United States Department of Agriculture

Soil Conservation Service

In cooperation with Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

Soil Survey of Decatur County, Iowa

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How To Use This Soil Survey

General Soil Map

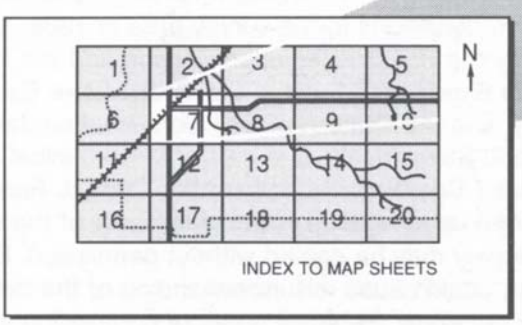
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

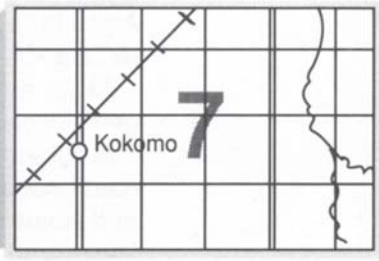
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

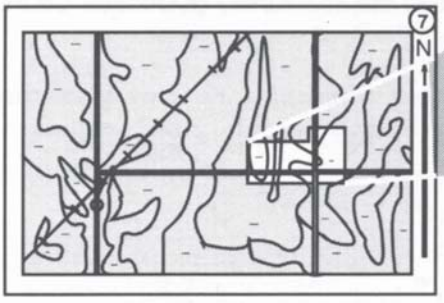


INDEX TO MAP SHEETS

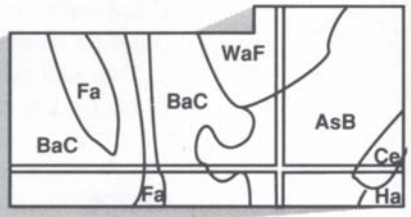


MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

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

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service and the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. It is part of the technical assistance furnished to the Decatur County Soil Conservation District. Funds appropriated by Decatur County were used to defray part of the cost of the survey.

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.

This soil survey supersedes the soil survey of Decatur County, Iowa, published in 1939 (*15*).

Cover: A cow-calf herd is grazing improved pasture on the Arispe-Clarinda-Lamoni association.

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Soil Series

Issued March 1990

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Summary of Tables

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Preface

This soil survey contains information that can be used in land-planning programs in Decatur County, Iowa. 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.

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Soil Survey of Decatur County, Iowa

By Thomas A. DeWitt, Soil Conservation Service

Fieldwork by Thomas A. DeWitt, Gary A. Lindgren, James M. Gertsma, and Stephen J. Ernst, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

DECATUR COUNTY is in the south-central part of Iowa (fig. 1). It has an area of 342,624 acres, or 535 square miles. Leon is the county seat. It is in the center of the county, about 70 miles south of Des Moines.

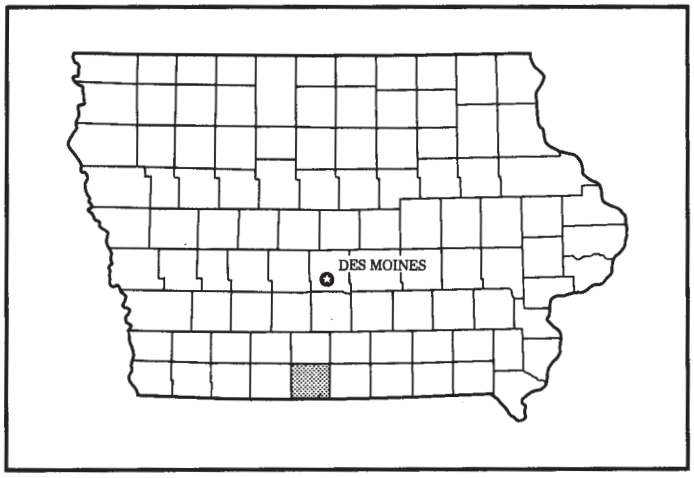

Figure 1.—Location of Decatur County in Iowa.

General Nature of the County

This section provides general information about the history, the farming, the climate, the physiography and relief, the drainage, and the transportation facilities of Decatur County, Iowa.

History

The Sac and Fox Indians first inhabited the area of Iowa now known as Decatur County. They ceded the area to the U.S. Government in a treaty dated October 11, 1842. The county itself was created by an act of the legislature of the Territory of Iowa, approved January 13, 1846. It was named after Commodore Stephen Decatur.

The first settlers arrived in about 1840, and settled in the southern part of the county.

In 1851, the county seat was Decatur City, and 2 years later was moved to South Independence. In 1855, the name of this town was changed to Leon.

Farming

Farming is the chief economic enterprise in Decatur County. Most of the local income is derived from row crops, such as corn and soybeans, and the sale of beef cattle and hogs.

The main crops are corn, soybeans, oats, wheat, hay, and pasture. Corn is the most important cash crop, but the amount sold varies from year to year, depending on the price of feeder cattle, the market for fattened cattle, the market for hogs, the cash price of corn, and the quality of the corn crop. In 1984, corn was grown on 58,000 acres in the county, soybeans on 43,000 acres,

oats on 5,500 acres, wheat on 3,000 acres, and hay on 43,000 acres (*4*).

Farms in Decatur County, like those throughout the Midwest, have been decreasing in number and increasing in size. During the period 1975 to 1984, they decreased in number from 910 to 750, and increased in average size from 363 to 433 acres. In 1984, the average size farm in the state was 297 acres. In the same year, 69 percent of farms in the county were owner operated; in the state 53 percent were owner operated (*4*).

Climate

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

Decatur County is cold in winter, and is quite hot and has occasional cool spells in summer. Precipitation in winter frequently occurs as snowstorms, and during the warm months it is chiefly showers, often heavy, when warm moist air moves in from the south. Total annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Lamoni in the period 1962 to 1984. 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 25 degrees F, and the average daily minimum temperature is 16 degrees. The lowest temperature on record, which occurred at Lamoni on January 10, 1982, is -22 degrees. In summer the average temperature is 74 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Lamoni on July 30, 1980, is 106 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 (50 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 about 36 inches. Of this, 25 inches, or about 70 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 19 inches. The heaviest 1-day rainfall during the period of record was 4.76 inches at Lamoni on August 31, 1980. Thunderstorms occur on about 50 days each year, and most occur in summer.

The average seasonal snowfall is 26.5 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 43 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 50 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring.

Tornadoes and severe thunderstorms strike occasionally. These storms are local and of short duration, and result in sparse damage in narrow belts. Hailstorms occur at times during the warmer part of the year in irregular patterns and in relatively small areas.

Physiography and Relief

Decatur County is part of what was once a broad plain (*6*). Most of the streams have considerably cut the landscape. Also, the tributaries have cut headward into the divides. The cutting has given the county the broken appearance characteristic of the south-central part of Iowa.

Remnants of the original plain make up a comparatively small part of the county. They are winding, nearly level, upland divides ranging from 1/8 to 1/4 mile in width. The upper part of the break from the stable summits of the divides to the streams is a gentle slope. At lower elevations, however, the slopes generally are steeper. The vertical interval between the lowlands and the adjoining uplands ranges from 100 to 150 feet. Landsurface elevations in the county range from about 1,190 feet above mean sea level to about 890 feet along the flood plains of the Grand and Weldon Rivers near the Iowa-Missouri state line. Maximum relief is thus about 300 feet between the highest surface and the lowest surface.

Drainage

Almost all of the runoff in Decatur County travels through the Grand River drainage system to the Missouri River. The runoff in a very small area in the northeastern part, however, drains toward the Chariton River and eventually into the Missouri River. The Grand River (formerly named the Thompson River) drains most of the western half of the county, and the eastern half is drained by the Little and Weldon Rivers. The southwest corner of the county is drained by the east and west forks of Big Creek and by Shane Creek.

Transportation

Three major highways serve Decatur County. U.S. 69 and Interstate 35 traverse the county dominantly north and south, and State Highway 2 runs east and west. U.S. 69 and State Highway 2 intersect at Leon. These major highways are connected to all of the smaller communities in the county by hard-surfaced state highways and by county roads. The major county roads

are well distributed throughout the county. Almost all farms are on farm-to-market roads of crushed limestone.

Other important transportation includes bus routes and motor freight lines, which serve every trading center in the county.

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, soil reaction, 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.

This soil survey supersedes the soil survey of Decatur County published in 1939 (*15*). It provides additional information and contains larger maps that show the soils in more detail.

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 named and mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

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

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

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

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

Soil Descriptions

1. Grundy-Haig-Edina Association

Nearly level to gently sloping, somewhat poorly drained and poorly drained, silty soils that formed in loess; on uplands

This association consists of soils on broad upland flats and convex ridgetops. The landscape is nearly level to undulating. Slopes range from 0 to 5 percent.

This association makes up about 5 percent of the county. It is about 45 percent Grundy soils, 30 percent Haig soils, 15 percent Edina soils, and 10 percent soils of minor extent (fig. 2).

Grundy soils are somewhat poorly drained and gently sloping. They are on convex upland ridgetops. Haig soils are poorly drained and nearly level. They are on broad upland flats. Edina soils are poorly drained, nearly level, and in slightly depressional areas on broad upland flats. They have a subsurface layer that is lighter colored than that of the adjacent Haig soils.

Typically, the surface layer of Grundy soils is black, friable silty clay loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. In the upper part it is dark brown, friable silty clay loam. In the next part it is dark grayish brown and grayish brown, mottled, firm silty clay. In the lower part it is grayish brown, mottled, firm silty clay loam.

Typically, the surface layer of Haig soils is black, friable silty clay loam about 7 inches thick. The subsurface layer is black and very dark gray, friable silty clay loam about 6 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is very dark gray, very dark grayish brown, and dark grayish brown, friable silty clay loam. In the next part it is dark grayish brown and grayish brown, firm silty clay. In the lower part it is olive gray, firm silty clay loam.

Typically, the surface layer of Edina soils is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is very dark gray and dark gray, mottled, friable silt loam about 8 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is dark gray, firm silty clay. In the lower part it is olive gray, firm silty clay and silty clay loam.

The soils of minor extent in this association are Arispe soils. They are moderately sloping and on short convex side slopes in coves at the heads of drainageways. They contain less clay in the subsoil.

Most of this association is used for row crops, small grain, and hay. The main enterprises are growing cash crops and feeding livestock. Corn, soybeans, oats, and hay grow fairly well or well on this association. The main management needs are measures that help to control water erosion, to improve drainage, and to maintain fertility. On the moderately sloping Arispe soils, water erosion is a hazard. In the nearly level areas a subsurface drainage system is needed. Tile intakes help to remove surface water from depressional areas.

2. Arispe-Clarinda-Lamoni Association

Moderately sloping and strongly sloping, somewhat poorly drained and poorly drained, silty and loamy soils that formed in loess and in a paleosol that formed in glacial till; on uplands

This association consists of soils on long and narrow, convex ridgetops, side slopes, and coves at the heads of drainageways. In most areas the landscape is gently rolling or rolling. Slopes ranges from 5 to 14 percent.

The association makes up about 16 percent of the county. It is about 30 percent Arispe soils, 25 percent Clarinda soils, 15 percent Lamoni soils, and 30 percent minor soils (fig. 3).

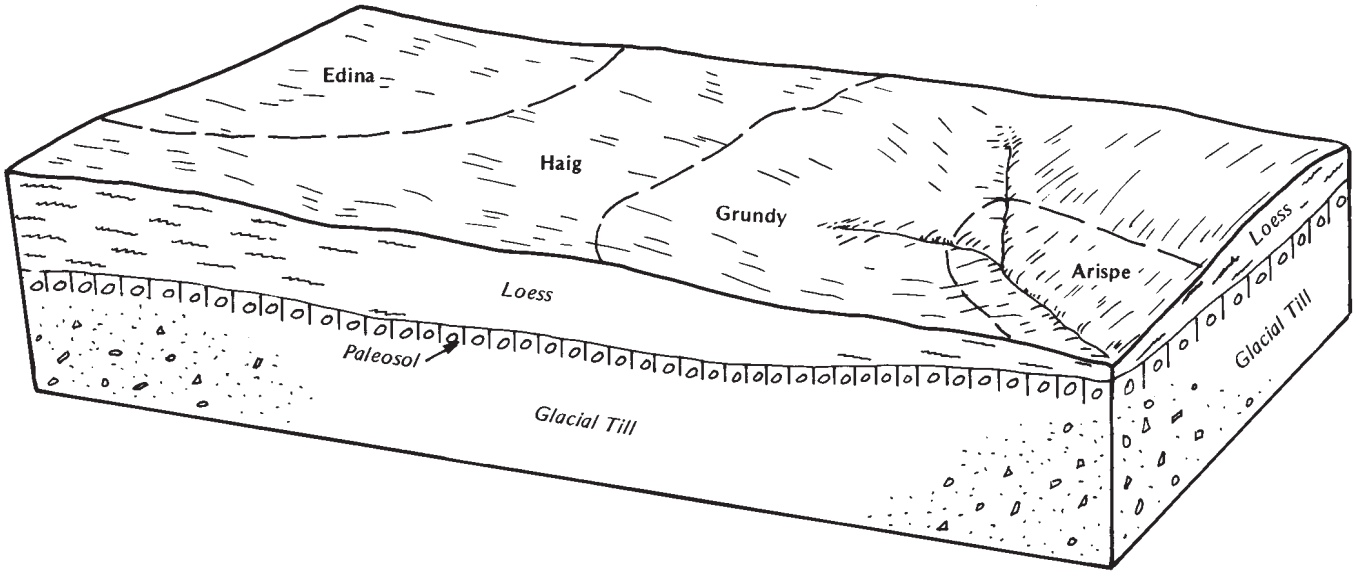

Figure 2.—Typical landscape pattern of the soils and the parent material in the Grundy-Haig-Edina association.

Arispe soils are somewhat poorly drained and moderately sloping. They are on short convex side slopes, in coves at the heads of drainageways, and on lower narrow ridges on uplands. Clarinda soils are poorly drained and downslope from Arispe soils in similar landscape positions. They are moderately sloping and strongly sloping. Lamoni soils are somewhat poorly drained and on lower side slopes along drainageways. They are moderately sloping and strongly sloping.

Typically, the surface layer of Arispe soils is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is dark grayish brown, friable silty clay loam. In the middle part it is olive brown and grayish brown, friable silty clay. In the lower part it is grayish brown, friable and firm silty clay loam.

Typically, the surface layer of Clarinda soils is black, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 3 inches thick. The subsoil to a depth of about 60 inches is firm and very firm, mottled silty clay. In the upper part it is dark grayish brown, in the middle part it is dark gray, and in the lower part it is grayish brown.

Typically, the surface layer of Lamoni soils is very dark grayish brown, friable clay loam about 8 inches thick. It is mixed with streaks and pockets of olive brown subsoil material. The subsoil is about 52 inches thick. In the upper part it is olive brown, mottled, firm clay. In the lower part it is mottled grayish brown, yellowish brown, and strong brown, very firm clay loam.

The soils of minor extent in this association are Adair, Grundy, and Shelby soils. Adair soils are somewhat poorly drained. They are on ridges and side slopes below Arispe soils. Shelby soils are moderately well drained, and formed in glacial till. They are strongly sloping to steep, and are on convex side slopes downslope from the adjacent Lamoni soils.

Most of this association is used for row crops in rotation with small grain, hay, and pasture. The main enterprises are growing cash crops and feeding livestock. Corn and soybeans grow fairly well on the moderately sloping areas. Oats, wheat, hay, and pasture are more commonly grown than row crops on the strongly sloping areas. The main management needs are measures that help to control rill, sheet, and gully erosion, to improve drainage, and to maintain fertility.

3. Gara-Armstrong-Lineville Association

Moderately sloping to steep, moderately well drained and somewhat poorly drained, silty and loamy soils that formed in glacial till and in loess or sediments over a paleosol; on uplands

This association consists of soils on long narrow convex ridgetops and nose slopes and on dissected side slopes. The landscape is gently rolling to steep. Slopes range from 5 to 25 percent.

The association makes up about 30 percent of the county. It is about 30 percent Gara soils, 20 percent Armstrong soils, 10 percent Lineville soils, and 40 percent soils of minor extent (fig. 4).

Gara soils are moderately well drained and strongly sloping to steep. They are on convex upland side slopes. Armstrong soils are somewhat poorly drained, and

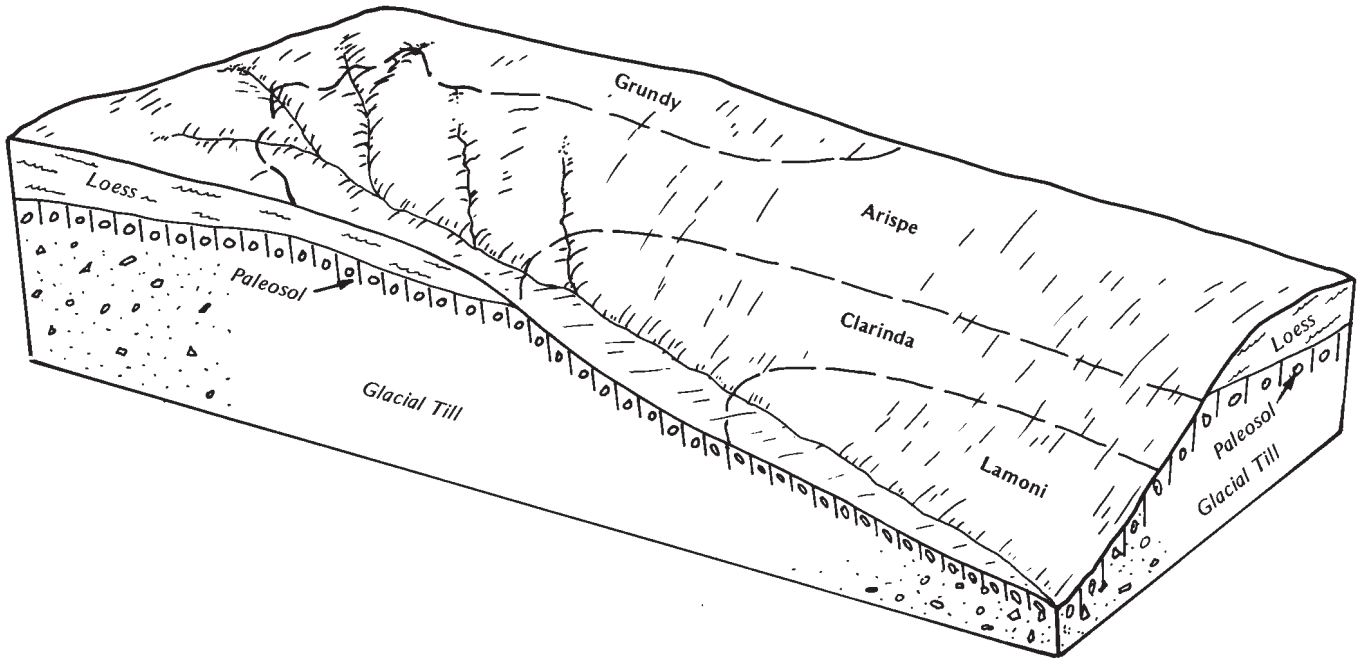

Figure 3.—Typical landscape pattern of the soils and the parent material in the Arispe-Clarinda-Lamoni association.

moderately sloping and strongly sloping. They are on ridgetops and upper side slopes. Lineville soils are moderately well drained and moderately sloping. They are on convex upland ridgetops and nose slopes.

