United States
Department of
Agriculture

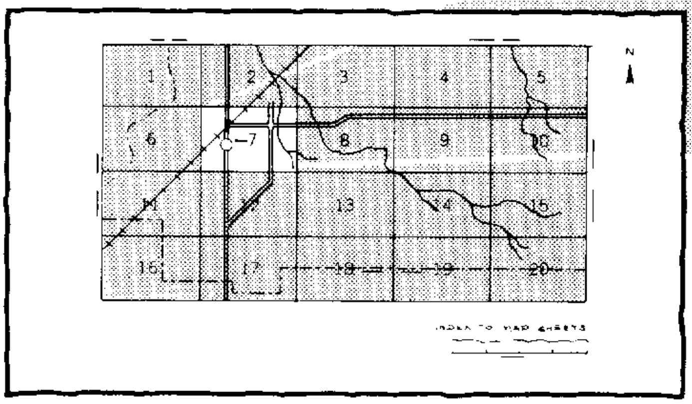
Soil
Conservation
Service

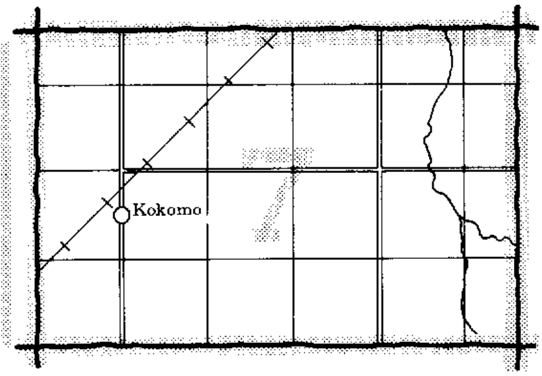
In cooperation with
Purdue University
Agricultural Experiment
Station and
Indiana Department of
Natural Resources,
Soil and Water
Conservation Committee

Soil Survey of Blackford and Jay Counties, Indiana

HOW TO USE

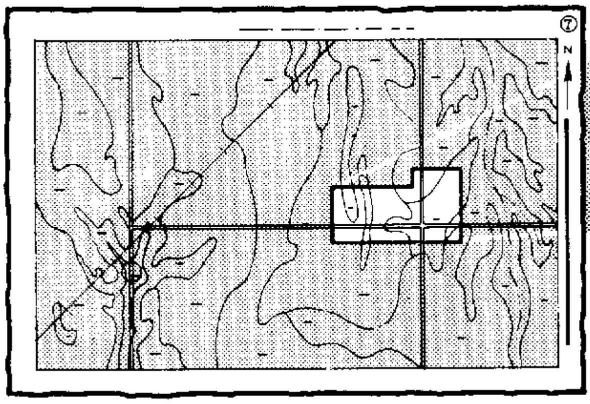
1. Locate your area of interest on the ''Index to Map Sheets''

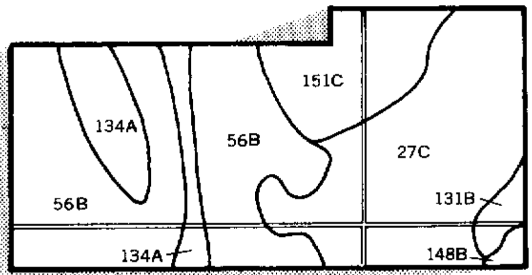




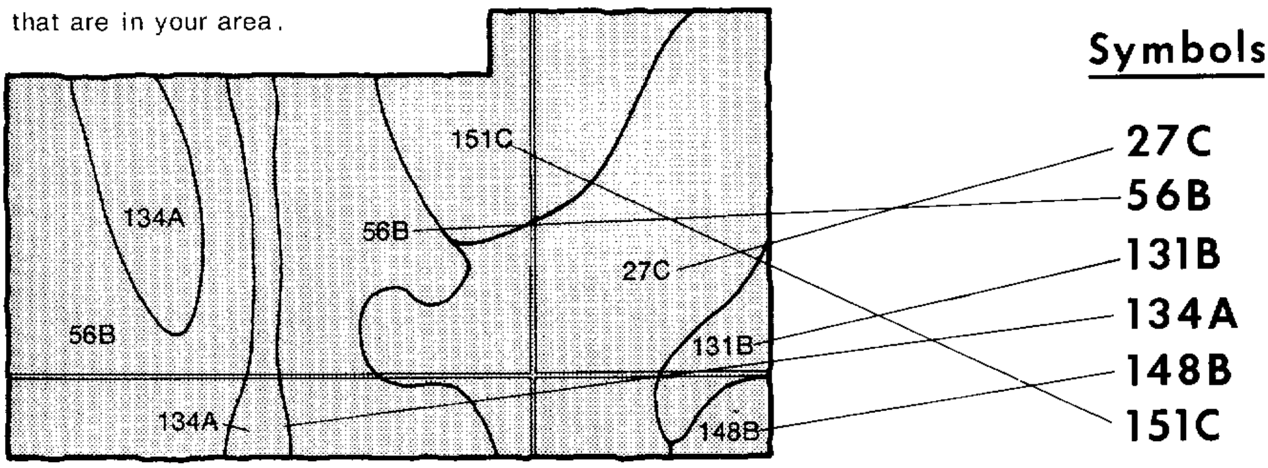
2. Note the number of the map sheet and turn to that sheet.

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



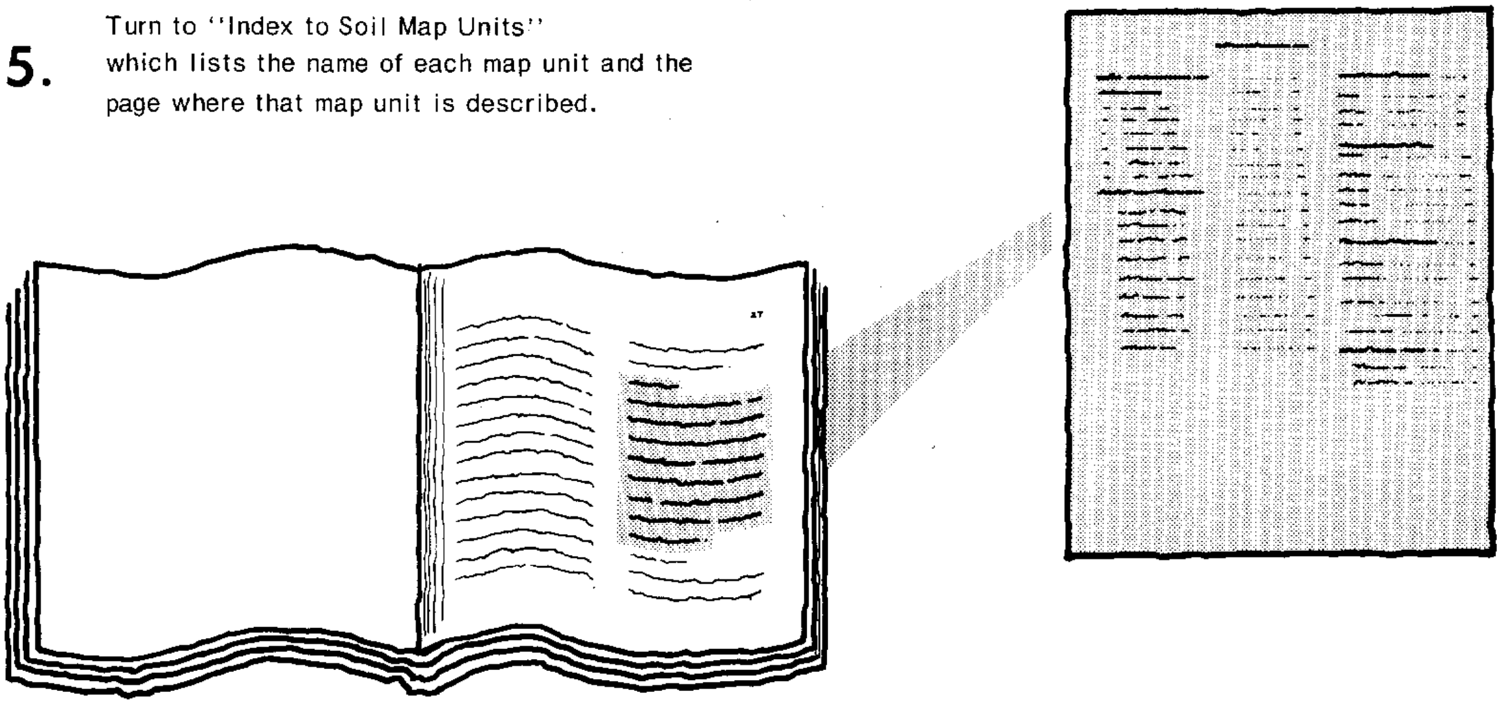


4. List the map unit symbols that are in your area.

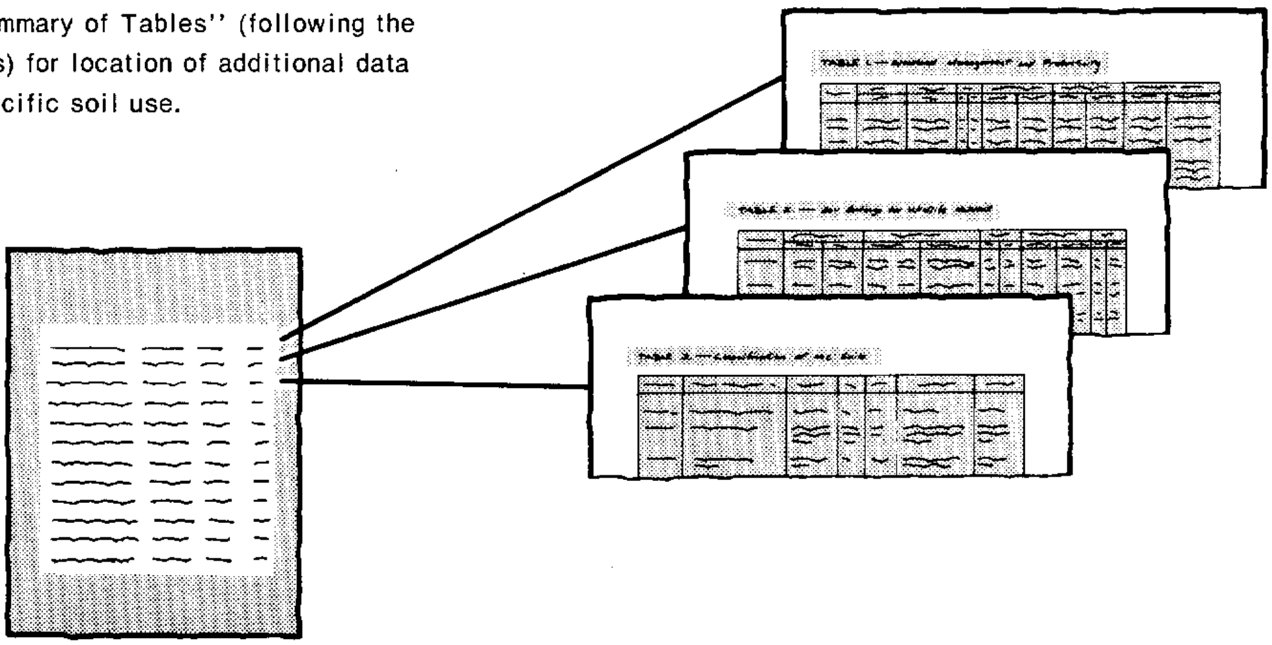


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1982. This survey was made cooperatively by the Soil Conservation Service; the Purdue University Agricultural Experiment Station; and the Indiana Department of Natural Resources, Soil and Water Conservation Committee. It is part of the technical assistance furnished to the Blackford County Soil and Water Conservation District and the Jay County Soil and Water Conservation District. Financial assistance was made available by the Board of County Commissioners in the two counties.

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: A small recreational pond in an area of Pewamo silty clay. Glynwood clay loam, thin solum, 6 to 12 percent slopes, severely eroded, is in the background.

Contents

Soil Series

Issued March 1986

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Blackford and Jay Counties, Indiana. 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

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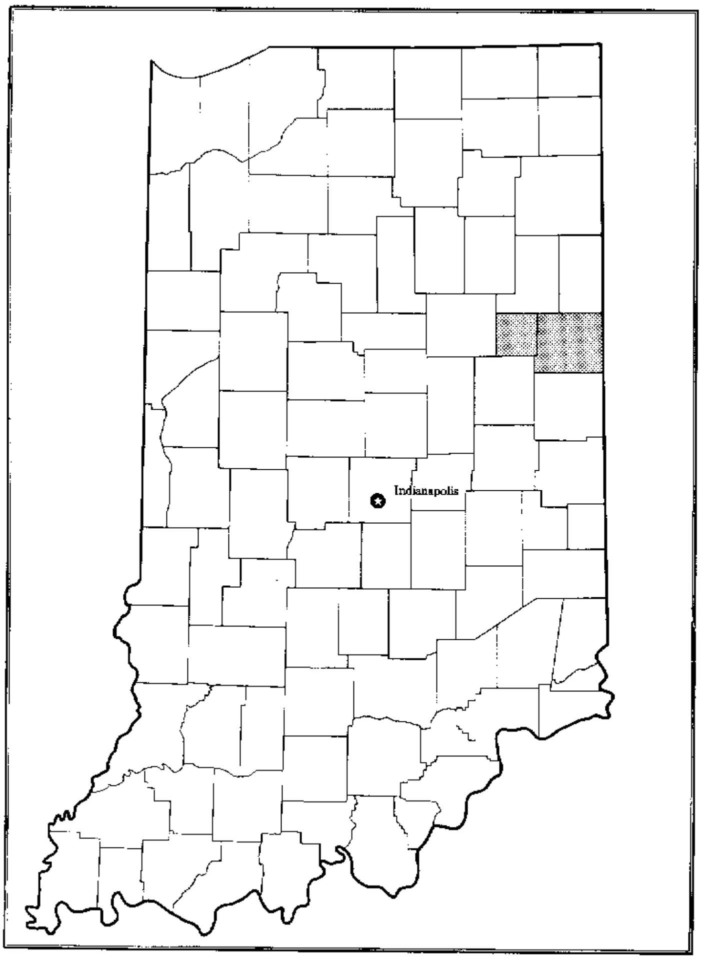

Location of Blackford and Jay Counties in Indiana.

Soil Survey of
Blackford and Jay Counties, Indiana

By Steven K. Kluess, Soil Conservation Service

Fieldwork by Steven K. Kluess, Bobby L. Pirtle, and James R. Blank,
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Indiana Department of Natural Resources,
Soil and Water Conservation Committee

United States Department of Agriculture, Soil Conservation Service,
in cooperation with
Purdue University Agricultural Experiment Station and
Indiana Department of Natural Resources,
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Blackford and Jay Counties are in east-central Indiana. They have a combined area of 351,808 acres, or 550 square miles. Blackford County has 106,022 acres, and Jay County has 245,786 acres. Hartford City is the county seat of Blackford County, and Portland is the county seat of Jay County. There are many small businesses in Blackford and Jay Counties, but many workers commute to Muncie and Marion for employment.

About 80 percent of Blackford County and 76 percent of Jay County are actively farmed. Corn, soybeans, and small grain are the principal crops. Hogs, beef, and some dairy operations are the main source of income for livestock farmers in the counties.

This survey updates the soil survey of Blackford County published in 1928 (*3*). It provides additional information and larger maps, which show the soils in greater detail.

General Nature of the Counties

This section gives general information concerning the counties. It describes relief and drainage, transportation facilities, water supplies, trends in population and land use, and climate.

Relief and Drainage

The two counties are characterized by nearly level areas between a series of three concentric moraines. The nearly level areas have little relief. The breaks to drainageways are not steep or very long in these areas. In the morainic areas, the relief is greater and slopes generally are long and are gently sloping and moderately sloping. Some areas along rivers and the major streams are steeper.

The highest elevation is 1,121 feet above sea level. It is in an area 0.5 mile north of the southeast corner of Jay County, at the Indiana-Ohio state line. The lowest elevation is 825 feet above sea level, in an area where Loblolly Creek leaves Jay County, north of Bryant.

Three rivers and many streams and ditches drain surface water from the counties. The drainageways are well defined. Some are forested.

Transportation Facilities

Blackford County has 44 miles of federal and state roads and 330 miles of county roads. Jay County has 63 miles of federal and state roads and 802 miles of county roads. Many county roads are paved, and the rest have a gravel surface. Portland has a municipal airport, and both counties have several private landing strips.

Water Supplies

Ground water supplies most of the water needed in the counties. One municipality, however, supplements this water with surface water from a major stream. Ground water is drawn from a layer of sand and gravel below at a depth of about 150 feet. This layer is below glacial till. Wells drilled into this layer generally supply adequate quantities of water. Wells drilled only into the glacial till yield very little water. Wells deeper in the limestone generally can yield water only if they are drilled into cracks and voids in the rock, which hold water. Teays Valley, an old subterranean valley running east to west through the counties, is beneath the glacial till. This valley was filled with sand and gravel. Water is plentiful in this aquifer. Wells drilled into this deposit average about 400 feet deep.

Trends in Population and Land Use

The population is 15,570 in Blackford County and 22,389 in Jay County. It increased by 5.0 percent in Blackford County and 0.8 percent in Jay County during the period 1960 to 1980.

During the period 1970 to 1980, about 500 acres in Blackford County was converted from agricultural to urban uses and about 200 acres in Jay County was converted from woodland to cropland. These trends are likely to continue in the future. The conversion from agricultural to urban uses probably will accelerate as people move in from the larger nearby cities.

Climate

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

Blackford and Jay Counties are cold in winter but quite hot in summer. Winter precipitation, frequently snow, results in a good accumulation of soil moisture by spring and minimizes drought during summer on most soils. Normal annual precipitation is adequate for all the crops that are adapted to the temperature and length of growing season in the counties.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Berne, Indiana, in the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 28 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Berne on January 24, 1963, is -18 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred on September 2, 1953, is 101 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 36.36 inches. Of this, about 21 inches, or 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 4.88 inches at Berne on September 20, 1957. Thunderstorms occur on about 40 days each year, and most occur in summer. Tornadoes and severe thunderstorms occur occasionally. These storms are usually local in extent and of short duration and cause damage in a variable pattern.

The average seasonal snowfall is about 29 inches. The greatest snow depth at any one time during the period of record was 14 inches. On the average, 17 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.

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 broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in 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 map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

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

Each map unit is rated for *cultivated crops, specialty crops, woodland, urban uses,* and *intensive recreation areas.* Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments. Intensive recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic.

The names, descriptions, and delineations of the soils identified on the general soil map of this survey area 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.

Soil Descriptions

1. Bono-Houghton

Nearly level, very poorly drained, clayey and mucky soils formed in lacustrine clay over outwash material and in organic deposits; in depressions on lake plains, till plains, and moraines

This map unit is in large, nearly level or slightly concave areas that are subject to ponding.

This unit makes up about 1 percent of the counties. It is about 70 percent Bono soils, 10 percent Houghton soils, and 20 percent soils of minor extent.

Bono soils are on lake plains. Typically, they have a clayey surface layer and subsoil.

Houghton soils are in depressions. Typically, they are muck to a depth of more than 50 inches.

The minor soils in this unit are the somewhat poorly drained Blount soils in the higher lying areas, Bono Variant soils in the lower lying areas, the moderately well drained Glynwood soils in the higher lying areas, and the poorly drained Pewamo soils in drainageways.

This unit is used mainly for cultivated crops, such as corn, soybeans, and wheat. Some areas are used for woodland. Very few are used for pasture or hay. A few areas are idle and suitable for the development of wildlife habitat.

This unit has only fair potential for cultivated crops because of wetness. A surface drainage system helps to prevent the damage caused by ponding, and additional subsurface tile drainage also reduces the wetness. Plowing when the soils are wet can cause surface compaction and the formation of clods. Excessive drainage and intensive cultivation cause substantial decomposition of the muck. Overgrazing pastures during wet periods causes surface compaction and reduces plant density.

This unit has poor potential for trees because of the wetness. Harvesting is usually confined to dry periods or to periods when the ground is frozen. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns.

This unit is generally unsuited to building site development and sanitary facilities. A seasonal high water table and ponding in areas of both the major soils and seepage and low strength in the Houghton soils are the main limiting factors.

2. Saranac-Eel

Nearly level, very poorly drained and moderately well drained, clayey and loamy soils formed in alluvium; on flood plains

This map unit is on nearly level bottom land that is frequently or occasionally flooded by overflowing streams and drainageways. It is generally adjacent to more sloping morainic ridges.

This unit makes up about 3 percent of the counties. It is about 59 percent Saranac soils, 25 percent Eel soils, and 16 percent soils of minor extent.

Saranac soils are very poorly drained. Typically, they have a clay surface layer and a clayey or loamy subsoil.

Eel soils are moderately well drained. Typically, they have a clay loam surface layer and loamy underlying material.

The minor soils in this unit are the moderately well drained Glynwood soils on the higher lying uplands and the very poorly drained Houghton and Wallkill Variant soils in depressions. The Houghton soils are muck throughout, and the Wallkill Variant soils have muck in the underlying material.

This unit is used mainly for cultivated crops, such as corn, soybeans, and wheat. Some areas are used for pasture or hay or for woodland. A few areas are idle.

The Saranac soils have poor potential for cultivated crops because of the flooding and the wetness, but the Eel soils have good potential. A surface drainage system helps to prevent flood damage. Providing additional subsurface drainage reduces the wetness. Plowing when the soils are wet causes surface compaction and the formation of clods. Overgrazing pastures during wet periods causes surface compaction and reduces plant density.

The Saranac soils have poor potential for trees because of the flooding and the wetness, but the Eel soils have good potential. Harvesting is usually confined to dry periods or to periods when the ground is frozen. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns.

This unit is generally unsuited to building site development and sanitary facilities. The flooding and a seasonal high water table are the main limiting factors.

3. Blount-Pewamo-Glynwood

Nearly level and gently sloping, poorly drained to moderately well drained, silty, clayey, and loamy soils formed in glacial till; on till plains and moraines

This map unit is on glacial till uplands that are characterized by slight swells and swales. Areas are fairly large and are between rolling moraines.

This unit makes up about 46 percent of the counties. It is about 45 percent Blount soils, 40 percent Pewamo soils, 10 percent Glynwood soils, and 5 percent soils of minor extent (fig. 1).

The somewhat poorly drained, nearly level and gently sloping Blount soils are on till plains. Typically, they have a silt loam surface layer and a clayey subsoil.

