	6-21
Metea	0-9	Loamy fine sand	SM	A-2-4	0	100	100	50-80	15-35	---	---
	9-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-41	Sandy loam, sandy clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-55	18-27	4-9
	41-50	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	50-60	Loam	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
MvC	0-7	Loam	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
Morley	7-14	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	14-24	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	24-34	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
	34-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
MxC3, MxD3	0-7	Silty clay loam	CL	A-6, A-7	0-5	95-100	90-100	85-95	80-90	30-45	15-25
Morley	7-10	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	10-20	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	20-28	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
	28-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
MzB*:											
Morley	0-9	Loam	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	9-18	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	18-32	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	32-42	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
	42-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30

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	
MzB*:											
Glynwood--------	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	90-100	80-100	55-90	23-40	4-15
	14-33	Clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0-5	95-100	85-100	75-100	65-95	35-55	15-30
	33-60	Clay loam, silty clay loam.	CL	A-6, A-4	0-5	95-100	80-100	75-95	65-90	25-40	7-18
OrA, OrB, OrC----	0-22	Loamy sand-------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
Ormas	22-34	Sand, fine sand	SW-SM, SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-70	10-20	---	NP
	34-48	Gravelly sandy loam, sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0	60-95	55-95	35-70	20-45	20-40	6-20
	48-60	Gravelly sand, very gravelly coarse sand, gravelly coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
OtA, OtB, OtC----	0-20	Loamy sand-------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
Ormas	20-32	Sand, loamy sand	SM, SP-SM	A-2-4, A-1-b	0	95-100	95-100	45-70	10-20	---	NP
	32-46	Sandy loam, fine sandy loam, loamy sand.	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<25	NP-5
	46-60	Sand, coarse sand	SP, SP-SM, SM	A-1, A-3, A-2	0	90-100	85-100	40-65	3-15	---	NP
Pa---------------	0-33	Sapric material	PT	---	---	---	---	---	---	---	---
Palms	33-60	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
Pb---------------	0-28	Sapric material	PT	A-8	0	---	---	---	---	---	---
Palms	28-42	Sandy clay loam, loam.	CL-ML, CL, SC	A-4, A-6	0	90-100	80-95	75-90	35-75	20-35	5-15
	42-60	Fine sand, loamy fine sand, gravelly coarse sand.	SM, SP-SM, SP, GP	A-2, A-4, A-3, A-1	0-5	60-100	40-100	20-100	2-40	---	NP
Pe---------------	0-14	Silty clay loam	CL	A-6, A-7	0-5	90-100	80-100	80-100	70-90	35-50	15-25
Pewamo	14-37	Silty clay loam, clay, silty clay.	CL, CH	A-7, A-6	0-5	95-100	90-100	90-100	75-95	35-55	15-30
	37-60	Clay loam, silty clay loam.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
Pg*.											
Pits											
Re---------------	0-9	Loam-------------	CL, ML, CL-ML	A-4, A-6	0	95-100	90-100	80-100	55-90	15-35	4-15
Rensselaer	9-15	Clay loam, silty clay loam, loam.	CL	A-6, A-4	0	95-100	90-100	80-100	50-95	25-40	8-20
	15-42	Sandy clay loam, loam, sandy loam.	CL, SC	A-6, A-4, A-2-4, A-2-6	0	95-100	90-100	55-100	25-65	25-35	8-15
	42-60	Stratified fine sand to silt loam.	CL, SC, ML, SM	A-4, A-2	0	95-100	90-100	45-95	25-85	<25	2-10

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	
R1A, R1B, R1C, R1D---------- Riddles	0-20	Fine sandy loam	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	20-43	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	43-60	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
RxB*, RxC*: Riddles---------	0-20	Fine sandy loam	SM, SC, SM-SC	A-2-4, A-4	0	95-100	85-95	50-70	25-40	20-30	2-10
	20-43	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	90-100	80-95	75-90	35-75	25-40	10-20
	43-60	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
Ormas----------	0-24	Loamy sand-------	SM	A-2-4	0	98-100	95-100	50-75	15-30	---	NP
	24-34	Sand, fine sand	SW-SM, SM, SP-SM	A-2-4, A-1-b	0	95-100	90-100	45-70	10-20	---	NP
	34-39	Sandy loam, fine sandy loam.	SM-SC, SM	A-2-4, A-4	0	90-100	85-100	50-70	25-40	<15	NP-5
	39-48	Gravelly sandy clay loam, gravelly sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2-4, A-2-6	0	60-80	55-80	35-70	20-45	20-40	6-20
	48-60	Gravelly sand, very gravelly coarse sand, gravelly coarse sand.	SP, SP-SM	A-3, A-1-b, A-2-4	0	60-80	55-80	30-55	3-12	---	NP