Typically, the surface layer of Gara soils is very dark gray, friable loam about 8 inches thick. The subsurface layer is dark grayish brown and brown, friable loam about 6 inches thick. The subsoil is mottled and about 32 inches thick. In the upper part it is dark yellowish brown, firm clay loam. In the lower part it is yellowish brown, firm clay loam. The substratum to a depth of about 60 inches is mottled grayish brown and yellowish brown, very firm, calcareous clay loam. Stones and pebbles are in the subsoil and the substratum.

Typically, the surface layer of Armstrong soils is very dark grayish brown, friable clay loam or loam about 6 inches thick. It is mixed with some streaks and pockets of subsoil material of dark yellowish brown clay loam. The subsoil is mottled, firm clay loam or clay about 36 inches thick. In the upper part it is dark yellowish brown, in the next part it is grayish brown, and in the lower part it is strong brown. The substratum to a depth of about 60 inches is mottled grayish brown and brown clay loam.

Typically, the surface layer of Lineville soils is very dark grayish brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. In the upper part it is brown, friable silty clay loam. In the next part it is dark yellowish brown and brown, mottled friable silty clay loam. In the lower part it is strong brown and yellowish brown, mottled, very firm and firm clay.

The soils of minor extent in this association are Kniffin, Olmitz, Pershing, Vesser, and Zook soils. Olmitz soils are well drained, formed in loamy alluvium on foot slopes, and have a thick, dark colored surface soil. Pershing and Kniffin soils formed entirely in loess and are upslope from Lineville soils on the broader ridgetops. Vesser soils are somewhat poorly drained, formed in silty alluvium, and have a thick, dark colored surface soil. Zook soils are poorly drained and formed in alluvium on flood plains.

Most of the moderately sloping soils in the association are used for row crops, small grain, and hay. Most of the strongly sloping to steep soils are used as permanent pasture, woodland, and wildlife areas. The many ponds in the steep areas help to control gully erosion and provide a water supply for livestock. The bottom land, depending on its width and the amount of stream channel meanders, is used for cultivated crops and hay and as permanent pasture and woodland. The main farm enterprises are growing cash grain crops and raising cow-calf herds.

Corn, soybeans, oats, and hay grow fairly well on the moderately sloping soils in this association. The main management needs are measures to control water erosion, to prevent the formation of gullies, to control brush and weeds, and to maintain fertility.

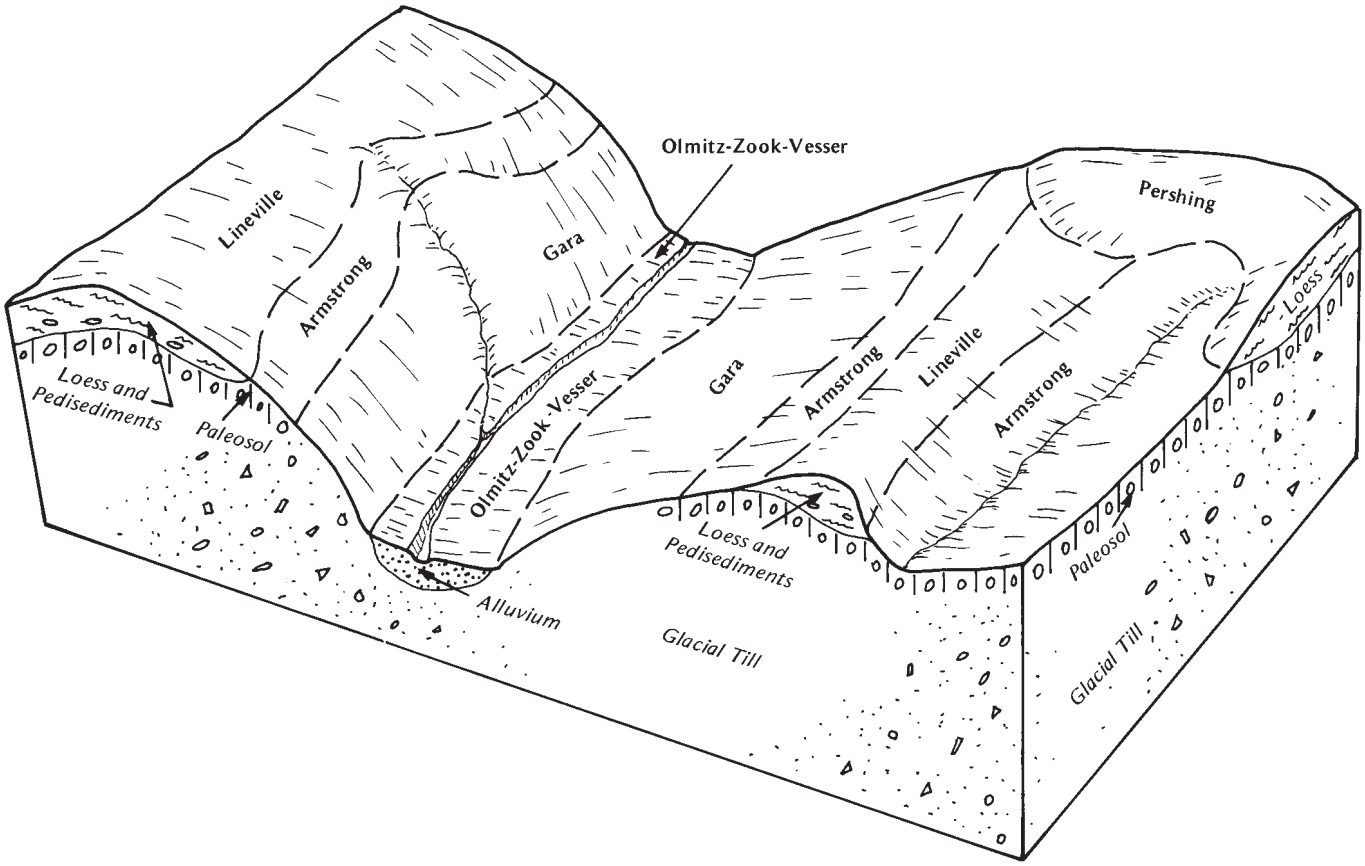

Figure 4.—Typical landscape pattern of the soils and the parent material in the Gara-Armstrong-Lineville association.

4. Nodaway-Lawson-Zook Association

Nearly level and very gently sloping, moderately well drained to poorly drained, silty soils that formed in alluvium; on bottom land

This association consists of soils on flood plains along the major streams. These soils are subject to flooding. Slopes range from 0 to 3 percent.

This association makes up about 12 percent of the county. It is about 25 percent Nodaway soils, 20 percent Lawson soils, 15 percent Zook soils, and 40 percent soils of minor extent (fig. 5).

Nodaway and Lawson soils are nearly level and very gently sloping, and commonly are adjacent to the stream channels. Nodaway soils are moderately well drained, and Lawson soils are somewhat poorly drained. Zook soils are poorly drained, and on nearly level areas adjacent to foot slopes of benches or uplands.

Typically, the surface layer of Nodaway soils is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, dark grayish brown, and grayish brown, friable silt loam.

Typically, the surface layer of Lawson soils is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 38 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown and dark grayish brown, friable silt loam.

Typically, the surface layer of Zook soils is black, friable silty clay loam or silt loam about 7 inches thick. The subsurface layer is very dark gray and black, firm silty clay about 27 inches thick. The subsoil is very dark gray, mottled, firm silty clay to a depth of 60 inches or more.

The soils of minor extent in this association are Cantril, Humeston, Klum, Keswick, Lindley, and Vesser soils. Cantril soils formed in loamy local alluvium on foot slopes and alluvial fans. Humeston and Vesser soils are grayer in the subsoil than the major soils. They are on flood plains, second bottoms, and alluvial fans of slightly higher elevation than the major soils. Keswick and

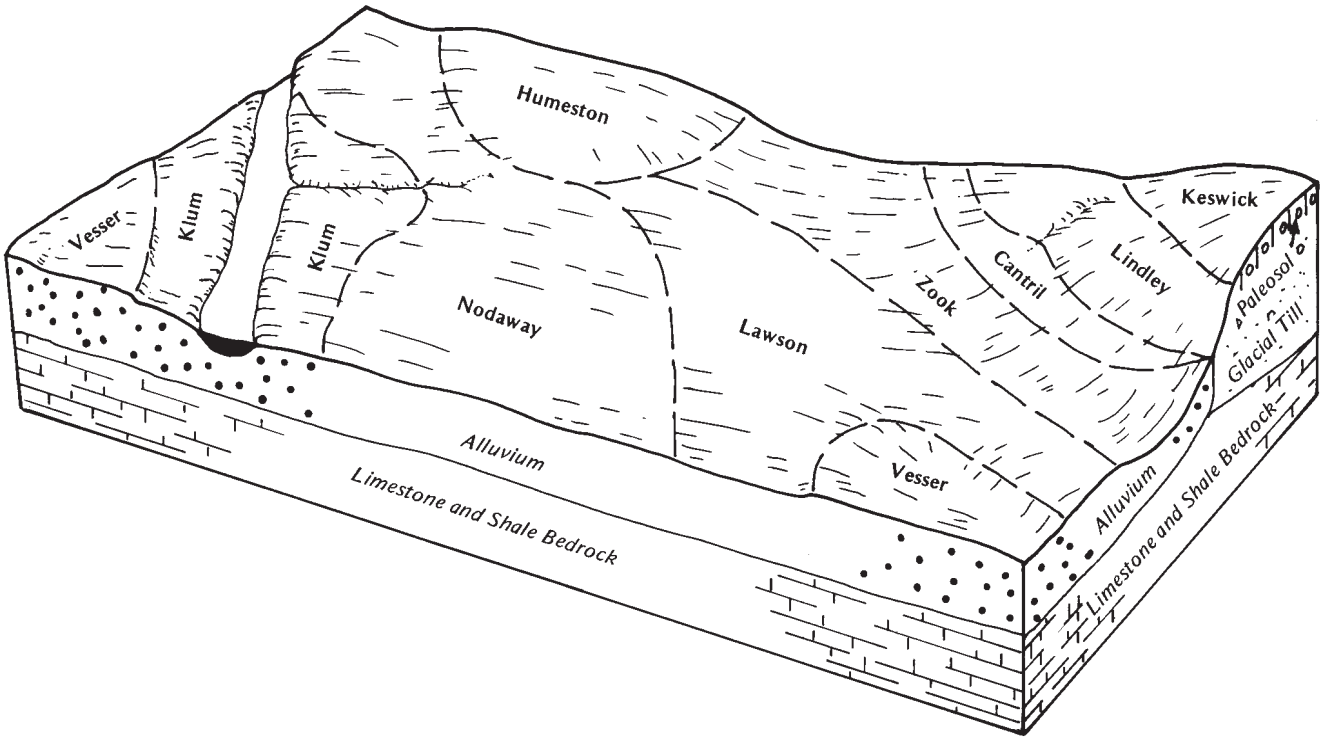

Figure 5.—Typical landscape pattern of the soils and the parent material in the Nodaway-Lawson-Zook association.

Lindley soils are loamy and on adjacent, dissected upland glacial areas. Klum soils contain more sand than Nodaway, Lawson, and Zook soils, and are commonly adjacent to meandering stream channels.

Most of this association is used for row crops, small grain, and hay. Areas characterized by meandering stream channels and narrow streams valleys are used for pasture or as habitat for woodland wildlife. The main enterprise is growing cash grain crops.

The soils in this association generally are well suited to row crops if they are adequately drained and protected from flooding. Corn, soybeans, oats, hay, and pasture plants grow well. The main management needs are measures to improve drainage, to protect the soils from floodwater, and to maintain fertility. The soils can be drained by tile and surface drains if adequate outlets are available. Diversion terraces help to control runoff from adjacent upland areas.

5. Lindley-Keswick Association

Moderately sloping to very steep, well drained and moderately well drained, silty and loamy soils that formed in glacial till and in loess or sediments over a paleosol; on uplands

This association consists of soils on long and narrow coves, ridgetops, nose slopes, and dissected side slopes. In most areas the landscape is gently rolling to very steep. Slopes range from 5 to 40 percent.

This association makes up about 22 percent of the county. It is about 45 percent Lindley soils, 20 percent Keswick soils, and 35 percent soils of minor extent.

Lindley soils are well drained and strong sloping to very steep. They are on convex ridgetops and side slopes on uplands. Keswick soils are moderately well drained, and moderately sloping and strongly sloping. They are on short, convex shoulder slopes and nose slopes on uplands.

Typically, the surface layer of Lindley soils is very dark grayish brown, friable loam about 3 inches thick. The subsurface layer is dark brown, friable loam about 3 inches thick. The subsoil is about 33 inches thick. In the upper part it is yellowish brown, firm clay loam, and in the lower part it is yellowish brown, mottled firm and very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, very firm, calcareous clay loam.

Typically, the surface layer of Keswick soils is very dark gray, friable loam about 4 inches thick. The subsurface layer is yellowish brown and brown loam about 8 inches thick. The subsoil extends to a depth of about 60 inches. It is firm and mottled. In the upper part it is brown and strong brown clay. In the next part it is

strong brown clay loam. In the lower part it is yellowish brown clay loam.

The soils of minor extent in this association are Cantril, Coppock, Douds, and Galland soils. Cantril soils are somewhat poorly drained and formed in loamy alluvium on foot slopes and alluvial fans. Coppock soils are somewhat poorly drained, and formed in silty alluvium on foot slopes, alluvial fans, and flood plains. Douds and Galland soils formed in alluvium on high benches downslope from Lindley and Keswick soils and adjacent to the major streams.

Most of the moderately sloping and strongly sloping areas of this association are used as hayland, pasture, woodland, and wildlife. Some areas are used for row crops grown in rotation with small grain and hay. Most of the moderately steep to very steep soils are used for permanent pasture, as woodland, and as wildlife areas. The many ponds in this association help to control gully erosion and provide a water supply for woodland, wildlife, and recreation areas. The bottom land in this association is narrow and dissected by streams, uncrossable waterways, and gullies. The main enterprises are growing small grain crops, raising cow-calf herds, producing firewood and dimension lumber, and hunting and fishing.

The main management needs are measures to control sheet, rill, and gully erosion, to control brush, and to maintain fertility, proper grazing of pastures, and fencing to prevent grazing of woodland areas.

6. Seymour-Kniffin-Bucknell Association

Gently sloping to strongly sloping, somewhat poorly drained, silty and loamy soils that formed in loess and in a paleosol that formed in glacial till; on uplands

This association consists of soils on upland convex ridgetops, side slopes, and head slopes of drainageways. The landscape is undulating to rolling. Slopes range from 2 to 14 percent.

This association makes up about 6 percent of the county. It is about 40 percent Seymour soils, 15 percent Kniffin soils, 15 percent Bucknell soils, and 30 percent soils of minor extent (fig. 6).

Seymour and Kniffin soils are somewhat poorly drained, gently sloping and moderately sloping soils formed in loess on convex ridgetops and upper side slopes. Bucknell soils are somewhat poorly drained, moderately sloping and strongly sloping soils formed in a paleosol that developed in glacial till. They are on lower

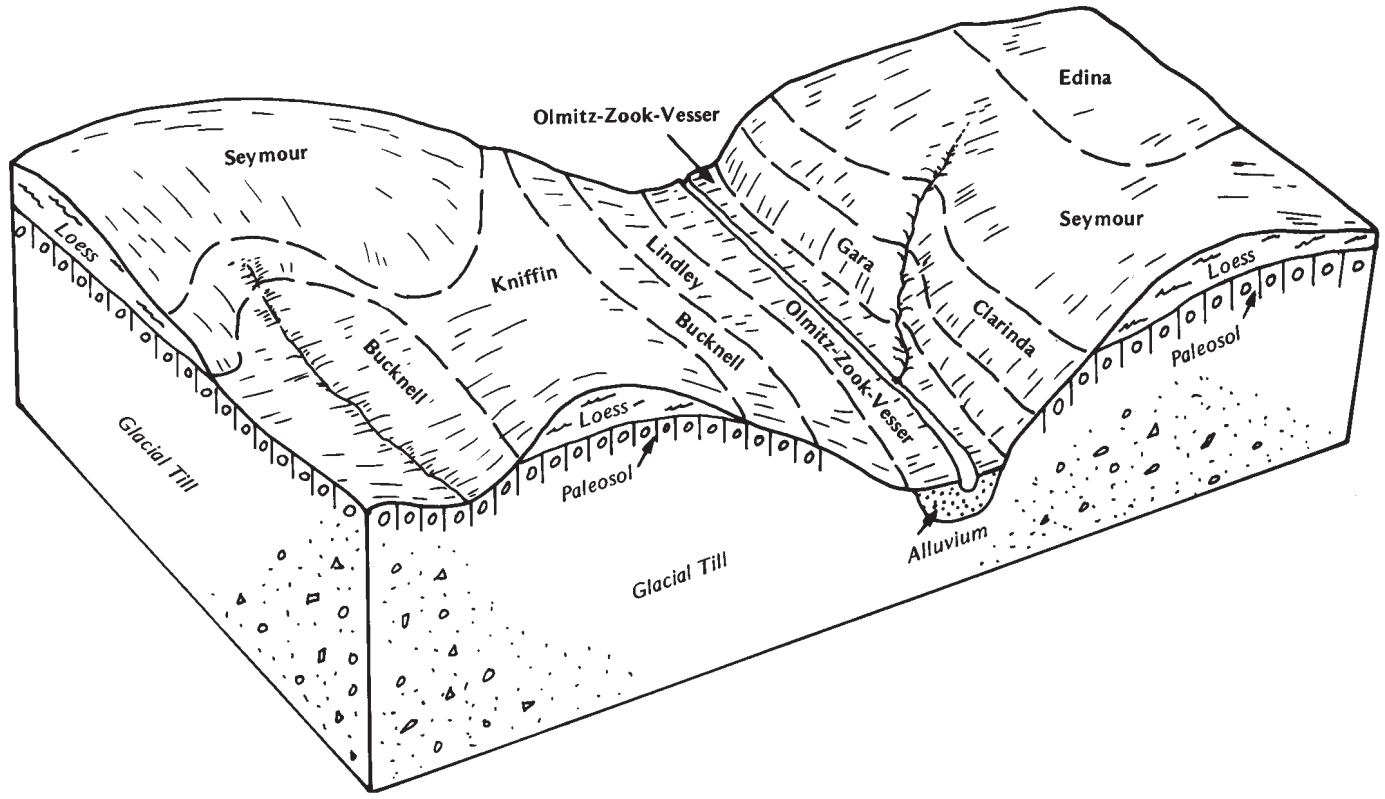

Figure 6.—Typical landscape pattern of the soils and the parent material in the Seymour-Kniffin-Bucknell association.

side slopes and head slopes of drainageways downslope from Seymour and Kniffin soils.