The poorly drained, nearly level Pewamo soils are in drainageways or depressions on till plains and moraines. Typically, they have a silty clay surface layer and a clayey subsoil.

The moderately well drained, nearly level and gently sloping Glynwood soils are on convex slopes on till plains and moraines. Typically, they have a clay loam surface layer and a clayey subsoil.

The minor soils in this unit are the very poorly drained Bono soils in the lower lying depressions. These soils formed in lacustrine deposits over outwash material.

This unit is used dominantly for cultivated crops, such as corn, soybeans, and wheat. A few areas are wooded or pastured.

The wetness of the Blount and Pewamo soils is the main limitation affecting both agricultural and urban uses. Erosion is the major hazard on the Glynwood soils. Most of the wetter areas are artificially drained. Additional drainage, however, would further reduce the wetness.

This unit has good potential for cultivated crops if adequately drained. Erosion-control measures are needed in the more sloping areas to help prevent excessive soil loss during cultivation. Ponding is common in winter and spring in the lower lying areas of the Pewamo soils. Overgrazing pastures during wet periods causes surface compaction and reduces plant density.

This unit generally has good potential for trees. The Pewamo soils, however, have poor potential because of the wetness. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Trees are usually harvested during extremely dry periods or during periods when the soil is frozen.

This unit has poor potential for building site development and sanitary facilities. Moderately slow or slow permeability and a seasonal high water table are the main limiting factors. Ponding is an additional limiting factor on the Pewamo soils.

4. Glynwood-Blount-Pewamo

Nearly level to moderately sloping, moderately well drained to poorly drained, loamy, silty, and clayey soils formed in glacial till; on till plains and moraines

This map unit is on glacial till uplands that are characterized by rolling or undulating till plains and moraines.

This unit makes up about 32 percent of the counties. It is about 45 percent Glynwood soils, 30 percent Blount soils, 20 percent Pewamo soils, and 5 percent soils of minor extent (fig. 2).

The moderately well drained, gently sloping and moderately sloping Glynwood soils are on convex slopes

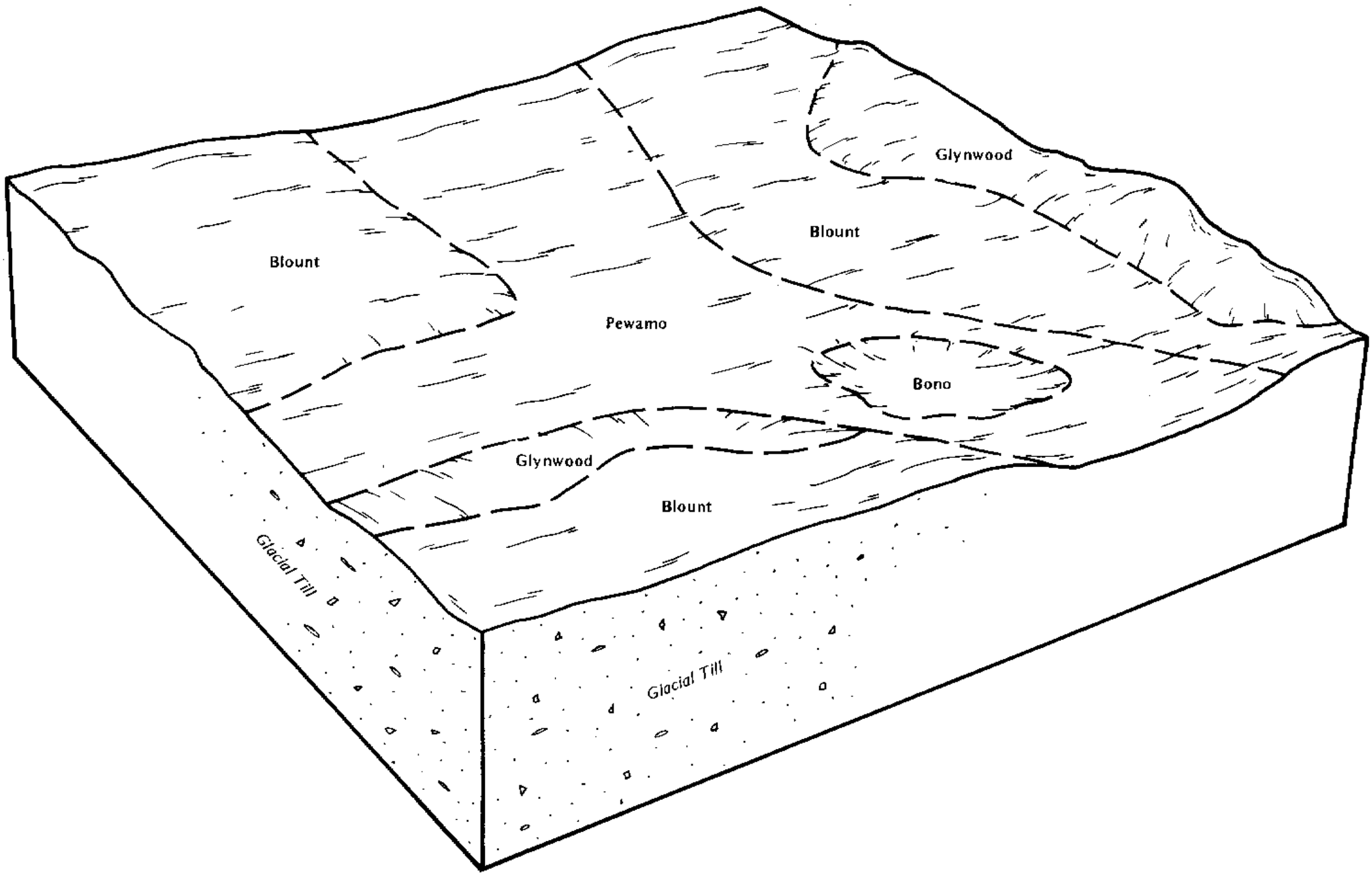

Figure 1.—Pattern of soils and underlying material in the Blount-Pewamo-Glynwood map unit.

on till plains and moraines. Typically, they have a clay loam surface layer and a clayey subsoil.

The somewhat poorly drained, nearly level and gently sloping Blount soils are on till plains and on the tops and bases of rises and ridges. Typically, they have a silt loam surface layer and a clayey subsoil.

The poorly drained, nearly level Pewamo soils are in drainageways and depressions on till plains and moraines. Typically, they have a silty clay surface layer and a clayey subsoil.

The minor soils in this unit are the very poorly drained Saranac soils in the larger drainageways. These soils formed in alluvium.

This unit is used mainly for cultivated crops, such as corn, soybeans, and wheat. Some areas are used for pasture or hay or for woodland. A few areas are idle.

This unit has good potential for cultivated crops. Erosion-control measures are needed on the Glynwood soils. Artificial drainage reduces the wetness of the Blount and Pewamo soils. Overgrazing pastures during wet periods causes surface compaction and reduces plant density.

This unit has good potential for trees. Harvesting on Blount and Pewamo soils is usually confined to dry periods or to periods when the ground is frozen.

This unit has poor potential for building site development and sanitary facilities. Moderately slow or slow permeability and a seasonal high water table are the main limiting factors. Ponding is an additional limiting factor on the Pewamo soils.

5. Eldean

Nearly level to moderately sloping, well drained, loamy and silty soils formed in outwash material; on outwash plains and terraces

This map unit is on outwash plains and terraces characterized by rolling and undulating slopes and by many kames, ridges, and small valleys.

This unit makes up about 1 percent of the counties. It is about 70 percent Eldean soils and 30 percent soils of minor extent (fig. 3).

Typically, Eldean soils have a clay loam surface layer and a gravelly clay or gravelly sandy clay subsoil.

The minor soils in this unit are the somewhat poorly drained Blount soils, the very poorly drained Bono soils, the moderately well drained Glynwood soils, and the poorly drained Pewamo soils. All of these soils are in the lower lying areas.

This unit is used mainly for cultivated crops, such as corn, soybeans, and wheat. Some areas are pastured or wooded. Most of the woodland is in the steeper areas and in abandoned gravel pits.

A severe erosion hazard and droughtiness are the main management concerns affecting agricultural uses. The droughtiness can be lessened by crop residue management. Erosion can be controlled by a cropping sequence that includes grasses and legumes, a system of conservation tillage that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, terraces, or a combination of these.

This unit has only fair potential for cultivated farm crops because of past erosion, a severe hazard of further erosion, and low available water capacity. Overgrazing pastures during wet periods causes surface compaction and reduces plant density.

This unit has good potential for trees. Plant competition is moderate.

This unit has fair potential for building site development. It is poorly suited to sanitary facilities because of the poor filtering capacity of the sand and gravelly sand in the underlying material.

6. Glynwood

Gently sloping and moderately sloping, moderately well drained, loamy soils formed in glacial till; on till plains and moraines

This unit is on morainic ridges characterized by long, convex or plane slopes and breaks adjacent to

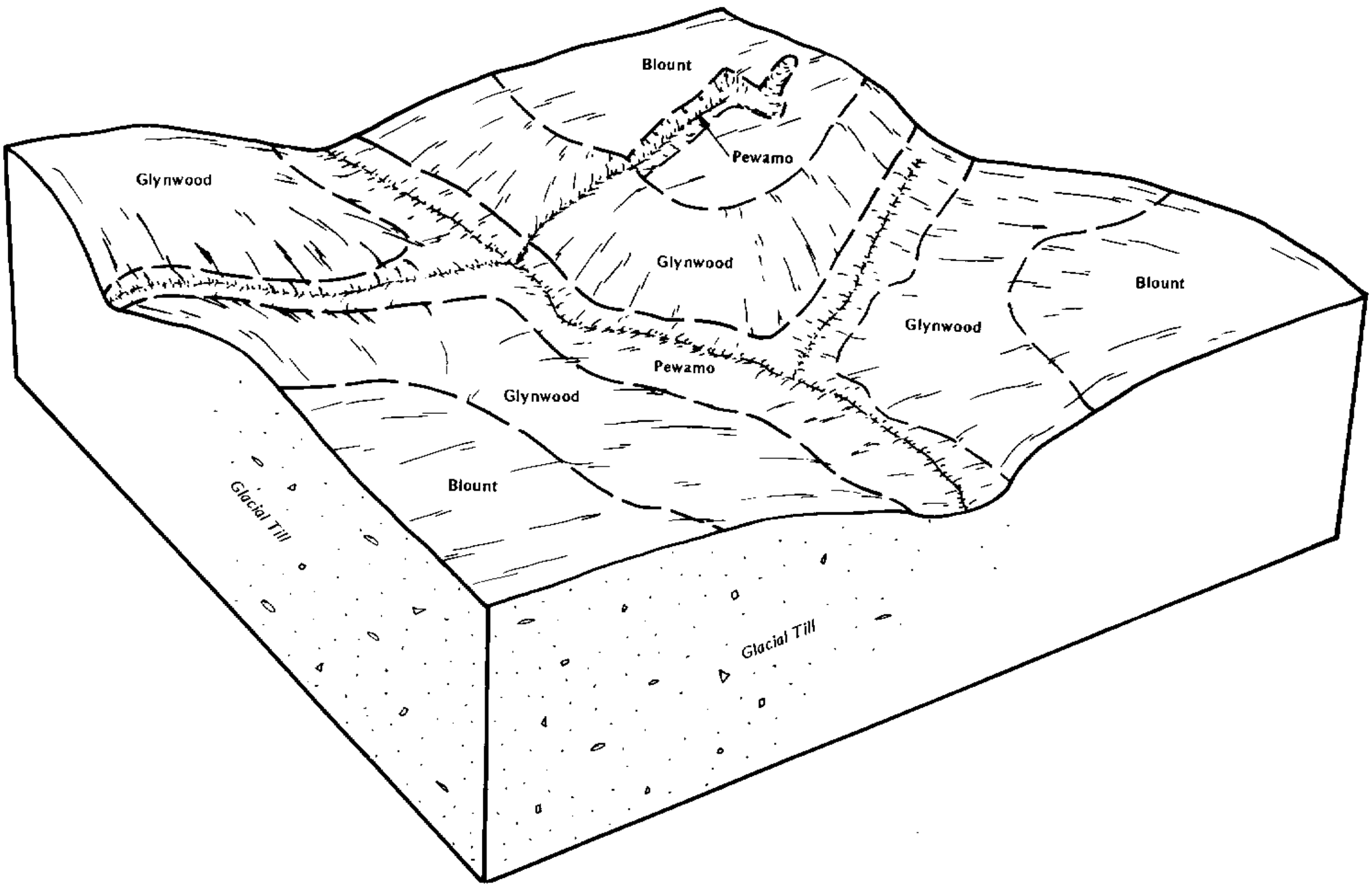

Figure 2.—Pattern of soils and underlying material in the Glynwood-Blount-Pewamo map unit.

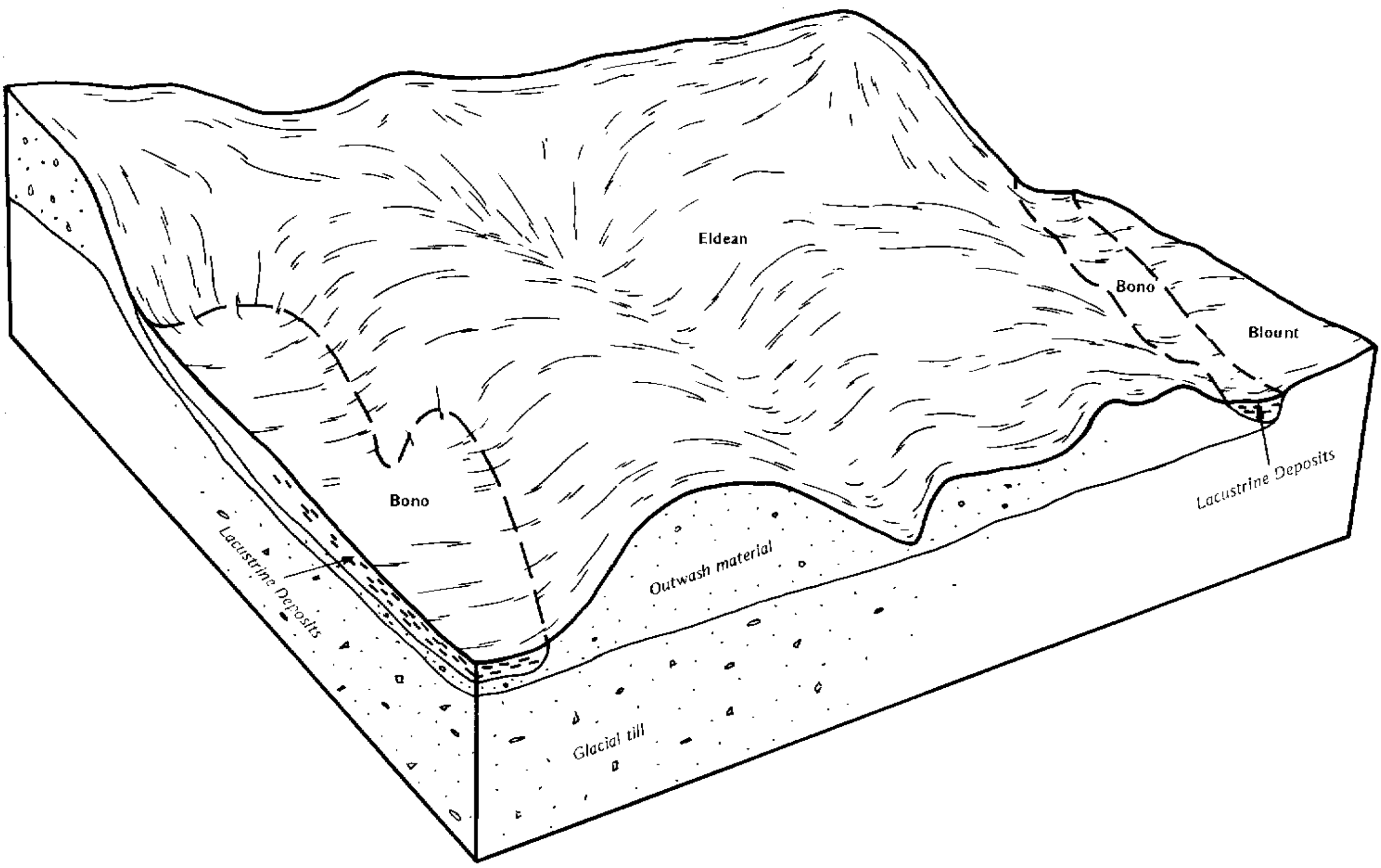

Figure 3.—Pattern of soils and underlying material in the Eldean map unit.

drainageways. The landscape is dissected by many small streams.

This unit makes up about 17 percent of the counties. It is about 65 percent Glynwood soils and 35 percent soils of minor extent.

Typically, Glynwood soils have a clay loam surface layer and a clay and clay loam subsoil.

The minor soils in this unit are the somewhat poorly drained, nearly level and gently sloping Blount soils on ridgetops; Eel Variant soils in narrow drainageways; the well drained, strongly sloping Morley soils on breaks to narrow drainageways; and the poorly drained Pewamo soils in depressions and drainageways. The Eel Variant soils formed in alluvium.

This unit is used dominantly for cultivated crops, such as corn, soybeans, and wheat. Some areas are wooded, and a few areas are pastured.

A severe erosion hazard is the main management concern affecting agricultural uses. Wetness is a limitation in the nearly level and gently sloping areas. A subsurface drainage system reduces the wetness.

This unit has poor potential for cultivated crops because of the past erosion and a severe hazard of further erosion. Overgrazing pastures during wet periods causes surface compaction and reduces plant density.

This unit has good potential for trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are the main management concerns. Replanting of seedlings may be necessary.

This unit has only fair potential for building site development because the wetness is a moderate limitation. It is poorly suited to sanitary facilities because of slow permeability and the wetness.

Broad Land Use Considerations

The major land use in Blackford and Jay Counties is cropland. Corn, soybeans, and wheat are the dominant crops. Although the survey area is used mainly for cash grain crops, hog, beef, and dairy enterprises contribute substantially to the economy. Most of the general soil map units are suited or well suited to these land uses.

The main management concerns are flooding on the Saranac-Eel unit, wetness on the Blount-Pewamo-Glynwood unit, and the erosion hazard on the Glynwood soils in the Blount-Pewamo-Glynwood, Glynwood-Blount-Pewamo, and Glynwood units. Adequate surface and subsurface water management is needed on all of the units, except for the Eldean unit. Even in the Eldean unit, artificial drainage of some type is needed in areas of the minor soils. Many areas throughout the units are adequately drained, but in some areas additional drainage is needed. The Glynwood unit is poorly suited or unsuited to cultivated crops because of past erosion and a severe hazard of further erosion.

The map units are either poorly suited or well suited to trees. The Eldean and Glynwood units are better suited than the other units. The Bono-Houghton and the Saranac units have the most limitations. The organic soils are poorly suited to trees. Wetness and a high content of clay limit tree growth in all of the units. Because of these limitations, woodlots can be severely damaged by logging operations. The trees should be logged during periods when the ground is frozen or during dry periods. The trend toward cash grain crops is causing rapid destruction of small and large wooded areas throughout the counties. The merchantable timber is sold and the remaining trees are destroyed, leaving little or no chance for young trees to grow and supply wood for the near future.

The general soil map is useful in locating areas that have the fewest limitations and hazards for building site development. Residential and urban developments can be established in areas that are not prime farmland, such as areas of the Eldean and Glynwood units. These units have the fewest limitations and hazards for building site development, but they both have severe limitations if used as sites for septic tank absorption fields. All of the other units have severe limitations or hazards if used as sites for buildings and septic tank absorption fields. These limitations and hazards include flooding on the Saranac-Eel unit and wetness and ponding on the Blount-Pewamo-Glynwood unit.

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, Martinsville loam, 2 to 6 percent slopes, eroded, is one of several phases in the Martinsville series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, 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. Blount-Glynwood, thin solum complex, 0 to 3 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. 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.

The names, descriptions, and delineations of the soils identified on the detailed soil maps of this survey area 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 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

BIA—Blount-Glynwood, thin solum complex, 0 to 3 percent slopes. These deep, nearly level and gently sloping soils are on till plains. Areas range from 4 to 500 acres in size. The dominant size is about 80 acres.

This map unit is about 70 percent Blount soil and 20 percent Glynwood soil. The somewhat poorly drained Blount soil is in nearly level areas, and the moderately well drained Glynwood soil is on gently sloping ridges, knolls, and breaks to drainageways. Areas of these soils are so intricately mixed or so small that separating them in mapping is not practical.

In a typical profile, the Blount soil has a surface layer of dark brown silt loam about 9 inches thick. The subsoil is yellowish brown, mottled, firm silty clay, clay, and silty clay loam about 25 inches thick. The underlying material to a depth of 60 inches is yellowish brown, very firm silty clay loam. In some areas it is stratified. In a few places the depth to free carbonates is less than 16 inches. In some places the depth to the underlying material is more than 45 inches. In other places the surface layer contains more clay. In some areas the subsoil contains less clay.

In a typical profile, the Glynwood soil has a surface layer of brown clay loam about 9 inches thick. The subsoil is about 12 inches thick. It is yellowish brown, mottled, firm clay loam, silty clay loam, and silty clay. The underlying material to a depth of 60 inches is yellowish brown, very firm silty clay loam. In some places the slope is more than 3 percent. In other places the depth to the underlying material is less than 16 or more than 30 inches thick. In some areas the upper part of the subsoil does not have gray colors. In other areas the surface layer is silt loam. In a few places the underlying material is stratified. In places the upper part of the soil has more sand.

Included with these soils in mapping are the poorly drained, nearly level Pewamo soils in the lower lying depressional areas. These included soils make up about 10 percent of the map unit.

The Blount and Glynwood soils are slowly permeable. Organic matter content in the surface layer is moderate. Available water capacity is moderate. The water table in the Blount soil is at a depth of 1.0 to 3.0 feet late in winter and in spring. That in the Glynwood soil is at a depth of 2.0 to 3.5 feet late in winter and in spring. Surface runoff is slow on the Blount soil and medium on the Glynwood soil. The surface layer of the Blount soil is friable and can be easily tilled. That of the Glynwood soil is firm and can be fairly easily tilled under the proper moisture conditions. Cultivating when this soil is too wet results in compaction and the formation of clods.

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

These soils are well suited to corn, soybeans, and small grain. The wetness is the major limitation, and erosion is the major hazard. Subsurface drains and open ditches help to remove excess water. Erosion can be controlled by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface (fig. 4), contour farming, grassed waterways, terraces, or a combination of these. Crop residue management improves or maintains tilth and organic matter content.