Kosciusko-------	0-13	Sandy loam-------	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	85-100	80-100	50-90	30-70	<30	NP-10
	13-34	Gravelly sandy clay loam, gravelly sandy loam.	SM-SC, SC, GC, GM-GC	A-4, A-6, A-2, A-1	0-3	55-80	55-75	35-65	15-40	20-40	5-20
	34-39	Gravelly loamy sand, very gravelly sandy loam, gravelly sandy loam.	SM, GM, GP-GM, SP-SM	A-1, A-2-4	0-5	45-75	40-70	20-50	10-30	<20	NP
	39-60	Stratified very gravelly coarse sand to coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-8	30-60	30-55	15-40	2-10	<20	NP
Sa----------	0-16	Clay loam--------	CL	A-6	0	100	100	90-100	70-95	30-40	10-15
Saranac	16-45	Silty clay loam, silty clay, clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-20
	45-60	Loam, gravelly loamy coarse sand.	GM, SC, SM, ML	A-4, A-1, A-2, A-3	0	45-100	45-95	45-75	25-85	<25	2-10
Se----------	0-11	Loam----------	CL, CL-ML, ML	A-4, A-6	0	95-100	80-100	75-95	50-90	15-30	3-15
Sebewa	11-30	Sandy clay loam, loam, clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	30-60	Gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP

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	
Sf---------- Sebewa	0-13	Mucky loam-------	CL, CL-ML, ML	A-4, A-6	0	95-100	80-100	75-95	50-90	15-30	3-15
	13-38	Sandy clay loam, loam, gravelly clay loam.	SC, CL	A-4, A-6	0	95-100	65-95	55-85	40-75	25-40	8-20
	38-60	Gravelly sand----	SP, SP-SM, GP, GP-GM	A-1	0-5	40-75	35-70	20-40	0-10	---	NP
ShA, ShB---------- Shipshe	0-12	Sandy loam-------	SC, SM-SC, SM	A-2-4, A-2-6, A-4, A-6	0-2	90-100	75-100	45-70	20-40	<25	NP-12
	12-39	Very gravelly sandy loam, very gravelly sandy clay loam, gravelly clay loam.	GC, GW-GM, GM, GP-GM	A-2, A-1, A-4, A-6	0-2	30-60	25-50	15-50	5-40	<25	NP-12
	39-60	Stratified sandy loam to very gravelly sand.	SW, GP, SP, GW	A-1	1-5	30-70	20-55	5-20	2-10	---	NP
Sn---------- Shoals	0-9	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	75-100	55-90	20-30	5-15
	9-30	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	70-100	50-75	25-36	5-15
	30-48	Clay loam, loam, sandy loam.	CL, ML, SM, SC	A-4, A-2, A-6	0	100	100	50-100	25-90	20-35	NP-15
	48-60	Gravelly loamy sand, gravelly sand.	SP, SP-SM	A-2, A-3, A-1	0-3	70-90	60-80	30-60	3-10	---	NP
To---------- Toledo	0-9	Silty clay-------	MH, CL, ML, CH	A-7	0	100	100	90-100	80-100	40-65	18-36
	9-42	Silty clay, clay	CH, CL	A-7	0	100	100	95-100	80-100	40-65	18-36
	42-60	Silty clay, clay, silty clay loam.	CH, CL, ML, MH	A-7	0	100	100	95-100	80-100	40-65	18-36
Ud*. Udorthents											
Uf*: Udorthents.											
Urban land.											
Wa---------- Wallkill	0-8	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	95-100	90-100	75-100	60-85	16-32	3-12
	8-24	Silt loam, loam	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-100	60-85	20-34	6-13
	24-60	Sapric material, hemic material.	PT, OH	A-8	0	---	---	---	---	---	---
Wc---------- Washtenaw	0-8	Silt loam--------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	27-36	4-12
	8-38	Silt loam, loam	CL, ML	A-6, A-4	0	100	100	90-100	70-90	27-36	4-12
	38-54	Silty clay loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	75-95	36-50	15-28
	54-60	Loam-------------	CL	A-4, A-6	0-3	90-100	85-95	80-95	60-75	22-33	8-15

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---------- Washtenaw	0-11	Loam----------	CL, CL-ML, ML	A-4	0	95-100	90-100	80-100	60-90	<29	3-10
	11-40	Silt loam, sandy loam, loam.	ML, CL, SM, SC	A-4, A-2-4	0	90-100	85-100	50-95	30-85	<25	3-8
	40-56	Sandy clay loam, loam, sandy loam.	SC, SM-SC	A-4, A-6, A-2-4, A-2-6	0-3	75-100	70-95	40-85	20-50	20-35	5-15
	56-60	Stratified very gravelly coarse sand to loamy sand.	SM, SP-SM, GP, SP	A-1, A-2-4, A-3	0-5	40-95	35-90	20-70	2-25	<20	NP-4
W1B, W1C2, W1D2-- Wawasee	0-8	Fine sandy loam	SM, SM-SC	A-2-4, A-4	0	90-100	85-95	80-95	30-50	<25	NP-6
	8-38	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	90-100	85-95	80-95	45-70	25-35	7-15
	38-60	Loam, sandy loam, fine sandy loam.	SM-SC, SC, CL-ML, CL	A-4, A-6, A-2	0	90-100	80-95	50-90	25-66	20-30	4-12
Wt---------- Whitaker	0-15	Loam----------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	60-90	15-35	2-15
	15-44	Clay loam, silty clay loam, sandy clay loam.	CL, CL-ML	A-6, A-4	0	100	95-100	90-100	70-80	20-35	5-15
	44-60	Stratified coarse sand to silt loam.	ML, SM, CL-ML, SM-SC	A-4	0	98-100	98-100	60-85	40-60	<25	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE 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	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Ab	0-9	4-18	1.20-1.60	2.0-6.0	0.12-0.15	6.1-7.3	Low	0.20	5	3	.5-3
Abscota	9-60	0-10	1.25-1.60	6.0-20	0.05-0.11	6.1-8.4	Low	0.17			
Ao*:											
Aquents.											