Typically, the surface layer of Seymour soils is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay, and in the lower part it is grayish brown, firm and very firm silty clay and silty clay loam.

Typically, the surface layer of Kniffin soils is very dark gray, very friable silt loam or silty clay loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 3 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the middle part it is grayish brown, firm silty clay. In the lower part it is grayish brown and light brownish gray, friable silty clay loam.

Typically, the surface layer of Bucknell soils is very dark gray, friable clay loam about 9 inches thick. It is mixed with some streaks and pockets of subsoil material of dark grayish brown clay loam. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is mottled, dark grayish brown clay loam and clay. In the middle part it is grayish brown clay and grayish brown and yellowish brown clay loam. In the lower part it is light brownish gray, firm clay loam.

The soils of minor extent in this association are Clarinda, Edina, Gara, Lindley, Olmitz, Vesser, and Zook soils. Clarinda soils are poorly drained and in coves at the headland of drainageways. Edina soils are poorly drained and in depressional areas on upland ridgecrests. Gara soils are moderately well drained, and Lindley soils are well drained. Gara and Lindley soils are on dissected side slopes and nose slopes, and are downslope from Bucknell soils. Olmitz soils are well drained, formed in loamy alluvium on foot slopes, and have a thick, dark colored surface soil. Vesser soils are somewhat poorly drained and formed in silty alluvium on foot slopes and alluvial fans. Zook soils are poorly drained and formed in alluvium on flood plains.

Most of this association is used for row crops in rotation with small grain, hay, and pasture. The main enterprises are growing cash crops and feeding livestock. Corn and soybeans grow fairly well on the gently sloping and moderately sloping areas. Oats, wheat, hay, and pasture plants are more commonly grown than row crops on the strongly sloping areas. The main management needs are measures to control sheet, rill, and gully erosion, to improve drainage, to control weeds and brush, and to maintain fertility.

7. Pershing-Mystic-Caleb Association

Gently sloping to moderately steep, somewhat poorly drained and moderately well drained, silty and loamy soils that formed in loess and in alluvial sediments derived from glacial till; on high stream benches

This association consists of soils on convex ridgetops and side slopes of dissected, high stream benches. The landscape is undulating to rolling. Slopes range from 2 to 18 percent.

This association makes up about 9 percent of the county. It is about 45 percent Pershing soils, 25 percent Mystic soils, 15 percent Caleb soils, and 15 percent soils of minor extent.

Pershing soils are somewhat poorly drained, gently sloping and moderately sloping, and formed in loess on upland ridgetops and on stream benches. Mystic soils are somewhat poorly drained, moderately sloping and strongly sloping, and formed in Late Sangamon paleosols derived from alluvial sediments. Caleb soils are moderately well drained, moderately sloping to moderately steep, and formed in alluvial sediments derived from glacial till.

Typically, the surface layer of Pershing soils is very dark grayish brown, friable silt loam or silty clay loam about 8 inches thick. The subsurface layer is brown, friable silty clay loam about 6 inches thick. The subsoil extends to a depth of 60 inches. In the upper part it is brown, mottled, friable silty clay loam. In the middle part it is brown, grayish brown, and strong brown, firm silty clay. In the lower part it is mottled, grayish brown and strong brown, firm and friable silty clay loam and silt loam. Brown, loamy, stratified alluvium is at a depth of 5 to 7 feet.

Typically, the surface layer of Mystic soils is very dark grayish brown, friable clay loam or silt loam about 8 inches thick. Generally, plowing has mixed some grayish brown clay subsoil material in the surface layer. The subsoil is mottled and about 52 inches thick. In the upper part it is grayish brown, firm clay. In the middle part it is grayish brown, firm clay loam. In the lower part it is brown, firm clay loam.

Typically, the surface layer of Caleb soils is very dark grayish brown, friable loam about 7 inches thick. Generally, plowing has mixed some dark brown subsoil material into the surface layer. The subsoil is about 41 inches thick. In the upper part it is dark brown, friable and firm clay loam. In the middle part it is mottled, strong brown and brown, firm sandy clay loam. In the lower part it is yellowish brown, friable sandy clay loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm, stratified loam and clay loam.

The soils of minor extent in this association are Belinda, Cantril, and Coppock soils. Belinda soils are poorly drained and on the broad, nearly level divides of stream benches. Cantril soils are somewhat poorly drained and formed in loamy alluvium on foot slopes and alluvial fans. Coppock soils are somewhat poorly drained and formed in silty alluvium on foot slopes, alluvial fans, and flood plains.

Most of the gently sloping and moderately sloping soils are used for row crops, small grain, and hay. Most of the strongly sloping, moderately steep soils are used as pasture, woodland, and wildlife areas. Some bottom land is used for row crops. Other bottom land is narrow, is dissected by meandering streams and gullies, and is used as pasture, woodland, and wildlife. The main farm enterprises are growing cash grain crops and raising cow-calf herds.

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 substratum, 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 substratum. 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, Gara clay loam, 14 to 18 percent slopes, moderately eroded, is a phase of the Gara 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. Olmitz-Zook-Vesser complex, 0 to 5 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.

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

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

13B—Olmitz-Zook-Vesser complex, 0 to 5 percent slopes. This map unit consists of nearly level to gently sloping soils in narrow drainageways and on narrow foot slopes. It is about 40 percent Olmitz soil, 30 percent Zook soil, 20 percent Vesser soil, and 10 percent other soils. The Olmitz soil is moderately well drained, and the Vesser soil is somewhat poorly drained. They are on the upper parts of slopes. The Zook soil is poorly drained and is in the lower areas near the stream channels (fig. 7). It is subject to occasional flooding. The three soils are in areas so intricately mixed or so small that they could not be separated at the scale used for mapping. Areas of the map unit are long and narrow, and range from 10 to more than 100 acres in size.

Typically, the surface layer of the Olmitz soil is very dark brown, friable loam about 8 inches thick. The subsurface layer is about 26 inches thick. In the upper part it is very dark grayish brown, friable loam, in the middle part is black, friable clay loam, and in the lower part it is very dark grayish brown, firm clay loam. The subsoil to a depth of about 60 inches is brown, mottled, firm clay loam.

Typically, the surface layer of the Zook soil is black, friable silty clay loam about 7 inches thick. The subsurface layer is black, firm silty clay about 27 inches thick. The subsoil to a depth of about 60 inches is very dark gray, mottled, firm silty clay about 26 inches thick.

Typically, the surface layer of the Vesser soil is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 19 inches

Figure 7.—An area of Olmitz-Zook-Vesser complex, 0 to 5 percent slopes. The Zook soil is in the lower areas near the stream channel. It is subject to occasional flooding.

thick. The subsoil to a depth of about 60 inches is very dark grayish brown and dark grayish brown, mottled, firm silty clay loam.

Included with these soils in mapping are small areas of Nodaway soils. Nodaway soils are moderately well drained, stratified, and near stream channels. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Olmitz and Vesser soils and slow in the Zook soil. The Zook and Vesser soils have a seasonal high water table. Surface runoff is slow on all three soils. Available water capacity is high. The content of organic matter is 2.5 to 7.0 percent. Shrink-swell potential of the Zook soil is high. In all of these soils, the amount of available phosphorus ranges from very low to medium, and that of available potassium is very low or low in the subsoil. Tilth is fair, but the soils tend to puddle if worked when wet.

In most areas these soils and the included Nodaway soils are used as pasture, hayland, woodland, or habitat for wildlife, or for row crops. In most areas they can be used for intensive row cropping if runoff from steeper

soils is controlled and if drainage is installed. Many areas are dissected by gullies and waterways that cannot be crossed by machinery. Generally, these soils are fairly suited to corn and soybeans and well suited to small grain.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, restricts root development, and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When pasture and hayland are renovated, cultivating and preparing a seedbed on the contour help to control erosion.

The land capability classification is IIw.

23C—Arispe silty clay loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on short, convex side slopes, in coves at the heads of drainageways, and on lower narrow ridges on uplands. Areas are long and narrow, or irregularly shaped, and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is dark grayish brown, friable silty clay loam and olive brown, friable silty clay loam. In the middle part it is olive brown and grayish brown, friable silty clay. In the lower part it is grayish brown, friable and firm silty clay loam.

Included with this soil in mapping are small areas of Clarinda and Lamoni soils. These soils formed in paleosols that weathered from glacial till. They occur on the lower parts of side slopes in the landscape. In these areas, which are seepy and wet in spring and fall, seedbeds are more difficult to prepare. They make up 5 to 10 percent of the map unit.

Permeability of this Arispe soil is moderately slow. Available water capacity is high, and runoff is medium. The content of organic matter is 3 to 4 percent. This soil has a seasonal high water table. Shrink-swell potential is high. The subsoil typically is very low in available phosphorus and low in available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are used as pasture or hayland.

This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If this soil is used for cultivated crops, water erosion is a severe hazard. If an intensive row cropping system is used, a combination of conservation tillage, which leaves crop residue on the surface, terracing, contouring, grassed waterways, and crop rotations help to control erosion. A combination of tile drainage and terraces allows more timely field operations in wet springs and helps to control erosion. Returning crop residue to the soil or regularly adding other organic material improves soil fertility and tilth and increases the rate of water infiltration.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling water erosion. Overgrazing or grazing when the soil is wet causes surface compaction, restricts root development, and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, all cultivating, preparing a seedbed, and interseeding on the contour help to control water erosion.

The land capability classification is IIIe.

23C2—Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on short, convex side slopes, in coves at the heads of drainageways, and on lower narrow ridges on uplands. Areas are long and narrow or irregularly shaped, and range from 5 to 40 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. It is mixed with some streaks and pockets of olive brown subsoil material. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is olive brown, friable silty clay loam. In the middle part it is olive brown and grayish brown, friable silty clay. In the lower part it is grayish brown, friable and firm silty clay loam.

Included with this soil in mapping are small areas of Clarinda and Lamoni soils. These soils formed in paleosols that weathered from glacial till. They are on the lower parts of side slopes in the landscape. In these areas, which are seepy and wet in spring and fall, seedbeds are more difficult to prepare. These areas make up 5 to 10 percent of the map unit.

Permeability of this Arispe soil is moderately slow. Available water capacity is high, and runoff is medium. The content of organic matter is 2 to 3 percent. This soil has a seasonal high water table. Shrink-swell potential is high. The subsoil typically is very low in available phosphorus and low in available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are used for cultivated crops. This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If it is used for cultivated crops, water erosion is a severe hazard. If an intensive row cropping system is used, a combination of conservation tillage, which leaves crop residue on the surface, terracing, contouring, grassed waterways, and crop rotations help to control erosion. A combination of tile drainage and terraces allows more timely field

operations in wet springs and helps to control water erosion. Returning crop residue to the soil or regularly adding other organic material improves soil fertility and tilth and increases the rate of water infiltration.

This soil is suited to grasses and legumes for hay and pasture, which is also effective in controlling water erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, restricts root development, and increases runoff. Proper stocking rates, pasture rotation, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control water erosion.

The land capability classification is IIIe.

24D—Shelby loam, 9 to 14 percent slopes. This is a strongly sloping, moderately well drained soil on irregular convex side slopes on uplands that are dissected by small drainageways. Slopes typically are short. Most areas are irregular in shape, but some are long and narrow. Areas range from 5 to 20 acres in size.

Typically, the surface layer is very dark brown, friable loam about 8 inches thick. The subsurface layer is dark brown, friable clay loam about 6 inches thick. The subsoil is clay loam about 30 inches thick. In the upper part it is dark brown and friable, and in the lower part it is dark yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm, calcareous clay loam. Pebbles are in the subsoil and the substratum.

Included with this soil in mapping are some small areas of Adair and Lamoni soils. These soils contain more clay in the subsoil than the Shelby soil. Also, they are higher on the landscape. They make up about 10 percent of the unit.

Permeability of this Shelby soil is moderately slow. The content of organic matter is 3 to 4 percent. Runoff is rapid. Available water capacity is high. The subsoil generally is very low in available phosphorus and available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

In most areas this soil is used for pasture and hay. In most areas it is managed along with adjacent soils.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a hazard. It can be controlled in row-cropped areas by a system of conservation tillage that leaves crop residue on the surface and crop rotations that include meadow crops. Some areas have slopes long and smooth enough to be farmed on the contour and terraced. If slopes are terraced, minimizing cuts prevents unnecessary exposure of the less productive, underlying, firm glacial till, which is low in fertility. Medium- and large-size stones in the subsoil generally interfere with some tillage operations. A combination of these conservation measures is commonly needed to control water erosion. Conservation practices upslope, which increase infiltration, also help to control erosion on this soil. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, to improve fertility, and to increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control water erosion. In some places, terraces and diversions generally are needed to protect critically seeded areas.

The land capability classification is IIIe.

24D2—Shelby clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, moderately well drained soil on irregular convex side slopes on uplands. Slopes are typically short. Most are irregular in shape, but some are long and narrow. Areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. Plowing has mixed some streaks and pockets of subsoil material of dark brown clay loam into the surface layer. The subsoil is clay loam about 30 inches thick. In the upper part it is dark brown and dark yellowish brown, and friable, and in the lower part it is dark yellowish brown, mottled, and firm. The substratum to a depth of about 60 inches is yellowish brown, mottled, firm clay loam. Pebbles are in the subsoil and the substratum. In some places erosion has thinned the surface layer. In these places stones and pebbles are on the surface.

Included with this soil in mapping are some small areas of Adair and Lamoni soils. These soils contain more clay in the subsoil than the Shelby soil. Also, they are higher on the landscape. They make up about 10 percent of the unit.

Permeability of this Shelby soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The subsoil generally has low amounts of available phosphorus and high amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Some areas are cultivated, and some are used for pasture. In most areas this soil is managed along with adjacent soils.

This soil is fairly suited to corn and soybeans. If cultivated crops are grown, further water erosion is a hazard. It can be controlled in row-cropped areas by a system of conservation tillage that leaves crop residue on the surface and crop rotations that include meadow crops. In some areas slopes are long enough and smooth enough to be farmed on the contour and terraced. If slopes are terraced, productivity of the soil after construction is limited. Cuts needed for terraces will expose the subsoil, which is low in fertility. Topsoil material, therefore, is needed to cover this construction. In some places, medium- and large-size stones in the subsoil also interfere with some tillage operations. A combination of these conservation measures is commonly needed to control erosion. Conservation practices that increase infiltration upslope will also help to control erosion on this soil. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, to improve fertility, to prevent surface crusting, and to increase the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

The land capability classification is IIIe.

24E2—Shelby clay loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, moderately well drained soil on convex side slopes on uplands. Areas are long and narrow and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. Plowing has mixed some streaks and pockets of subsoil material of dark brown clay loam into the surface layer. The subsoil is clay loam about 28 inches thick. In the upper part it is dark brown and dark yellowish brown, and friable, and in the lower part it is dark yellowish brown and firm. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous clay loam. Stones and pebbles are in the subsoil and the substratum. In some places severe erosion has thinned the surface layer. In these places stones and pebbles are on the surface.

Included with this soil in mapping are small areas of Adair and Lamoni soils. These soils contain more clay in the subsoil than the Shelby soil. Also, they are higher on the landscape. They make up 5 to 10 percent of the unit.

Permeability of this Shelby soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The subsoil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

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

This soil is poorly suited to corn, soybeans, and small grain. If cultivated crops are grown, water erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface and contour stripcropping help to control water erosion. Conservation tillage and contour farming increase the rate of water infiltration and help to reduce runoff. Grassed waterways help to prevent the formation of gullies. This soil is poorly suited to terracing because slopes are too steep and because depth to the glacial till is too shallow. Returning crop residue to the soil or regularly adding other organic material helps to improve tilth and fertility and to increase the rate of water infiltration.

This soil is best suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

The land capability classification is IVe.

24F2—Shelby clay loam, 18 to 25 percent slopes, moderately eroded. This is a steep, moderately well drained soil on convex side slopes on uplands. Areas are long and narrow and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. Plowing has mixed some streaks and pockets of subsurface material of dark brown clay loam into the surface layer. The subsurface layer is dark brown, friable clay loam about 5 inches thick. The subsoil is clay loam about 21 inches thick. In the upper part it is dark brown and dark yellowish brown, and friable and firm, and in the lower part it is dark yellowish brown and firm. The substratum to a depth of about 60 inches is yellowish brown, firm, calcareous clay loam. Stones and pebbles are in the subsoil and the substratum. In some places the surface layer is thicker and darker. In other places severe erosion has thinned

the surface layer. In these places stones and pebbles are on the surface.

Included with this soil in mapping are small areas of Adair and Lamoni soils. These soils contain more clay in the subsoil than the Shelby soil. Also, they are higher on the landscape. They make up 5 to 10 percent of the unit.