These soils are well suited to grasses and legumes for hay or pasture. The Blount soil is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. Erosion is a hazard in pastured areas of the Glynwood soil. Once established, however, a cover of grasses and legumes is effective in controlling erosion. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing,

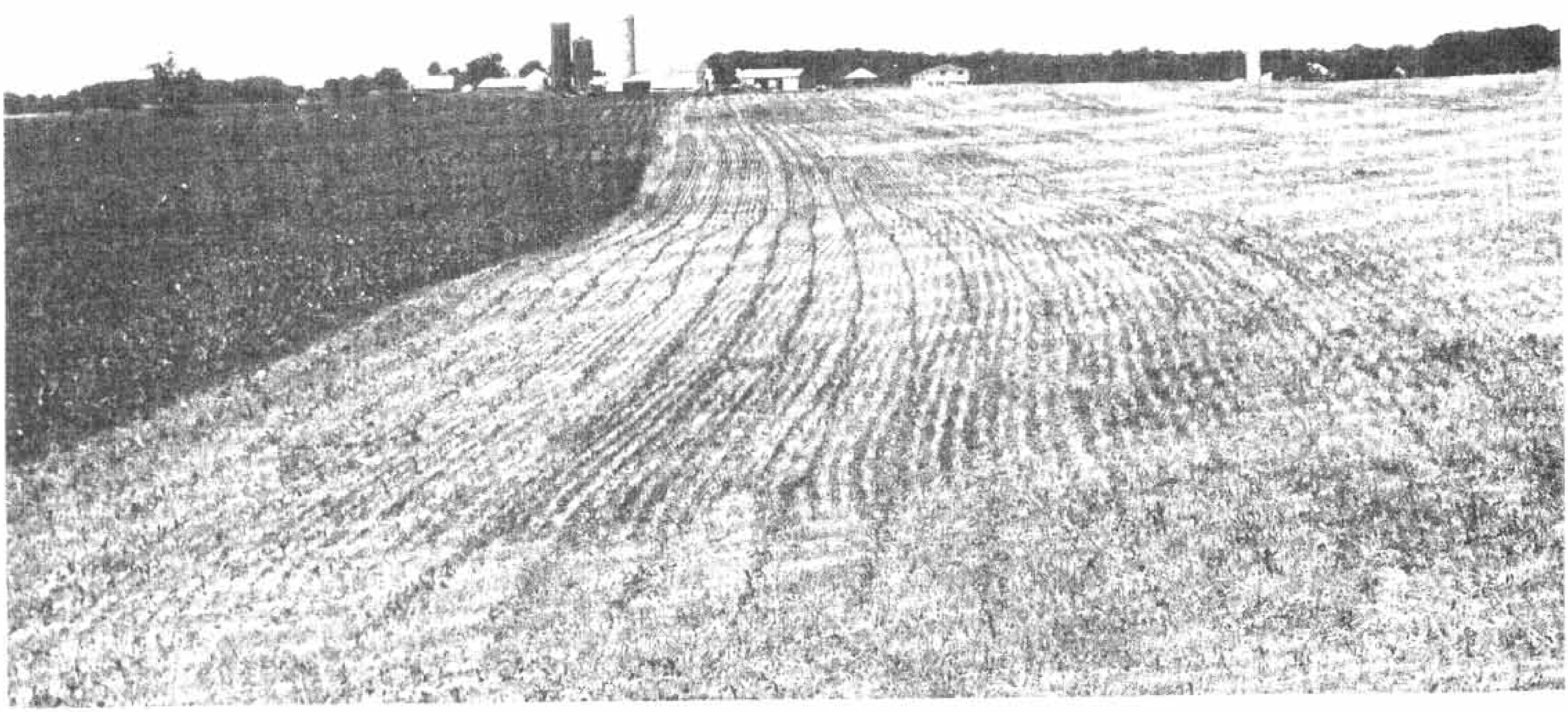

Figure 4.—Corn and soybeans planted in wheat stubble on Blount and Glynwood soils. No-till planting helps to control erosion and conserves moisture.

and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

These soils are fairly well suited to trees. Seedling mortality, the windthrow hazard, plant competition, and the erosion hazard are management concerns. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation. The use of special planting stock helps to overcome seedling mortality. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Laying out logging trails on the contour helps to control erosion. The trees, especially those on the Blount soil, should be logged during dry periods or during periods when the ground is frozen.

Because of the wetness, these soils are severely limited as sites for dwellings with basements. They are limited as sites for dwellings without basements because of the wetness of both soils and the shrink-swell potential of the Glynwood soil. Installing subsurface drains lowers the water table and thus helps to keep the wetness from becoming a problem. Dwellings should be constructed without basements. Backfilling with coarser material helps to prevent the damage to foundations and basement walls caused by shrinking and swelling.

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

These soils are severely limited as sites for septic tank absorption fields because of the wetness and the slow permeability. Installing perimeter subsurface drains lowers the water table. Enlarging the absorption field helps to compensate for the slow permeability. Installing the fields when the soils are dry helps to keep the excavated sides from sealing. Scarification of the sides allows fluid to move out of the bed.

The Blount soil is assigned to land capability classification IIw and woodland ordination symbol 3c. The Glynwood soil is assigned to land capability classification IIIe and woodland ordination symbol 2c.

Bo—Bono silty clay. This nearly level, deep, very poorly drained soil is on lake plains. It is subject to ponding. Areas range from 4 to 400 acres in size. The dominant size is about 60 acres.

In a typical profile, the surface layer is very dark grayish brown silty clay about 9 inches thick. The subsurface layer is very dark grayish brown, mottled clay about 5 inches thick. The subsoil is about 35 inches thick. The upper part is grayish brown and olive gray, mottled, firm clay. The lower part is olive gray, mottled, firm silty clay. The upper part of the underlying material is stratified, olive, friable silt loam and very fine sand. The lower part to a depth of 70 inches is stratified, yellow, loose coarse sand and gray, loose fine sand. In some places the surface layer is muck. In other places as much as 15 inches of loam is on the surface. In some areas the slope is more than 2 percent. In other areas the subsoil has less clay.

Included with this soil in mapping are the somewhat poorly drained Blount soils in the higher lying areas, the moderately well drained Glynwood soils on the higher lying convex slopes, and the organic Houghton soils in the lower lying areas. Included soils make up 10 to 15 percent of the map unit.

The Bono soil is slowly permeable. Organic matter content in the surface layer is high. Available water capacity is high. Surface runoff is very slow. Ponding is common in many areas. The water table is at or above the surface late in winter and in spring. The surface layer is firm and very difficult to till. Tilling when the soil is too dry or too wet results in compaction and the formation of clods.

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

If adequately drained, this soil is fairly well suited to corn, soybeans, and small grain. The wetness is the major limitation. Surface drains, subsurface drains, and open ditches help to remove excess water. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to prevent compaction and improves soil structure and tilth.

This soil is well suited to grasses and legumes for hay and pasture. It is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. Overgrazing and grazing when the soil is wet reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting, logging, and planting. The trees should be logged during dry periods or during periods when the ground is frozen. Replanting may be necessary. Water-tolerant species are favored in timber stands. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation. The use of special planting stock helps to overcome seedling mortality. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because the ponding and the shrink-swell potential are severe limitations, this soil is generally unsuitable as a site for dwellings. It is generally unsuitable as a site for septic tank absorption fields because the ponding and the slow permeability are severe limitations. The soil is severely limited as a site for local roads because of the ponding, the shrink-swell potential, and low strength. Constructing the roads on raised, well compacted fill material and installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by ponding and frost action. Providing better suited base material improves the capacity of the roads to support vehicular traffic.

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

Bs—Bono Variant mucky silty clay. This nearly level, deep, very poorly drained soil is in depressions on lake plains. It is subject to ponding. Areas range from 4 to 160 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is black mucky silty clay about 10 inches thick. The subsoil is dark grayish brown, gray, and grayish brown, mottled, firm silty clay about 23 inches thick. The upper part of the underlying material is grayish brown and gray, firm silty clay stratified with thin layers of very fine sand. The lower part to a depth of 60 inches is gray, firm silty clay. In some areas clay loam is within a depth of 60 inches. In other areas the soil does not have free carbonates within a depth of 60 inches. In some places as much as 5 inches of silty overwash is on the surface. In other places the mucky surface layer is more than 16 inches thick.

Included with this soil in mapping are the somewhat poorly drained Blount soils in the higher lying areas. Also included are Bono soils on slight rises. Included soils make up 5 to 10 percent of the map unit.

The Bono Variant soil is very slowly permeable. Organic matter content in the surface layer is very high. Available water capacity is high. Surface runoff is very slow. Ponding is common in many areas. The water table is at or above the surface late in winter and in spring. The surface layer is friable and can be easily tilled under the proper moisture conditions. Cultivating when the soil is too wet, however, results in compaction.

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

If adequately drained, this soil is fairly well suited to corn, soybeans, and small grain. It is suited to intensive row cropping only if the drainage system is properly managed. Excessive drainage and intensive cultivation cause further decomposition of the organic portion of the surface layer. The wetness is the major limitation. Subsurface drains, surface drains, and open ditches help to remove excess water. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to prevent compaction and improves soil structure and tilth.

This soil is well suited to grasses and legumes for hay and pasture. It is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting, logging, and planting. The trees should be logged during dry periods or during periods when the ground is frozen. Replanting may be necessary. Water-tolerant species are favored ir timber stands. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation. Using special planting stock and overstocking help to overcome seedling mortality. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because the ponding and the shrink-swell potential are severe limitations, this soil is generally unsuitable as a site for dwellings. It is generally unsuitable as a site for septic tank absorption fields because the ponding and the slow permeability are severe limitations. The soil is limited as a site for local roads because of the ponding, the shrink-swell potential, and low strength. Constructing the roads on raised, well compacted fill material and installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by ponding. Providing better suited base material improves the capacity of the roads to support vehicular traffic.

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

Ee—Eel clay loam, frequently flooded. This nearly level, deep, moderately well drained soil is on broad bottom land. It is frequently flooded for brief periods late in winter and early in spring. Areas range from 10 to 600 acres in size. The dominant size is about 160 acres.

In a typical profile, the surface layer is brown clay loam about 9 inches thick. The underlying material extends to a depth of more than 60 inches. The upper part is brown, mottled clay loam. The next part is brown and yellowish brown, mottled loam. The lower part is dark brown and grayish brown, mottled sandy loam and loam. In some areas the dark surface layer is thick. In other areas the underlying material does not have grayish brown mottles. In some places it contains more sand or clay. In other places the upper part of underlying material is grayish brown.

Included with this soil in mapping are the well drained Martinsville soils in the slightly higher lying areas and the very poorly drained Saranac soils in the slightly lower depressions. These soils make up 10 to 15 percent of the map unit.

The Eel soil is moderately permeable. Organic matter content in the surface layer is moderately low. Available water capacity is very high. The seasonal high water table is at a depth of 1.5 to 3.0 feet. Surface runoff is slow. The surface layer is friable and can be fairly easily tilled under the proper moisture conditions.

Most areas of this soil are used for cultivated crops. Some are used for woodland.

This soil is well suited to corn and soybeans. The flooding is the major hazard. If a good surface drainage system is installed, crops can be planted after floodwater recedes. Replanting of crops may be necessary because of the flooding. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to maintain organic matter content and good tilth.

This soil is well suited to grasses and legumes for hay or pasture; however, alfalfa can be severely damaged by floodwater. Overgrazing or grazing when the soil is too wet causes surface compaction and poor tilth. Overgrazing also reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. No major management concerns affect planting or harvesting.

Because the wetness and the flooding are severe limitations, 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 flooding and frost action. Constructing the roads on raised, well compacted fill material and installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by flooding and frost action. Providing better suited base material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 1a.

Ef—Eel Variant silty clay, occasionally flooded. This nearly level, moderately well drained soil is in the higher lying areas on bottom land. It is occasionally flooded for brief periods late in winter and early in spring. Areas range from 20 to 80 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is dark brown silty clay about 6 inches thick. The subsurface layer is also dark brown silty clay. It is about 5 inches thick. The underlying material to a depth of 80 inches is yellowish brown and brown, mottled, firm silty clay and silty clay loam. In some areas the underlying material contains less clay.

Included with this soil in mapping are the well drained Eldean soils on the higher lying outwash plains and the very poorly drained Saranac soils in the lower lying depressions. These soils make up 10 to 15 percent of the map unit.

The Eel Variant soil is moderately slowly permeable. Organic matter content in the surface layer is moderate. Available water capacity is high. The water table is often at a depth of 1.5 to 3.0 feet. Surface runoff is slow. The surface layer is firm and very difficult to till. Cultivating when the soil is too wet results in compaction and the formation of clods.

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

This soil is well suited to corn and soybeans. The flooding and the wetness are the main management concerns. Replanting of crops may be necessary because of the flooding. Excess water can be removed by open ditches, subsurface drains, or a combination of these. A conservation tillage system that leaves protective amounts of crop residue on the surface maintains organic matter content and good tilth.

This soil is well suited to grasses and legumes for hay or pasture; however, alfalfa can be severely damaged by floodwater in areas not protected by levees. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. No major management concerns affect planting or harvesting.

Because the flooding, the wetness, and the slow permeability are severe limitations, 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 flooding, low strength, and frost action. Constructing the roads on raised, well compacted fill material and installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by flooding and frost action. Providing better suited base material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 1a.

ElA—Eldean silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is moderately deep over sand and gravel. It is on outwash plains and stream terraces. Areas range from 4 to 80 acres in size. The dominant size is about 30 acres.

In a typical profile, the surface layer is dark brown silt loam about 7 inches thick. The subsurface layer is dark brown loam about 4 inches thick. The subsoil is about 22 inches thick. The upper part is brown, firm gravelly clay. The lower part is strong brown, firm gravelly clay loam. The underlying material to a depth of 60 inches is light yellowish brown, loose gravelly coarse sand. In some areas the subsoil contains less clay. In other areas the subsoil and the underlying material do not have gravel. In places the underlying material is glacial till. In some places the lower part of the subsoil has gray mottles. In other places the depth to the underlying material is more than 40 inches. In some areas the slope is more than 2 percent.

Included with this soil in mapping are the moderately well drained Eel Variant soils in the higher lying areas on bottom land and the somewhat poorly drained Whitaker soils in the lower lying areas on outwash terraces. These soils make up about 10 to 15 percent of the unit.

The Eldean soil is moderately slowly permeable in the subsoil and rapidly permeable in the underlying material. Organic matter content in the surface layer is moderate. Available water capacity is low. Surface runoff is slow. The surface layer is friable and can be fairly easily tilled under the proper moisture conditions. Cultivating when the soil is too wet, however, results in the formation of clods.

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

This soil is well suited to corn, soybeans, and small grain. It is droughty during extended dry periods. Crop residue management conserves soil moisture.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

Some areas are forested. This soil is well suited to trees. Plant competition is a management concern. It can be controlled by proper site preparation or by cutting, spraying, or girdling.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is well suited to dwellings with basements. Backfilling with coarser material helps to prevent the damage caused by shrinking and swelling. This soil is severely limited as a site for local roads and streets because of low strength. Providing better suited base material improves the capacity of the roads and streets to support vehicular traffic. The soil is severely limited as a site for septic tank absorption fields because of a poor filtering capacity, which can result in the pollution of ground water supplies.

The land capability classification is IIs. The woodland ordination symbol is 2a.

EnB3—Eldean clay loam, 2 to 6 percent slopes, severely eroded. This gently sloping, well drained soil is moderately deep over sand and gravel. It is on outwash plains and stream terraces. Areas range from 4 to 150 acres in size. The dominant size is about 40 acres.

In a typical profile, the surface layer is dark brown clay loam about 8 inches thick. The subsoil is reddish brown, firm gravelly clay and gravelly sandy clay about 24 inches thick. The underlying material to a depth of 60 inches is yellowish brown and pale brown gravelly coarse sand. In some areas the subsoil has less clay. In other areas the subsoil and the underlying material do not have gravel. In some places they are glacial till. In other areas the slope is less than 2 or more than 6 percent.

Included with this soil in mapping are the moderately well drained Eel Variant soils in the higher lying areas on bottom land and the somewhat poorly drained Whitaker soils in the lower lying convex areas on outwash terraces. These soils make up about 10 to 15 percent of the map unit.

The Eldean soil is moderately slowly permeable in the upper part and rapidly permeable in the underlying material. Organic matter content in the surface layer is moderate. Available water capacity is low. Surface runoff is medium. The surface layer is firm but can be easily tilled under the proper moisture conditions. Cultivating when the soil is too wet results in the formation of clods.

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

This soil is well suited to corn, soybeans, and small grain. It is droughty during extended dry periods. Erosion is the major hazard. It can be controlled by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, grassed waterways, terraces, or a combination of these. Crop residue management improves or maintains tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Erosion is a hazard. Once established, however, a cover of grasses and legumes is effective in controlling erosion. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent compaction and maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is a management concern. Replanting may be necessary. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is well suited to dwellings with basements. Backfilling with coarser material helps to prevent the damage caused by shrinking and swelling. The soil is severely limited as a site for local roads and streets because of low strength. Providing better suited base material improves the capacity of the roads and streets to support vehicular traffic. The soil is severely limited as a site for septic tank absorption fields because of a poor filtering capacity, which can result in the pollution of ground water supplies.

The land capability classification is IIIe. The woodland ordination symbol is 2a.

EnC3—Eldean clay loam, 6 to 12 percent slopes, severely eroded. This moderately sloping, well drained soil is moderately deep over sand and gravel. It is on outwash plains and stream terraces. Areas range from 5 to 40 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark brown clay loam about 9 inches thick. The subsoil is about 13 inches thick. It is dark reddish brown, firm sandy clay and sandy clay loam. The underlying material to a depth of 60 inches is pale brown, loose sand and gravelly coarse sand. In some areas the subsoil contains less clay. In other areas the subsoil and underlying material contain less gravel. In some places the underlying material is at a depth of 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 the moderately well drained Eel Variant soils in the higher lying areas on bottom land and the somewhat poorly drained Whitaker soils in the lower lying areas on outwash terraces. These soils make up 10 to 15 percent of the map unit.

The Eldean soil is moderately slowly permeable in the upper part and rapidly permeable in the underlying material. Organic matter content in the surface layer is moderate. Available water capacity is low. Surface runoff is rapid. The surface layer is firm and can be fairly easily tilled under the proper moisture conditions. Cultivating when the soil is too wet, however, results in the formation of clods.

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

This soil is poorly suited to cultivated crops. It is droughty during extended dry periods. Erosion is a severe hazard. It can be controlled by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, grassed waterways, terraces, or a combination of these. Crop residue management improves or maintains tilth and organic matter content.

This soil is fairly well suited to grasses and legumes for hay or pasture. Erosion is a hazard. Once established, however, a cover of grasses and legumes is effective in controlling erosion. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent compaction and maintain good tilth and plant density.

This soil is well suited to trees. Plant competition is a management concern. Replanting may be necessary. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation.

Because of the slope, this soil is moderately limited as a site for dwellings. The shrink-swell potential also is a moderate limitation on sites for dwellings without basements. Backfilling with better suited material helps to prevent the damage caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land. The soil is severely limited as a site for local roads and streets because of low strength. Providing better suited base material improves the capacity of the roads and streets to support vehicular traffic. The soil is severely limited as a site for septic tank absorption fields because of a poor filtering capacity, which can result in the pollution of ground water supplies.

The land capability classification is IVe. The woodland ordination symbol is 2a.

GsB3—Glynwood clay loam, thin solum, 2 to 6 percent slopes, severely eroded. This gently sloping, deep, moderately well drained soil is on convex slopes on till plains and moraines (fig. 5). Areas range from 10 to 600 acres in size. The dominant size is about 80 acres.

In a typical profile, the surface layer is brown clay loam about 9 inches thick. The subsoil is about 11 inches thick. It is yellowish brown, mottled, and firm. The upper part is clay, and the lower part is clay loam. The underlying material to a depth of 60 inches is yellowish brown, very firm clay loam. In some areas the slope is less than 2 or more than 6 percent. In other areas the depth to the underlying material is less than 16 or more than 30 inches. In some places the subsoil is not mottled. In other places the surface layer and the subsoil have more sand and less clay.

Included with this soil in mapping are the somewhat poorly drained Blount soils in nearly level and gently sloping areas and the very poorly drained Bono and poorly drained Pewamo soils in the lower lying depressions. These soils make up 10 to 15 percent of the map unit.

The Glynwood soil is slowly permeable. Organic matter content in the surface layer is moderately low. Available water capacity is moderate. The water table is often at a depth of 2.0 to 3.5 feet late in winter and in spring. Surface runoff is medium. The surface layer is firm but can be fairly easily tilled under the proper moisture conditions. Cultivating when the soil is too wet results in the formation of clods.

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

This soil is poorly suited to corn, soybeans, and small grain. Erosion is the major management concern. It can be controlled by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, grassed waterways, terraces, or a combination of these. Crop residue management improves or maintains tilth and organic matter content.

This soil is fairly well suited to grasses and legumes for hay or pasture. Erosion is a hazard. Once established, however, a cover of grasses and legumes is effective in controlling erosion. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Seedling mortality, the windthrow hazard, and the erosion hazard are management concerns. Replanting may be necessary.

Figure 5.—An area of light colored Glynwood clay loam, thin solum, 2 to 6 percent slopes, severely eroded. The included Pewamo soils are in the dark areas.

Seedlings survive and grow well if competing vegetation is controlled by proper site preparation. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Laying out logging trails on the contour helps to control erosion.

Because of the wetness, this soil is severely limited as a site for dwellings with basements. It is limited as a site for dwellings without basements because of the wetness and the shrink-swell potential. Installing subsurface drains lowers the water table and thus helps to keep the wetness from becoming a problem. Backfilling with coarser material helps to prevent the damage to foundations, footings, and basement walls caused by shrinking and swelling.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Providing better suited base material helps to prevent the damage caused by frost action and improves the capacity of the roads and streets to support vehicular traffic. An adequate drainage system along the roads also helps to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the slow permeability. Installing perimeter subsurface drains lowers the water table. Enlarging the absorption field helps to compensate for the slow permeability. Installing the fields when the soil is dry helps to keep the sides from sealing. Scarification of the sides allows fluid to move out of the bed.

The land capability classification is IVe. The woodland ordination symbol is 2c.