Urban land.											
ArA	0-16	8-15	1.45-1.55	0.6-6.0	0.12-0.18	5.6-7.3	Low	0.24	5	3	1-3
Aubbeenaubbee	16-38	10-25	1.55-1.65	0.6-6.0	0.11-0.16	5.1-6.5	Low	0.24			
	38-56	22-32	1.40-1.65	0.2-0.6	0.14-0.18	5.6-7.3	Moderate	0.32			
	56-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.32			
AtA	0-8	8-15	1.45-1.55	0.6-6.0	0.12-0.18	5.6-7.3	Low	0.24	5	3	1-3
Aubbeenaubbee	8-22	10-25	1.55-1.65	0.6-6.0	0.11-0.16	5.1-6.5	Low	0.24			
	22-44	22-32	1.40-1.65	0.6-2.0	0.14-0.18	5.6-7.3	Moderate	0.32			
	44-60	10-20	1.55-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low	0.32			
Bc	0-15	8-18	1.60-1.75	0.6-2.0	0.20-0.22	6.1-7.8	Low	0.28	5	5	4-7
Barry	15-50	15-25	1.25-1.85	0.6-2.0	0.14-0.19	6.1-7.8	Low	0.28			
	50-60	5-18	1.80-2.00	2.0-6.0	0.10-0.13	7.4-8.4	Low	0.28			
BlA	0-11	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	3	6	2-3
Blount	11-30	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-6.5	Moderate	0.43			
	30-60	27-38	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate	0.43			
BnB*:											
Blount	0-11	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	3	6	2-3
	11-30	35-50	1.40-1.70	0.06-0.2	0.12-0.19	4.5-6.5	Moderate	0.43			
	30-60	27-38	1.60-1.85	0.06-0.2	0.07-0.10	7.4-8.4	Moderate	0.43			
Glynwood	0-14	16-27	1.25-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	3	6	1-3
	14-33	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-7.8	Moderate	0.32			
	33-60	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate	0.32			
BoB, BoC	0-9	0-10	1.15-1.60	6.0-20	0.08-0.10	5.6-7.3	Low	0.17	4	2	.5-3
Boyer	9-37	10-25	1.25-1.60	2.0-6.0	0.11-0.13	5.6-7.8	Low	0.24			
	37-60	0-10	1.20-1.45	>20	0.02-0.04	7.4-8.4	Low	0.10			
Bp	0-11	2-15	1.25-1.40	2.0-6.0	0.12-0.15	5.6-7.3	Low	0.20	5	3	1-4
Brady	11-40	5-22	1.35-1.45	2.0-6.0	0.12-0.17	5.1-6.5	Low	0.20			
	40-54	5-20	1.25-1.50	2.0-6.0	0.08-0.10	5.1-7.8	Low	0.20			
	54-60	0-10	1.25-1.50	>20	0.02-0.04	6.6-8.4	Low	0.10			
BrA	0-17	2-15	1.14-1.60	2.0-6.0	0.13-0.15	5.1-7.3	Low	0.24	4	3	1-3
Bronson	17-32	10-20	1.26-1.59	2.0-6.0	0.12-0.18	5.1-7.3	Low	0.24			
	32-59	0-20	1.26-1.59	2.0-6.0	0.06-0.08	5.1-7.3	Low	0.17			
	59-70	0-5	1.20-1.47	6.0-20	0.02-0.04	7.4-8.4	Low	0.10			
CaA	0-19	10-20	1.40-1.55	2.0-6.0	0.13-0.20	5.1-7.8	Low	0.20	4	3	2-3
Carmi	19-35	15-22	1.45-1.65	2.0-6.0	0.12-0.19	4.5-6.5	Low	0.20			
	35-60	5-15	1.60-1.80	6.0-20	0.02-0.07	5.1-7.8	Low	0.15			
ClB, ClC	0-8	2-10	1.35-1.65	6.0-20	0.08-0.12	4.5-6.5	Low	0.17	5	2	<1
Coloma	8-28	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low	0.15			
	28-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.5	Low	0.15			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
CrA, CrB	0-9	7-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low	0.32	5	5	1-3
Crosier	9-36	20-33	1.40-1.60	0.2-0.6	0.15-0.19	5.1-7.3	Moderate	0.32			
	36-60	10-20	1.40-1.60	0.2-0.6	0.10-0.19	6.1-8.4	Low	0.32			
De	0-8	15-30	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	3	6	2-3
Del Rey	8-36	35-45	1.40-1.65	0.06-0.2	0.12-0.20	4.5-8.4	Moderate	0.43			
	36-60	25-35	1.50-1.70	0.06-0.2	0.09-0.11	7.9-8.4	Moderate	0.43			
Ed	0-34	---	0.30-0.55	0.2-6.0	0.35-0.45	5.6-7.8	---	---	2	2	55-75
Edwards	34-60	---	---	---	---	7.4-8.4	---	---			
Gf, Gm	0-12	8-20	1.50-1.70	2.0-6.0	0.16-0.18	5.6-7.3	Low	0.20	4	3	2-7
Gilford	12-35	8-20	1.60-1.80	2.0-6.0	0.10-0.14	5.6-7.3	Low	0.20			
	35-55	3-12	1.70-1.90	6.0-20	0.05-0.08	6.1-7.3	Low	0.15			
	55-60	1-5	1.70-1.90	>20	0.02-0.04	7.4-8.4	Low	0.10			
Go	0-6	5-12	1.20-1.60	2.0-6.0	0.07-0.08	6.1-7.8	Low	0.17	4	2	2-5
Gravelton	6-22	5-18	1.25-1.60	2.0-6.0	0.12-0.13	6.6-7.8	Low	0.32			
	22-40	1-10	1.55-1.75	>6.0	0.01-0.04	7.4-8.4	Low	0.10			