Permeability of this Shelby soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The subsoil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are used for pasture and hayland. This soil is not suited to corn, soybeans, or small grain, mainly because it is subject to erosion.

This soil is best suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

The land capability classification is VIe.

43—Bremer silty clay loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on low, alluvial second bottoms. It is subject to rare flooding of very brief periods. Areas range from 5 to 100 acres in size and are irregularly shaped.

Typically, the surface layer is black, very friable silty clay loam about 8 inches thick. The subsurface layer is black and very dark gray, friable and firm silty clay loam about 12 inches thick. The subsoil to a depth of about 54 inches is firm silty clay loam. In the upper part it is very dark gray, and in the lower part it is dark gray and mottled. The substratum to a depth of 60 inches is mottled, dark grayish brown and dark brown, firm silty clay loam. In places the subsoil contains more clay.

Permeability of this Bremer soil is moderately slow. Runoff is slow. Available water capacity is high. The content of organic matter is 5 to 7 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The subsoil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. A drainage system is needed to lower the seasonal high water table and to provide good aeration and a deep root zone for plants. Surface drains are needed in some areas. Tile drains work well if they are properly installed and if an adequate outlet is available. Good tilth generally can be easily maintained. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, to improve fertility, to prevent surface crusting, and to increase the rate of water infiltration.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland.

This soil is well suited to growing trees, but most areas of trees are limited to groves and plantings around farmsteads. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIw.

51—Vesser silt loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil in the higher areas on bottom lands and alluvial fans. It is subject to occasional flooding of brief duration. Areas are irregular in shape and commonly range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 19 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is very dark grayish brown and dark grayish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of Zook soils on the lower slopes. Zook soils are poorly drained, contain more clay, and cannot be drained as easily as the Vesser soil. They make up 5 to 10 percent of the unit.

Permeability of this Vesser soil is moderate. The soil has a seasonal high water table. Surface runoff is very slow. Available water capacity is high. The content of organic matter is 3 to 4 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high

water table is the major limitation for crop production. Row crops can be grown in many years if the soil is adequately drained and protected from floodwater. A subsurface drainage system is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise low soil temperature.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland.

The land capability classification is IIw.

51B—Vesser silt loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil in the higher areas on bottom lands and on foot slopes and alluvial fans. It is subject to rare flooding of brief duration. Areas are irregular in shape, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 19 inches thick. It is mottled in the lower part. The subsoil to a depth of about 60 inches is very dark grayish brown and dark grayish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of Zook soils on the lower slopes. Zook soils are poorly drained, contain more clay, and cannot be drained as easily as the Vesser soil. They make up 5 to 10 percent of the unit.

Permeability of this Vesser soil is moderate. The soil has a seasonal high water table. Surface runoff is slow. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. Row crops can be grown in many years if the soil is adequately drained and protected from floodwater. A subsurface drainage system is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher, surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise the soil temperature.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland.

The land capability classification is IIw.

54—Zook silty clay loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on bottom lands. Unless it is protected, it is subject to occasional flooding for brief to long periods. Areas are irregular in shape, and commonly range from 5 to more than 40 acres in size.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer is very dark gray and black, firm silty clay about 27 inches thick. The subsoil is very dark gray, mottled, firm silty clay to a depth of 60 inches or more. In some small areas the surface layer is overwash of very dark grayish brown silt loam as much as 10 inches thick.

Included with this soil in mapping are small areas of Olmitz soils. These soils are higher on the landscape and are better drained than the Zook soil. They make up 5 to 10 percent of the unit.

Permeability of the Zook soil is slow. The soil has a seasonal high water table. Surface runoff is very slow. Available water capacity is high. The content of organic matter is 2 to 4 percent. Shrink-swell potential also is high. Tilth is fair, but the soil tends to puddle if worked when wet. The subsoil generally has medium amounts of available phosphorus and low amounts of available potassium.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Row crops can be grown in many years if the soil is adequately drained and protected from floodwater. The seasonal high water table is the major limitation for crop production. A surface or subsurface drainage system with tile intakes is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise soil temperature.

This soil is suited to grasses and legumes for hay and pasture. However, management may be difficult because this soil is poorly drained and occasionally flooded. Forage species that tolerate wetness will help to maintain productivity. Drainage is needed for alfalfa crops. Diversions or terraces on adjacent soils on uplands and dikes or levees along major stream

channels may be needed to protect this soil from flooding. Overgrazing or grazing when the soil is too wet causes surface compaction; this restricts root development and increases ponding. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

The land capability classification is IIw.

54+—Zook silt loam, overwash, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on first bottoms along the major streams. Unless it is protected, it is subject to occasional flooding for brief to long periods. Areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is black and very dark gray, friable and firm, silt loam, silty clay loam, and silty clay about 30 inches thick. The subsoil to a depth of about 60 inches is black and very dark gray, mottled, firm silty clay.

Permeability of this Zook soil is slow. The soil has a seasonal high water table. Surface runoff is very slow. Available water capacity is high. The content of organic matter is 2 to 4 percent. Shrink-swell potential is high. The subsoil has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. Row crops can be grown in many years if the soil is adequately drained and protected from floodwater. A surface or subsurface drainage system with tile intakes is needed. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise low soil temperature.

This soil is suited to grasses and legumes for hay and pasture. However, management may be difficult because this soil is poorly drained and occasionally flooded. Forage species that tolerate wetness will help to maintain productivity. Drainage is needed for alfalfa crops. In some areas diversions or terraces on adjacent soils on uplands and dikes or leeves along major stream channels are needed to protect this soil from flooding. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted use of equipment during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

The land capability classification is IIw.

56B—Cantril loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on low, slightly concave foot slopes and convex alluvial fans. It is downslope from moderately steep or steep soils that formed in clay loam glacial till. Areas are long and narrow, and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. The subsurface layer is about 11 inches thick. In the upper part it is very dark grayish brown friable loam. In the next part it is dark grayish brown, friable silt loam. In the lower part it is grayish brown, friable loam. The subsoil to a depth of about 60 inches is friable and firm clay loam. In the upper part it is dark brown, and in the lower part it is grayish brown and strong brown.

Permeability of this Cantril soil is moderate. This soil has a seasonal high water table. The content of organic matter is 5 to 7 percent. Runoff is slow. Available water capacity is high. The soil has very low amounts of available phosphorus and available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. It can be controlled in intensively row cropped areas by a system of conservation tillage that leaves crop residue on the surface in combination with diversion terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is well suited to trees, and a few small areas remain in native hardwoods. There are no particular problems when planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIe.

56C—Cantril loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on low, slightly concave foot slopes and convex alluvial fans. It is downslope from moderately steep or steep soils that formed in clay loam glacial till. Areas are long and narrow, and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 6 inches thick. The subsurface layer is about 7 inches thick. In the upper part it is very dark grayish brown, friable loam, and in the lower part it is grayish brown, friable loam. The subsoil to a depth of about 60 inches is friable and firm clay loam. In the upper part it is dark brown and grayish brown, and in the lower part it is grayish brown and strong brown, and mottled.

Permeability of this Cantril soil is moderate. This soil has a seasonal high water table. Runoff is medium. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil has very low amounts of available phosphorus and available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is fairly well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface in combination with diversion terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is well suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

58E—Douds loam, 14 to 18 percent slopes. This is a moderately steep, moderately well drained soil on convex side slopes of high stream benches along the major streams and rivers. Areas are long and narrow and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 5 inches thick. The subsurface layer is dark grayish brown and dark yellowish brown, friable loam about 10 inches thick. The subsoil is about 36 inches thick. In the upper part it is dark brown, friable and firm sandy clay loam. In the next part it is dark brown, firm clay and clay loam. In the lower part it is mottled, strong brown and yellowish brown, friable sandy clay loam. The substratum to a depth of 60 inches is friable, stratified, strong brown and yellowish brown sandy clay loam.

Included with this soil in mapping are small areas of Weller soils upslope on the center of narrow, convex ridgetops. They contain less sand, are more fertile, and formed in loess. They make up 5 to 15 percent of the unit.

Permeability of this Douds soil is moderate. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. The subsoil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used as pasture or woodland. This soil generally is not suited to cultivated crops because of slope and a severe hazard of erosion. Managing areas that have been cleared for pasture is difficult because of slope. In these areas water erosion is a severe hazard because reestablishing a plant cover is difficult.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. Laying out logging trails and roads on or nearly on the contour will help to control erosion. Because of slope use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

58E2—Douds loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, moderately well drained soil on convex side slopes of high stream benches along the major streams and rivers. Areas are long and narrow, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is dark grayish brown, friable loam about 6 inches thick. It is mixed with streaks and pockets of dark brown subsoil material. The subsoil is about 36 inches thick. In the upper part it is dark brown, friable and firm sandy clay loam. In the next part it is dark brown, firm clay and clay loam. In the lower part it is mottled, strong brown and yellowish brown, friable sandy clay loam. The substratum to a depth of

about 60 inches is stratified, strong brown and yellowish brown, friable sandy clay loam.

Included with this soil in mapping are small areas of Weller soils upslope on the center of narrow, convex ridgetops. They contain less sand, are more fertile, and formed in loess. They make up 5 to 15 percent of the unit.

Permeability of the Douds soil is moderate. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 1.5 to 2.5 percent. The subsoil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for hay, pasture, or woodland. Some areas are cultivated. Most areas have been cultivated at some time in the past. This soil generally is not suited to cultivated crops because of slope and a severe hazard of further water erosion. Managing areas that have been cleared for pasture is difficult because of slope. In these areas water erosion is a severe hazard because reestablishing a plant cover is difficult.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

65D—Lindley loam, 9 to 14 percent slopes. This is a strongly sloping, well drained soil on convex nose slopes and side slopes on uplands. Areas are long and narrow, and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 5 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is yellowish brown clay loam about 37 inches thick. In the upper part it is firm, and in the lower part it is firm and very firm, and mottled. The substratum to a depth of about 60 inches is yellowish brown, mottled, very firm, calcareous clay loam. In some places the surface layer is brown and yellowish brown loam.

Included with this soil in mapping are small areas of Keswick soils. They occur on narrow, convex interfluves and nose slopes in the upper parts of the landscape. They contain more clay than Lindley soils. These soils make up about 5 to 10 percent of the unit.

Permeability of this Lindley soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The subsoil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture and woodland.

This soil is poorly suited to corn or soybeans. It is best suited to small grains and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface and grassed waterways help to control erosion. Growing the row crops in rotation with oats, hay, and pasture also is helpful. This soil is not suitable for terracing. Fertility is low, and the subsoil is highly dense. Revegetating is difficult if the subsoil is exposed. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to prevent surface crusting, and increases the rate of water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, pasture grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IVe.

65E—Lindley loam, 14 to 18 percent slopes. This is a moderately steep, well drained soil on convex nose slopes and side slopes on uplands. Areas are long and narrow, and range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is about 36 inches thick. In the upper part it is yellowish brown, firm clay loam, and in the lower part it is yellowish brown, mottled, firm and very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, very firm, calcareous clay loam.

Included with this soil in mapping are small areas of Keswick soils. They are on narrow, convex interfluves and nose slopes on the upper parts of the landscape. They contain more clay than the Lindley soil. They make up about 5 to 10 percent of the unit.

Permeability of this Lindley soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture and woodland. This soil is not suitable for cultivated crops because of slope and the severe hazard of water erosion. It is best suited to grasses and legumes for hay and pasture.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

65E2—Lindley clay loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, well drained soil on convex nose slopes and side slopes on uplands. Areas are long and narrow, and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 7 inches thick. It is mixed with streaks and pockets of subsoil material of yellowish brown clay loam. The subsoil is yellowish brown clay loam about 32 inches thick. In the upper part it is firm, and in the lower part it is firm and very firm, and mottled. The substratum to a depth of about 60 inches is yellowish brown, mottled, very firm, calcareous clay loam. In some places the surface layer is brown and yellowish brown.

Included with this soil in mapping are small areas of Keswick soils. They occur on narrow, convex interfluves and nose slopes in the upper parts of the landscape. They contain more clay than the Lindley soil. They make up about 5 to 10 percent of the unit.

Permeability of this Lindley soil is moderately slow. Runoff is rapid. Available water capacity is moderate or high. The content of organic matter is 1.5 to 2.5 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture and hay, but have been cultivated at some time in the past. This soil is not suitable for cultivated crops because of slope and the severe hazard of further erosion. It is best suited to grasses and legumes for hay and pasture.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and a few areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

65F2—Lindley clay loam, 18 to 25 percent slopes, moderately eroded. This is a steep, well drained soil on dissected, short, convex side slopes and nose slopes on uplands. Areas are long and narrow, and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 6 inches thick. It is mixed with streaks and pockets of subsoil material of yellowish

brown clay loam. The subsoil is yellowish brown clay loam about 31 inches thick. In the upper part it is firm, and in the lower part it is firm and very firm, and mottled. The substratum to a depth of about 60 inches is yellowish brown, mottled, very firm, calcareous clay loam. In some places the surface layer is brown and yellowish brown.

Included with this soil in mapping are small areas of Keswick soils. They occur on narrow, convex interfluves and nose slopes in the upper parts of the landscape. They contain more clay than the Lindley soil. These soils make up about 5 to 10 percent of the unit.

Permeability of this Lindley soil is moderately slow, and runoff is very rapid. Available water capacity is moderate or high. The content of organic matter is 1.5 to 2.5 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture or woodland. Some have been cultivated at some time in the past. This soil is not suited to cultivated crops because of the severe hazard of further erosion. In some steep areas use of ordinary farm machinery is too hazardous. This soil is best suited to use as pasture, woodland, and habitat for wildlife.

The use of this soil for pasture or hay is effective in controlling water erosion. However, overgrazing or grazing when the soil is too wet causes surface compaction and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland use of special equipment and cultivating on the contour are needed because of the hazard of erosion. On pasture, brush control is generally needed because of overgrazing and low or moderate forage production.

This soil is fairly suited to trees, and few areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, use of equipment is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIIe.

65G—Lindley loam, 18 to 40 percent slopes. This is a steep and very steep, well drained soil on dissected, convex side slopes along the major streams. Areas are long and narrow, and range from 10 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 3 inches thick. The subsurface layer is dark brown, friable loam about 3 inches thick. The subsoil is about 33 inches thick. In the upper part it is yellowish brown, firm clay loam, and in the lower part it is yellowish brown, mottled, firm and very firm clay loam. The substratum to a depth of about 60 inches is yellowish brown, mottled, very firm, calcareous clay loam.

Included with this soil in mapping are small areas of Keswick soils. They are on narrow, convex interfluves and nose slopes in the upper parts of the landscape. They contain more clay than the Lindley soil. They make up about 5 to 10 percent of the unit.

Permeability of this Lindley soil is moderately slow. Runoff is very rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The subsoil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, and the soil generally is not tilled.

Most areas of this soil are used as woodland. Many remain in native hardwoods. This soil is moderately suited to trees. It generally is not suitable for cultivated crops, hay, and pasture because of slope and the severe hazard of water erosion.

This soil is fairly suited to trees, and most areas remain in native hardwoods (fig. 8). Erosion is a hazard on logging trails or roads. Laying out the trails or roads on the contour will help to control erosion. Because of slope, use of equipment is hazardous. Special equipment and caution in its use are needed. Seedlings do not survive well; thus, spacing seedlings closer together achieves the desired stand density.

The land capability classification is VIIe.

88—Nevin silty clay loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on low second bottoms. It is subject to rare flooding. Areas are irregular in shape, and range from 5 to 20 acres or more.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray and very dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil is very dark grayish brown and dark grayish brown, mottled, firm silty clay loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Bremer soils. Bremer soils contain more clay and are poorly drained. These areas make up 5 to 10 percent of the unit.

Permeability of this Nevin soil is moderate. Runoff is slow. Available water capacity is high. The content of organic matter is 4 to 6 percent. This soil has a seasonal high water table. The subsoil is medium in available phosphorus and low in available potassium. Tilth is good.

This soil is used mostly for cultivated crops. It is well suited to corn, soybeans, small grain, and grasses and legumes for hay and pasture. Row crops can be grown

Figure 8.—Native hardwoods adjacent to Nine Eagles Lake provide habitat for woodland wildlife. The soil is Lindley loam, 18 to 40 percent slopes.

much of the time. Drainage is adequate on this soil, but in wet years tile drains allow timely field operations.

This soil is suited to pasture or hay. Most areas that are narrow and flooded are in permanent pasture. However, overgrazing or grazing during wet periods after flooding causes surface compaction and puddling of the soil. Rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

The land capability classification is I.

94E—Caleb-Mystic complex, 9 to 18 percent slopes. This map unit consists of strongly sloping and moderately steep soils on high stream benches. It is 70 percent Caleb soil and 30 percent Mystic soil. The Caleb soil is moderately well drained on side slopes. The Mystic soil is somewhat poorly drained and on convex ridgetops. The two soils are in areas so intricately mixed or so small that they could not be separated at the scale used for mapping. Individual areas are long, narrow, and irregular in shape, and range from 5 to 30 acres in size.

Typically, the surface layer of the Caleb soil is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is dark brown and brown, friable loam about 6 inches thick. The subsoil extends to a

depth of 60 inches. It is dark yellowish brown, friable loam and sandy clay loam in the upper part and dark yellowish brown, friable sandy clay loam in the lower part.

Typically, the surface layer of the Mystic soil is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. In the upper part it is grayish brown, mottled, firm clay. In the middle part it is grayish brown, mottled, firm clay loam. In the lower part it is brown, mottled, firm clay loam.

Permeability is slow in the Mystic soil and moderate in the Caleb soil. Runoff is rapid on both soils. Both soils have moderate available water capacity and a seasonal high water table. The content of organic matter is 2.5 to 3.5 percent. Shrink-swell potential is high for the Mystic soil. Available phosphorus and available potassium are very low in the subsoil for both soils. Both soils have poor tilth, and tend to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture or hayland. This soil is generally not suited to cultivated crops because erosion is a severe hazard.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, operation of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification of both soils is VIe.