GsC3—Glynwood clay loam, thin solum, 6 to 12 percent slopes, severely eroded. This moderately sloping, deep, moderately well drained soil is on convex slopes on till plains and moraines. Areas range from 5 to 80 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown clay loam about 9 inches thick. The subsoil is yellowish brown, mottled, firm clay about 5 inches thick. The underlying material to a depth of 60 inches is brown and yellowish brown, very firm clay loam. In some places the subsoil does not have mottles. In other places free carbonates are throughout the surface layer and subsoil. In some areas the slope is less than 6 or more than 12 percent.

Included with this soil in mapping are the somewhat poorly drained Blount soils in nearly level and gently sloping areas and the very poorly drained Bono and poorly drained Pewamo soils in the lower lying depressions. These soils make up 10 to 15 percent of the map unit.

The Glynwood soil is slowly permeable. Organic matter content in the surface layer is moderately low. Available water capacity is moderate. The water table is often at a depth of 2.0 to 3.5 feet late in winter and in spring. Surface runoff is rapid. The surface layer is firm but can be fairly easily tilled under the proper moisture conditions. Cultivating when the soil is too wet results in the formation of clods.

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

Because of a severe erosion hazard, this soil is generally unsuited to cultivated crops. It is poorly suited to grasses and legumes for hay or pasture. Erosion is a hazard. Once established, however, a cover of grasses and legumes is effective in controlling erosion. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. Seedling mortality, the windthrow hazard, and the erosion hazard are the main management concerns. Replanting may be necessary. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Laying out logging roads on the contour helps to control erosion.

Because of the wetness, this soil is severely limited as a site for dwellings with basements. It is limited as a site for dwellings without basements because of the wetness, the shrink-swell potential, and the slope. Installing subsurface drains lowers the water table and thus helps to keep the wetness from becoming a problem. Backfilling with coarser material helps to prevent the damage to foundations, footings, and basement walls caused by shrinking and swelling. The dwellings should be designed so that they conform to the natural slope of the land.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Providing better suited base material helps to prevent the damage caused by frost action and improves the capacity of the roads and streets to support vehicular traffic. An adequate drainage system along the roads also helps to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the wetness and the slow permeability. Installing perimeter subsurface drains lowers the water table. Enlarging the absorption field helps to compensate for the slow permeability. Installing the fields when the soil is dry helps to keep the sides from sealing. Scarification of the sides allows fluid to move out of the bed.

The land capability classification is VIe. The woodland ordination symbol is 2c.

Ho—Houghton muck, drained. This nearly level, deep, very poorly drained soil is in depressions on lake plains, till plains, and moraines. It is frequently ponded by surface runoff from adjacent areas. Areas range from 4 to 50 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is black muck about 12 inches thick. Below this to a depth of 60 inches is dark reddish brown and dark brown muck. In some areas the underlying material is coprogenous earth or marl. In other areas the muck is overlain by as much as 15 inches of silty overwash. In places the underlying material is silty clay loam, clay loam, or clay within a depth of 51 inches.

Included with this soil in mapping are the mineral Bono and Bono Variant soils in the slightly higher lying areas. These soils make up about 10 percent of the map unit.

The Houghton soil is moderately slowly permeable to moderately rapidly permeable. Organic matter content in the surface layer is very high. Available water capacity is very high. The water table is at or above the surface late in winter and in spring. Surface runoff is very slow. Ponding is common in most areas. The surface layer is very friable and can be easily tilled under a wide range of moisture conditions.

Most areas of this soil are drained and used for cultivated crops. A few are undrained and support grasses, cattails, or water-tolerant shrubs and trees.

This soil is fairly well suited to corn, soybeans, and small grain. The wetness and the ponding are the major management concerns. Subsurface drains, surface drains, and open ditches help to remove excess water. Pumping stations also help to remove the water. Intensive cultivation and excessive drainage over a period of years cause substantial subsidence of the organic material. Keeping the water table high during periods other than the growing season helps to control subsidence. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to control soil blowing.

This soil is poorly suited to grasses and legumes for hay or pasture. Ponding for long periods drowns most grasses and legumes in the stand. A drainage system is needed.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Harvesting is limited to periods when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because the ponding and low strength are severe limitations, 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 installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by ponding and frost action. Providing better suited base material improves the capacity of the roads to support vehicular traffic.

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

MaA—Martinsville loam, 0 to 2 percent slopes. This nearly level, deep, well drained soil is in outwash areas on till plains and terraces. Areas range from 4 to 160 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark yellowish brown loam about 9 inches thick. The subsoil is about 39 inches thick. It is strong brown and firm. The upper part is sandy clay loam, and the lower part is clay loam. The underlying material to a depth of 65 inches is light yellowish brown and brownish yellow, friable sandy loam stratified with thin layers of silt loam, loamy sand, and loam. In some areas the surface layer is darker. In other areas the soil has a higher content of coarse fragments. In some places the subsoil is loam or gravelly clay loam. In other places the lower part of the subsoil and the underlying material are mottled. In some areas the underlying material is clay loam. In other areas it is sand or gravelly coarse sand.

Included with this soil in mapping are the moderately well drained Eel soils on flood plains and the somewhat poorly drained Whitaker soils in the lower lying convex areas. These soils make up 10 to 15 percent of the map unit.

The Martinsville soil is moderately permeable. Organic matter content in the surface layer is moderate. Available water capacity is high. Surface runoff is slow. The surface layer is friable and can be easily tilled under the proper moisture conditions. Cultivating when the soil is too wet, however, results in the formation of clods.

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

This soil is well suited to corn, soybeans, and small grain. A conservation tillage system that leaves crop residue on the surface improves or maintains tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

Some areas are forested. This soil is well suited to trees. No major management concerns affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is well suited to dwellings with basements. Backfilling with coarser material helps to prevent the damage caused by shrinking and swelling. The soil is moderately limited as a site for local roads and streets because of the shrink-swell potential and frost action. Providing better suited base material improves the capacity of the roads and streets to support vehicular traffic. The soil is suited to septic tank absorption fields.

The land capability classification is I. The woodland ordination symbol is 1a.

MaB2—Martinsville loam, 2 to 6 percent slopes, eroded. This gently sloping, deep, well drained soil is in outwash areas on till plains and terraces. Areas range from 4 to 100 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is brown loam about 8 inches thick. The subsoil is about 47 inches thick. The upper part is dark brown, firm clay loam. The next part is dark brown and dark yellowish brown, firm sandy clay loam and sandy loam. The lower part is reddish brown, firm sandy loam. The underlying material to a depth of 69 inches is dark yellowish brown and yellowish brown loamy coarse sand and loamy fine sand. In some areas the subsoil has more clay. In other areas it is loam or gravelly clay loam. In many places the underlying material is glacial till. In other areas it is sand or gravelly coarse sand.

Included with this soil in mapping are the moderately well drained, nearly level Eel soils on flood plains and the somewhat poorly drained Whitaker soils in the lower lying convex areas. These soils make up 10 to 15 percent of the map unit.

The Martinsville soil is moderately permeable. Organic matter content in the surface layer is moderate. Available water capacity is high. Surface runoff is medium. The surface layer is friable and can be easily tilled under the proper moisture conditions. Cultivating when the soil is too wet, however, results in the formation of clods.

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

This soil is well suited to corn, soybeans, and small grain. Erosion is the major hazard. It can be controlled by a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves protective amounts of crop residue on the surface, contour farming, grassed waterways, terraces, or a combination of these. Crop residue management improves or maintains tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. Erosion is a hazard. Once established, however, a cover of grasses and legumes is effective in controlling erosion. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

This soil is well suited to trees. No major management concerns affect planting or harvesting.

Because of the shrink-swell potential, this soil is moderately limited as a site for dwellings without basements. It is well suited to dwellings with basements. Backfilling with coarser material helps to prevent damage caused by shrinking and swelling. The soil is moderately limited as a site for local roads and streets because of frost action and the shrink-swell potential. Providing better suited base material improves the capacity of the roads and streets to support vehicular traffic. The soil is suited to septic tank absorption fields.

The land capability classification is IIe. The woodland ordination symbol is 1a.

MoD3—Morley clay loam, 12 to 20 percent slopes, severely eroded. This strongly sloping and moderately steep, deep, well drained soil is on convex slopes on moraines. Areas range from 4 to 100 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is dark brown clay loam about 5 inches thick. The subsoil is dark yellowish brown and yellowish brown, firm clay loam about 17 inches thick. The underlying material to a depth of 60 inches is yellowish brown, very firm clay loam. In some areas the slope is less than 12 or more than 20 percent. In other areas the depth to the underlying material is more than 30 inches. In some places the subsoil contains more sand. In other places the upper part of the subsoil has gray mottles.

Included with this soil in mapping are the poorly drained Pewamo soils in the lower lying areas. These soils make up 10 to 15 percent of the map unit.

The Morley soil is moderately slowly permeable. Organic matter content in the surface layer is moderately low. Available water capacity is moderate. Surface runoff is rapid. The surface layer is firm but can be fairly easily tilled under the proper moisture conditions. Cultivating when the soil is too wet results in the formation of clods.

Most areas of this soil are used for pasture (fig. 6), hay, or woodland. A few are used for cultivated crops. A few are idle.

Figure 6.—A pastured area of Morley clay loam, 12 to 20 percent slopes, severely eroded.

This soil is generally unsuited to corn, soybeans, and small grain. Operating some equipment is hazardous because of the strongly sloping and moderately steep slopes.

This soil is poorly suited to grasses and legumes for hay or pasture. Erosion is a hazard. Once established, however, a cover of grasses and legumes is effective in controlling erosion. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density. Operating some equipment may be difficult in some of the moderately steep areas.

Many areas are forested. This soil is well suited to trees. The erosion hazard, the equipment limitation, and plant competition are management concerns because of the slope and the clayey surface layer. Logging trails should be layed out on the contour. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation.

Because of the slope, this soil is severely limited as a site for dwellings. Land shaping and installing retaining walls helps to overcome this limitation.

Because of slope and low strength, this soil is severely limited as a site for local roads and streets. Land shaping and constructing the roads on the contour help to overcome the slope. Providing better suited base material improves the capacity 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 slope and the moderately slow permeability. Installing the absorption field on the contour helps to overcome the slope. Enlarging the absorption field helps to compensate for the moderately slow permeability. Installing the field when the soil is dry helps to keep the sides from sealing. Scarification of the sides allows fluid to move out of the bed.

The land capability classification is VIe. The woodland ordination symbol is 2r.

Pm—Pewamo silty clay. This nearly level, deep, poorly drained soil is in drainageways and depressions on till plains and moraines. It is frequently ponded by surface runoff from adjacent areas. Areas range from 4 to 300 acres in size. The dominant size is about 80 acres.

In a typical profile, the surface layer is very dark grayish brown silty clay about 10 inches thick. The subsoil is about 35 inches thick. It is mottled and firm. The upper part is grayish brown and light brownish gray silty clay and silty clay loam. The lower part is yellowish brown clay loam. The underlying material to a depth of 60 inches is yellowish brown, mottled, firm clay loam. In some areas it is stratified sand and loam. In other areas the surface layer is less than 10 inches thick. In some places as much as 15 inches of overwash is on the surface. In other places the subsoil has less clay. In places the soil has more clay throughout.

Included with this soil in mapping are the somewhat poorly drained Blount soils in the higher lying areas and the moderately well drained Glynwood soils on the higher lying convex slopes. These soils make up 10 to 15 percent of the map unit.

The Pewamo soil is moderately slowly permeable. Organic matter content in the surface layer is high. Available water capacity is high. The water table is at or above the surface late in winter and in spring. Surface runoff is very slow. Ponding is common in many areas. The surface layer is firm and difficult to till. Cultivating when the soil is too wet results in compaction and the formation of clods.

Most areas of this soil are drained and used for cultivated crops (fig. 7). A few are used for hay, pasture, or woodland.

If adequately drained, this soil is well suited to corn, soybeans, and small grain. The wetness is the major limitation. Subsurface drains and open ditches help to remove excess water. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to prevent compaction and improves soil structure and tilth.

This soil is well suited to grasses and legumes for hay or pasture. It is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

Some areas are forested. This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Prolonged seasonal wetness hinders harvesting, logging, and planting. The trees should be logged during dry periods or during periods when the ground is frozen. Replanting and overstocking help to overcome seedling mortality. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Proper site preparation may be needed to control plant competition.

Because the ponding is a severe limitation, this soil is generally unsuitable as a site for dwellings. It is generally unsuitable as a site for septic tank absorption fields because the ponding and the moderately slow permeability are severe limitations. The soil 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 installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by ponding and frost action. Providing better suited base material

Figure 7.—Ridge planting of soybeans on Pewamo silty clay. Glynwood clay loam, thin solum, 2 to 6 percent slopes, severely eroded, is in the background.

improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 2w.

So—Saranac clay loam, stratified substratum, occasionally flooded. This nearly level, deep, very poorly drained soil is on broad bottom land. It is occasionally flooded for brief periods late in winter and early in spring. Areas range from 40 to 200 acres in size. The dominant size is about 100 acres.

In a typical profile, the surface layer is very dark grayish brown clay loam about 12 inches thick. The subsoil is grayish brown, mottled, firm clay loam about 34 inches thick. The underlying material to a depth of 60 inches is dark gray and gray, mottled, friable gravelly loam. In some areas the surface layer and subsoil contain less clay. In other areas the upper part of the subsoil does not have dominant gray colors. In places the surface layer is not thick and dark.

Included with this soil in mapping are the moderately well drained Eel and Eel Variant soils in the higher lying areas on flood plains. These soils make up 10 to 15 percent of the map unit.

The Saranac soil is moderately slowly permeable. Organic matter content in the surface layer is high. Available water capacity is high. The water table is at or near the surface late in winter and in spring. Surface runoff is very slow. The surface layer is firm and difficult to till when wet. Cultivating when the soil is too wet results in compaction and the formation of clods.

Most areas of this soil are drained and used for cultivated crops. A few are used for woodland.

This soil is well suited to corn and soybeans. The flooding and the wetness are the major management concerns. If a good surface drainage system is installed, crops can be grown. Subsurface drains and open ditches help to remove excess water. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to prevent compaction and improves soil structure and tilth.

This soil is well suited to grasses and legumes for hay and pasture. It is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

Some areas are forested. This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees should be logged during dry periods or during periods when the ground is frozen. Replanting may be necessary because of the seasonal flooding. Water-tolerant species are favored in timber stands. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because the flooding and the wetness are severe limitations, this soil is generally unsuitable as a site for dwellings and sanitary facilities. It is severely limited as a site for local roads because of the flooding, the wetness, and low strength. Constructing the roads on raised, well compacted fill material and installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by the flooding, frost action, and wetness. Providing better suited base material improves the capacity of the roads to support vehicular traffic.

The land capability classification is IIw. The woodland ordination symbol is 2w.

St—Saranac clay, frequently flooded. This nearly level, deep, very poorly drained soil is on broad bottom land. It is frequently flooded for brief periods late in winter and in spring. Areas range from 40 to 400 acres in size. The dominant size is about 100 acres.

In a typical profile, the surface layer is very dark gray clay about 10 inches thick. The subsoil is about 34 inches thick. It is mottled and firm. The upper part is dark grayish brown and dark gray clay, and the lower part is gray and light brownish gray silty clay. The underlying material to a depth of 60 inches is light brownish gray, mottled silty clay loam. In some areas as much as 15 inches of silty overwash is on the surface. In other areas the underlying material has thick layers of muck. In some places the surface layer and subsoil have less clay and more sand. In other places the underlying material has more sand.

Included with this soil in mapping are the moderately well drained Eel and Eel Variant soils in the higher lying areas on flood plains. These soils make up 10 to 15 percent of the map unit.

The Saranac soil is moderately slowly permeable. Organic matter content in the surface layer is high. Available water capacity is high. The water table is at or near the surface late in winter and in spring. Surface runoff is very slow. The surface layer is firm and very difficult to till. Cultivating when the soil is too wet results in compaction and the formation of clods.

Most areas of this soil are drained and used for cultivated crops. A few are used for woodland.

This soil is fairly well suited to corn and soybeans. The flooding and the wetness are the major management concerns. If a good surface drainage system is installed, crops can be grown. Subsurface drains and open ditches help to remove excess water. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to prevent compaction and improves soil structure and tilth.

This soil is well suited to grasses and legumes for hay and pasture. It is not well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. Overgrazing reduces plant density and hardiness. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

A few areas are forested. This soil is fairly well suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. The trees should be logged during dry periods or during periods when the ground is frozen. Replanting may be necessary because of the seasonal flooding. Water-tolerant species are favored in timber stands. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation or by spraying, cutting, or girdling. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because the flooding and the wetness are severe limitations, 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 flooding, the wetness, and low strength. Constructing the roads on raised, well compacted fill material and installing an adequate roadside drainage system that includes culverts help to prevent the damage caused by flooding and wetness. Providing better suited base material improves the capacity of the roads to support vehicular traffic.

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

Ud—Udorthents, loamy. These nearly level to moderately steep, shallow to deep, well drained to somewhat poorly drained soils are in areas which have been disturbed and modified. Areas range from 4 to 60 acres in size. The dominant size is about 20 acres.

This unit occurs basically as two different kinds of areas—those around gravel pits in outwash plains and terraces and those around borrow pits, quarries, excavated or built-up areas, and sanitary landfills on till plains. The texture is dominantly loamy.

Included with these soils in mapping are areas of sand and gravel, small areas of water, and areas where the soils contain fill material. In many areas the fill is mainly soil material, but in some areas it contains discarded bricks, stones, wood, glass, metal, concrete, and cinders. Also included are poorly drained areas.

These soils are highly variable. They are slowly permeable to rapidly permeable. Organic matter content in the surface layer is very low. Available water capacity is low to high. The water table is often at a depth of 1 to 6 feet late in winter and in spring. Surface runoff is very slow to rapid.

The vegetation on these soils generally is poor quality grasses interspersed with bare areas. Tilled areas and construction sites should be revegetated as soon as possible. Diversions, box inlet structures, grade stabilization structures, cover crops, a conservation tillage system that leaves all or part of the crop residue on the surface, and grassed waterways help to control erosion.

Onsite investigation is needed if these soils are to be used as sites for dwellings, septic tank absorption fields, or local roads and streets. The depth to the water table should be checked late in the winter or early in the spring. Removing as little vegetation as possible and establishing a protective plant cover as soon as possible after construction help to control erosion. Settlement of the soil material and escaping gases could be problems on sites that once were sanitary landfills.

No land capability classification or woodland ordination symbol is assigned to these soils.

Wa—Wallkill Variant silty clay, frequently flooded. This nearly level, deep, very poorly drained soil is in depressions on lake plains, till plains, moraines, and broad bottom land. It is frequently flooded for brief periods late in winter and in spring. It is frequently ponded by surface runoff from adjacent areas. Areas range from 4 to 40 acres in size. The dominant size is about 15 acres.

In a typical profile, the surface layer is very dark grayish brown silty clay about 8 inches thick. The next layer is dark grayish brown, firm silty clay about 9 inches thick. The upper part of the underlying material is black and dark brown, friable muck. The lower part to a depth of 60 inches is dark grayish brown and olive gray, friable coprogenous earth. In places the silty clay extends to a depth of less than 15 or more than 40 inches.

Included with this soil in mapping are the moderately well drained Eel Variant soils in the higher lying areas on bottom land. These soils make up 10 to 15 percent of the map unit.

The Wallkill Variant soil is slowly permeable in the mineral and coprogenous layers and moderately rapidly permeable in the muck layers. Organic matter content in the surface layer is high. Available water capacity is very high. The water table is at or above the surface late in winter and in spring. Surface runoff is very slow or ponded. The surface layer is friable and can be easily tilled under the proper moisture conditions.

Most areas of this soil are drained and used for cultivated crops. A few are undrained and support cattails, sedges, and water-tolerant trees and shrubs.

This soil is poorly suited to corn, soybeans, and small grain. The flooding and the wetness are the main management concerns. Also, the ponding drowns crops in some years. If a good surface drainage system is installed, crops can be grown. Subsurface drains and open ditches help to remove excess water. A conservation tillage system that leaves protective amounts of crop residue on the surface helps to prevent compaction and improves soil structure and tilth.

This soil is fairly well suited to grasses and legumes for hay or pasture. Floodwater drowns most grasses and legumes in the stand. A drainage system is needed.

This soil is poorly suited to trees. The equipment limitation, seedling mortality, the windthrow hazard, and plant competition are management concerns. Seasonal flooding hinders harvesting, logging, and planting. The trees should be logged during dry periods or during periods when the ground is frozen. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation. The windthrow hazard can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. The natural vegetation provides an abundance of protective cover and food for wildlife.

Because the flooding, the ponding, low strength, and the slow permeability are severe limitations, 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 flooding, the ponding, and frost action, all of which can damage the roads. Constructing the roads on raised, well compacted fill material and installing an adequate roadside drainage system that includes culverts help to prevent this damage.

The land capability classification is IVw. The woodland ordination symbol is 4w.

Wh—Whitaker silt loam. This nearly level, deep, somewhat poorly drained soil is on outwash terraces. Areas range from 4 to 60 acres in size. The dominant size is about 20 acres.

In a typical profile, the surface layer is brown silt loam about 13 inches thick. The subsoil is about 35 inches thick. It is mottled and firm. The upper part is brown clay loam, the next part is brown sandy clay loam and clay loam, and the lower part is dark yellowish brown sandy clay loam. The underlying material to a depth of 65 inches is very friable sandy loam. The upper part is yellowish brown, and the lower part is light yellowish brown and is stratified with thin layers of loamy sand. In some areas the surface layer is dark brown. In other areas the subsoil has more or less clay. In some places the underlying material is gravelly coarse sand. In other places it is silty clay loam.

Included with this soil in mapping are the well drained Eldean and Martinsville soils on the higher lying convex slopes and on slight rises. These soils make up 10 to 15 percent of the map unit.

The Whitaker soil is moderately permeable. Organic matter content in the surface layer is moderate. Available water capacity is high. The water table is often at a depth of 1 to 3 feet late in winter and in spring. Surface runoff is slow. The surface layer is friable and can be easily tilled throughout a wide range of moisture conditions.

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

This soil is well suited to corn, soybeans, and small grain. The wetness is the major limitation. Subsurface drains, surface drains, and open ditches help to remove excess water. A conservation tillage system that leaves all or part of the crop residue on the surface improves or maintains tilth and organic matter content.

This soil is well suited to grasses and legumes for hay or pasture. It is not as well suited to alfalfa, however, because of wetness and frost heaving. A drainage system is needed. Proper stocking rates, rotation grazing, and restricted use during wet periods help to prevent surface compaction and maintain good tilth and plant density.