	40-60	1-5	1.55-1.75	>6.0	0.01-0.04	7.4-8.4	Low	0.10			
Gr*:											
Gravelton	0-6	5-12	1.20-1.60	2.0-6.0	0.07-0.08	6.1-7.8	Low	0.17	4	2	2-5
	6-22	5-18	1.25-1.60	2.0-6.0	0.12-0.18	6.6-7.8	Low	0.32			
	22-40	1-10	1.55-1.75	>6.0	0.01-0.04	7.4-8.4	Low	0.10			
	40-60	1-5	1.55-1.75	>6.0	0.01-0.04	7.4-8.4	Low	0.10			
Palms	0-28	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8	---	---	2	2	>75
	28-46	7-30	1.45-1.70	0.6-2.0	0.16-0.20	6.1-7.8	Low	0.32			
	46-60	0-8	1.70-1.90	>6.0	0.02-0.08	7.4-8.4	Low	0.10			
GtA	0-14	15-25	1.10-1.30	0.6-2.0	0.16-0.22	5.6-7.8	Low	0.32	5	5	2-6
Griswold	14-34	20-32	1.20-1.40	0.6-2.0	0.14-0.19	5.6-7.8	Low	0.32			
	34-39	18-28	1.40-1.60	0.6-2.0	0.12-0.14	5.6-7.8	Low	0.32			
	39-60	15-20	1.45-1.65	0.6-2.0	0.11-0.13	7.4-8.4	Low	0.32			
He*:											
Histosols.											
Aquolls.											
Ho	0-9	6-15	1.40-1.60	0.6-2.0	0.13-0.15	5.1-7.3	Low	0.24	4	3	1-3
Homer	9-26	20-35	1.45-1.65	0.6-2.0	0.17-0.19	5.1-6.5	Moderate	0.37			
	26-36	17-27	1.45-1.65	0.6-2.0	0.15-0.17	5.1-7.3	Low	0.37			
	36-60	1-10	1.65-1.95	>20	0.01-0.04	7.9-8.4	Low	0.10			
Ht, Hx	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	---	---	2	2	>70
Houghton											
KoA, KoB, KoC, KoE	0-13	7-25	1.30-1.45	0.6-2.0	0.13-0.20	5.1-6.5	Low	0.28	4	3	.5-3
Kosciusko	13-34	18-27	1.40-1.60	0.6-2.0	0.10-0.15	5.1-6.5	Moderate	0.28			
	34-39	4-12	1.50-1.70	0.6-2.0	0.05-0.11	5.1-7.8	Low	0.28			
	39-60	1-5	1.70-1.90	>20	0.02-0.04	7.4-8.4	Low	0.10			
KtA	0-9	10-20	1.30-1.45	0.6-2.0	0.19-0.23	5.1-6.5	Low	0.37	4	5	.5-3
Kosciusko	9-34	18-27	1.40-1.60	0.6-2.0	0.10-0.15	5.1-6.5	Moderate	0.28			
	34-39	4-12	1.50-1.70	0.6-2.0	0.05-0.11	5.1-7.8	Low	0.28			
	39-60	1-5	1.70-1.90	>20	0.02-0.04	7.4-8.4	Low	0.10			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
KxC3----------	0-6	7-25	1.30-1.45	0.6-2.0	0.13-0.20	5.1-6.5	Low----------	0.28	4	3	.5-2
Kosciusko	6-27	18-27	1.40-1.60	0.6-2.0	0.10-0.15	5.1-6.5	Moderate-----	0.28			
	27-30	4-12	1.50-1.70	0.6-2.0	0.05-0.11	5.1-7.8	Low----------	0.28			
	30-60	1-5	1.70-1.90	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
MaA, MaB, MaC----	0-18	5-15	1.35-1.50	2.0-6.0	0.13-0.18	5.1-7.3	Low----------	0.24	5	3	1-3
Martinsville	18-40	20-33	1.40-1.60	0.6-2.0	0.16-0.20	5.1-6.5	Moderate-----	0.37			
	40-50	15-25	1.40-1.60	0.6-2.0	0.12-0.17	5.1-7.3	Low----------	0.24			
	50-60	2-20	1.50-1.70	0.6-6.0	0.08-0.17	5.6-8.4	Low----------	0.24			
MbA, MbB, MbC----	0-10	3-8	1.55-1.65	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	.5-3
Metea	10-32	2-10	1.65-1.80	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-40	12-22	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.32			
	40-50	24-30	1.45-1.65	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	50-60	10-24	1.55-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.32			
MeA, MeB, MeC----	0-9	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-3
Metea	9-29	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	29-36	12-22	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.32			
	36-50	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	50-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
MlB, MlC----------	0-8	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.37	5	5	.5-3
Miami	8-30	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.37			
	30-36	20-30	1.45-1.65	0.6-2.0	0.14-0.19	6.6-7.8	Low----------	0.37			
	36-60	15-25	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Moderate-----	0.37			
MrC3, MrD3-------	0-6	27-35	1.35-1.60	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.37	3	6	.5-3
Miami	6-25	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.37			