94E2—Caleb-Mystic complex, 9 to 18 percent slopes, moderately eroded. This map unit consists of strongly sloping and moderately steep soils on high stream benches. It is 70 percent Caleb soil and 30 percent Mystic soil. The Caleb soil is moderately well drained and on side slopes. The Mystic soil is somewhat poorly drained and on convex ridgetops. The two soils are in areas so intricately mixed or so small that they could not be separated at the scale used for mapping. Individual areas are long, narrow, and irregular in shape, and range from 5 to 30 acres in size.

Typically, the surface layer of the Caleb soil is very dark grayish brown, friable loam about 6 inches thick. Generally, it is mixed with streaks and pockets of yellowish brown subsoil material. The subsoil extends to a depth of 60 inches. It is dark yellowish brown, friable loam and firm sandy clay loam in the upper part and dark yellowish brown, friable sandy clay loam in the lower part.

Typically, the surface layer of the Mystic soil is very dark grayish brown mottled, friable clay loam about 8 inches thick. Generally, plowing has mixed some of the grayish brown clay subsoil into the surface layer. The subsoil is about 52 inches thick. In the upper part it is grayish brown, mottled firm clay. In the middle part it is grayish brown, mottled, firm clay loam. In the lower part it is brown, mottled, firm clay loam.

Permeability is slow in the Mystic soil and moderate in the Caleb soil. Runoff is rapid for both soils. Both soils have moderate available water capacity and a seasonal high water table. The organic matter content is 2 to 3 percent. Shrink-swell potential for the Mystic soil is high. The available phosphorus and available potassium in the subsoil are very low for both soils. Both soils have poor tilth and tend to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of this soil are in pasture and hayland.

This map unit is not suited to corn and soybeans. It is best suited to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. It can be controlled, however, by contour farming, grassed waterways, a system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops. Returning crop residue to the soil or regularly adding other organic material and deferring tillage when the soil is wet help to maintain tilth, to improve fertility, to prevent surface crusting, and to increase the rate of water infiltration.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling water erosion. However, management is generally difficult because this map unit is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legume crops for hay as well as grasses for pasture. Overgrazing or grazing when the soils are wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and

hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This map unit is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification of both soils is VIe.

131B—Pershing silt loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on convex, upland ridgetops. Areas are irregular in shape or long and narrow, and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is brown, friable silty clay loam about 5 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is brown, friable silty clay loam. In the middle part it is brown and grayish brown firm silty clay. In the lower part it is grayish brown, firm and friable silty clay loam and silt loam.

Included with this soil in mapping are small areas of poorly drained soils on the less sloping parts of the landscape. These soils make up about 5 to 15 percent of the unit.

Permeability of this Pershing soil is slow. Runoff is slow. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The subsoil typically is very strongly acid or strongly acid. It generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are cultivated or are used for hay and pasture.

This soil is moderately well suited to corn, soybeans, and small grain and to grass and legumes for hay or pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, contour stripcropping, crop rotations that include meadow crops, and terraces help to control erosion. If terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Seepy terrace channels generally result if cuts are made too deep. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, as well as interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and many areas are woodland. Natural and planted seedlings do not survive well; thus seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other limitations or hazards when planting or harvesting trees.

The land capability classification is IIIe.

131C—Pershing silt loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on narrow, convex ridgetops and short, convex side slopes on uplands. Areas are long and narrow or irregularly shaped, and range from 5 to 80 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. It is mixed with streaks and pockets of the brown silty clay loam subsurface layer. The subsurface layer is brown, friable silty clay loam about 3 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is brown, friable silty clay loam. In the middle part it is brown and grayish brown, firm silty clay. In the lower part it is grayish brown, firm and friable silty clay loam and silt loam.

Included with this soil in mapping are small areas of Armstrong and Bucknell soils on the lower parts of side slopes. These soils contain more clay in the subsoil than the Pershing soil, and in some areas are seepy during wet periods. They make up about 5 to 10 percent of the unit.

Permeability of this Pershing soil is slow. Runoff is medium. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas of this soil are in pasture and hayland.

This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. In intensively row cropped areas it can be controlled by a system of conservation tillage that leaves crop residue on the surface, terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. If terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Seepy terrace channels generally result if cuts are made too deep. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth. Generally, a combination of these practices on this soil as well as upslope helps to control erosion.

This soil is fairly suited to trees, and many areas are woodland. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

131C2—Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on narrow, convex ridgetops and short, convex side slopes on uplands. Areas are long and narrow or irregularly shaped, and range from 5 to 130 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is brown, friable silty clay loam. In the middle part it is brown and grayish brown, firm silty clay. In the lower part it is grayish brown, firm and friable silty clay loam and silt loam.

Included with this soil in mapping are small areas of Armstrong and Bucknell soils on the lower parts of side slopes. These soils contain more clay in the subsoil than the Pershing soil, and can be seepy during wet periods. They make up about 5 to 10 percent of the unit.

Permeability of this Pershing soil is slow. Runoff is medium. Available water capacity is high. The content of organic matter is 2 to 3 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The subsoil typically is very strongly acid or strongly acid. It generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling emergence and development is limited if crusting occurs before seedling emergence.

In most areas this soil is cultivated or used for hay and pasture.

This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay or pasture. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, and terraces help to control erosion. If terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Seepy terrace channels generally result if cuts are made too deep. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, but most areas are cultivated. Natural and planted seedlings do not survive well; thus seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

132C—Weller silt loam, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on narrow, convex ridgetops on uplands. Areas are long and narrow or irregularly shaped, and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown and dark brown, friable silt loam about 19 inches thick. The subsoil extends to a depth of 60 inches. In the upper part it is yellowish brown, friable silty clay loam. In the next part it is strong brown and grayish brown, very firm silty clay. In the lower part it is grayish brown, mottled firm silty clay loam.

Included with this soil in mapping are small areas of Keswick and Ashgrove soils. Keswick soils are moderately well drained, and Ashgrove soils are poorly drained or somewhat poorly drained. These soils are on lower side slopes. The subsoil of these soils contains more clay than that of the Weller soil. These soils make up about 5 to 10 percent of the unit.

Permeability of this Weller soil is slow. Runoff is medium. Available water capacity is high. The content of organic matter is 2 to 3 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, but the soil tends to puddle if worked when wet. It crusts after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

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

This soil is fairly suited to corn and soybeans. It is best suited to small grains and to grasses and legumes for hay or pasture. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, crop rotation that includes grasses and legumes, and terraces help to control erosion. In places, contour farming or terracing is

difficult because of short, irregular slopes. If terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Seepy terrace channels generally result if cuts are made too deep. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and most areas are in trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no limitations or hazards when planting or harvesting trees.

The land capability classification is IIIe.

132C2—Weller silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, moderately well drained soil on narrow, convex ridgetops on uplands. Areas are long and narrow or irregularly shaped, and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. It is mixed with some streaks and pockets of yellowish brown subsoil material. The subsoil extends to a depth of 60 inches. In the upper part it is yellowish brown, friable silty clay loam. In the next part it is strong brown and grayish brown, very firm silty clay. In the lower part it is grayish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of Keswick soils and poorly drained or somewhat poorly drained Ashgrove soils. These soils are on the lower slopes. They contain more clay in the subsoil than that of the Weller soil. These areas make up about 5 to 10 percent of the unit.

Permeability of this Weller soil is slow. Runoff is medium. Available water capacity is high. The content of organic matter is 1.5 to 2.5 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, but the soil tends to puddle if worked when wet. It crusts after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated or are used for pasture and hay. A few areas support trees. Many of the pastured and wooded areas have been cropped in the past.

This soil is fairly suited to corn and soybeans. If cultivated crops are grown, further water erosion is a hazard. A system of conservation tillage that leaves crop residue on the surface, contour farming, crop rotations that include grasses and legumes, and terraces help to control erosion. In places, contour farming or terracing is difficult because of short, irregular slopes. If terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Seepy terrace channels generally result if cuts are made too deep. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling water erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and most areas are in trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

172—Wabash silty clay, 0 to 1 percent slopes. This is a nearly level, very poorly drained soil in low areas on wide bottom lands. It is subject to frequent flooding for brief to long periods, but most areas are protected. Areas are irregularly shaped, and range from 20 to 100 or more acres in size.

Typically, the surface layer is very dark gray silty clay about 6 inches thick. The subsurface layer is black, firm silty clay about 15 inches thick. The subsoil is mottled very firm clay about 31 inches thick. In the upper part it is black. In the lower part it is very dark gray. The substratum to a depth of 60 inches or more is very dark gray very firm clay.

Permeability of this Wabash soil is very slow. Runoff is very slow or ponded. Available water capacity is moderate. The content of organic matter is 4 to 6

percent. The soil has a seasonal high water table. Shrink-swell potential is very high. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is fairly suited to corn and soybeans, and is poorly suited to small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major soil limitation for crop production. If cultivated crops are grown, a drainage system is needed to lower the seasonal high water table, to aerate the soil, and to provide a deep root zone for plants. A tile drainage system generally does not function satisfactorily because of very slow permeability. In most areas a surface drainage system or open ditches are used to lower the seasonal high water table. Even though some areas are protected by levees, flooding still occurs if the levees are breached by the floodwater. Tilth generally is poor in the surface layer. Returning crop residue to the soil or deferring fieldwork when the soil is wet improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. However, management may be difficult because of the seasonal high water table and flooding. Forage species that tolerate wetness will help to maintain productivity. Drainage is needed for alfalfa crops. In some areas diversions or terraces on adjacent soils on uplands and dikes or levees along major stream channels are needed to protect this soil from flooding. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed control, and timely applications of lime help to improve the productivity of the pasture and hayland.

This soil is moderately well suited to trees, and few areas remain in native hardwoods. The seasonal high water table limits use of equipment to drier periods or winter, when the ground is frozen. During wet periods special high flotation equipment may be needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction on these soils is not erosive.

The land capability classification is IIIw.

179D2—Gara clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, moderately well drained soil on convex side slopes on uplands. Areas are long and narrow, and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 7 inches thick. Plowing has mixed some of the subsoil of dark yellowish brown clay loam with the surface layer. The subsoil is about 32 inches thick. In the upper part it is dark yellowish brown, firm clay loam, and in the lower part it is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is mottled, grayish brown and yellowish brown, very firm, calcareous clay loam. In some places the surface layer is thicker or darker. Stones and pebbles are in the subsoil and the substratum.

Included with this soil in mapping are areas of Rinda and Bucknell soils in coves near heads of drains and on the upper parts of the landscape. Rinda soils are poorly drained, and Bucknell soils are somewhat poorly drained. They have a subsoil of gray clay. Also included are Armstrong soils that formed in a red clayey paleosol. They are moderately well drained and are in shoulder and nose positions upslope on the landscape. These areas make up about 5 to 10 percent of the unit.

Permeability of this Gara soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The subsoil typically is very strongly acid to neutral. It generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Many areas are cultivated. Some areas are used for pasture or hay. Nearly all areas were cultivated at some time in the past.

This soil is poorly suited to corn and soybeans. It is better suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. A system of conservation tillage that leaves crop residue on the surface, and crop rotations that include meadow crops help to control erosion. Some areas have slopes long and smooth enough to be terraced and formed on the contour. Construction is limited. Cuts needed for terraces will expose the subsoil, which is low in fertility. Therefore, topsoil material is needed to cover this construction. In some places, medium- and large-size stones from the subsoil also interfere with some tillage operations. A combination of these conservation measures is commonly needed to control erosion. Conservation practices upslope that increase infiltration upslope will also help to control erosion on this soil. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is best suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and

the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. Cultivating, preparing a seedbed, as well as interseeding on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to growing trees, and a few scattered small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IVe.

179E—Gara loam, 14 to 18 percent slopes. This is a moderately steep, moderately well drained soil on convex side slopes on uplands. Areas are long and narrow, and range from 5 to 30 acres in size.

Typically, the surface layer is very dark gray, friable loam about 8 inches thick. The subsurface layer is dark grayish brown and brown, friable loam about 6 inches thick. The subsoil is mottled and about 32 inches thick. In the upper part it is dark yellowish brown, firm clay loam, and in the lower part it is yellowish brown, firm clay loam. The substratum to a depth of about 60 inches or more is mottled, grayish brown and yellowish brown, very firm, calcareous clay loam. Stones and pebbles are in the subsoil and the substratum.

Included with this soil in mapping are areas of Rinda and Bucknell soils in coves near the heads of drains and on the upper parts of the landscape. Rinda soils are poorly drained, and Bucknell soils are somewhat poorly drained. They have a subsoil of gray clay. Also included are areas of Armstrong soils. These soils are somewhat poorly drained, and formed in a red clayey paleosol. They are in shoulder and nose positions upslope in the landscape. These soils make up about 5 to 10 percent of the unit.

Permeability of this Gara soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The subsoil typically is very strongly acid to neutral. It generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of this soil are used for pasture or woodland.

This soil is generally not suited to cultivated crops because erosion is a severe hazard. This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour helps to control erosion. Because of slope, use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

179E2—Gara clay loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, moderately well drained soil on convex side slopes on uplands. Areas are long and narrow, and range from 5 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. Plowing has mixed some of the subsoil of dark yellowish brown clay loam with the surface layer. The subsoil is mottled and about 30 inches thick. In the upper part it is dark yellowish brown, firm clay loam, and in the lower part it is yellowish brown, firm clay loam. The substratum to a depth of about 60 inches or more is mottled, grayish brown and brown, very firm, calcareous clay loam. Stones and pebbles are on the surface and throughout the soil. In some places the surface layer is thicker and darker. In other places severe erosion has thinned the surface layer. In some places the subsoil is thinner and the calcareous substratum is closer to the surface.

Included with this soil in mapping are areas of Rinda and Bucknell soils in coves near the heads of drains and on the upper parts of the landscape. Rinda soils are poorly drained, and Bucknell soils are somewhat poorly drained. They have a subsoil of gray clay. Also included are areas of Armstrong soils. These soils are somewhat poorly drained, and formed in a red clayey paleosol. They occur in shoulder and nose positions upslope in the landscape. These soils make up about 5 to 10 percent of the unit.

Permeability of this Gara soil is moderately slow. Runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for hay, for pasture, or as woodland. Some areas are cultivated. Most areas have been cultivated at some time in the past. This soil

generally is not suited to cultivated crops because erosion is a severe hazard. This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and few areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

179F—Gara loam, 18 to 25 percent slopes. This is a steep, moderately well drained soil on dissected side slopes that border upland drainageways. Areas are long and narrow, and range from 5 to 40 acres in size.

Typically, the surface layer is very dark gray, friable loam about 6 inches thick. The subsurface layer is dark grayish brown, friable loam about 5 inches thick. The subsoil is about 28 inches thick. In the upper part it is dark yellowish brown, firm clay loam, and in the lower part it is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is multicolored, firm, calcareous clay loam. Pebbles are in the subsoil and the substratum.

Included with this soil in mapping are small areas of Armstrong soils along the upslope margins of the unit. These soils contain more clay in the subsoil than the Gara soil. They make up about 10 percent of the map unit.

Permeability of this Gara soil is moderately slow. Runoff is very rapid. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture or woodland. This soil is best suited to pasture, hay, and trees. It generally is not suitable for cultivated crops because slopes are steep and because water erosion is a severe hazard. A permanent plant cover is effective in controlling sheet and gully erosion.

The use of this soil for pasture or hay is effective in controlling water erosion. However, overgrazing or grazing when the soil is too wet causes surface compaction and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. Water erosion is a hazard because of steepness of slope. When renovating pasture and hayland, using special equipment and cultivating on the contour help to control erosion. On pasture, brush control is generally needed because of overgrazing and low or moderate forage production.

This soil is fairly suited to trees, and many areas remain in native hardwoods. Water erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control water erosion. Because of slope, use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

179F2—Gara clay loam, 18 to 25 percent slopes, moderately eroded. This is a steep, moderately well drained soil on dissected side slopes that border upland drainageways. Areas are long and narrow, and range from 10 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. It is mixed with streaks and pockets of dark yellowish brown subsoil material. The subsoil is about 27 inches thick. In the upper part it is dark yellowish brown, firm clay loam, and in the lower part it is yellowish brown, mottled, firm clay loam. The substratum to a depth of about 60 inches is multicolored, firm, calcareous clay loam. Stones and pebbles are in the subsoil and the substratum.

Included with this soil in mapping are small areas of Armstrong soils on the upslope edge of the unit. These soils contain more clay in the subsoil than the Gara soil. They make up about 10 percent of the map unit.

Permeability of this Gara soil is moderately slow. Runoff is very rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. The soil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used as pasture, hayland, or woodland. Some areas have been cultivated at some time in the past. This soil is best suited to pasture, hay, and trees. It generally is not suitable for cultivated crops because of steepness of slope and the severe hazard of erosion. A permanent plant cover is effective in controlling sheet and gully erosion.

The use of this soil for pasture or hay is effective in controlling erosion. However, overgrazing or grazing when the soil is too wet causes surface compaction and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. Because of steepness of slope, erosion is a hazard. When renovating pasture and hayland, use of special equipment and cultivating on the contour help to control erosion. On pasture, brush control is generally needed because of overgrazing and low or moderate forage production.

This soil is fairly suited to trees, and a few scattered areas remain in native woodlands. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, use of equipment on this soil is hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIIe.

192C—Adair clay loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on convex, narrow ridgetops and nose slopes. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. The subsurface layer is dark brown, friable clay loam about 4 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark yellowish brown, firm clay loam and clay, and in the lower part it is yellowish brown and strong brown, firm clay loam. In places the subsoil is clay to a depth of 60 inches.

Included with this soil in mapping are small areas of Shelby soils on the lower parts of the side slopes. These soils are better drained and contain less clay in the subsoil than the Adair soil. Included soils make up 5 to 10 percent of the unit.

Permeability of the Adair soil is slow. The soil has a seasonal high water table. Surface runoff is moderate. Available water capacity is moderate. The content of organic matter is 3 to 4 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas of this soil are in pasture.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IIIe.

192C2—Adair clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on convex, narrow ridgetops and nose slopes. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. It is mixed with some streaks and pockets of dark yellowish brown subsoil material. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is dark yellowish brown, firm clay loam and clay, and in the lower part it is yellowish brown and strong brown, firm clay loam. In places the subsoil is clay to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Shelby soils on the lower parts of side slopes. Shelby soils are better drained and contain less clay in the subsoil. Included soils make up 5 to 10 percent of the unit.