Some areas are forested. This soil is well suited to trees. Plant competition is a management concern. It can be controlled by proper site preparation. No other management concerns affect planting or harvesting.

Because of the wetness, this soil is severely limited as a site for dwellings. Dwellings should be constructed without basements. Installing subsurface drains lowers the water table and thus helps to keep the wetness from becoming a problem.

Because of frost action and low strength, this soil is severely limited as a site for local roads and streets. Providing better suited base material improves the capacity of the roads to support vehicular traffic. An adequate roadside drainage system that includes culverts helps to prevent the damage caused by frost action.

This soil is severely limited as a site for septic tank absorption fields because of the wetness. Installing perimeter subsurface drains lowers the water table. Installing the absorption fields when the soil is dry helps to keep the sides from sealing. Scarification of the sides allows fluid to move out of the bed.

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

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 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 economically to produce a sustained high yield of crops. 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 224,066 acres in the survey area, or nearly 62 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the counties, mainly in map units 2, 3, 4, and 5, which are described under the heading "General Soil Map Units." Nearly all of this prime farmland is used for corn and soybeans.

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 this section. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. 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 on the following list. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

The map units that meet the requirements for prime farmland are:

BlA Blount-Glynwood, thin solum complex, 0 to 3 percent slopes (where the Blount soil is drained)
Bo Bono silty clay (where drained)
Bs Bono Variant mucky silty clay (where drained)
Ef Eel Variant silty clay, occasionally flooded
ElA Eldean silt loam, 0 to 2 percent slopes
MaA Martinsville loam, 0 to 2 percent slopes
MaB2 Martinsville loam, 2 to 6 percent slopes, eroded
Pm Pewamo silty clay (where drained)
So Saranac clay loam, stratified substratum, occasionally flooded (where drained)
Wh Whitaker silt loam (where drained)

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

John P. VanDenBosch, district conservationist for Blackford and Jay Counties, helped write 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.

According to estimates made by the local soil and water conservation districts in 1980, approximately 72 percent of Blackford and Jay Counties is cropland, 6 percent is woodland, 2 percent is pasture, and 20 percent is urban areas, nonfarm rural areas, roads, and farmsteads. About 51 percent of the cropland is used for soybeans, 30 percent for corn, 8 percent for wheat, 8 percent for hay and pasture, 2 percent for oats, and 1 percent for other crops.

The following paragraphs describe the management needed to overcome the more common soil limitations and hazards on the cropland and pasture in Blackford and Jay Counties.

Inadequate natural drainage is a major limitation on at least 90 percent of the cropland and pasture in Blackford and Jay Counties. Most of the areas where natural drainage is a problem have been partially drained. Only a very small acreage, however, has been drained to the extent that maximum productivity can be expected in most years.

Farm drainage systems are made up of natural and artificial surface drains, subsurface drains, and open ditches. Surface drains and open ditches carry off most of the excess water which cannot be absorbed by the soil after heavy rains. Subsurface drains keep the soil from being too wet for cultivation and help to prevent crop damage. Drainage systems are needed in Blount, Bono, Pewamo, and Whitaker soils. They can vary greatly. The design depends on the type of soil, the topography, the location and type of drainage outlet, and the type of crop to be grown.

The counties have hundreds of miles of open ditches and subsurface drains. Many of the open ditches are adequate and well maintained, but others should be redesigned and reconstructed.

Water erosion is a hazard on at least 37 percent of the cropland and pasture in Blackford and Jay Counties. Examples of soils that are easily eroded are Eldean, Glynwood, Martinsville, and Morley soils. Erosion can be a hazard if the slope is more than about 2 percent. On many of the erosive soils, drainage also is a problem. As a result, managing these soils is extremely difficult.

Erosion is damaging for several reasons. It results in nutrient losses and thus in reduced productivity. If the friable surface layer is removed and firm soil material exposed, the quality of the seedbed deteriorates. Erosion causes sedimentation, or the deposition of soil in the lower lying areas and in open ditches, streams, and rivers.

Erosion can be controlled by proper conservation practices. These include crop residue management, a cropping sequence that includes grasses and legumes, a conservation tillage system that leaves all or part of the crop residue on the surface, grassed waterways, and parallel tile outlet terraces. These practices can be used alone or in combination with one another, depending on the soil type and the topography.

Soil blowing occurs if Houghton and Wallkill Variant soils are fall plowed. It is readily apparent when snow is on the ground. The amount of soil lost through soil blowing in this survey area is of minor importance compared to the amount lost through water erosion.

Drought is a hazard on the soils that formed in outwash, such as Eldean soils. These soils make up a small portion of the total cropland in the survey area, but they are important in some areas. They have enough moisture for crop establishment in the spring, but crop yields may be reduced if rainfall is insufficient throughout the summer. Most of these soils have a low available water capacity and are subject to erosion because they are sloping. Irrigation can reduce the hazard of drought. In this survey area, however, a sufficient supply of water for irrigation commonly is not available. Also, the cost of irrigation systems may be prohibitive.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Some of the soils used for crops in Blackford and Jay Counties have a silt loam surface layer that contains a moderate amount of organic matter. Examples are Blount, Eldean, and Whitaker soils. Heavy rainfall causes the formation of a crust on the surface. When dry, the crust is very hard and nearly impervious to water. Once a hard crust forms, the runoff rate and the susceptibility to erosion are increased and water is not available to plants. Crop residue management improves soil structure and helps to prevent crusting.

On light colored soils, such as Blount and Glynwood soils, fall plowing is not a good practice. Many areas of these soils are sloping and consequently are subject to severe erosion when plowed in the fall.

Cultivating dark, clayey soils, such as Bono, Saranac, and Pewamo soils, is difficult because these soils remain wet throughout the spring. If cultivated when wet, the soils tend to form clods and have thick compacted layers under the plow layer. Consequently, preparing a good seedbed is difficult. Fall plowing may be beneficial because of the wetness in the spring. Fall chiseling and ridge planting also are helpful on these wet soils.

Field crops commonly grown in this survey area are corn, soybeans, wheat (fig. 8), oats, and hay. Other crops that are suitable in this area are barley, rye, sunflowers, and sorghum.

Specialty crops are of limited importance in the survey area; however, there are several acres of tomatoes, green beans, popcorn, and some orchard crops. A high level of management that gives special attention to drainage and soil tilth is needed before these crops can be successfully grown.

Many *grasses and legumes* for hay and pasture are suitable in this survey area. Grasses include orchardgrass, reed canarygrass, timothy, bromegrass, tall fescue, and Kentucky bluegrass. Legumes include alfalfa, birdsfoot trefoil, ladino clover, red clover, alsike clover, and sweet clover.

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.

Figure 8.—Wheat on Bono silty clay and Pewamo silty clay.

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 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, 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 suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. It is based on the site index of the species listed first in the *common trees* column. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *r* indicates steep slopes; *x*, stoniness or rockiness; *w*, excessive 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*, high content of coarse fragments in the soil profile. 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.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that few trees may be blown down by strong winds; *moderate*, that some trees will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, 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

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

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, soybeans, wheat, oats, sorghum, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, orchardgrass, bromegrass, bluegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, ragweed, pokeweed, sheep sorrel, dock, crabgrass, and dandelion.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, maple, poplar, beech, wild cherry, sweetgum, willow, black walnut, apple, hawthorn, dogwood, hickory, hazelnut, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub dogwood, autumn-olive, Washington hawthorn, and crabapple.

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, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, spikerush, wild millet, wildrice, cattail, waterplantain, 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 quail, pheasant, dove, meadowlark, field sparrow, cottontail, red fox, and woodchuck.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, 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 is the 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 habitat 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

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; embankments, dikes, and levees; and 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, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of 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.

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.

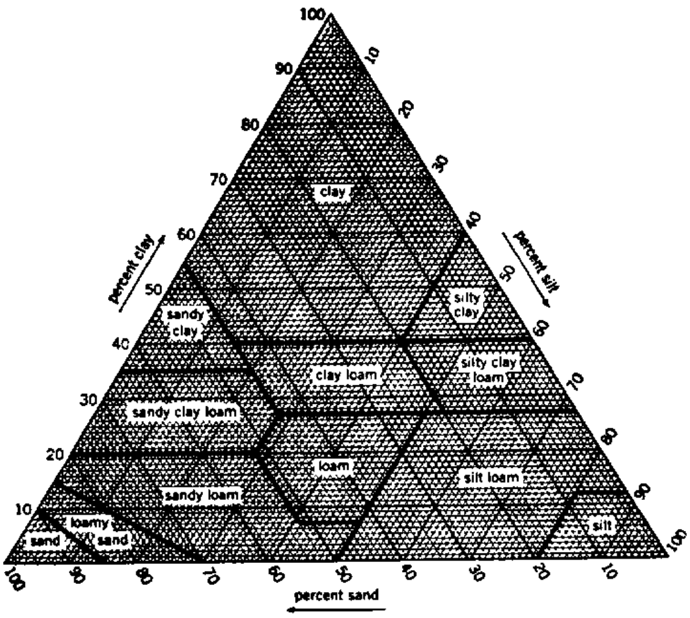

Figure 9.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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. 9). "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 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to 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.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). 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 19 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 have a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the 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* (*4*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*5*). 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."

Blount Series

The Blount series consists of deep, somewhat poorly drained, slowly permeable soils on till plains. These soils formed in glacial till. Slopes range from 0 to 3 percent.

Blount soils are adjacent to Glynwood and Pewamo soils. Glynwood soils are browner in the upper part of the solum than the Blount soils. They are in the slightly higher, convex, more sloping areas. Pewamo soils are poorly drained and are in the lower depressions and drainageways.

A typical pedon of Blount silt loam, in a cultivated area of Blount-Glynwood, thin solum complex, 0 to 3 percent slopes; 1,120 feet west and 2,310 feet north of the southeast corner of sec. 11, T. 24 N., R. 14 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; about 1 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—9 to 15 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; thick continuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt2—15 to 19 inches; yellowish brown (10YR 5/4) silty clay; common fine distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) clay films on faces of peds; about 8 percent coarse fragments; very strongly acid; clear wavy boundary.

Bt3—19 to 24 inches; yellowish brown (10YR 5/4) clay; common medium distinct grayish brown (10YR 5/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin discontinuous dark grayish brown (10YR 4/2) and dark brown (10YR 4/3) clay films on faces of peds; about 13 percent coarse fragments; neutral; clear wavy boundary.

Bt4—24 to 34 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate thick platy structure parting to weak fine subangular blocky; firm; thin discontinuous gray (10YR 5/1) and dark grayish brown (10YR 4/2) clay films on faces of peds; about 14 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

C—34 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; strong thick platy rock structure; very firm; discontinuous light gray (10YR 7/2) carbonate films on faces of cracks; discontinuous gray (10YR 5/1) vertical streaks; about 14 percent coarse fragments; violent effervescence; moderately alkaline.

The solum is 22 to 45 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3. It is slightly acid or medium acid.

The Bt1 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is silty clay, clay, or clay loam. It ranges from neutral to strongly acid. The Bt2 horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 4. It is silty clay loam, silty clay, or clay. It is neutral to strongly acid. Some pedons have a BC horizon. This horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is silty clay loam or clay loam. It is mildly alkaline or moderately alkaline.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. It is silty clay loam or clay loam. It is mildly alkaline or moderately alkaline.

Bono Series

The Bono series consists of deep, very poorly drained, very slowly permeable soils in depressions on lake plains. These soils formed in lacustrine deposits over outwash material. Slopes range from 0 to 2 percent.

These soils irregularly decrease in content of organic carbon with increasing depth and have slightly more clay than is definitive for the Bono series. These differences, however, do not alter the usefulness or behavior of the soils.

Bono soils are similar to Pewamo and Saranac soils and are adjacent to Blount, Glynwood, Houghton, and Pewamo soils. Pewamo soils formed in water-worked glacial till. Saranac soils formed in alluvial material. Blount soils formed in glacial till and are in the higher lying areas. Glynwood soils are moderately well drained and are in gently sloping areas. Houghton soils formed in organic material and are in the lower lying areas.

A typical pedon of Bono silty clay, in a cultivated field; 500 feet east and 1,500 feet south of the northwest corner of sec. 3, T. 22 N., R. 11 E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate fine angular blocky structure; firm; slightly acid; abrupt smooth boundary.

A—9 to 14 inches; very dark grayish brown (10YR 3/2) clay, grayish brown (10YR 5/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; massive; firm; thin discontinuous grayish brown (10YR 5/2) silt films on vertical faces of peds; neutral; clear wavy boundary.

Bg1—14 to 19 inches; grayish brown (2.5Y 5/2) clay; common medium distinct red (2.5YR 5/6) mottles; weak coarse prismatic structure; firm; thin discontinuous gray (10YR 5/1) and thick continuous dark gray (10YR 4/1) silt films on faces of peds; neutral; clear wavy boundary.

Bg2—19 to 28 inches; grayish brown (2.5Y 5/2) clay; common coarse distinct red (2.5YR 5/8) mottles; weak coarse prismatic structure; firm; thick continuous dark gray (10YR 4/1) silt films on faces of peds; dark gray (10YR 4/1) krotovinas; neutral; clear wavy boundary.

Bg3—28 to 33 inches; grayish brown (2.5Y 5/2) clay; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; thin discontinuous very dark gray (10YR 3/1) silt films on faces of peds; thick continuous dark yellowish brown (10YR 4/6) remnant root channels; neutral; clear wavy boundary.

Bg4—33 to 40 inches; olive gray (5Y 4/2) clay; common medium distinct red (2.5YR 5/8) mottles; weak coarse prismatic structure; firm; thin continuous gray (10YR 5/1) and very dark gray (10YR 3/1) silt films on faces of peds; very dark gray (10YR 3/1) krotovinas; slight effervescence; mildly alkaline; clear wavy boundary.

Bg5—40 to 49 inches; olive gray (5Y 5/2) silty clay; few fine faint dark yellowish brown (10YR 4/6) mottles; moderate medium subangular blocky structure; firm; continuous dark grayish brown (10YR 4/2) and gray (10YR 5/1) silt films on faces of peds; dark gray (10YR 4/1) krotovinas; slight effervescence; mildly alkaline; clear wavy boundary.

2C—49 to 57 inches; olive (5Y 5/3) stratified silt loam and very fine sand; common coarse distinct yellowish brown (10YR 5/8) mottles; massive; friable; dark gray (10YR 4/1) and gray (10YR 5/1) films on faces of cracks; dark gray (10YR 4/1) krotovinas; about 1 to 5 percent coarse fragments; violent effervescence; mildly alkaline; abrupt wavy boundary.

3C—57 to 70 inches; mottled yellow (10YR 7/8) and gray (N 5/0) stratified coarse sand and fine sand; single grain; loose; about 5 to 10 percent coarse fragments; violent effervescence; mildly alkaline.

The solum is 40 to 60 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is clay or silty clay. It is neutral or slightly acid.

The Bg horizon has hue of 2.5Y, 5Y, or 10YR, value of 4 or 5, and chroma of 1 or 2. It is clay or silty clay. It is slightly acid or neutral in the upper part and neutral or mildly alkaline in the lower part. Some pedons have a BC horizon. This horizon has hue of 2.5Y, 5Y, or 10YR, value of 4 to 6, and chroma of 1 to 6. It is silty clay or silty clay loam. It is mildly alkaline or moderately alkaline.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7, and chroma of 1 to 8. It is fine sand, coarse sand, loam, silty clay, or clay loam and has thin strata of silt loam or silty clay. It is mildly alkaline or moderately alkaline. The content of coarse fragments in this horizon is 0 to 15 percent.

Bono Variant

The Bono Variant consists of deep, very poorly drained, very slowly permeable soils in depressions on lake plains. These soils formed in thin organic deposits and in the underlying lacustrine deposits. Slopes range from 0 to 2 percent.

Bono Variant soils are adjacent to Blount, Bono, and Houghton soils. Houghton soils formed entirely in organic material. Blount soils are somewhat poorly drained and are in the slightly higher, more sloping areas. Bono soils have a mineral surface layer.

A typical pedon of Bono Variant mucky silty clay, in a cultivated field; 125 feet west and 1,350 feet south of the northeast corner of sec. 3, T. 23 N., R. 11 E.

Ap—0 to 10 inches; black (N 2/0) rubbed mucky silty clay; about 10 percent fiber, a trace rubbed; moderate medium granular structure; very friable; strongly acid; abrupt smooth boundary.

2Bg1—10 to 14 inches; dark grayish brown (10YR 4/2) silty clay; common coarse distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin continuous dark gray (10YR 4/1) and very dark gray (10YR 3/1) organic coatings on faces of peds; slightly acid; clear irregular boundary.

2Bg2—14 to 23 inches; gray (10YR 5/1) silty clay; many coarse distinct yellowish brown (10YR 5/4) mottles; very weak coarse prismatic structure; firm; many gray (10YR 6/1) medium and fine root fillings; thin continuous dark grayish brown (10YR 4/2) coatings on faces of peds; very dark gray (10YR 3/1) krotovinas; neutral; clear wavy boundary.

2Bg3—23 to 33 inches; grayish brown (10YR 5/2) silty clay; many coarse distinct yellowish brown (10YR 5/6) mottles surrounding old root channels; weak very coarse prismatic structure; firm; thin continuous gray (10YR 5/1) coatings on faces of peds; many gray (10YR 6/1) root fillings; mildly alkaline; slight effervescence; clear wavy boundary.

2Cg1—33 to 44 inches; grayish brown (10YR 5/2) silty clay; many coarse distinct dark yellowish brown (10YR 4/6) mottles surrounding old root channels; massive; firm; gray (10YR 6/1) coatings on faces of peds; very thin strata of very fine sand; about 1 percent coarse fragments; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg2—44 to 48 inches; gray (10YR 5/1) silty clay; many coarse distinct dark yellowish brown (10YR 4/6) mottles surrounding old root channels; massive; firm; many and common gray (10YR 6/1) root channel fillings; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) iron accumulations; about 1 percent coarse fragments; violent effervescence; moderately alkaline; clear wavy boundary.

2Cg3—48 to 60 inches; gray (10YR 5/1) silty clay; many medium faint grayish brown (2.5Y 5/2) and common medium distinct dark yellowish brown (10YR 4/6) mottles surrounding old root channels; massive; firm; common gray (10YR 5/1) crack coatings; common gray (10YR 6/1) to dark gray (10YR 4/1) fillings in old root channels; about 1 percent coarse fragments; violent effervescence; moderately alkaline.

The solum is approximately 25 to 40 inches thick. The Ap horizon has hue of N, 10YR, or 7.5YR, value of 2 or

3, and chroma of 0 or 1. It is mucky clay or mucky silty clay. It is strongly acid or medium acid.

The 2Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It is silty clay or silty clay loam. It is slightly acid to mildly alkaline.

The 2Cg horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay or silty clay loam. It is mildly alkaline or moderately alkaline.

Eel Series

The Eel series consists of deep, moderately well drained, moderately permeable soils on broad bottom land. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Eel soils are adjacent to Martinsville and Saranac soils. Martinsville soils have an argillic horizon. They are in the higher positions on the landscape. Saranac soils are very poorly drained and are in the lower lying areas.

A typical pedon of Eel clay loam, frequently flooded, in a soybean field; 1,850 feet west and 265 feet north of the southeast corner of sec. 5, T. 24 N., R. 13 E.

Ap—0 to 9 inches; brown (10YR 4/3) clay loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; about 1 to 5 percent coarse fragments; medium acid; abrupt smooth boundary.

C1—9 to 16 inches; brown (10YR 5/3) clay loam; common medium distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable; thin continuous dark brown (10YR 4/3) organic films on faces of peds; about 1 percent coarse fragments; slightly acid; clear smooth boundary.

C2—16 to 23 inches; brown (10YR 5/3) loam; common medium distinct gray (10YR 5/1) and grayish brown (10YR 5/2) and few fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin discontinuous dark brown (10YR 4/3) coatings on faces of peds; about 1 percent coarse fragments; medium acid; clear smooth boundary.

C3—23 to 32 inches; yellowish brown (10YR 5/4) loam; common medium distinct yellowish brown (10YR 5/6) and gray (10YR 5/1) mottles; moderate medium subangular blocky structure; friable; common medium distinct black (10YR 2/1) iron and manganese oxide accumulations; about 1 percent coarse fragments; medium acid; clear wavy boundary.

C4—32 to 40 inches; yellowish brown (10YR 5/4) loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; black (10YR 2/1) iron and manganese oxide accumulations; about 1 percent coarse fragments; medium acid; clear smooth boundary.

C5—40 to 46 inches; dark brown (10YR 4/3) sandy loam; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) mottles; massive; friable; thin discontinuous dark grayish brown (10YR 4/2) coatings in vertical cracks; about 1 percent coarse fragments; slightly acid; clear smooth boundary.

C6—46 to 60 inches; grayish brown (10YR 5/2) loam; many medium distinct dark gray (10YR 4/1) and common coarse distinct brown (7.5YR 5/4) mottles; massive; friable; about 5 percent coarse fragments; slightly acid.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 1 to 3. When dry, it has value of 5 or 6 and chroma of 2 or 3. It is clay loam, loam, or silt loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, sandy loam, loam, or silty clay loam.

Eel Variant

Eel Variant consists of deep, moderately well drained, moderately slowly permeable soils on bottom land. These soils formed in clayey and silty alluvium. Slopes range from 0 to 2 percent.

Eel Variant soils are adjacent to Eldean and Saranac soils. Eldean soils are well drained and are in the higher positions on the landscape. Their underlying material is sand and gravel outwash. Saranac soils have a thick, dark surface layer. They are very poorly drained and are in depressions.

A typical pedon of Eel Variant silty clay, occasionally flooded, in a cultivated field; 1,010 feet west of the Blackford-Jay county line and 3,100 feet northeast of the southern boundary road of the Godfrey Reserve, T. 24 N., R. 12 E.

Ap—0 to 6 inches; dark brown (10YR 3/3) silty clay, light brownish gray (10YR 6/2) dry; moderate fine subangular blocky structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

A—6 to 11 inches; dark brown (10YR 3/3) silty clay, brown (10YR 5/3) dry; few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; slightly acid; abrupt smooth boundary.

C1—11 to 18 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin continuous grayish brown (10YR 5/2) coatings on faces of peds; few medium distinct black (N 2/0) iron and manganese oxide accumulations; medium acid; clear wavy boundary.

C2—18 to 24 inches; yellowish brown (10YR 5/4) silty clay; common medium distinct grayish brown (10YR

5/2) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin continuous grayish brown (10YR 5/2) coatings on faces of peds; few medium distinct black (N 2/0) iron and manganese oxide accumulations; strongly acid; clear wavy boundary.