	25-30	20-30	1.45-1.65	0.6-2.0	0.14-0.19	6.6-7.8	Low----------	0.37			
	30-60	15-25	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Moderate-----	0.37			
MsB*, MsD*:											
Miami----------	0-8	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.37	5	5	.5-3
	8-30	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.37			
	30-36	20-30	1.45-1.65	0.6-2.0	0.14-0.19	6.6-7.8	Low----------	0.37			
	36-60	15-25	1.55-1.90	0.2-0.6	0.05-0.19	7.4-8.4	Moderate-----	0.37			
Owosso----------	0-9	5-18	1.10-1.65	2.0-6.0	0.13-0.18	5.1-7.3	Low----------	0.24	5	3	1-3
	9-36	10-22	1.10-1.65	2.0-6.0	0.09-0.17	5.1-7.3	Low----------	0.24			
	36-60	18-35	1.30-1.75	0.2-0.6	0.14-0.20	5.1-8.4	Low----------	0.24			
Metea----------	0-9	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-3
	9-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-41	12-22	1.45-1.55	0.6-2.0	0.15-0.19	5.6-7.3	Low----------	0.32			
	41-50	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	50-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
MvC----------	0-7	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.43	3	6	1-3
Morley	7-14	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	14-24	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate-----	0.43			
	24-34	27-50	1.60-1.80	0.2-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	34-60	27-40	1.60-1.80	0.2-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
MxC3, MxD3-------	0-7	27-35	1.40-1.60	0.2-0.6	0.18-0.22	5.1-6.5	Moderate-----	0.43	2	7	1-3
Morley	7-10	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	10-20	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate-----	0.43			
	20-28	27-50	1.60-1.70	0.2-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	28-60	27-40	1.60-1.70	0.2-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
MzB*:											
Morley	0-9	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low	0.43	3	6	1-3
	9-18	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate	0.43			
	18-32	35-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate	0.43			
	32-42	27-50	1.60-1.80	0.2-0.6	0.07-0.12	6.1-8.4	Moderate	0.43			
	42-60	27-40	1.60-1.80	0.2-0.6	0.07-0.12	6.1-8.4	Moderate	0.43			
Glynwood	0-14	16-27	1.25-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	3	6	1-3
	14-33	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-7.8	Moderate	0.32			
	33-60	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate	0.32			
OrA, OrB, OrC	0-22	5-12	1.40-1.60	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	5	2	1-3
Ormas	22-34	3-10	1.45-1.60	6.0-20	0.07-0.09	5.6-6.5	Low	0.17			
	34-48	18-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.8	Low	0.32			
	48-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low	0.15			
OtA, OtB, OtC	0-20	5-12	1.40-1.60	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	5	2	1-3
Ormas	20-32	3-10	1.45-1.60	6.0-20	0.07-0.09	5.6-6.5	Low	0.17			
	32-46	10-25	1.50-1.70	2.0-6.0	0.12-0.14	5.1-7.3	Low	0.17			
	46-60	1-5	1.55-1.75	6.0-20	0.05-0.07	7.4-8.4	Low	0.15			
Pa	0-33	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8		----	2	3	>75
Palms	33-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-8.4	Low	----			
Pb	0-28	---	0.25-0.45	0.2-6.0	0.35-0.45	5.1-7.8		----	2	2	>75
Palms	28-42	7-35	1.45-1.70	0.6-2.0	0.16-0.20	6.1-7.8	Moderate	----			
	42-60	0-10	1.50-1.65	6.0-20	0.04-0.10	7.4-7.8	Low	----			
Pe	0-14	27-40	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.3	Moderate	0.28	5	6	3-10
Pewamo	14-37	35-50	1.40-1.70	0.2-0.6	0.12-0.20	5.6-7.8	Moderate	0.28			
	37-60	30-40	1.50-1.75	0.2-0.6	0.14-0.18	7.4-8.4	Moderate	0.28			
Pg*.											