Permeability of this Adair soil is slow. The soil has a seasonal high water table. Surface runoff is moderate. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour

farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IIIe.

192D2—Adair clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, somewhat poorly drained soil on convex, narrow ridgetops, nose slopes, and side slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. It is mixed with some streaks and pockets of dark yellowish brown subsoil material. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark yellowish brown, firm clay loam and clay, and in the lower part it is yellowish brown and strong brown, firm clay loam.

Included with this soil in mapping are small areas of Shelby soils on the lower parts of side slopes. Shelby soils are better drained and contain less clay in the subsoil. Included soils make up 5 to 10 percent of the unit.

Permeability of this Adair soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IVe.

208—Klum fine sandy loam, 0 to 3 percent slopes. This is a nearly level and very gently sloping, moderately well drained soil on flood plains along rivers and the major streams. It is subject to occasional flooding for brief periods. Areas are long and narrow or irregularly shaped, and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, friable fine sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, brown, and pale brown loam, silt loam, and loamy fine sand.

Included with this soil in mapping are scattered, small areas of Lawson and Nodaway soils. Lawson soils are somewhat poorly drained, and Nodaway soils are moderately well drained. These soils contain more clay and organic matter than the Klum soil. They are in similar landscape positions, and make up about 5 to 10 percent of the unit.

Permeability of this Klum soil is moderately rapid. Runoff is slow. Available water capacity is moderate. The content of organic matter is 1.5 to 2.5 percent. The soil has a seasonal high water table. It generally has very low amounts of available phosphorus and available potassium. Tilth is good.

Most areas are cultivated. This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. It is droughty, and is subject to soil blowing and flooding. Levees or dikes along stream channels help to control flood water. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to control soil blowing. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to control soil blowing and to prevent surface crusting and loss of tilth.

The use of this soil for pasture or hay is effective in controlling soil blowing. However, this soil is droughty,

and forage production is generally low and difficult to maintain. Proper stocking rates, rotation grazing, and timely deferred grazing, especially during dry periods, help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, the use of reduced tillage methods on the contour also helps to control erosion.

The land capability classification is IIs.

211—Edina silt loam, 0 to 1 percent slopes. This is a nearly level, poorly drained soil in slightly depressional areas on broad, upland flats. Areas are irregular in shape, and range from 3 to 30 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is very dark gray and dark gray, mottled, friable silt loam about 8 inches thick. The subsoil is mottled and extends to a depth of about 60 inches. In the upper part it is dark gray, firm silty clay loam. In the middle part it is dark gray, dark grayish brown and grayish brown, firm silty clay. In the lower part it is olive gray, firm silty clay and silty clay loam.

Permeability of this Edina soil is very slow. Available water capacity is high. The content of organic matter is 2.0 to 3.5 percent. Runoff is very slow. The soil tends to pond water for brief periods. It has a seasonal high water table. Shrink-swell potential is very high. The subsoil typically is very low in available phosphorus and very low in available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is fairly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. Adequate subsurface drainage is very difficult to obtain because of high clay in the subsoil. In small areas surface drainage or tile intake systems have been installed to reduce ponding and drowning of crops. Ridge planting, in which row crops are planted on ridges, helps to overcome the wetness and to raise the soil temperature. However, planting needs to be arranged so that water will run off this soil.

This soil is suited to grasses and legumes for hay and pasture. However, management may be difficult because the soil is poorly drained and ponds water for brief periods. Forage species that tolerate wetness will help to maintain productivity. Surface drainage is needed for alfalfa crops. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

The land capability classification is IIIw.

220—Nodaway silt loam, 0 to 2 percent slopes. This is a nearly level, moderately well drained soil in areas of recent deposition on bottom lands near the major streams. It is subject to occasional flooding for very brief or brief periods. Areas are long and narrow or irregularly shaped, and commonly range from 10 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, dark grayish brown, and grayish brown, friable silt loam. In some areas the surface layer is loam, silty clay loam, or sandy loam.

Included with this soil in mapping are scattered small areas of Klum soils. These soils are in landscape positions similar to those of the Nodaway soil, and contain more sand than the Nodaway soil. They make up 5 to 10 percent of the unit.

Permeability of the Nodaway soil is moderate. The soil has a seasonal high water table. Surface runoff is slow. Available water capacity is high. The content of organic matter is 1.5 to 2.5 percent. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is good.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. Flooding is the major limitation to crop production. Row crops can be grown in many years if the soil is adequately protected from floodwater.

This soil is suited to pasture or hay. Most areas that are narrow and subject to flooding are in permanent pasture. However, overgrazing or grazing during wet periods after flooding causes surface compaction and puddling of the soil. Rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is moderately well suited to trees, and a few small areas remain in native hardwoods. There are no problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIw.

222C—Clarinda silty clay loam, 5 to 9 percent slopes. This is a moderately sloping, poorly drained soil on short, convex side slopes and in coves at the heads of drainageways on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 10 to more than 50 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 3 inches thick. The subsoil to a depth of about 60 inches is firm and very firm, mottled silty clay. In the upper part it is dark grayish brown, in the next part it is dark gray, and the lower part it is grayish brown.

Included with this soil in mapping are small areas of Arispe and Seymour soils. Arispe and Seymour soils are better drained and upslope on narrow ridgecrests. Included soils make up 5 to 15 percent of the unit.

Permeability of the Clarinda soil is very slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is high. The content of organic matter is 3 to 4 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is poorly suited to intensive row cropping. It is moderately well suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, the seasonal high water table is a very serious limitation and erosion is a severe hazard. In row cropped areas, erosion can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. In many areas a narrow, seepy band is on the upper part of side slopes. This band warms slowly in spring, and dries very slowly after rains. Planting is delayed in wet years. Because of permeability, tile drainage is not feasible on this soil, but interceptor tile can be installed on upslope, adjacent soils.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IVw.

222C2—Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, poorly drained soil on short, convex side slopes and in coves at the heads of drainageways on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 10 to more than 50 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 6 inches thick. It is mixed with some streaks and pockets of subsoil material of dark grayish brown silty clay. The subsoil to a depth of about 60 inches is very firm, mottled silty clay. In the upper part it is dark grayish brown, in the next part it is dark gray, and in the lower part it is grayish brown.

Included with this soil in mapping are small areas of Arispe and Seymour soils. Arispe and Seymour soils are better drained and upslope on narrow ridgecrests. Included soils make up 5 to 15 percent of the unit.

Permeability of the Clarinda soil is very slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is high. The content of organic matter is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. If cultivated crops are grown, the seasonal high water table is a very serious limitation and further erosion is a severe hazard. In row cropped areas, erosion can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. In many areas a narrow, seepy band is on the upper part of side slopes. This band commonly remains wet until midsummer. The soil warms slowly in spring, and dries very slowly after rains. Planting is delayed in wet years. Because of permeability, tile drainage is not feasible on this soil, but inceptor tile can be installed in the upslope, adjacent soils.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IVw.

222D2—Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, poorly drained soil on short, convex side slopes and in coves at the heads of drainageways on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 10 to more than 50 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 6 inches thick. It is mixed with some streaks and pockets of subsoil material of dark grayish brown silty clay. The subsoil to a depth of about 60 inches is very firm, mottled silty clay. In the upper part it is dark grayish brown, in the next part it is dark gray, and in the lower part it is grayish brown.

Included with this soil in mapping are small areas of Arispe and Seymour soils. Arispe and Seymour soils are better drained, and upslope on narrow ridgecrests. Included soils make up 5 to 15 percent of the unit.

Permeability of the Clarinda soil is very slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. Water erosion is the major limitation for crop production. If row crops are grown, the seasonal high water table is a serious limitation and further water erosion is a severe hazard. Water erosion can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. In many areas a narrow, seepy band is on the upper part of side slopes. This band commonly remains wet until midsummer. The soil warms slowly in spring, and dries very slowly after rains. Planting is delayed in wet years. Because of permeability, tile drainage is not feasible in this soil, but interceptor tile can be installed in upslope, adjacent soils.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IVe.

223C2—Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, poorly drained soil on short, convex side slopes and in coves at the heads of drainageways on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 4 to more than 20 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 6 inches thick. It is mixed with some streaks and pockets of subsoil material of dark grayish brown silty clay loam. The subsoil is mottled, and extends to a depth of more than 60 inches. In the upper part it is dark grayish brown, friable silty clay loam, in the next part it is mottled, dark gray and strong brown, very firm silty clay, and in the lower part it is dark gray, very firm silty clay.

Included with this soil in mapping are small areas of Armstrong soils on the lower parts of side slopes. Rinda soils are better drained, and contain less clay. They make up 5 to 15 percent of the unit.

Permeability of the Rinda soil is very slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is high. The content of organic matter is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has very low amounts of available phosphorus and low or very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, the seasonal high water table is a serious limitation and further erosion a severe hazard. Erosion can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. In many areas a narrow, seepy band is on the upper part of side slopes. This band commonly remains wet until midsummer. The soil warms slowly in spring, and dries very slowly after rains. Planting is delayed in wet years. Because of permeability, tile drainage is not feasible in this soil, but interceptor tile can be installed in upslope, adjacent soils.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that

tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees, and many areas remain in native hardwoods. The seasonal high water table restricts use of equipment to drier periods or winter, when the ground is frozen. In some areas during wet periods special high flotation equipment is needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be planted closer together. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction are not erosive. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVw.

223D2—Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, poorly drained soil on short, convex side slopes, on convex nose slopes, and in coves at the upper end of drainageways on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 4 to more than 20 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 6 inches thick. It is mixed with streaks and pockets of subsoil material of dark grayish brown silty clay. The subsoil to a depth of about 60 inches is mottled, firm and very firm silty clay. In the upper part it is dark grayish brown, and in the lower part it is dark gray.

Included with this soil in mapping are small areas of Armstrong soils on the lower parts of side slopes. These soils are better drained than the Rinda soil, and contain less clay. They make up 5 to 15 percent of the unit.

Permeability of this Rinda soil is very slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. Shrink-swell potential also is high. The content of organic matter typically is about 1 to 2 percent in the surface layer. This layer typically is acid, unless the soil has been limed. The subsoil commonly is strongly acid to neutral. It generally has very low amounts of available phosphorus and low or very low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, the seasonal high water table is a serious limitation and further erosion is a severe hazard. Erosion can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. In many areas a narrow, seepy band is on the upper part of side slopes. This band commonly remains wet until midsummer. The soil warms slowly in spring, and dries very slowly after rains. Planting is delayed in wet years. Because of permeability, tile drainage is not feasible in this soil, but inceptor tiles can be installed in upslope, adjacent soils.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IVe.

232C—Keswick silt loam, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on narrow, convex ridgetops and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 3 inches thick. The subsurface layer is yellowish brown silt loam and silty clay loam about 6 inches thick and mottled. The subsoil extends to a depth of about 60 inches. In the upper part it is yellowish brown, mottled, firm and very firm clay loam. In the next part it is yellowish brown, mottled firm and very firm clay and is mottled. In the lower part it is grayish brown, mottled, very firm clay loam.

Included with this soil in mapping are small areas of Weller soils upslope on broader ridgecrests. These soils formed in loess, are more fertile, and contain less sand

than the Keswick soil. These soils make up 5 to 10 percent of the unit.

Permeability of this Keswick soil is slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 2 to 3 percent. Shrink-swell potential is also high. The subsoil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used as pasture and woodland.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. It can be controlled in intensively row cropped areas by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. There are no problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

232C2—Keswick silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, moderately well drained soil on narrow, convex ridgetops, and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. It is mixed with streaks and pockets of subsoil material of dark yellowish brown silty clay loam. The subsoil is mottled, and extends to a depth of about 60 inches. In the upper part it is dark yellowish brown, friable clay loam, silt loam, and loam. In the next part it is grayish brown and yellowish brown, friable and firm, loam and clay loam. In the lower part it is strong brown and yellowish brown, firm clay and clay loam.

Included with this soil in mapping are small areas of Weller soils upslope on broader ridgecrests. These soils formed in loess, are more fertile, and contain less sand than the Keswick soil. They make up 5 to 10 percent of the unit.

Permeability of this Keswick soil is slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 1.5 to 2.5 percent. Shrink-swell potential is also high. The subsoil generally has low amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of this soil are used for hay and pasture. These soils have been cultivated at one time or another.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. It can be controlled in intensively row cropped areas by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

269—Humeston silt loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on bottom land. It is subject to occasional flooding for very brief periods. Areas are irregular in shape, and range from 5 to 100 acres or more.

Typically, the surface layer is very dark gray, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and grayish brown, mottled, friable silt loam about 7 inches thick. The subsoil is about 46 inches thick. In the upper part it is very dark gray, mottled, firm silty clay loam. In the next part it is very

dark gray, very dark grayish brown, and grayish brown, mottled, firm silty clay. In the lower part it is mottled, grayish brown and strong brown, firm silty clay loam.

Included with this soil in mapping are small areas of Vesser soils in random positions throughout the map unit. Vesser soils are easier to drain, and contain less clay than the Humeston soil. These soils make up 5 to 10 percent of the unit.

Permeability of this Humeston soil is very slow. Runoff is very slow. Available water capacity is high. The content of organic matter is 3 to 4 percent. This soil has a seasonal high water table. Shrink-swell potential is high. The subsoil has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

This soil is generally cultivated. It is fairly suited to corn, soybeans, and small grains, and is well suited to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. Row crops can be grown much of the time if adequate drainage can be provided. Tile drains generally are not satisfactory, and flooding limits their use in lower lying areas. Open ditches, surface drainage, and diversion terraces are all used to remove surface water. This soil warms slowly in spring, and dries slowly after rains. In years when rainfall is heavy, planting is delayed. The soil is fairly difficult to manage, so farming operations must be timely. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise the soil temperature. Returning crop residue to the soil or regularly adding other organic material, and deferring tillage when the soil is wet help to maintain tilth, to improve fertility, to prevent surface crusting, and to increase the rate of water infiltration.

The land capability classification is IIIw.

273B—Olmitz loam, 2 to 5 percent slopes. This is a gently sloping, moderately well drained soil on low, slightly concave foot slopes and on convex alluvial fans. It is downslope from moderately steep or steep soils that formed in clay loam glacial till. Areas of this Olmitz soil are long and narrow, and range from 5 to 20 acres in size.

Typically, the surface layer is very dark brown, friable loam about 8 inches thick. The subsurface layer is about 26 inches thick. In the upper part it is very dark grayish brown, friable loam. In the next part it is black, friable clay loam. In the lower part it is dark brown, firm clay loam. The subsoil to a depth of about 60 inches is brown, mottled, firm clay loam.

Included with this soil in mapping are small areas of Zook soils on the lower slopes. These soils have a higher clay content than the Olmitz soil, and are poorly drained. These areas make up 5 to 15 percent of the unit.

Permeability of this Olmitz soil is moderate. Runoff is slow. Available water capacity is high. The content of organic matter is 3 to 4 percent. The soil has very low amounts of available phosphorus and low amounts of available potassium. Tilth is good.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. In intensively row cropped areas, erosion can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with diversion terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

The land capability classification is IIe.

273C—Olmitz loam, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on low, slightly concave foot slopes and on convex alluvial fans. It is downslope from moderately steep or steep soils that formed in clay loam glacial till. Areas are long and narrow, and range from 5 to 10 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. The subsurface layer is about 27 inches thick. In the upper part it is very dark grayish brown, friable loam. In the next part it is black, friable clay loam. In the lower part it is dark brown, firm clay loam. The subsoil to a depth of about 60 inches is brown, mottled, firm clay loam.

Included with this soil in mapping are small areas of Zook soils on the lower slopes. These soils have higher clay content and are poorly drained. These areas make up 5 to 15 percent of the unit.

Permeability of this Olmitz soil is moderate. Runoff is medium. Available water capacity is high. The content of organic matter is 3 to 4 percent. The soil has very low amounts of available phosphorus and low amounts of available potassium. Tilth is good.

Most areas are cultivated. This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. In intensively row cropped areas, it can be controlled by a conservation

tillage system that leaves crop residue on the surface, in combination with diversion terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

The land capability classification is IIIe.

312B—Seymour silty clay loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on short, slightly convex side slopes and ridgetops near broad upland flats. Areas are irregular in shape or long and narrow, and extend for as much as several miles. Areas range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the lower part it is grayish brown, firm and very firm silty clay and silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Edina soils in depressional areas of upland ridgecrests. These soils pond water. They make up about 5 to 10 percent of the unit.

Permeability of this Seymour soil is very slow. Surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 3 to 4 percent. Shrink-swell potential is high. The soil generally has low amounts of phosphorus and very low amounts of potassium. Tilth is good.

Most areas are cultivated. This soil is fairly suited to corn and soybeans. It is best suited to small grains and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. Intensively row cropped areas can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

The land capability classification is IIIe.

312C—Seymour silty clay loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on short, slightly convex side slopes and ridgetops near broad, upland flats. Areas are irregular in shape or long and narrow, and extend for as much as several miles. Areas range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silty clay loam about 4 inches thick. The subsoil is mottled and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the lower part it is grayish brown, firm and very firm silty clay and silty clay loam.

Included with this soil in mapping are small areas of Clarinda soils. These soils are poorly drained and on convex side slopes and in coves at the heads of drainageways. They make up about 5 to 10 percent of the unit.

Permeability of this Seymour soil is very slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 3 to 4 percent. Shrink-swell potential also is high. The soil generally has low amounts of phosphorus and very low amounts of potassium. Tilth is good.

Most areas are in pasture or hayland. This soil is fairly suited to corn and soybeans. It is best suited to small grains and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

The land capability classification is IIIe.

312C2—Seymour silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on short, slightly convex side slopes and ridgetops near broad, upland flats. Areas are irregular in shape or long and narrow, and extend for as much as several miles. Areas range from 5 to 100 acres in size.

Typically, the surface layer is very dark grayish brown, friable silty clay loam about 8 inches thick. It is mixed with some streaks and pockets of subsoil material of dark grayish brown silty clay. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the lower part it is grayish brown, firm and very firm silty clay and silty clay loam.

Included with this soil in mapping are small areas of Clarinda soils. These soils are poorly drained and on convex side slopes and in coves at the heads of drainageways. They make up about 5 to 10 percent of the unit.