C3—24 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct gray (10YR 5/1) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin continuous grayish brown (10YR 5/2) coatings on faces of peds; few medium distinct black (N 2/0) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

C4—30 to 40 inches; brown (10YR 5/3) silty clay; common medium distinct dark gray (10YR 4/1) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) and gray (10YR 5/1) coatings on faces of peds; few medium distinct black (N 2/0) iron and manganese oxide accumulations; very strongly acid; clear wavy boundary.

C5—40 to 44 inches; brown (10YR 5/3) silty clay; common medium distinct dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark gray (10YR 4/1) coatings on faces of peds; patchy dark brown (10YR 3/3) crack fillings; strongly acid; gradual wavy boundary.

C6—44 to 54 inches; brown (10YR 5/3) silty clay; common medium distinct dark grayish brown (10YR 4/2) and few fine faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; firm; continuous dark grayish brown (10YR 4/2) coatings on faces of peds; medium acid; gradual wavy boundary.

C7—54 to 60 inches; yellowish brown (10YR 5/4) silty clay; many medium distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; firm; discontinuous dark gray (10YR 4/1) coatings on faces of peds; strongly acid.

The Ap and A horizons have hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The C horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 6. It is silty clay loam or silty clay. It is neutral to strongly acid.

Eldean Series

The Eldean series consists of well drained soils that are moderately deep over sand and gravel. These soils formed in outwash material on outwash plains and stream terraces. Permeability is moderately slow in the subsoil and rapid in the underlying material. Slopes range from 0 to 12 percent.

These soils are taxadjuncts to the Eldean series because the particle-size class of the upper part contrasts strongly with that of the lower part. This difference, however, does not alter the usefulness or behavior of the soils.

Eldean soils are adjacent to Eel Variant and Whitaker soils. The adjacent soils are in the lower lying areas. Eel Variant soils have more clay in the underlying material than the Eldean soils. Whitaker soils have gray mottles in the subsoil and are somewhat poorly drained.

A typical pedon of Eldean clay loam, 2 to 6 percent slopes, severely eroded, in a cultivated field; 440 feet south and 946 feet west of the northeast corner of sec. 35, T. 24 N., R. 12 E.

Ap—0 to 8 inches; dark brown (7.5YR 4/4) clay loam, brown (7.5YR 5/4) dry; about 5 percent intermixed reddish brown (5YR 4/4) clay; moderate medium granular structure; firm; about 5 percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—8 to 14 inches; reddish brown (5YR 4/4) gravelly clay; moderate medium subangular blocky structure; firm; thin continuous dark brown (7.5YR 4/4) and reddish brown (5YR 4/3) clay films on faces of peds; thick continuous dark reddish brown (5YR 3/3) organic films on faces of peds; about 15 percent coarse fragments; neutral; clear wavy boundary.

Bt2—14 to 20 inches; reddish brown (5YR 4/4) gravelly clay; moderate medium subangular blocky structure; firm; thick continuous dark reddish brown (5YR 3/3) clay films on faces of peds; thin discontinuous dark reddish gray (5YR 4/2) organic films on faces of peds; about 15 percent coarse fragments; neutral; clear wavy boundary.

Bt3—20 to 26 inches; reddish brown (5YR 4/3) gravelly sandy clay; moderate medium subangular blocky structure; firm; thick continuous dark reddish brown (5YR 3/3) clay films on faces of peds; thin patchy dark reddish brown (5YR 3/2) organic films on faces of peds; about 20 percent coarse fragments; neutral; clear wavy boundary.

Bt4—26 to 32 inches; reddish brown (5YR 4/3) gravelly sandy clay; weak medium subangular blocky structure; firm; thick continuous dark reddish brown (5YR 3/2) clay films on faces of peds; thin patchy black (N 2/0) organic films around coarse fragments; about 20 percent coarse fragments; neutral; abrupt wavy boundary.

2C1—32 to 36 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 25 percent coarse fragments; strong effervescence; mildly alkaline; clear wavy boundary.

2C2—36 to 60 inches; pale brown (10YR 6/3) gravelly coarse sand; single grain; loose; about 20 percent coarse fragments; strong effervescence; mildly alkaline.

The solum is 20 to 40 inches thick. The Ap horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is clay loam, loam, or silt loam. It is slightly acid or neutral.

The Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 4 to 6. It is clay, sandy clay, or clay loam or the gravelly analogs of these textures. The content of coarse fragments ranges from 5 to 30 percent in the upper part of this horizon and from 10 to 40 percent in the lower part. Some pedons have a BC horizon. This horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 3 to 6. It is sandy clay, sandy clay loam, or clay loam or gravelly analogs of these textures. The content of coarse fragments in this horizon ranges from 5 to 60 percent.

The 2C horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is gravelly coarse sand or gravelly loamy coarse sand.

Glynwood Series

The Glynwood series consists of deep, moderately well drained, slowly permeable soils on convex slopes on till plains and moraines. These soils formed in glacial till. Slopes range from 0 to 12 percent.

Glynwood soils are similar to Morley soils and are adjacent to Blount, Bono, and Pewamo soils. Morley soils are well drained. Blount soils are somewhat poorly drained and are in nearly level and gently sloping areas. Bono and Pewamo soils have a mollic epipedon. They are very poorly drained and poorly drained, respectively, and are in concave areas.

A typical pedon of Glynwood clay loam, thin solum, 2 to 6 percent slopes, severely eroded, in a cultivated field; 150 feet east and 1,850 feet south of the northwest corner of sec. 35, T. 22 N., R. 15 E.

Ap—0 to 9 inches; brown (10YR 4/3) clay loam, very pale brown (10YR 7/3) dry; 40 percent intermixed yellowish brown (10YR 5/6) clay; moderate medium subangular blocky structure; firm; about 1 percent coarse fragments; neutral; abrupt smooth boundary.

Bt1—9 to 14 inches; yellowish brown (10YR 5/6) clay; common medium distinct grayish brown (10YR 5/2) mottles; moderate fine and medium subangular blocky structure; firm; thin continuous dark brown (10YR 4/3) and thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent coarse fragments; mildly alkaline; clear wavy boundary.

Bt2—14 to 20 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) and few fine distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; thin continuous gray (10YR 5/1) and thin discontinuous very dark grayish brown (10YR 3/2) clay films on faces of peds; patchy brown (10YR 4/3) clay films on faces of peds; white (10YR 8/1) carbonate coatings on faces of peds; about 8 percent coarse fragments; slight effervescence; mildly alkaline; clear wavy boundary.

C1—20 to 25 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; strong thick platy rock structure; very firm; patchy very dark grayish brown (10YR 3/2) organic coatings on vertical cracks; gray (10YR 6/1) carbonate coatings on horizontal plates; about 13 percent coarse fragments; violent effervescence; moderately alkaline; clear wavy boundary.

C2—25 to 60 inches; yellowish brown (10YR 5/4) clay loam; strong thick platy rock structure; very firm; dark grayish brown (10YR 4/2) coatings; dark brown (10YR 3/3) horizontal crack fillings; light gray (10YR 7/1) carbonate coatings on plates; about 14 percent coarse fragments; violent effervescence; moderately alkaline.

The solum is 16 to 30 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silty clay loam or clay loam. It is slightly acid or neutral.

The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam, clay loam, silty clay, or clay. It ranges from slightly acid to mildly alkaline. Some pedons have a BC horizon. This horizon has hue of 10YR, value of 5, and chroma of 4 to 6. It is silty clay loam or clay loam. It is mildly alkaline.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or clay loam. It is mildly alkaline or moderately alkaline.

Houghton Series

The Houghton series consists of deep, very poorly drained, moderately slowly permeable to moderately rapidly permeable soils in depressions on lake plains, till plains, and moraines. These soils formed in herbaceous organic deposits more than 51 inches thick. Slopes are 0 to 1 percent.

Houghton soils are adjacent to Bono soils. The adjacent soils do not have organic layers. They are slightly higher on the landscape than the Houghton soils.

A typical pedon of Houghton muck, drained, in a cultivated field; 1,200 feet north and 300 feet east of the southwest corner of sec. 32, T. 24 N., R. 11 E.

Oap—0 to 12 inches; black (N 2/0) broken face and rubbed muck; about 5 percent fiber, a trace rubbed; moderate medium granular structure; very friable; neutral; abrupt smooth boundary.

Oa1—12 to 18 inches; dark reddish brown (5YR 3/2) broken face and rubbed muck; about 10 percent fiber, a trace rubbed; weak coarse subangular blocky structure; very friable; common woody fragments 0.25 inch to 2 inches in diameter; neutral; clear wavy boundary.

Oa2—18 to 24 inches; dark reddish brown (5YR 3/2) broken face and rubbed sapric material; 30 to 50 percent fiber, a trace rubbed; moderate medium subangular blocky structure; very friable; common woody fragments 0.125 to 1 inch in diameter; neutral; gradual wavy boundary.

Oa3—24 to 60 inches; dark brown (7.5YR 3/4) broken face and rubbed sapric material; about 90 percent fiber, 5 percent rubbed; massive; very friable; neutral.

The organic layer is more than 51 inches thick. The Oap horizon is black (N 2/0 or 10YR 2/1). It is slightly acid or neutral. The Oa horizon has hue of 7.5YR or 5YR, value of 2 to 4, and chroma of 1 or 2. It is dominantly sapric material but may have thin hemic layers.

Martinsville Series

The Martinsville series consists of deep, well drained, moderately permeable soils in outwash areas on till plains and terraces. These soils formed in outwash. Slopes range from 0 to 6 percent.

Martinsville soils are adjacent to Eel and Whitaker soils. Eel soils do not have an argillic horizon. They are in the lower positions on the landscape. Whitaker soils are somewhat poorly drained and are in the slightly lower positions on the landscape.

A typical pedon of Martinsville loam, 0 to 2 percent slopes, in a cultivated field; 1,980 feet east and 925 feet south of the northwest corner of sec. 15, T. 22 N., R. 14 E.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; about 1 percent coarse fragments; slightly acid; abrupt smooth boundary.

Bt1—9 to 16 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; thin discontinuous brown (7.5YR 4/4) clay films on faces of peds; about 1 percent coarse fragments; slightly acid; clear wavy boundary.

Bt2—16 to 25 inches; strong brown (7.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; firm; thin continuous dark brown (7.5YR 3/4) clay films on faces of peds; about 1 percent coarse fragments; medium acid; clear wavy boundary.

Bt3—25 to 33 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; firm; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; about 1 percent coarse fragments; slightly acid; clear wavy boundary.

Bt4—33 to 42 inches; strong brown (7.5YR 5/6) clay loam; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark yellowish brown (10YR 4/4) and dark brown (7.5YR 3/4) clay films on faces of peds; about 5 percent coarse fragments; slightly acid; clear wavy boundary.

Bt5—42 to 48 inches; strong brown (7.5YR 4/6) clay loam; common coarse distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thin discontinuous dark grayish brown (10YR 4/2) clay films on faces of peds; about 5 percent coarse fragments; neutral; abrupt wavy boundary.

C1—48 to 53 inches; light yellowish brown (10YR 6/4) sandy loam that has thin strata of loamy sand and silt loam; common medium distinct yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2) mottles; massive; friable; about 10 percent coarse fragments; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—53 to 57 inches; brownish yellow (10YR 6/6) sandy loam that has thin strata of loamy sand and loam; common distinct light brownish gray (10YR 6/2) mottles; massive; friable; about 10 percent coarse fragments; strong effervescence; mildly alkaline; gradual wavy boundary.

C3—57 to 65 inches; brownish yellow (10YR 6/6) sandy loam that has thin strata of silt loam and loamy sand; about 10 percent coarse fragments; massive; friable; strong effervescence; mildly alkaline.

The solum is 40 to 60 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is a silt loam or loam. It is slightly acid or neutral.

The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 4 to 6. It is clay loam, sandy clay loam, or sandy loam. It is medium acid to neutral.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 4 to 6. It is dominantly sandy loam, silt loam, or loam, but it has strata of sand, fine sand, loamy very fine sand, loamy sand, or loamy coarse sand 0.5 to 1.0 inch thick.

Morley Series

The Morley series consists of deep, well drained, moderately slowly permeable soils on convex slopes on moraines. These soils formed in glacial till. Slopes range from 12 to 20 percent.

Morley soils are similar to Glynwood soils and are adjacent to Eel and Pewamo soils. Glynwood soils have gray mottles in the upper 10 inches of the argillic horizon. Eel soils are underlain by sand and gravel and are on bottom land. Pewamo soils have a mollic epipedon, are poorly drained, and are in the lower positions on the landscape.

A typical pedon of Morley clay loam, 12 to 20 percent slopes, severely eroded, in a pasture; 1,170 feet north and 65 feet west of the southeast corner of sec. 18, T. 24 N., R. 13 E.

Ap—0 to 5 inches; dark brown (10YR 4/3) clay loam, brown (10YR 5/3) dry; about 10 percent intermixed dark yellowish brown (10YR 4/4) clay loam; weak coarse subangular blocky structure parting to moderate medium granular; firm; about 2 percent gravel; slightly acid; abrupt smooth boundary.

Bt1—5 to 14 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thick discontinuous distinct dark brown (10YR 3/3) clay films on faces of peds; about 5 percent gravel; mildly alkaline; clear wavy boundary.

Bt2—14 to 22 inches; yellowish brown (10YR 5/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thick continuous brown (10YR 4/3) clay films on faces of peds; about 5 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C—22 to 60 inches; yellowish brown (10YR 5/4) clay loam; massive; very firm; discontinuous white (10YR 8/1) carbonate films in cracks; about 7 percent gravel; violent effervescence; strongly alkaline.

The solum is 20 to 30 inches thick. The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 3.

The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, silty clay, or clay. It is neutral or mildly alkaline. Some pedons have a BC horizon. This horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam or silty clay loam.

Pewamo Series

The Pewamo series consists of deep, poorly drained, moderately slowly permeable soils in drainageways and depressions on till plains and moraines. These soils formed in water-worked glacial till. Slopes range from 0 to 2 percent.

These soils are taxadjuncts to the Pewamo series because they do not regularly decrease in content of organic carbon with increasing depth and lack an argillic horizon. These differences, however, do not alter the usefulness or behavior of the soils.

Pewamo soils are similar to Bono and Saranac soils and are adjacent to Blount, Glynwood, and Morley soils. Bono soils formed in lacustrine deposits in the slightly lower lying areas. Saranac soils formed in alluvium. Blount, Glynwood, and Morley soils have a subsoil that is browner than that of the Pewamo soils. Blount soils are in the slightly higher convex areas. Glynwood soils are in the more sloping areas. Morley soils are in the higher positions on the landscape.

A typical pedon of Pewamo silty clay, in a cultivated field; 1,320 feet west and 1,915 feet south of the northeast corner of sec. 2, T. 22 N., R. 10 E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; about 1 percent gravel; neutral; abrupt smooth boundary.

Btg1—10 to 14 inches; grayish brown (2.5Y 5/2) silty clay; few fine distinct brownish yellow (10YR 6/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin continuous distinct dark gray (N 4/0) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

Btg2—14 to 28 inches; light brownish gray (2.5Y 6/2) silty clay; common medium distinct light olive brown (2.5Y 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin continuous distinct gray (10YR 5/1) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

Btg3—28 to 39 inches; light brownish gray (2.5Y 6/2) silty clay loam; many coarse distinct light olive brown (2.5Y 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin continuous distinct gray (N 5/0) clay films on faces of peds; about 1 percent gravel; mildly alkaline; clear wavy boundary.

Btg4—39 to 45 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; thin continuous distinct gray (10YR 5/1) clay films on faces of peds; about 2 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

Cg—45 to 60 inches; yellowish brown (10YR 5/8) clay loam; common medium distinct gray (10YR 5/1) mottles; moderate thick platy structure; firm; about 2 percent gravel; strong effervescence; moderately alkaline.

The solum is 40 to 70 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is silty clay or silty clay loam. It is slightly acid or neutral.

The Btg horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 or 2. It is silty clay, clay, or silty clay loam. It is slightly acid or neutral. Some pedons have a BC horizon. This horizon has hue of 10YR, value of 5, and chroma of 4 to 6. It is clay loam or silty clay loam.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5, and chroma of 1 to 8. It is clay loam or silty clay loam.

Saranac Series

The Saranac series consists of deep, very poorly drained, moderately slowly permeable soils on broad bottom land. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Saranac soils are adjacent to Eel and Eel Variant soils. Eel soils are browner than the Saranac soils and contain less clay. Eel Variant soils are browner in the solum than the Saranac soils and have a lighter colored surface layer.

A typical pedon of Saranac clay, frequently flooded, in a cultivated field; 2,110 feet north and 1,520 feet east of the southwest corner of sec. 1, T. 24 N., R. 13 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; moderate medium granular structure; firm; neutral; abrupt smooth boundary.

Bg1—10 to 18 inches; dark grayish brown (10YR 4/2) clay; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; continuous dark gray (10YR 4/1) and discontinuous very dark gray (10YR 3/1) organic films on faces of peds; neutral; clear wavy boundary.

Bg2—18 to 25 inches; dark gray (10YR 4/1) clay; common medium distinct yellowish brown (10YR 5/4) mottles and few coarse distinct strong brown (7.5YR 4/6) mottles along old root channels; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; continuous dark gray (N 4/0) organic films on faces of peds; about 1 percent gravel; slightly acid; clear wavy boundary.

Bg3—25 to 29 inches; gray (10YR 5/1) silty clay; common coarse distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; continuous dark gray (10YR 4/1) organic films on faces of peds; few olive brown (2.5Y 4/8) iron accumulations; slightly acid; clear wavy boundary.

BCg—29 to 44 inches; light brownish gray (2.5Y 6/2) silty clay; common medium distinct strong brown (7.5YR 4/6) mottles; moderate medium subangular blocky structure; firm; discontinuous gray (10YR 5/1) organic films on faces of peds; many yellowish red (5YR 4/6) iron accumulations; medium acid; clear wavy boundary.

Cg—44 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium faint gray (N 6/0) mottles; massive; firm; common yellowish red (5YR 5/6) iron accumulations; neutral.

The solum is 35 to 55 inches thick. The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2. It is slightly acid or medium acid.

The Bg horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 1 or 2. It is clay, silty clay, clay loam, and silty clay loam. It is strongly acid to slightly acid.

The Cg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It is medium acid to neutral. It is dominantly silty clay or silty clay loam. In some pedons, however, it has thin strata of loam, clay loam, or sandy loam and the content of coarse fragments is as much as 5 percent.

Wallkill Variant

The Wallkill Variant consists of deep, very poorly drained soils in depressions on lake plains, till plains, moraines, and broad bottom land. These soils formed in recent alluvium over organic deposits. They are slowly permeable in the alluvial layer, moderately rapidly permeable in the organic layer, and slowly permeable in the underlying coprogenous earth. Slopes range from 0 to 2 percent.

Wallkill Variant soils are similar to Saranac soils and adjacent to Eel Variant soils. Saranac and Eel Variant soils do not have underlying organic layers. They are on the higher lying parts of the landscape.

A typical pedon of Wallkill Variant silty clay, frequently flooded, in a cultivated field; 530 feet south and 330 feet west of the center of sec. 12, T. 24 N., R. 12 E.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay, grayish brown (10YR 5/2) dry; weak medium granular structure; friable; slightly acid; abrupt smooth boundary.

Cg—8 to 17 inches; dark grayish brown (10YR 4/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; slightly acid; clear wavy boundary.

2Oa1—17 to 21 inches; black (N 2/0) broken face and rubbed sapric material; about 5 percent fiber, a trace rubbed; weak coarse subangular blocky structure; few dark brown (7.5YR 3/4) sedge leaf fragments; slightly acid; clear wavy boundary.

2Oa2—21 to 36 inches; dark brown (7.5YR 3/2) broken face and rubbed sapric material; about 10 percent fiber, a trace rubbed; moderate medium platy structure; friable; few thin layers of strong brown (7.5YR 4/6) sedge leaf fragments; medium acid; clear wavy boundary.

3C1—36 to 44 inches; dark grayish brown (2.5Y 4/2) coprogenous earth; a trace of fiber; massive; friable; many white (10YR 8/1) shell fragments; violent effervescence; moderately alkaline; gradual wavy boundary.

3C2—44 to 60 inches; olive gray (5Y 5/2) coprogenous earth; a trace of fiber; massive; many white (10YR 8/1) shell fragments; violent effervescence; moderately alkaline.

The Ap horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. It is silty clay or clay. It is medium acid to mildly alkaline.

The Cg horizon has hue of 10YR, value of 3 or 4, and chroma of 2. It is silty clay or silty clay loam. It is medium acid to neutral.

The 2Oa horizon has hue of N, 7.5YR, or 10YR, value of 2, and chroma of 0 to 2. It is sapric material. It is slightly acid or medium acid. The 3C horizon has hue of 5Y or 2.5Y, value of 3 or 4, and chroma of 2. It is coprogenous earth or marl. It is slightly acid to moderately alkaline.

Whitaker Series

The Whitaker series consists of deep, somewhat poorly drained, moderately permeable soils on outwash terraces. These soils formed in outwash. Slopes range from 0 to 2 percent.

Whitaker soils are similar to Blount soils and are adjacent to Eldean and Martinsville soils. Blount soils have more clay in the subsoil than the Whitaker soils and are not stratified. Eldean soils have more clay in the subsoil than the Whitaker soils. They are in the higher lying areas. Martinsville soils are browner in the upper part of the subsoil than the Whitaker soils. They are in the higher positions on the landscape.

A typical pedon of Whitaker silt loam, in a cultivated field; 245 feet east and 330 feet south of the northwest corner of sec. 3, T. 22 N., R. 11 E.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; about 1 percent gravel; slightly acid; clear smooth boundary.

E—8 to 13 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate coarse granular structure; friable; thin discontinuous grayish brown (10YR 5/2) silt films on faces of peds; about 1 percent gravel; neutral; abrupt smooth boundary.

Bt1—13 to 17 inches; brown (7.5YR 5/4) clay loam; common medium distinct gray (10YR 5/1) and few fine distinct brownish yellow (10YR 6/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

Bt2—17 to 28 inches; brown (7.5YR 5/4) sandy clay loam; common medium distinct gray (10YR 5/1) and few fine distinct yellowish brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous grayish brown (10YR 5/2) clay films on faces of peds; about 5 percent gravel; slightly acid; clear wavy boundary.