Pits											
Re	0-9	11-27	1.30-1.45	0.6-2.0	0.20-0.24	6.1-7.3	Low	0.32	5	5	2-8
Rensselaer	9-15	20-35	1.40-1.60	0.6-2.0	0.15-0.20	6.1-7.3	Moderate	0.32			
	15-42	20-30	1.40-1.60	0.6-2.0	0.16-0.19	6.6-7.8	Moderate	0.32			
	42-60	8-20	1.50-1.70	0.6-2.0	0.10-0.18	7.4-8.4	Low	0.43			
RlA, RlB, RlC,											
RlD	0-20	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low	0.24	5	3	.5-3
Riddles	20-43	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate	0.32			
	43-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low	0.32			
RxB*, RxC*:											
Riddles	0-20	4-14	1.35-1.55	2.0-6.0	0.13-0.15	6.1-7.3	Low	0.24	5	3	.5-3
	20-43	18-35	1.40-1.60	0.6-2.0	0.16-0.18	5.1-7.3	Moderate	0.32			
	43-60	8-25	1.40-1.60	0.6-2.0	0.05-0.19	6.6-8.4	Low	0.32			
Ormas	0-24	5-12	1.40-1.60	6.0-20	0.10-0.12	5.6-7.3	Low	0.17	5	2	1-3
	24-34	3-10	1.45-1.60	6.0-20	0.07-0.09	5.6-6.5	Low	0.17			
	34-39	10-20	1.50-1.70	2.0-6.0	0.12-0.14	5.1-6.5	Low	0.17			
	39-48	18-25	1.50-1.60	2.0-6.0	0.11-0.14	5.6-7.8	Low	0.32			
	48-60	1-8	1.55-1.70	>20	0.03-0.05	7.4-8.4	Low	0.15			
Kosciusko	0-13	7-25	1.30-1.45	0.6-2.0	0.13-0.20	5.1-6.5	Low	0.28	4	3	.5-3
	13-34	18-27	1.40-1.60	0.6-2.0	0.10-0.15	5.1-6.5	Moderate	0.28			
	34-39	4-12	1.50-1.70	0.6-2.0	0.05-0.11	5.1-7.8	Low	0.28			
	39-60	1-5	1.70-1.90	>20	0.02-0.04	7.4-8.4	Low	0.10			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Sa	0-16	26-33	1.40-1.50	0.2-0.6	0.21-0.24	6.1-7.8	Moderate	0.28	5	6	4-8
Saranac	16-45	27-41	1.50-1.60	0.2-0.6	0.11-0.20	6.6-7.3	Moderate	0.43			
	45-60	3-15	1.70-1.80	2.0-20	0.02-0.11	7.4-7.8	Low	0.10			
Se	0-11	10-25	1.10-1.60	0.6-2.0	0.18-0.25	6.1-7.8	Low	0.24	4	5	1-6
Sebewa	11-30	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	Low	0.24			
	30-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	Low	0.10			
Sf	0-13	10-25	1.10-1.60	0.6-2.0	0.18-0.25	6.1-7.8	Low	0.24	4	5	>16
Sebewa	13-38	18-35	1.50-1.80	0.6-2.0	0.15-0.19	6.1-7.8	Low	0.24			
	38-60	0-3	1.55-1.75	6.0-20	0.02-0.04	7.4-8.4	Low	0.10			
ShA, ShB	0-12	8-18	1.35-1.45	2.0-6.0	0.13-0.15	5.6-7.3	Low	0.20	3	3	2-5
Shipshe	12-39	14-30	1.40-1.55	2.0-6.0	0.05-0.07	5.6-7.3	Low	0.10			
	39-60	2-5	1.60-1.80	>20	0.02-0.04	7.9-8.4	Low	0.10			
Sn	0-9	15-27	1.35-1.45	0.6-2.0	0.20-0.24	6.6-7.8	Low	0.37	5	5	2-4
Shoals	9-30	15-27	1.35-1.50	0.6-2.0	0.17-0.19	6.6-7.8	Low	0.37			
	30-48	10-30	1.35-1.55	0.6-2.0	0.17-0.22	6.1-7.8	Low	0.37			
	48-60	0-10	1.50-1.65	>6.0	0.02-0.05	6.6-8.4	Low	0.10			
To	0-9	40-50	1.40-1.60	0.2-0.6	0.17-0.23	5.6-7.3	Moderate	0.28	5	7	3-6
Toledo	9-42	40-60	1.40-1.70	0.06-0.2	0.09-0.13	6.1-7.8	High	0.28			
	42-60	35-60	1.45-1.75	0.06-0.2	0.08-0.12	7.4-8.4	High	0.28			
Ud*. Udorthents											
Uf*: Udorthents.											
Urban land.											