Permeability of this Seymour soil is very slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has low amounts of phosphorus and very low amounts of potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is fairly suited to corn and soybeans. It is best suited to small grains and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. In intensively row cropped areas, it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

The land capability classification is IIIe.

362—Haig silty clay loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on broad, upland flats. Areas are irregular in shape, and range from 5 to 150 acres in size.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer is black and very dark gray, friable silty clay loam about 6 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is very dark gray, very dark grayish brown and dark grayish brown, friable silty clay loam. In the next part it is dark grayish brown and grayish brown, firm silty clay. In the lower part it is olive gray, firm silty clay loam.

Included with this soil in mapping are small depressional areas of Edina soils. These soils pond water, and are more difficult to drain than the Haig soil. They make up about 5 to 10 percent of the unit.

Permeability of this Haig soil is slow. Runoff is very slow. Available water capacity is high. The content of organic matter is 3.5 to 4.5 percent. The soil has a seasonal high water table. Shrink-swell potential also is high. The soil generally has low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. If the soil is adequately drained, row crops can be grown in many years. Tile drains generally do not function very satisfactorily, because permeability is slow and outlets are not available. A surface drainage system will help to remove surface water. Because the soil warms slowly in spring and dries slowly after rainfall, fieldwork is delayed. If rainfall is heavy, planting is delayed. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, help to overcome the wetness and to raise soil temperature. However, this ridge system needs to be arranged so that water will leave this soil. Fall plowing improves the timeliness of fieldwork, but increases the hazard of wind erosion. Leaving a rough plowed surface and alternating plowed and unplowed strips help to control the wind erosion. Chisel plowing areas where crop residue has been left on the surface also helps to control wind erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland.

The land capability classification is IIw.

364B—Grundy silty clay loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on convex ridges on uplands. Areas are irregular in shape or long and narrow, and extend for as much as several miles. Areas range from 5 to 160 acres in size.

Typically, the surface layer is black, friable silty clay loam about 7 inches thick. The subsurface layer is very dark grayish brown silty clay loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. In the upper part it is dark brown, friable silty clay loam. In the next part it is dark grayish brown and grayish brown, mottled, firm silty clay. In the lower part it is grayish brown, mottled, firm silty clay loam.

Included with this soil in mapping are small areas of Haig soils. These soils are poorly drained and on the less sloping parts of the landscape. They are wetter, and in some years delay field operations in spring. They make up about 10 to 15 percent of the unit.

Permeability of this Grundy soil is slow. Runoff is slow. Available water capacity is high. The content of organic matter is 3 to 4 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The soil generally has low amounts of available phosphorus and available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard in the more sloping areas. Row crops can be grown in most years, if erosion is controlled. A conservation tillage system that leaves crop residue on the surface, contour farming, and terraces help to control erosion. In places, contour farming or terracing is difficult because of undulating, short slopes. If terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Because exposing the subsoil generally results in seepy terrace channels, a combination of tile drainage and terraces works well. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

The land capability classification is IIe.

423C2—Bucknell clay loam, 5 to 9 percent slopes, moderately eroded. This is a strongly sloping, somewhat poorly drained soil on the lower side slopes and head slopes of drainageways that extend into the uplands. Areas are long and irregularly shaped, and commonly range from 10 to more than 60 acres in size.

Typically, the surface layer is very dark gray, friable clay loam about 9 inches thick. It is mixed with some streaks and pockets of subsoil material of dark grayish brown clay loam. The subsoil extends to a depth of about 60 inches. In the upper part it is dark grayish brown, mottled, friable and firm clay loam and clay. In the next part it is mottled grayish brown, firm clay. In the lower part it is mottled grayish brown and light brownish gray, firm clay loam. In places the subsoil contains less clay.

Permeability of the Bucknell soil is slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is high. The content of organic matter is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is fairly suited to intensive row cropping. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees, and many areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IIIe.

423D2—Bucknell clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, somewhat poorly drained soil on the lower side slopes and headslopes of drainageways that extend into uplands. Areas are long and irregularly shaped, and commonly range from 10 to more than 600 acres in size.

Typically, the surface layer is very dark gray, friable clay loam about 9 inches thick. It is mixed with some streaks and pockets of subsoil material of dark grayish brown clay loam. The subsoil is mottled, and extends to a depth of about 60 inches. In the upper part it is dark grayish brown, friable and firm clay loam and clay. In the next part it is grayish brown, firm clay. In the lower part it is mottled, grayish brown and light brownish gray, firm clay loam. In places the subsoil contains less clay.

Permeability of this Bucknell soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is high. The content of organic matter is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding help to control erosion.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVe.

425C—Keswick loam, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on short, convex side slopes, ridgetops, and nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 50 acres in size.

Typically, the surface layer is very dark gray, friable loam about 4 inches thick. The subsurface layer is yellowish brown and brown loam about 8 inches thick. The subsoil is firm and mottled, and extends to a depth of about 60 inches or more. In the upper part it is brown and strong brown clay. In the next part it is strong brown, clay loam. In the lower part it is yellowish brown clay loam.

Included with this soil in mapping are small areas of Weller and Rathbun soils at the center of narrow ridgetops. They are more fertile, and formed in loess. These soils make up 5 to 15 percent of the unit.

Permeability of the Keswick soil is slow. It has a seasonal high water table. The soil is seepy during some wet periods. Surface runoff is medium. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of this soil are in pasture.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. It can be controlled in intensively row cropped areas by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and

hayland, cultivating and preparing a seedbed on the contour or interseeding help to control erosion.

This soil is fairly suited to trees, and many areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IIIe.

425D—Keswick loam, 9 to 14 percent slopes. This is a strongly sloping, moderately well drained soil on short, convex side slopes and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 10 to more than 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is yellowish brown, friable loam about 6 inches thick. The subsoil extends to a depth of about 60 inches. It is firm and mottled. In the upper part it is yellowish red and brown clay. In the next part it is brown and yellowish brown clay loam. In the lower part it is yellowish brown clay loam. In places the subsoil does not have red colors.

Included with this soil in mapping are small areas of Weller and Rathbun soils in the center of narrow ridgetops. These soils are more fertile, and formed in loess. They make up 5 to 15 percent of the unit.

Permeability of the Keswick soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture, for hay, or as woodland and habitat for wildlife. This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees, and many areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVe.

425D2—Keswick clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, moderately well drained soil on short, convex side slopes and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 5 inches thick. It is mixed with some streaks and pockets of subsoil material of yellowish red and brown clay. The subsoil is firm clay and clay loam about 55 inches thick. In the upper part it is yellowish red and brown. In the next part it is mottled brown and yellowish brown. In the lower part it is yellowish brown.

Included with this soil in mapping are small areas of Weller and Rathbun soils. Weller and Rathbun soils are on the center of narrow ridgetops. Weller and Rathbun soils are more fertile, and formed in loess. These soils make up 5 to 15 percent of the unit.

Permeability of this Keswick soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 1.5 to 2.5 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture, hay, or row crops.

This soil is poorly suited to row crops. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further water erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling water erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage

species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is suited to trees, and small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVe.

425D3—Keswick clay, 9 to 14 percent slopes, severely eroded. This is a strongly sloping, moderately well drained soil on short, convex side slopes and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is brown, firm clay about 3 inches thick. Erosion has removed most of the original surface layer and plowing has mixed the rest with material from the subsoil. The subsoil extends to a depth of about 60 inches or more. It is firm and mottled. In the upper part it is yellowish red and brown clay. In the next part it is brown and yellowish brown clay loam. In the lower part it is yellowish brown clay loam.

Included with this soil in mapping are small areas of Weller and Rathbun soils at the center of narrow ridgetops. These soils are more fertile, and formed in loess. They make up 5 to 15 percent of the unit.

Permeability of the Keswick soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 1 to 2 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is very poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture, hay, or row crops. This soil is not suited to row crops. It is best suited to small grain and to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is VIe.

451C2—Caleb loam, 5 to 9 percent slopes, moderately eroded. This is a strongly sloping, moderately well drained soil on convex side slopes of high stream benches. Areas are long, narrow, and irregular in shape, and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. It is mixed with streaks and pockets of subsoil material of dark brown friable and firm clay loam. The subsoil is about 41 inches thick. In the upper part it is dark brown, friable, and firm clay loam. In the middle part it is mottled, strong brown and brown, firm sandy clay loam. In the lower part it is yellowish brown, friable sandy clay loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm, stratified loam and clay loam. In places the subsoil is red colored and higher in clay.

Included with this soil in mapping are small areas of Pershing soils on narrow, convex ridgetops. These soils are more fertile, formed in loess, and contain less sand. They make up 5 to 15 percent of the unit.

Permeability of this Caleb soil is moderate. The available water capacity is moderate. The content of organic matter is 2 to 3 percent. Runoff is medium. This soil has a seasonal high water table. The subsoil is very low in available phosphorus and low in available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

This soil is used mostly for pasture and hay or as woodland. It is fairly suited to corn and soybeans. It is better suited to small grains and to grasses and legumes for hay and pasture. If the soil is tilled for row crops, further erosion is a very severe hazard. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation practices, such as

farming on the contour, grassed waterways, and a cropping sequence that includes grasses and legumes, and conservation tillage help to control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and many areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

451D2—Caleb loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, moderately well drained soil on convex side slopes of high benches. Areas are long, narrow, and irregular in shape, and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown, friable loam about 7 inches thick. Generally, plowing has mixed some of the dark brown subsoil into the surface layer. The subsoil is about 41 inches thick. In the upper part it is dark brown, friable and firm clay loam. In the middle part it is mottled, strong brown and brown, firm sandy clay loam. In the lower part it is yellowish brown, friable sandy clay loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm, stratified loam and clay loam. In some small, severely eroded areas the surface layer is mostly brown clay loam. In other small areas the surface layer is silt loam.

Included with this soil in mapping are small areas of Pershing soils on narrow, convex ridgetops. These soils make up 5 to 15 percent of the unit. They are more fertile, formed in loess, and contain less sand.

Permeability of this Caleb soil is moderate. The available water capacity is moderate. The content of organic matter is 2 to 3 percent. Runoff is rapid. This soil has a seasonal high water table. The subsoil is very low in available phosphorus and low in available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

This soil is used mostly for pasture and hay.

This soil is poorly suited to corn and soybeans. It is better suited to small grains and to grasses and legumes for hay and pasture. The tillage of row crops creates a very severe hazard of further erosion. Row crops can be grown some of the time if adequate erosion protection is provided. Conservation tillage, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes help to control erosion. In some places this soil is suited to erosion control practices, such as contouring and terracing, but in other places these practices are difficult because of undulating topography and short slopes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IVe.

451E2—Caleb loam, 14 to 18 percent slopes, moderately eroded. This is a moderately steep, moderately well drained soil on convex side slopes of high benches. Areas are long, narrow, and irregular in shape, and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown, friable loam about 6 inches thick. Generally, plowing has mixed some of the subsoil into the surface layer. The subsoil extends to a depth of 60 inches. In the upper part it is dark yellowish brown, friable loam and sandy clay loam. In the middle part it is dark yellowish brown, friable and firm sandy clay loam. In the lower part it is yellowish brown and dark yellowish brown, mottled sandy clay loam.

Included with this soil in mapping are small areas of Pershing soils. These soils contain less sand than the Caleb soil. They make up 5 to 15 percent of the unit.

Permeability of this Caleb soil is moderate. Runoff is rapid. The available water capacity is moderate. The content of organic matter is 2 to 3 percent. This soil has a seasonal high water table. The subsoil is very low in available phosphorus and low in available potassium.

Tilth is poor, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

This soil is used mostly for pasture and hay.

This soil is generally not suited to corn and soybeans. It is better suited to small grains and to grasses and legumes for hay and pasture. Conservation tillage, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes help to control erosion. Intensive cultivation is not possible, because the rate of soil loss on this moderately steep soil is too great. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and a few areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on or nearly on the contour will help to control erosion. Because of slope, use of equipment on this soil is somewhat hazardous. Special equipment and caution in its use are needed. Seedlings can be expected to survive.

The land capability classification is VIe.

452C—Lineville silt loam, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on narrow, convex ridgetops and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches or more. In the upper part it is brown, friable silty clay loam. In the next part it is dark yellowish brown and brown, mottled, friable silty clay loam and loam. In the lower part it is yellowish brown, mottled, very firm and firm clay.

Included with this soil in mapping are small areas of Pershing soils upslope on the broader ridgecrests. These soils formed in loess, are more fertile, and contain less sand than the Lineville soil. They make up 5 to 10 percent of the unit.

Permeability of this soil is slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. Shrink-swell potential is also high. The subsoil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for hay and pasture. This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to growing trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

452C2—Lineville silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, moderately well drained soil on narrow, convex ridgetops and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. It is mixed with streaks and pockets of subsoil material of brown silty clay loam. The subsoil extends to a depth of about 60 inches or more. In the upper part it is brown, friable silty clay loam. In the next part it is brown and yellowish brown, mottled, friable loam and clay loam. In the lower part it is strong brown and yellowish brown, mottled, very firm and firm clay.

Included with this soil in mapping are small areas of Pershing soils upslope on broader ridgecrests. These soils formed in loess, are more fertile, and contain less

sand than the Lineville soil. They make up 5 to 10 percent of the unit.

Permeability of this Lineville soil is slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 2 to 3 percent. Shrink-swell potential is also high. The subsoil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of this soil are used for hay and pasture. This soil has been cultivated at some time in the past.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. Further water erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

453—Tuskeego silt loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on low stream terraces in bottom lands. It is subject to rare flooding. Areas are irregular in shape, and range from 5 to 50 acres or more.

Typically, the surface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 3 inches thick. The subsoil is 48 inches thick. In the upper part it is dark grayish brown, mottled, firm silty clay loam. In the middle part it is dark grayish brown, mottled, firm silty clay and silty clay loam. In the lower part it is mottled, grayish brown and yellowish brown, very firm silty clay loam. The substratum to a depth of 60 inches is light brownish gray, mottled, friable silt loam.

Included with this soil in mapping are small areas of Coppock soils occurring at random throughout the unit. These soils are easier to drain, and contain less clay than the Tuskeego soil. They make up 5 to 15 percent of the unit.

Permeability of this Tuskeego soil is very slow. Available water capacity is high. The content of organic matter is 3 to 4 percent. Runoff is very slow. This soil has a seasonal high water table. Shrink-swell potential is high. The subsoil is low in available phosphorus and very low in available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

This soil is used mostly for cultivated crops, hay, and pasture. It is moderately suited to corn, soybeans, small grains, and grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. Row crops can be grown much of the time if adequate drainage can be provided. Because of permeability, tile drains generally are not satisfactory on this soil; suitable outlets are difficult to find in wide, relatively low-lying areas. Open ditches, surface drainage, landscaping, and bedding are all used to remove surface water. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise the soil temperature. In years when rainfall is heavy, planting is delayed. Because this soil is fairly difficult to manage, timely farming operations are needed. An occasional year of meadow improves tilth and helps to control weeds and insects.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland.

This soil is well suited to trees, and few areas remain in native hardwoods. The seasonal high water table restricts the use of equipment to drier periods or winter, when the ground is frozen. During wet periods special high flotation equipment may be needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction are not erosive on this soil.

The land capability classification is IIIw.

484—Lawson silt loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil in areas

of recent deposition on bottom lands near the major streams. It is subject to occasional flooding. Areas are long and narrow or irregularly shaped, and range from 10 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 38 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown and dark grayish brown, friable silt loam.

Included with this soil in mapping are scattered small areas of Klum soils. These soils are in similar landscape positions, and contain more sand than the Lawson soil. They make up 5 to 10 percent of the unit.

Permeability of the Lawson soil is moderate. The soil has a seasonal high water table. Surface runoff is slow. Available water capacity is high. The content of organic matter is 4.5 to 6.0 percent. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is good.

Most areas are cultivated. This soil is well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table and flooding are the major limitations for crop production. In many years row crops can be grown if the soil is adequately drained and protected from floodwater. A subsurface drainage system is beneficial for timeliness of field operations. In many areas diversion terraces are needed to protect the soil from runoff from the higher surrounding areas.

This soil is suited to pasture or hay. Most areas that are narrow and flooded are in permanent pasture. However, overgrazing or grazing during wet periods after flooding causes surface compaction and puddling of the soil. Rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is moderately well suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIw.

520—Coppock silt loam, 0 to 2 percent slopes. This is a nearly level, somewhat poorly drained soil on second bottom flood plains and alluvial fans along streams and rivers. It is subject to occasional flooding for brief periods, but some areas are protected by diversion terraces. Areas are irregularly shaped, and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 24 inches thick. In the upper part the subsoil is dark grayish brown, mottled, firm silty clay loam. In the lower part, to a depth of about 60 inches, it is mottled, grayish brown and dark yellowish brown, firm silty clay loam. In places the surface layer is dark grayish brown silt loam, and contains less organic matter.

Included with this soil in mapping are areas of Tuskeego soils on lower slopes. These soils are poorly drained, and contain more clay in the subsoil. They cannot be drained as easily as the Coppock soil. They make up about 5 to 10 percent of the unit.

Permeability of this Coppock soil is moderate. Runoff is very slow. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil has a seasonal high water table. It generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Many areas are cultivated. Some areas are used for pasture. A few areas support native hardwoods. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. If the soil is adequately drained and protected from flooding, in most years row crops can be grown. A subsurface drainage system functions satisfactorily if suitable outlets are available. Diversion terraces on adjacent foot slopes help to control runoff from the higher areas. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise the soil temperature. Good tilth generally can be easily maintained.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland.

The land capability classification is IIw.

520B—Coppock silt loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on foot slopes and alluvial fans along the streams and rivers. It is subject to rare flooding for brief periods, but some areas are protected by diversion terraces. Areas are irregularly shaped, and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 22 inches thick. In the upper part the subsoil is dark grayish brown, mottled, firm silty clay loam. In the lower part, to a depth of about 60 inches, it is mottled, grayish brown and dark yellowish brown, firm

silty clay loam. In places the surface layer is dark grayish brown silt loam, and contains less organic matter.

Included with this soil in mapping are areas of Tuskeego soils in small depressions on the lower areas. These soils are poorly drained, and contain more clay in the subsoil. They cannot be drained as easily as the Coppock soil. These soils make up about 5 to 10 percent of the unit.