Bt3—28 to 35 inches; brown (7.5YR 5/4) sandy clay loam; common medium distinct gray (10YR 5/1) and many medium distinct brownish yellow (10YR 6/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thin continuous dark gray (10YR 4/1) clay films on faces of peds; about 10 percent gravel; neutral; clear wavy boundary.

Bt4—35 to 43 inches; brown (10YR 4/3) clay loam; common medium distinct grayish brown (10YR 5/2), common medium prominent yellow (10YR 7/6), and many fine prominent very pale brown (10YR 7/3) mottles; moderate medium subangular blocky structure; firm; thin discontinuous grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) clay films on faces of peds; thin continuous light gray (10YR 7/2) films around pebbles; about 14 percent gravel; mildly alkaline; clear wavy boundary.

BC—43 to 48 inches; dark yellowish brown (10YR 4/4) sandy clay loam; common medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; discontinuous grayish brown (10YR 5/2) clay films on faces of peds; about 14 percent gravel; slight effervescence; mildly alkaline; abrupt wavy boundary.

C1—48 to 57 inches; yellowish brown (10YR 5/4) sandy loam; massive; very friable; about 14 percent gravel; violent effervescence; moderately alkaline; clear wavy boundary.

C2—57 to 65 inches; light yellowish brown (10YR 6/4) sandy loam; massive; very friable; about 14 percent gravel; stratum of strong brown (7.5YR 5/6) loamy sand 0.5 to 1.0 inch thick; violent effervescence; moderately alkaline.

The solum is 30 to 50 inches thick. The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3. It is silt loam or loam. It is slightly acid or neutral.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is medium acid to mildly alkaline. Some pedons have a BC horizon. This horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam, sandy clay loam, or loam. It is neutral or mildly alkaline.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam, loamy sand, loam, or silt loam. It is mildly alkaline or moderately alkaline.

Formation of the Soils

This section relates the major factors of soil formation to the soils in Blackford and Jay Counties. It also describes the processes of soil formation.

Factors of Soil Formation

Soil forms through processes acting on deposited or accumulated 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 formed, the plant and animal life on and in the soil, the relief, 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 to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in some extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Some time is always needed for the differentiation of soil horizons. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effects of any one factor unless conditions are specified for the other four.

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 of the soils of Blackford and Jay Counties were deposited by glaciers or by melted water from the glaciers. Some of these materials were subsequently reworked and redeposited by water and wind. The glaciers retreated from the counties about 12,000 to 15,000 years ago. Although the parent materials are commonly of glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant parent materials in Blackford and Jay Counties were deposited as glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till is material laid down directly by a glacier with a minimum of water action. It consists of particles of different sizes that are mixed together. Many of the small pebbles in glacial till have sharp edges and corners, indicating that they have not been worn by water. The glacial till in Blackford and Jay Counties is calcareous, very firm clay loam or silty clay loam. An example of soils that formed in glacial till are those in the Blount series. These soils typically are fine 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 material varies according to the speed of the stream that carried them. When the water slowed down, the coarser particles were deposited first. Finer particles, such as very fine sand, silt, and clay, were carried farther by the more slowly moving water. Outwash deposits generally consist of layers of particles of similar size, such as sandy loam, sand, and gravel (fig. 10). Eldean soils are an example of soils that formed in the outwash deposits in Blackford and Jay Counties.

Lacustrine material was deposited from still, or ponded, glacial melt water. Because the coarser particles had 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 Blackford and Jay Counties that formed in lacustrine deposits are typically fine textured. Bono soils are an example.

Alluvium was deposited by floodwater along the present streams in recent time. It varies in texture, depending on the speed of the water from which it was deposited. The alluvium deposited along a swift river, such as the Salamonie River, is coarser textured than that deposited along a slow, sluggish stream, such as Big Lick Creek. Eel and Saranac soils are examples of soils that formed in alluvium.

Organic material is made up of deposits of plant remains. After the glaciers withdrew from the area, water was left standing in depressions in outwash areas and on lake plains and till plains. Grasses and sedges growing around the edges of these lakes died, and their remains settled to the bottom. Because the areas were wet, the plant remains did not decompose but remained around the edges of the lakes. Later white-cedar, black spruce, and other water-tolerant trees grew in these areas. As these trees died, their residue became part of

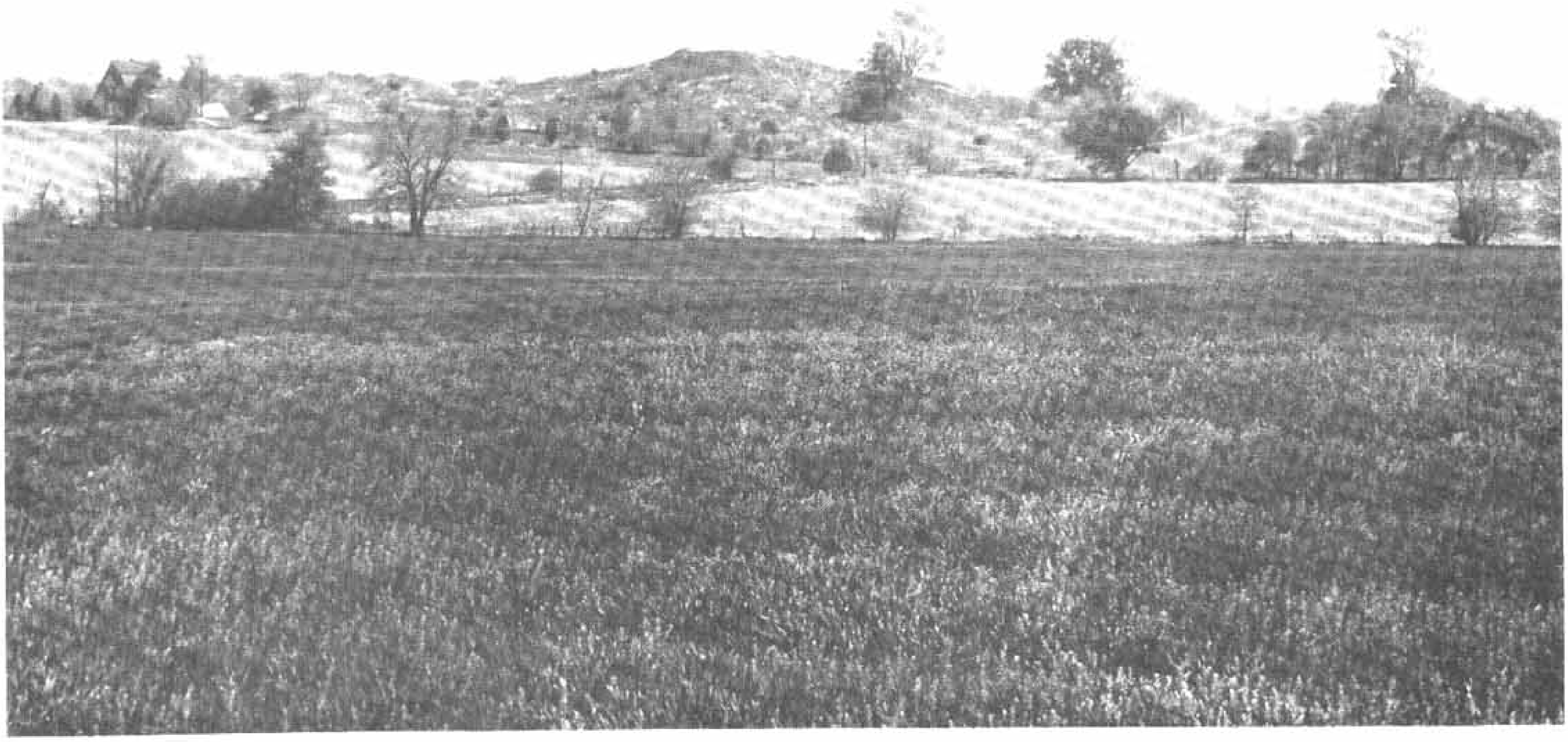

Figure 10.—Twin Hills, a deposit of sand and gravel along the Salamonie River. Martinsville, Saranac, and Whitaker soils are in the foreground.

the organic accumulation. The lakes were eventually filled with organic material and developed into areas of muck and other organic deposits. In some of these areas, the material has changed very little since deposition. Houghton soils are an example of soils that formed in organic material.

Plant and Animal Life

Plants have been the principal kind of organism influencing the soils in Blackford and Jay Counties; however, bacteria, fungi, earthworms, and human activities have also been important. 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 in the surface layer, decomposed, and eventually became humus. Their roots provided channels for the downward movement of water and air through the soil and added organic matter as they decomposed. Bacteria in the soil help to break down the organic matter into plant nutrients.

Before Blackford and Jay Counties were settled, the vegetation was primarily deciduous trees. Differences in natural soil drainage and slope and minor variations in the parent material affected the composition of the forests. In general, the moderately well drained upland soils, such as Glynwood soils, were covered by oaks, hickories, American beech, and sugar maple. The poorly drained soils supported primarily Ohio buckeye, pin oak, red maple, hickory, silver maple, and swamp white oak. A few wet soils also supported spruce and tamarack, sedges, reeds, and sphagnum and other mosses, which contributed substantially to the accumulation of organic matter. Houghton soils formed under wet conditions and contain a considerable amount of organic matter. Generally, the soils in Blackford and Jay Counties that formed dominantly under forest vegetation have less organic matter than the soils that formed dominantly under grasses.

Climate

Climate has important effects on the formation of soils. It determines the kind of plant and animal life on and in the soil. It determines the amount of water available for the weathering of minerals and the transporting of soil material. Through its effect on temperature, it determines the rate of chemical reaction in the soil. These influences tend to be uniform throughout areas the size of the two counties.

The climate in Blackford and Jay Counties is cool and humid. It is presumed to be similar to that which prevailed when the soils formed. The soils in the two counties differ from soils that formed under a dry, warm climate and from those that formed under a hot, moist climate. Although climate is uniform throughout the counties, its effect is modified locally by rivers and streams. Therefore, the differences among the soils in the counties result, to a minor extent, from differences in climate.

Relief

Relief affects soil formation through its effect on natural soil drainage, erosion, plant cover, and soil temperature. In Blackford and Jay Counties, slopes range from 0 to 20 percent. Natural soil drainage ranges from well drained on the sides of ridges to very poorly drained in the depressions. Through its effect on aeration, drainage helps to determine the color of the soil. Runoff is most rapid on the steeper slopes. It is temporarily ponded in some of the lower lying areas. Water and air move freely through well drained soils and slowly through very poorly drained soils. In soils that are well aerated, the iron compounds that give most soils their color are brightly colored and oxidized. Poorly aerated soils are mottled and gray. Morley and Eldean soils are examples of well drained, well aerated soils, and Saranac soils are an example of poorly aerated, very poorly drained soils.

Time

Time, usually a long time, is needed for distinct horizons to form in the parent material. Differences in the length of time that the parent materials have been in place are commonly reflected in the degree of profile development. Some soils form rapidly, and others form slowly.

The soils in Blackford and Jay Counties range from young to mature. The glacial deposits in which many of the soils formed have been exposed to soil-forming factors for a long enough time to allow distinct horizons to develop within the soil profile. Some soils, however, such as those that formed in recent alluvial sediments, have not been in place long enough for the development of distinct horizons.

Processes of Soil Formation

Several processes have been involved in the formation of the soils in Blackford and Jay Counties. 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 gleying. In most soils more than one of these processes have been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils in the counties. The content of organic matter in some of the soils is low, but that of others is high. Generally, the soils that have the most organic matter, such as Bono soils, have a thick, dark surface layer.

Carbonates and bases have been leached from the upper horizons of nearly all of the soils in the counties. Leaching generally precedes 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 or neutral reaction. Leaching of wet soils is slow because of a seasonal high water table or the slow movement of water through the profile.

Clay accumulates in pores and other voids and forms films or coatings on the surfaces 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 counties. Glynwood soils are an example of soils in which translocated silicate clays have accumulated in the Bt horizon as clay films on the faces of peds.

Gleying—the reduction and transfer of iron—has occurred in all of the very poorly drained, poorly drained, and somewhat poorly drained soils in the counties. In the naturally wet soils, this process has been significant in horizon differentiation. A gray color in the subsoil indicates reduction of iron oxides. Reduction is commonly accompanied by some transfer of iron, either from the upper horizons to the 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.

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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

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.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

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, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves 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.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

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.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 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.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an 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 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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

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.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

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, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 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.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant 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.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Much has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

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 multipled 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:

	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, 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.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

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

[Data were recorded in the period 1951-74 at Berne, 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----	34.0	18.4	26.2	60	-10	16	2.20	1.14	3.12	6	6.8
February---	37.3	20.4	28.8	61	- 8	11	1.93	.90	2.81	5	5.9
March------	47.3	29.1	38.3	78	3	142	3.16	1.43	4.63	7	7.0
April------	60.8	39.3	50.1	84	22	314	3.24	1.96	4.39	7	1.2
May--------	72.1	48.7	60.4	89	29	632	3.68	2.82	4.48	8	.0
June-------	82.5	58.8	70.7	96	41	921	4.12	2.38	5.66	7	.0
July-------	84.9	62.5	73.8	97	47	1,048	4.26	2.88	5.52	7	.0
August-----	83.9	60.4	72.2	96	42	998	2.93	1.56	4.13	5	.0
September--	77.9	54.0	66.0	95	36	780	3.31	1.36	4.95	6	.0
October----	66.3	43.2	54.8	87	23	465	2.36	1.07	3.47	5	.0
November---	50.1	33.5	41.8	73	12	115	2.86	1.44	4.10	6	2.0
December---	37.5	23.0	30.3	65	- 6	40	2.31	.88	3.49	6	6.2
Yearly:											
Average--	61.2	40.9	51.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	98	-15	---	---	---	---	---	---
Total----	---	---	---	---	---	5,482	36.36	29.91	39.36	75	29.1

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Data were recorded in the period 1951-74 at Berne, 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--	April 17	April 28	May 16
2 years in 10 later than--	April 12	April 23	May 11
5 years in 10 later than--	April 4	April 14	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	October 20	October 12	September 30
2 years in 10 earlier than--	October 25	October 18	October 5
5 years in 10 earlier than--	November 4	October 28	October 14

TABLE 3.--GROWING SEASON

[Data were recorded in the period 1951-74 at Berne, 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	194	175	148
8 years in 10	201	182	153
5 years in 10	214	196	165
2 years in 10	227	210	176
1 year in 10	234	217	182

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent of area	Cultivated crops	Specialty crops	Woodland	Urban uses	Intensive recreation areas
	Pct					
1. Bono-Houghton------	1	Fair: wetness.	Fair: wetness, ponding.	Poor: wetness, ponding.	Poor: wetness, ponding, excess humus.	Poor: ponding, too clayey, excess humus.
2. Saranac-Eel--------	3	Fair: wetness, flooding.	Fair: wetness, flooding.	Fair: wetness, flooding.	Poor: wetness, flooding.	Poor: flooding, too clayey.
3. Blount-Pewamo-Glynwood----------	46	Good-------	Fair: wetness.	Good-------	Poor: wetness, ponding, shrink-swell.	Poor: wetness, ponding, too clayey.
4. Glynwood-Blount-Pewamo------------	32	Good-------	Fair: erosion, wetness.	Good-------	Poor: shrink-swell, wetness, ponding.	Poor: slope, wetness, ponding.
5. Eldean-------------	1	Fair: erosion, slope.	Good-------	Good-------	Fair: poor filter, shrink-swell, slope.	Fair: percs slowly, slope, small stones.
6. Glynwood-----------	17	Poor: erosion, slope.	Poor: erosion, slope.	Good-------	Fair: shrink-swell, wetness.	Fair: wetness, slope, percs slowly.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Blackford County	Jay County	Total-- Area	Total-- Extent
		Acres	Acres	Acres	Pct
BlA	Blount-Glynwood, thin solum complex, 0 to 3 percent slopes-	33,650	80,280	113,930	32.4
Bo	Bono silty clay------------------------------------	4,050	2,450	6,500	1.8
Bs	Bono Variant mucky silty clay-----------------------	465	91	556	0.2
Ee	Eel clay loam, frequently flooded-------------------	650	3,450	4,100	1.2
Ef	Eel Variant silty clay, occasionally flooded--------	110	1,100	1,210	0.3
ElA	Eldean silt loam, 0 to 2 percent slopes-------------	190	450	640	0.2
EnB3	Eldean clay loam, 2 to 6 percent slopes, severely eroded---	290	640	930	0.3
EnC3	Eldean clay loam, 6 to 12 percent slopes, severely eroded--	7	280	287	0.1
GsB3	Glynwood clay loam, thin solum, 2 to 6 percent slopes, severely eroded-----------------------	28,370	70,600	98,970	28.1
GsC3	Glynwood clay loam, thin solum, 6 to 12 percent slopes, severely eroded-----------------------	3,050	7,200	10,250	2.9
Ho	Houghton muck, drained------------------------------	610	255	865	0.2
MaA	Martinsville loam, 0 to 2 percent slopes------------	295	460	755	0.2
MaB2	Martinsville loam, 2 to 6 percent slopes, eroded----------	45	630	675	0.2
MoD3	Morley clay loam, 12 to 20 percent slopes, severely eroded-	520	510	1,030	0.3
Pm	Pewamo silty clay-----------------------------------	29,750	69,500	99,250	28.2
So	Saranac clay loam, stratified substratum, occasionally flooded-------------------------------	0	780	780	0.2
St	Saranac clay, frequently flooded--------------------	3,050	5,600	8,650	2.5
Ud	Udorthents, loamy-----------------------------------	325	670	995	0.3
Wa	Wallkill Variant silty clay, frequently flooded-----------	375	270	645	0.2
Wh	Whitaker silt loam----------------------------------	220	570	790	0.2
	Total---	106,022	245,786	351,808	100.0

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	Grass-legume hay	Tall fescue
		Bu	Bu	Bu	Tons	AUM*
BlA:		96	31	43	4.3	7.1
Blount	IIw					
Glynwood	IIIe					
Bo: Bono	IIIw	115	38	---	4.2	8.4
Bs: Bono Variant	IIIw	100	35	---	---	---
Ee: Eel	IIw	105	37	---	3.5	8.0
Ef: Eel Variant	IIw	120	45	40	4.5	9.0
ElA: Eldean	IIs	110	35	42	4.5	9.0
EnB3: Eldean	IIIe	90	30	40	4.5	9.0
EnC3: Eldean	IVe	75	20	30	3.5	7.0
GsB3: Glynwood	IVe	50	15	20	3.8	6.5
GsC3: Glynwood	VIe	---	---	---	3.2	6.4
Ho: Houghton	IIIw	115	34	---	---	---
MaA: Martinsville	I	120	42	48	4.0	8.0
MaB2: Martinsville	IIe	115	40	46	3.8	7.6
MoD3: Morley	VIe	---	---	---	3.3	6.6
Pm: Pewamo	IIw	125	42	60	5.0	10.0
So: Saranac	IIw	110	38	---	3.5	6.7
St: Saranac	IIIw	95	35	45	---	---
Ud**. Udorthents						
Wa: Wallkill Variant	IVw	50	20	---	---	---
Wh: Whitaker	IIw	130	46	52	4.3	8.6

* 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. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I:				
Blackford County	295	---	---	---
Jay County	460	---	---	---
II:				
Blackford County	56,202	45	55,967	190
Jay County	136,690	630	135,610	450
III:				
Blackford County	16,878	8,703	8,175	---
Jay County	29,106	20,710	8,396	---
IV:				
Blackford County	28,752	28,377	375	---
Jay County	71,150	70,880	270	---
V:				
Blackford County	---	---	---	---
Jay County	---	---	---	---
VI:				
Blackford County	3,570	3,570	---	---
Jay County	7,710	7,710	---	---
VII:				
Blackford County	---	---	---	---
Jay County	---	---	---	---
VIII:				
Blackford County	---	---	---	---
Jay County	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
BlA*:								
Blount	3c	Slight	Slight	Severe	Severe	White oak Northern red oak Green ash Bur oak Pin oak	65 65 --- --- ---	Eastern white pine, red pine, yellow-poplar.
Glynwood	2c	Moderate	Slight	Severe	Moderate	Northern red oak Black oak White oak	75 75 75	Austrian pine, yellow-poplar, pin oak, green ash, black oak.
Bo Bono	3w	Slight	Severe	Severe	Severe	Pin oak Swamp white oak Green ash Red maple Eastern cottonwood Black cherry	80 --- --- --- --- ---	Red maple, eastern cottonwood, American sycamore, pin oak, green ash, swamp white oak, silver maple.
Bs Bono Variant	3w	Slight	Severe	Severe	Severe	Silver maple Hackberry Green ash	76 --- ---	Green ash, American sycamore, eastern cottonwood, pin oak, silver maple, swamp white oak.
Ee Eel	1a	Slight	Slight	Slight	Slight	Yellow-poplar Eastern cottonwood White ash Black walnut	100 --- --- ---	Eastern white pine, black walnut, yellow-poplar.
Ef Eel Variant	1a	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar Silver maple Green ash Eastern cottonwood	87 96 --- --- ---	White ash, yellow-poplar, eastern white pine, eastern cottonwood, white oak, black cherry.
ElA, EnB3, EnC3 Eldean	2a	Slight	Slight	Slight	Slight	Northern red oak Black oak White oak Black walnut Black cherry Sugar maple White ash Yellow-poplar	80 80 80 --- --- --- --- ---	Eastern white pine, black walnut, yellow-poplar, white ash, red pine, white oak.
GsB3, GsC3 Glynwood	2c	Moderate	Slight	Severe	Moderate	White oak Northern red oak Black oak	75 75 75	Austrian pine, yellow-poplar, pin oak, green ash, black oak.
Ho Houghton	4w	Slight	Severe	Severe	Severe	White ash Red maple Black willow Quaking aspen Silver maple	51 51 --- 56 76	
MaA, MaB2 Martinsville	1a	Slight	Slight	Slight	Slight	White oak Yellow-poplar	96 98	Eastern white pine, red pine, white ash, yellow-poplar, black walnut.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	
MoD3: Morley	2r	Moderate	Moderate	Slight	Slight	White oak Northern red oak Yellow-poplar Black walnut Bur oak Shagbark hickory	80 80 90 --- --- ---	White oak, black walnut, green ash, eastern white pine, Norway spruce, red pine, white spruce.
Pm: Pewamo	2w	Slight	Severe	Moderate	Moderate	Pin oak Swamp white oak Red maple White ash Eastern cottonwood Green ash	90 --- 71 71 98 ---	Norway spruce, white ash, eastern white pine, red maple, green ash.
So: Saranac	2w	Slight	Severe	Severe	Severe	Pin oak Red maple Bur oak White ash	86 --- --- ---	Eastern white pine, Norway spruce, red maple, white ash.
St: Saranac	2w	Slight	Severe	Severe	Severe	Pin oak Red maple Bur oak White ash	86 --- --- ---	Eastern white pine, Norway spruce, red maple, white ash.
Wa: Wallkill Variant	4w	Slight	Severe	Severe	Severe	Eastern cottonwood Silver maple	98 ---	American sycamore, eastern cottonwood, green ash, pin oak, red maple, silver maple, swamp white oak.
Wh: Whitaker	3a	Slight	Slight	Slight	Slight	White oak Pin oak Yellow-poplar Northern red oak	70 85 85 75	Eastern white pine, white ash, red maple, yellow-poplar, American sycamore.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
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.	---
Glynwood	---	Eastern redcedar, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
Bo: Bono	---	American cranberrybush, silky dogwood, Amur privet, Amur honeysuckle.	Northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine, Norway spruce.	---
Bs: Bono Variant	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Ee: Eel	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Ef: Eel Variant	---	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.
ElA, EnB3, EnC3: Eldean	Siberian peashrub	Autumn-olive, eastern redcedar, radiant crab-apple, Tatarian honeysuckle, Washington hawthorn, Amur honeysuckle, lilac.	Austrian pine, eastern white pine, jack pine, red 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
GsB3, GsC3: Glynwood	---	Eastern redcedar, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Pin oak, eastern white pine.	---
Ho: 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.
MaA, MaB2: 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.
MoD3: Morley	---	Amur honeysuckle, Washington hawthorn, osageorange, Amur privet, arrowwood, American cranberrybush, Tatarian honeysuckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Pm: 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.
So: 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.
St: Saranac	---	American cranberrybush, Amur privet, Amur honeysuckle, silky dogwood.	Northern white-cedar, Washington hawthorn, white fir, blue spruce, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Ud*. Udorthents					
Wa: Wallkill Variant	---	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.