Wa	0-8	10-27	1.15-1.40	0.6-2.0	0.16-0.21	5.1-7.8	Low	0.37	5	5	3-8
Wallkill	8-24	15-27	1.15-1.40	0.6-2.0	0.15-0.20	5.1-7.8	Low	0.32			
	24-60	---	0.25-0.45	2.0-6.0	0.35-0.45	5.6-7.8	---	---			
Wc	0-8	15-27	1.30-1.45	0.6-2.0	0.22-0.24	6.1-7.3	Low	0.37	5	5	3-7
Washtenaw	8-38	15-27	1.30-1.50	0.6-2.0	0.20-0.22	6.1-7.3	Low	0.37			
	38-54	28-35	1.40-1.60	0.06-0.2	0.15-0.20	6.1-7.3	Moderate	0.37			
	54-60	15-25	1.45-1.65	0.06-0.2	0.05-0.19	7.4-8.4	Moderate	0.37			
We	0-11	10-25	1.35-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.28	5	5	3-7
Washtenaw	11-40	10-20	1.35-1.50	0.6-2.0	0.13-0.24	5.6-7.3	Low	0.43			
	40-56	15-30	1.44-1.60	0.2-2.0	0.12-0.18	5.6-7.3	Moderate	0.24			
	56-60	1-12	1.70-1.85	>20	0.02-0.08	6.6-8.4	Low	0.10			
W1B, W1C2, W1D2	0-8	10-18	1.20-1.40	0.6-2.0	0.13-0.15	5.6-7.3	Low	0.28	5	3	1-3
Wawasee	8-38	18-27	1.50-1.70	0.6-2.0	0.12-0.18	5.1-7.3	Low	0.28			
	38-60	12-18	1.50-1.70	0.6-2.0	0.11-0.18	6.6-8.4	Low	0.28			
Wt	0-15	8-19	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.37	5	5	1-3
Whitaker	15-44	18-33	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate	0.37			
	44-60	3-18	1.50-1.70	0.6-6.0	0.19-0.21	6.1-8.4	Low	0.37			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "occasional," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ab---------- Abscota	A	Occasional	Brief-----	Mar-Jun	>6.0	---	---	Low------	Low------	Low.
Ao*: Aquents.										
Urban land.										
ArA, AtA---------- Aubbeenaubbee	B	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	Moderate.
Bc---------- Barry	B/D	None--------	---	---	+1-1.0	Apparent	Nov-May	High-----	High-----	Low.
BlA---------- Blount	C	None--------	---	---	1.0-3.0	Perched	Jan-May	High-----	High-----	High.
BnB*:										
Blount----------	C	None--------	---	---	1.0-3.0	Perched	Jan-May	High-----	High-----	High.
Glynwood---------	C	None--------	---	---	2.0-3.5	Perched	Jan-Apr	High-----	High-----	Moderate.
BoB, BoC---------- Boyer	B	None--------	---	---	>6.0	---	---	>60	Low------	Moderate.
Bp---------- Brady	B	None--------	---	---	1.0-3.0	Apparent	Nov-May	>60	Low------	Moderate.
BrA---------- Bronson	B	None--------	---	---	2.0-3.5	Apparent	Nov-May	>60	Low------	High.
CaA---------- Carmi	B	None--------	---	---	>6.0	---	---	>60	Low------	High.
ClB, ClC---------- Coloma	A	None--------	---	---	>6.0	---	---	Low------	Low------	Moderate.
CrA, CrB---------- Crosier	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	Low.
De---------- Del Rey	C	None--------	---	---	1.0-3.0	Apparent	Jan-May	High-----	High-----	Moderate.
Ed---------- Edwards	B/D	None--------	---	---	+1-0.5	Apparent	Sep-Jun	High-----	High-----	Low.
Gf, Gm---------- Gilford	B/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	High-----	High-----	Moderate.
Go---------- Gravelton	B/D	Occasional	Brief to long.	Nov-Apr	+1-1.0	Apparent	Oct-Jun	High-----	High-----	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Gr*:										
Gravelton	B/D	Frequent	Brief to long.	Nov-Apr	+1-1.0	Apparent	Oct-Jun	High	High	Low.
Palms	A/D	Frequent	Brief to long.	Nov-Jun	+1-1.0	Apparent	Nov-Jun	High	High	High.
GtA--Griswold	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
He*:										
Histosols.										
Aquolls.										
Ho--Homer	B	None	---	---	1.0-3.0	Apparent	Jan-Apr	High	High	High.
Ht, Hx--Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	High	High	Low.
KoA, KoB, KoC, KoE, KtA, KxC3--Kosciusko	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
MaA, MaB, MaC--Martinsville	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
MbA, MbB, MbC, MeA, MeB, MeC--Metea	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
MlB, MlC, MrC3, MrD3--Miami	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
MsB*, MsD*:										
Miami	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Owosso	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Metea	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
MvC, MxC3, MxD3--Morley	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
MzB*:										
Morley	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Glynwood	C	None	---	---	2.0-3.5	Perched	Jan-Apr	High	High	Moderate.
OrA, OrB, OrC, OtA, OtB, OtC--Ormas	B	None	---	---	>6.0	---	---	Moderate	Low	Moderate.
Pa--Palms	A/D	None	---	---	+1-1.0	Apparent	Nov-May	High	High	Moderate.
Pb--Palms	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	High	High	High.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Pe---------- Pewamo	C/D	None--------	---	---	+1-1.0	Apparent	Dec-May	High-----	High-----	Low.
Pg*. Pits										
Re---------- Rensselaer	B/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	High-----	Moderate	Low.
R1A, R1B, B1C, R1D---------- Riddles	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
RxB*, RxC*: Riddles----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Ormas----------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
Kosciusko--------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
Sa---------- Saranac	C	Occasional	Brief-----	Dec-May	+.5-1.0	Apparent	Dec-Jun	High-----	High-----	Low.
Se, Sf---------- Sebewa	B/D	None--------	---	---	+1-1.0	Apparent	Sep-May	High-----	High-----	Low.
ShA, ShB---------- Shipshe	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
Sn---------- Shoals	C	Occasional	Brief-----	Mar-Jun	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	Low.
To---------- Toledo	D	None--------	---	---	+1-1.0	Perched	Jan-Apr	High-----	High-----	Low.
Ud*. Udorthents										
Uf*: Udorthents.										
Urban land.										
Wa---------- Wallkill	B/D	None--------	---	---	+.5-1.0	Apparent	Sep-Jun	High-----	Moderate	Moderate.
Wc---------- Washtenaw	C/D	None--------	---	---	+.5-1.0	Apparent	Dec-May	High-----	High-----	Low.
We---------- Washtenaw	C/D	None--------	---	---	+1-1.0	Apparent	Dec-May	High-----	High-----	Low.
W1B, W1C2, W1D2--- Wawasee	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Wt---------- Whitaker	C	None--------	---	---	1.0-3.0	Apparent	Jan-Apr	High-----	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available. MAX means maximum dry density; OPT, optimum moisture; LL, liquid limit; PI, plasticity index; UN, Unified; and NP, nonplastic)

Soil name and location	Parent material	Report number S76-IN-085	Depth	Moisture density		Percentage passing sieve--				Percentage smaller than--				LL	PI	Classification	
				MAX	OPT	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHTO	UN
			In	Lb/cf	Pct									Pct			
Miami sandy loam: 1,660 feet north and 75 feet east of the southwest corner of sec. 25, T. 32 N., R. 5 E.	Loamy glacial till.	1-1	0-8	115	14	97	96	88	46	41	25	9	4	21	NP	A-4	SM
		1-3	14-28	118	13	98	96	89	54	54	47	27	23	27	15	A-6	CL
		1-5	38-60	127	10	96	91	81	48	40	25	14	11	19	1	A-4	SM
Shipshe sandy loam: 750 feet north and 700 feet east of the center of sec. 29, T. 34 N., R. 6 E.	Loamy outwash over stratified sand and gravelly coarse sand.	2-1	0-8	118	12	93	92	76	36	30	21	11	6	18	NP	A-4	SM
		2-4	18-34	121	12	73	64	37	15	15	13	10	8	14	NP	A-1-b	SM
		2-6	39-60	---	---	80	62	34	4	4	2	1	0	11	NP	A-1-b	SW

TABLE 20.--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
Abscota	Mixed, mesic Typic Udipsamments
Aquents	Mixed, nonacid, mesic Aquents
Aquolls	Loamy, mixed, mesic Haplaquolls
Aubbeenaubbee	Fine-loamy, mixed, mesic Aeric Ochraqualfs
*Barry	Fine-loamy, mixed, mesic Typic Argiaquolls
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
Brady	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Bronson	Coarse-loamy, mixed, mesic Aquic Hapludalfs
Carmi	Coarse-loamy, mixed, mesic Typic Hapludolls
Coloma	Mixed, mesic Alfic Udipsamments
Crosier	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Del Rey	Fine, illitic, mesic Aeric Ochraqualfs
Edwards	Marly, euic, mesic Limnic Medisaprists
Gilford	Coarse-loamy, mixed, mesic Typic Haplaquolls
Glynwood	Fine, illitic, mesic Aquic Hapludalfs
Gravelton	Sandy, mixed, mesic Fluvaquentic Haplaquolls
Griswold	Fine-loamy, mixed, mesic Typic Argiudolls
Histosols	Euic, mesic Medisaprists
Homer	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aeric Ochraqualfs
Houghton	Euic, mesic Typic Medisaprists
*Kosciusko	Fine-loamy, mixed, mesic Typic Hapludalfs
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Miami	Fine-loamy, mixed, mesic Typic Hapludalfs
Morley	Fine, illitic, mesic Typic Hapludalfs
Ormas	Loamy, mixed, mesic Arenic Hapludalfs
Owosso	Fine-loamy, mixed, mesic Typic Hapludalfs
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Pewamo	Fine, mixed, mesic Typic Argiaquolls
Rensselaer	Fine-loamy, mixed, mesic Typic Argiaquolls
Riddles	Fine-loamy, mixed, mesic Typic Hapludalfs
Saranac	Fine, mixed, mesic Fluvaquentic Haplaquolls
Sebewa	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiaquolls
Shipshe	Loamy-skeletal, mixed, mesic Typic Argiudolls
Shoals	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Toledo	Fine, illitic, nonacid, mesic Mollic Haplaquepts
Udorthents	Loamy, mixed, nonacid, mesic Udorthents
Wallkill	Fine-loamy, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Washtenaw	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Wawasee	Fine-loamy, mixed, mesic Typic Hapludalfs
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs

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