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
Wh----------------- Whitaker	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, Austrian pine, blue spruce, Washington hawthorn, northern white-cedar.	Norway spruce-----	Eastern white pine, pin oak.

* 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
BlA*:					
Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Glynwood	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Slight	Moderate: droughty.
Bo: Bono	Severe: ponding, too clayey, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: too clayey, ponding.
Bs: Bono Variant	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
Ee: Eel	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Ef: Eel Variant	Severe: flooding, too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
ElA: Eldean	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: small stones.	Severe: erodes easily.	Moderate: droughty.
EnB3: Eldean	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: droughty.
EnC3: Eldean	Moderate: percs slowly, slope.	Moderate: percs slowly, slope.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
GsB3: Glynwood	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, small stones, wetness.	Slight	Moderate: droughty.
GsC3: Glynwood	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty, slope.
Ho: Houghton	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.
MaA: Martinsville	Slight	Slight	Moderate: small stones.	Slight	Slight.
MaB2: Martinsville	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.

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
MoD3------------------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Pm--------------------- Pewamo	Severe: too clayey, ponding.	Severe: too clayey, ponding.	Severe: too clayey, ponding.	Severe: too clayey, ponding.	Severe: too clayey, ponding.
So--------------------- Saranac	Severe: flooding, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
St--------------------- Saranac	Severe: flooding, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.
Ud*. Udorthents					
Wa--------------------- Wallkill Variant	Severe: flooding, ponding, too clayey.	Severe: ponding, too clayey.	Severe: too clayey, ponding, flooding.	Severe: ponding, too clayey.	Severe: ponding, flooding, too clayey.
Wh--------------------- 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
BlA*:										
Blount	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Glynwood	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Bo: Bono	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Bs: Bono Variant	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ee: Eel	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
Ef: Eel Variant	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
ElA: Eldean	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EnB3: Eldean	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EnC3: Eldean	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
GsB3: Glynwood	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
GsC3: Glynwood	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ho: Houghton	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
MaA, MaB2: Martinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MoD3: Morley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Pm: Pewamo	Good	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
So, St: Saranac	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Ud*. Udorthents										
Wa: Wallkill Variant	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Wh: 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
BlA*:						
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.	Severe: low strength, frost action.	Moderate: droughty.
Bo: Bono	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell, low strength.	Severe: too clayey, ponding.
Bs: Bono Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: ponding, too clayey.
Ee: Eel	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
Ef: Eel Variant	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: too clayey.
ElA: Eldean	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
EnB3: Eldean	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: droughty.
EnC3: Eldean	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: droughty, slope.
GsB3: Glynwood	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Moderate: droughty.
GsC3: Glynwood	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: droughty, slope.
Ho: Houghton	Severe: ponding, excess humus.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength, frost action.	Severe: excess humus, ponding.
MaA: Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
MaB2: Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
MoD3: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: 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
Pm----------------- Pewamo	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: too clayey, ponding.
So----------------- Saranac	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, too clayey.
St----------------- Saranac	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding, too clayey.
Ud*. Udorthents						
Wa----------------- Wallkill Variant	Severe: excess humus, ponding.	Severe: flooding, ponding, low strength.	Severe: flooding, ponding, low strength.	Severe: flooding, ponding, low strength.	Severe: ponding, flooding, frost action.	Severe: ponding, flooding, too clayey.
Wh----------------- 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," "poor," 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
BlA*:					
Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Glynwood	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
Bo Bono	Severe: percs slowly, ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
Bs Bono Variant	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Ee Eel	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Ef Eel Variant	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey.
ElA, EnB3 Eldean	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
EnC3 Eldean	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
GsB3 Glynwood	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
GsC3 Glynwood	Severe: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness.
Ho Houghton	Severe: ponding, percs slowly.	Severe: seepage, ponding, excess humus.	Severe: ponding, excess humus, seepage.	Severe: ponding, seepage.	Poor: ponding, excess humus.
MaA, MaB2 Martinsville	Slight	Moderate: seepage.	Severe: seepage.	Slight	Fair: thin layer.
MoD3 Morley	Severe: percs slowly, 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
Pm------------------ Pewamo	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, ponding, hard to pack.
So, St-------------- Saranac	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Ud*. Udorthents					
Wa------------------ Wallkill Variant	Severe: flooding, ponding, percs slowly.	Severe: seepage, flooding, excess humus.	Severe: flooding, ponding, excess humus.	Severe: flooding, seepage, ponding.	Poor: hard to pack, ponding.
Wh------------------ 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
BlA*:				
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.
Bo: Bono	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Bs: Bono Variant	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Ee: Eel	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ef: Eel Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ElA, EnB3, EnC3: Eldean	Good	Probable	Probable	Poor: small stones, area reclaim.
GsB3, GsC3: Glynwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ho: Houghton	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
MaA, MaB2: Martinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MoD3: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
Pm: Pewamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
So: Saranac	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
St: Saranac	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Ud*. Udorthents				
Wa: Wallkill Variant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Wh: 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-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
BlA*:						
Blount	Slight	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
Glynwood	Slight	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, percs slowly, wetness.	Erodes easily, percs slowly, droughty.
Bo: Bono	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Percs slowly, ponding.	Ponding, percs slowly.	Wetness, percs slowly.
Bs: Bono Variant	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
Ee: Eel	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Erodes easily.
Ef: Eel Variant	Slight	Severe: wetness.	Severe: slow refill.	Flooding, frost action.	Wetness	Droughty.
ElA, EnB3: Eldean	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Erodes easily, too sandy.	Erodes easily, droughty.
EnC3: Eldean	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, erodes easily, too sandy.	Slope, erodes easily, droughty.
GsB3: Glynwood	Moderate: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, droughty.
GsC3: Glynwood	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, droughty.
Ho: Houghton	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Frost action, subsides, ponding.	Ponding, soil blowing.	Wetness.
MaA: Martinsville	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
MaB2: Martinsville	Moderate: seepage, slope.	Moderate: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
MoD3: Morley	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Pm: Pewamo	Slight	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Wetness.
So: Saranac	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, rooting depth, percs slowly.
St: Saranac	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness	Wetness, rooting depth, percs slowly.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ud*. Udorthents						
Wa----------------- Wallkill Variant	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, percs slowly, flooding.	Ponding, percs slowly.	Wetness, percs slowly.
Wh----------------- Whitaker	Severe: seepage.	Severe: wetness.	Moderate: slow refill, cutbanks cave.	Frost action---	Erodes easily, wetness.	Wetness, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BlA*:											
Blount----------	0-9	Silt loam--------	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	9-34	Silty clay loam, clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	34-60	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--------	0-9	Clay loam--------	CL	A-6, A-7	0-2	95-100	85-100	75-100	60-95	30-45	11-19
	9-20	Clay, clay loam	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	65-95	35-55	14-30
	20-60	Clay loam, silty clay loam.	CL	A-4, A-6	0-5	95-100	80-100	75-95	65-90	25-40	8-16
Bo--------------- Bono	0-9	Silty clay-------	CH, CL	A-7	0	100	98-100	95-100	80-95	40-60	20-35
	9-49	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	98-100	95-100	90-100	40-66	26-44
	49-80	Stratified silty clay to coarse sand.	CH, CL, CL-ML, SM	A-7, A-6, A-2	0	100	95-100	70-95	30-80	<35	NP-15
Bs--------------- Bono Variant	0-10	Mucky silty clay	CL, CH, MH	A-7	0	100	100	95-100	90-95	40-65	15-30
	10-33	Silty clay loam, silty clay.	CL, CH, MH	A-7	0	100	100	95-100	85-95	40-65	15-30
	33-60	Silty clay, silty clay loam.	CL, CH, MH	A-7	0	100	100	95-100	90-95	40-65	15-30
Ee--------------- Eel	0-9	Clay loam--------	CL	A-6	0	100	100	95-100	80-90	30-40	10-16
	9-40	Silt loam, loam, clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	75-85	24-40	3-15
	40-60	Stratified sandy loam to silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	90-100	70-80	55-70	24-40	3-15
Ef--------------- Eel Variant	0-11	Silty clay-------	CL	A-7, A-6	0	100	100	90-100	70-95	35-50	15-25
	11-60	Silty clay, silty clay loam.	CL	A-7, A-6	0	100	100	90-100	70-95	35-50	15-25
ElA-------------- Eldean	0-11	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	85-100	80-100	70-100	55-90	20-40	4-14
	11-33	Clay, gravelly sandy clay, gravelly clay loam.	CL, ML	A-7, A-6	0-5	75-100	60-100	55-95	50-80	38-50	12-23
	33-60	Stratified sand to gravel.	GM, SM, GP-GM, SP-SM	A-1, A-2	0-15	30-70	20-50	5-40	0-35	---	NP
EnB3, EnC3------- Eldean	0-8	Clay loam--------	CL	A-6, A-4	0-5	85-100	75-100	65-100	55-80	25-40	9-18
	8-32	Clay, gravelly sandy clay, gravelly clay loam.	CL, ML	A-7, A-6	0-5	75-100	60-100	55-95	50-80	38-50	12-23
	32-60	Stratified sand to gravel.	GM, SM, GP-GM, SP-SM	A-1, A-2	0-15	30-70	20-50	5-40	0-35	---	NP
GsB3, GsC3------- Glynwood	0-9	Clay loam--------	CL	A-6, A-7	0-2	95-100	85-100	75-100	60-95	30-45	11-19
	9-20	Clay, clay loam	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	65-95	35-55	14-30
	20-60	Clay loam, silty clay loam.	CL	A-4, A-6	0-5	95-100	80-100	75-95	65-90	25-40	8-16
Ho--------------- Houghton	0-60	Sapric material	PT	A-8	0	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
MaA, MaB2: Martinsville	0-9	Loam	CL, CL-ML, ML	A-4	0	100	85-100	75-100	65-90	<25	3-8
	9-48	Clay loam, sandy 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
	48-65	Stratified silt loam to loamy coarse sand.	SM, CL-ML, CL, SC	A-2, A-4, A-6	0	95-100	85-100	55-95	30-75	20-30	NP-11
MoD3: Morley	0-5	Clay loam	CL	A-6, A-7	0-5	95-100	90-100	85-95	80-90	30-45	15-25
	5-22	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	22-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-30
Pm: Pewamo	0-10	Silty clay	CH	A-7	0-5	90-100	80-100	80-100	75-95	50-55	25-30
	10-28	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
	28-60	Clay loam, silty clay loam.	CL	A-7	0-5	95-100	90-100	90-100	70-90	40-50	15-25
So: Saranac	0-12	Clay	CL, CH, ML, MH	A-7	0	100	95-100	90-100	80-95	40-55	15-25
	12-46	Clay, clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	70-90	30-60	10-30
	46-60	Gravelly loam	CL-ML, ML	A-4	0	100	85-100	75-90	65-85	15-40	3-20
St: Saranac	0-10	Clay	CL, CH	A-7	0	100	100	95-100	80-95	40-55	20-35
	10-44	Clay loam, silty clay loam, clay.	CL, CH	A-7	0	100	95-100	90-100	70-90	40-60	20-35
	44-60	Stratified silty clay loam to sandy loam.	CL, CH, SM-SC	A-7, A-6, A-4	0	100	95-100	90-100	70-90	40-60	20-35
Ud*. Udorthents											
Wa: Wallkill Variant	0-8	Silty clay	CH, CL	A-7	0	100	100	90-100	75-95	40-65	20-40
	8-17	Silty clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	75-95	40-65	20-40
	17-36	Sapric material	PT	A-8	0	---	---	---	---	---	---
	36-60	Coprogenous earth	OH, OL	A-8	0	---	---	---	---	---	---
Wh: Whitaker	0-13	Silt loam	CL, CL-ML, ML	A-4, A-6	0	100	95-100	80-100	60-90	15-35	2-15
	13-43	Clay loam, loam, sandy clay loam.	CL, CL-ML	A-6, A-4	0	100	95-100	90-100	70-80	20-35	5-15
	43-65	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/cm3	In/hr	In/in	pH					Pct
BlA*:											
Blount----------	0-9	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
	9-34	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-8.4	Moderate-----	0.43			
	34-60	27-38	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate-----	0.43			
Glynwood--------	0-9	27-38	1.35-1.55	0.2-0.6	0.17-0.22	5.6-7.3	Low----------	0.43	2	6	1-2
	9-20	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-7.8	Moderate-----	0.32			
	20-60	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate-----	0.32			
Bo--------------- Bono	0-9	35-45	1.20-1.45	0.2-2.0	0.20-0.23	6.1-7.3	High---------	0.28	5	4	4-8
	9-49	38-55	1.35-1.55	<0.2	0.10-0.14	6.1-8.4	High---------	0.28			
	49-80	8-45	1.25-1.50	0.6-2.0	0.10-0.18	7.4-8.4	Moderate-----	0.28			
Bs--------------- Bono Variant	0-10	40-60	0.85-1.40	0.2-6.0	0.20-0.25	5.1-6.0	Low----------	0.28	5	2	20-31
	10-33	38-60	1.35-1.55	<0.06	0.11-0.18	6.1-7.8	Moderate-----	0.28			
	33-60	40-60	1.45-1.60	<0.06	0.10-0.12	7.4-8.4	Moderate-----	0.28			
Ee--------------- Eel	0-9	27-32	1.35-1.55	0.6-2.0	0.21-0.23	6.1-7.3	Low----------	0.37	5	6	1-2
	9-40	18-32	1.30-1.50	0.6-2.0	0.17-0.22	5.6-7.8	Low----------	0.37			
	40-60	10-27	1.30-1.50	0.6-2.0	0.19-0.21	6.1-8.4	Low----------	0.37			
Ef--------------- Eel Variant	0-11	35-45	1.45-1.55	0.6-2.0	0.12-0.19	6.1-7.3	Low----------	0.32	5	4	2-4
	11-60	35-45	1.45-1.60	0.2-0.6	0.09-0.19	4.5-7.3	Moderate-----	0.32			
ElA-------------- Eldean	0-11	15-25	1.30-1.50	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.37	4	5	2-3
	11-33	35-48	1.40-1.60	0.2-2.0	0.08-0.14	5.6-7.8	Moderate-----	0.37			
	33-60	2-8	---	>6.0	0.01-0.04	7.4-8.4	Low----------	0.10			
EnB3, EnC3------- Eldean	0-8	27-33	1.35-1.55	0.6-2.0	0.16-0.18	5.6-7.3	Low----------	0.37	3	6	2-3
	8-32	35-48	1.40-1.60	0.2-2.0	0.08-0.14	5.6-7.8	Moderate-----	0.37			
	32-60	2-8	---	>6.0	0.01-0.04	7.4-8.4	Low----------	0.10			
GsB3, GsC3------- Glynwood	0-9	27-38	1.35-1.55	0.2-0.6	0.17-0.22	5.6-7.3	Low----------	0.43	2	6	1-2
	9-20	35-55	1.45-1.75	0.06-0.2	0.11-0.18	4.5-7.8	Moderate-----	0.32			
	20-60	27-36	1.65-1.85	0.06-0.2	0.06-0.10	7.4-8.4	Moderate-----	0.32			
Ho--------------- Houghton	0-60	---	0.15-0.45	0.2-6.0	0.35-0.45	5.6-7.8	-------------	----	2	2	>70
MaA, MaB2-------- Martinsville	0-9	8-20	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.37	5	5	2-3
	9-48	20-33	1.40-1.60	0.6-2.0	0.16-0.20	5.1-7.3	Moderate-----	0.37			
	48-65	8-25	1.25-1.60	0.6-2.0	0.12-0.17	5.1-7.8	Low----------	0.24			
MoD3------------- Morley	0-5	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
	5-22	35-50	1.55-1.70	0.2-0.6	0.11-0.15	6.1-7.8	Moderate-----	0.43			
	22-60	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
Pm--------------- Pewamo	0-10	40-45	1.35-1.55	0.2-0.6	0.12-0.20	6.1-7.3	Moderate-----	0.24	5	4	4-5
	10-28	35-50	1.40-1.70	0.2-0.6	0.12-0.20	5.6-7.8	Moderate-----	0.24			
	28-60	30-40	1.50-1.75	0.2-0.6	0.14-0.18	7.4-8.4	Moderate-----	0.24			
So--------------- Saranac	0-12	40-50	0.90-1.50	0.06-0.2	0.12-0.20	6.1-7.3	Moderate-----	0.24	5	4	4-6
	12-46	27-60	1.30-1.80	0.06-0.6	0.10-0.20	6.1-7.3	Moderate-----	0.24			
	46-60	10-35	1.40-1.95	0.06-0.6	0.10-0.20	6.1-7.3	Low----------	0.24			
St--------------- Saranac	0-10	40-60	0.90-1.50	0.06-0.2	0.12-0.20	6.1-7.8	Moderate-----	0.24	5	4	4-6
	10-44	35-60	1.30-1.80	0.2-0.6	0.10-0.20	5.6-7.8	Moderate-----	0.24			
	44-60	18-45	1.50-1.95	0.06-0.6	0.10-0.20	6.6-8.4	Moderate-----	0.24			
Ud*. Udorthents											

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 K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cm3	In/hr	In/in	pH					Pct
Wa---------------- Wallkill Variant	0-8	40-60	1.20-1.45	0.06-0.2	0.10-0.14	5.6-6.5	High---------	0.28	5	4	4-8
	8-17	38-60	1.35-1.55	0.06-0.2	0.08-0.12	5.1-6.5	High---------	0.28			
	17-36	---	---	0.2-6.0	0.35-0.45	5.1-7.3	-------------	----			
	36-60	---	---	0.06-0.2	0.18-0.24	6.6-8.4	-------------	----			
Wh---------------- Whitaker	0-13	8-19	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low-----------	0.37	5	5	2-3
	13-43	18-30	1.40-1.60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.37			
	43-65	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 "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	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
BlA*:												
Blount	C	None	---	---	1.0-3.0	Perched	Jan-May	>60	---	High	High	High.
Glynwood	C	None	---	---	2.0-3.5	Perched	Jan-Apr	>60	---	High	High	Moderate.
Bo Bono	D	None	---	---	+1-1.0	Apparent	Dec-May	>60	---	Moderate	High	Low.
Bs Bono Variant	B/D	None	---	---	+.5-1.0	Apparent	Nov-May	>60	---	Moderate	High	Low.
Ee Eel	B	Frequent	Brief	Oct-Jun	1.5-3.0	Apparent	Jan-Apr	>60	---	High	Moderate	Low.
Ef Eel Variant	C	Occasional	Brief	Feb-Jun	1.5-3.0	Apparent	Dec-Apr	>60	---	High	High	High.
ElA, EnB3, EnC3 Eldean	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
GsB3, GsC3 Glynwood	C	None	---	---	2.0-3.5	Perched	Jan-Apr	>60	---	High	High	Moderate.
Ho Houghton	A/D	None	---	---	+1-1.0	Apparent	Sep-Jun	>60	---	High	High	Low.
MaA, MaB2 Martinsville	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MoD3 Morley	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Pm Pewamo	C/D	None	---	---	+1-1.0	Apparent	Dec-May	>60	---	High	High	Low.
So Saranac	C/D	Occasional	Brief to very long.	Jan-Dec	0-1.0	Apparent	Sep-Jun	>60	---	High	High	Low.
St Saranac	C/D	Frequent	Very long	Jan-Dec	0-1.0	Apparent	Sep-Jun	>60	---	High	High	Low.
Ud*. Udorthents												
Wa Wallkill Variant	C	Frequent	Very long	Sep-Jun	+1-1.0	Apparent	Sep-Jun	>60	---	High	Moderate	Moderate.
Wh Whitaker	C	None	---	---	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Blount	Fine, illitic, mesic Aeric Ochraqualfs
*Bono	Fine, illitic, mesic Typic Haplaquolls
Bono Variant	Fine, illitic, nonacid, mesic Histic Humaquepts
Eel	Fine-loamy, mixed, nonacid, mesic Aquic Udifluvents
Eel Variant	Fine, mixed, nonacid, mesic Aquic Udifluvents
*Eldean	Fine, mixed, mesic Typic Hapludalfs
Glynwood	Fine, illitic, mesic Aquic Hapludalfs
Houghton	Euic, mesic Typic Medisaprists
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Morley	Fine, illitic, mesic Typic Hapludalfs
*Pewamo	Fine, mixed, mesic Typic Argiaquolls
Saranac	Fine, mixed, mesic Fluvaquentic Haplaquolls
Udorthents	Loamy, mixed, nonacid, mesic Udorthents
Wallkill Variant	Fine, mixed, nonacid, mesic Thapto-Histic Fluvaquents
Whitaker	Fine-loamy, mixed, mesic Aeric Ochraqualfs

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