Permeability of this Coppock soil is moderate. Runoff is slow. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil has a seasonal high water table. It generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Many areas are cultivated. Some areas are used for pasture. A few areas support native hardwoods. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. If the soil is adequately drained and protected from flooding, row crops can be grown in most years. A subsurface drainage system functions satisfactorily if suitable outlets are available. Diversion terraces on adjacent foot slopes help to control runoff from the higher areas. Good tilth generally can be easily maintained. Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise the soil temperature.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIw.

531B—Kniffin silt loam, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on convex ridgetops and on short convex side slopes on uplands. Areas are irregular in shape or long and narrow, and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 3 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the next part it is grayish brown, firm silty clay. In the lower part it is grayish brown and light brownish gray, friable silty clay loam.

Included with this soil in mapping are small areas of Edina soils in the depressional areas of upland ridgecrests. These soils will pond water. They make up about 5 to 10 percent of the unit.

Permeability of this Kniffin soil is very slow. Runoff is slow. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is good.

Most areas are cultivated. This soil is fairly suited to corn and soybeans. It is best suited to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. In intensively row cropped areas, it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. It is also effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and a few areas remain in native hardwoods. The seasonal high water table restricts use of equipment to drier periods or winter, when the ground is frozen. During wet periods special high flotation equipment may be needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction on this soil are not erosive.

The land capability classification is IIIe.

531C—Kniffin silt loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and on short, convex side slopes on uplands. Areas are irregular in shape or long and narrow, and range from 5 to 50 acres in size.

Typically, the surface layer is very dark gray, very friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silty clay loam about 3 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the next part it is grayish brown,

firm silty clay. In the lower part it is grayish brown and light brownish gray, friable silty clay loam.

Included with this soil in mapping are small areas of Rinda soils on convex side slopes and in coves at the heads of drainageways. These soils are poorly drained. They make up about 5 to 10 percent of the unit.

Permeability of this Kniffin soil is very slow. Runoff is medium. Available water capacity is high. The content of organic matter is 2.5 to 3.5 percent. The soil has a seasonal high water table. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are in hay and pasture. This soil is fairly suited to corn and soybeans. It is best suited to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling water erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and many areas remain in native hardwoods. The seasonal high water table restricts use of equipment to drier periods or winter, when the ground is frozen. During wet periods, special high flotation equipment may be needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction on this soil are not erosive.

The land capability classification is IIIe.

531C2—Kniffin silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and on short, convex side slopes on uplands. Areas are irregular in shape or long and narrow, and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the next part it is grayish brown, firm silty clay. In the lower part it is grayish brown and light brownish gray, friable silty clay loam.

Included with this soil in mapping are small areas of Rinda soils. These soils are poorly drained, and on convex side slopes and in coves at the heads of drainageways. They make up about 5 to 10 percent of the unit.

Permeability of this Kniffin soil is very slow. Runoff is medium. Available water capacity is high. The content of organic matter is 2 to 3 percent. The soil has a seasonal high water table. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is fairly suited to corn and soybeans. It is best suited to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. It can be controlled in intensively row cropped areas by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is suited to trees, and some areas remain in native hardwoods. The seasonal high water table restricts use of equipment to drier periods or winter, when the ground is frozen. During wet periods special high flotation equipment may be needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction are not erosive on this soil.

The land capability classification is IIIe.

532C—Rathbun silt loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and on short, convex side slopes on uplands. Areas are irregular in shape or long and narrow, and range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsurface layer is yellowish brown, friable silty clay loam about 3 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is yellowish brown and dark grayish brown, firm silty clay. In the next part it is grayish brown and olive gray, firm and very firm silty clay loam. In the lower part it is dark grayish brown, friable silt loam.

Included with this soil in mapping are small areas of Keswick soils on the lower side slopes. These soils are moderately well drained. They make up 5 to 15 percent of the unit.

Permeability of this Rathbun soil is very slow. Runoff is medium. Available water capacity is high. The content of organic matter is 2 to 3 percent. The soil has a seasonal high water table. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are in pasture or woodland. This soil is fairly suited to corn and soybeans. It is best suited to trees or to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. These uses are also effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is suited to trees, but most areas of trees are limited to groves and trees around farmsteads. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

532C2—Rathbun silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and on short, convex side slopes on uplands. Areas are irregular in shape or long and narrow, and range from 5 to 50 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 6 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is dark grayish brown and yellowish brown, firm silty clay. In the next part it is grayish brown, firm and very firm silty clay loam. In the lower part it is dark grayish brown, friable silt loam.

Included with this soil in mapping are small areas of Keswick soils on the lower side slopes. These soils are moderately well drained. They make up 5 to 15 percent of the unit.

Permeability of this Rathbun soil is very slow. Runoff is medium. Available water capacity is high. The content of organic matter is 1.5 to 2.5 percent. The soil has a seasonal high water table. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is fairly suited to corn and soybeans. It is best suited to trees or to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with terraces, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. These uses are also effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, but most areas of trees are limited to groves and trees around farmsteads. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

587—Chequest silty clay loam, 0 to 2 percent slopes. This is a nearly level, poorly drained soil in bayous and in low areas of bottom lands. It is subject to frequent flooding for long periods. Areas are irregularly shaped, and commonly range from 5 to 50 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam and silty clay about 11 inches thick. The subsoil extends to a depth of 60 inches. In the upper part it is dark gray, mottled, firm silty clay. In the lower part it is dark gray, mottled, firm silty clay loam.

Included with this soil in mapping are a few small areas of very poorly drained areas of marsh vegetation. They make up 5 to 10 percent of the unit.

Permeability of this Chequest soil is moderately slow. Surface runoff is very slow. The soil has a seasonal high water table. Available water capacity is high. The content of organic matter is 3 to 4 percent. Shrink-swell potential is also high. The soil generally has medium amounts of available phosphorus and low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is fairly suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. This poorly drained soil is generally farmed along with soils that are better suited to cultivated crops. If artificially drained, it can be frequently planted to row crops, but it is only fairly suited to row crops. Poor drainage and occasional flooding are the main limitations. If suitable outlets are available, open ditches or tile drains should be installed in cultivated areas. In undrained areas this soil is better suited to pasture than to row crops.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture or hayland.

This soil is well suited to trees, and a few areas remain in native hardwoods. The seasonal high water table restricts use of equipment to drier periods or winter, when the ground is frozen. During wet periods special high flotation equipment may be needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction are not erosive on this soil.

The land capability classification is IIw.

592C—Mystic silt loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and side slopes of high stream benches. Areas are long, narrow, and irregular in shape, and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil is mottled, and extends to a depth of about 60 inches. In the upper part it is grayish brown, firm clay. In the middle part it is grayish brown, firm clay loam. In the lower part it is brown, firm clay loam.

Included with this soil in mapping are small areas of Pershing soils. These soils formed in loess, and are more fertile than, and contain less sand than the Mystic soil. They are on narrow, convex ridgetops upslope from the Mystic soil. They make up 5 to 15 percent of the unit.

Permeability of this Mystic soil is slow. The available water capacity is moderate. The content of organic matter is 2.5 to 3.5 percent. Runoff is medium. This soil has a seasonal high water table, and seepy spots during wet periods. Shrink-swell potential is high. The subsoil is very low in available phosphorus and low in available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

This soil is used mostly for pasture and hay and as woodland.

It is fairly suited to corn and soybeans. It is best suited to small grains and grasses and legumes for hay and pasture. If this soil is used for row crops, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and

hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees, and many areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

592C2—Mystic clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and side slopes of high stream benches. Areas are long, narrow, and irregular in shape, and range from 5 to 20 acres or more.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. Generally, plowing has mixed some of the grayish brown clay subsoil into the surface layer. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is grayish brown, firm clay. In the middle part it is brown, firm clay loam. In the lower part it is brown, firm clay loam. In some small, severely eroded areas the surface layer is mostly grayish brown clay. In other small, uneroded areas the surface layer is very dark grayish brown silt loam about 9 inches thick. In places the subsoil has less clay and does not have red colors.

Included with this soil in mapping are small areas of Pershing soils. These soils formed in loess, and are more fertile and contain less sand than the Mystic soil. They are on narrow, convex ridgetops upslope from the Mystic soil. They make up 5 to 15 percent of the unit.

Permeability of this Mystic soil is slow. The available water capacity is moderate. The content of organic matter is 2 to 3 percent. Runoff is medium. This soil has a seasonal high water table, and seepy spots during wet periods. Shrink-swell potential is high. The subsoil is very low in available phosphorus and available potassium. Tilth is poor, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

This soil is used mostly for pasture, hay, and row crops.

This soil is fairly suited to corn and soybeans. It is best suited to small grains and grasses and legumes for hay and pasture. If the soil is used for crops, further water erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

592D2—Mystic clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, somewhat poorly drained soil on convex ridgetops and side slopes of high stream benches. Areas are long, narrow, and irregular in shape, and range from 5 to 30 acres or more.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. Generally, plowing has mixed some of the subsoil of grayish brown clay into the surface layer. The subsoil is mottled and about 52 inches thick. In the upper part it is grayish brown, firm clay. In the middle part it is grayish brown, firm clay loam. In the lower part it is brown, firm clay loam. In some small, severely eroded areas, the surface layer is mostly grayish brown clay. In other small, uneroded areas, the surface layer is very dark grayish brown silt loam about 9 inches thick.

Included with this soil in mapping and making up 5 to 10 percent of the unit are small areas of Pershing soils. These soils formed in loess, and are more fertile and contain less sand than the Mystic soil. They are on narrow, convex ridgetops.

Permeability of this Mystic soil is slow. Runoff is rapid. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. This soil has a seasonal high water table, and seepy spots during wet periods. Shrink-swell potential is high. The subsoil is very low in available phosphorus and low in available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

This soil is used mostly for pasture, hay, and row crops. It is poorly suited to corn and soybeans. It is best suited to small grains and to grasses and legumes for hay and pasture. If the soil is tilled for row crops, further erosion is a very severe hazard. Row crops can be grown some of the time on the soil if adequately

protected from erosion. Conservation tillage, contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes help to control erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, helps to maintain tilth, and increases water infiltration.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IVe.

594D—Galland loam, 9 to 14 percent slopes. This is a strongly sloping, somewhat poorly drained soil on convex ridgetops and side slopes of high stream benches along the major streams and rivers. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is grayish brown, friable loam about 6 inches thick. The subsoil is firm and friable clay loam, clay, and sandy clay loam about 47 inches thick. It is mottled. In the upper part it is strong brown. In the next part it is brown and strong brown. In the lower part it is brown and strong brown. The substratum to a depth of about 60 inches is pale brown and strong brown, stratified loam and sandy loam.

Included with this soil in mapping are small areas of Weller soils upslope in the center of narrow ridgetops. These soils formed in loess, and contain less sand and are more fertile than the Galland soil. They make up 5 to 10 percent of the unit.

Permeability of this Galland soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are woodland.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to growing trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVe.

594D2—Galland clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, somewhat poorly drained soil on convex ridgetops and side slopes of high benches along the major streams and rivers. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 6 inches thick. It is mixed with some streaks and pockets of strong brown subsoil material. The subsoil is mottled, firm and friable clay loam, sandy clay loam, and clay about 47 inches thick. In the upper part it is strong brown and friable. In the next part it is brown and strong brown. In the lower part it is brown and strong brown. The substratum to a depth of about 60 inches is pale brown and strong brown, mottled, friable, stratified loam and sandy loam.

Included with this soil in mapping are small areas of Weller soils upslope in the center of narrow ridgetops. These soils formed in loess, and contain less sand and are more fertile than the Galland soil. They make up 5 to 10 percent of the unit.

Permeability of this Galland soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The content of organic matter is 1.5 to 2.5 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated or in pasture.

This soil is poorly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVe.

678G—Gasconade-Rock outcrop complex, 18 to 50 percent slopes. This is a steep and very steep, somewhat excessively drained soil on side slopes and escarpments of uplands and stream benches. Areas are long and narrow or irregularly shaped, and commonly range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable, flaggy silty clay about 4 inches thick. The subsoil is firm, olive brown very flaggy clay about 8 inches thick. The substratum is fractured limestone bedrock.

Typically, Rock outcrop in most areas consists of limestone bedrock that crops out in thicknesses of 2 to 6 feet.

Included with this soil in mapping are small areas of Gara and Caleb soils on landscapes similar to those of the Gasconade soil. Gara soils are moderately well drained or well drained, and Caleb soils are moderately well drained. These soils are deeper and less droughty than the Gasconade soil. They make up about 5 to 20 percent of the unit.

Permeability of this Gasconade soil is moderately slow. Surface runoff is very rapid. Available water capacity is very low. The content of organic matter is 2 to 3 percent. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, and the soil generally is not tilled because of limestone fragments on the surface.

Most areas are used as pasture and woodland. This soil is not suited to cultivated crops because of stoniness and slope. It is best suited to pasture and woodland.

Use of this soil for pasture is effective in controlling erosion. However, overgrazing or grazing when the soil is too wet causes surface compaction and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, and weed control help to improve productivity of pasture. Because of slope, erosion is a hazard. Consequently, when renovating pasture using special equipment and cultivating on the contour are needed. On pasture, brush control is generally needed because of overgrazing and low or moderate forage production.

This soil is poorly suited to trees, and many areas remain in native hardwoods. Erosion is a hazard on logging trails or roads. Laying out the trails or roads on the contour helps to control erosion. Because of slope, use of equipment on this soil is somewhat hazardous. Special equipment and caution in its use are needed. Seedlings do not survive well, and can be spaced closer together to achieve desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is VIIs.

715—Nodaway-Lawson-Klum complex, 0 to 3 percent slopes. This map unit consists of nearly level and very gently sloping soils on flood plains near the two major rivers and streams. It is about 50 percent Nodaway soils, 30 percent Lawson soils, 10 percent Klum soils, and 10 percent other soils. Nodaway soils

are moderately well drained, and Lawson soils are somewhat poorly drained. These soils are commonly next to stream channels on flood plains that have recently received sediments. Klum soils are moderately well drained, and are on, in, and around old bayous and oxbows that are farmed. The soils in this map unit are subject to occasional flooding for very brief to long periods. Areas of these soils are long and narrow or irregularly shaped, and commonly range from 5 to 200 acres in size. The three soils are in areas so intricately mixed or so small that they could not be separated at the scale used for mapping.

Typically, the surface layer of the Nodaway soil is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, dark grayish brown, and grayish brown, friable silt loam. In some areas the surface layer is loam, silty clay loam, or sandy loam.

Typically, the surface layer of the Lawson soil is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 38 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown and dark grayish brown, friable silt loam.

Typically, the surface layer of the Klum soil is very dark grayish brown, friable fine sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, brown, and pale brown, loam, silt loam, and loamy fine sand.

Included with this unit in mapping are small areas of poorly drained Chequest soils. These soils are in similar landscape positions, and contain more clay in the subsoil than the Nodaway, Lawson, and Klum soils. They make up about 10 percent of the map unit.

Permeability is moderate in the Lawson and Nodaway soils and moderately rapid in the Klum soil. Surface runoff is slow on all these soils. The three soils have a seasonal high water table. Available water capacity is high in the Lawson and Nodaway soils and moderate in the Klum soils. The content of organic matter is 1.5 to 6.0 percent. All three soils have medium to very low amounts of available phosphorus and available potassium. Tilth is good.

Most areas of the soils in this map unit are cultivated. They are well suited to corn, soybeans, and small grains and to grasses and legumes for hay and pasture. The seasonal high water table and flooding are the major limitations for crop production. In many years row crops can be grown if the soil is adequately drained and protected from floodwater. In the lower areas and bayous a subsurface drainage system with tile intakes is needed (fig. 9). Levees or dikes along stream channels help to control floodwater. A conservation tillage system that leaves crop residue on the surface conserves moisture and helps to control wind erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility, and helps to control erosion and prevent surface crusting and loss of tilth.

These soils are suited to pasture or hay. Most areas that are narrow and flooded are in permanent pasture. However, overgrazing or grazing during wet periods after flooding causes surface compaction and puddling of the soil. Rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is moderately well suited to trees, and a few small areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIw.

730C—Cantril-Coppock-Nodaway complex, 2 to 9 percent slopes. This map unit consists of gently sloping and moderately sloping soils in narrow drainageways and on narrow foot slopes. It is about 40 percent Cantril soil, 30 percent Coppock soil, 20 percent Nodaway soil, and 10 percent other soils. Cantril and Coppock soils are somewhat poorly drained, and on the upper parts of slopes. The Nodaway soil is moderately well drained, and on the lower parts of slopes, nearer the stream channels. The Nodaway soil is subject to occasional flooding of very brief or brief periods. Areas are long and narrow, and range from 5 to 50 acres in size. The three soils are in areas so intricately mixed or so small that they could not be separated at the scale used for mapping.

Typically, the surface layer of the Cantril soil is very dark grayish brown, friable loam about 6 inches thick. The subsurface layer is about 7 inches thick. In the upper part it is very dark grayish brown, friable loam. In the lower part it is dark grayish brown, friable loam. The subsoil to a depth of about 60 inches is friable and firm clay loam. In the upper part it is dark brown and grayish brown. In the lower part it is grayish brown and strong brown, and mottled.

Typically, the surface layer of the Coppock soil is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 22 inches thick. In the upper part the subsoil is dark grayish brown, mottled, firm silty clay loam. In the lower part, to a depth of about 60 inches, it is mottled, grayish brown and dark yellowish brown, firm silty clay loam. In places the surface layer is dark grayish brown silt loam, and contains less organic matter.

Typically, the surface layer of the Nodaway soil is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, dark grayish brown, and grayish brown, friable silt loam. In some areas the surface layer is loam, silty clay loam, or sandy loam.

Figure 9.—Old bayous on the Nodaway-Lawson-Klum complex, 0 to 3 percent slopes, are subject to occasional flooding.

Included with these soils in mapping are small areas of Douds and Tuskeego soils. Douds soils are moderately well drained, and are in the more sloping areas. Tuskeego soils are poorly drained, and are in gently sloping areas slightly higher in elevation than this unit. These soils make up about 10 percent of the map unit.

Permeability is moderate in the Cantril, Coppock, and Nodaway soils. Surface runoff is medium on the Cantril soil and slow on the Coppock and Nodaway soils. The content of organic matter is 1.5 to 3.5 percent. The three soils have a seasonal high water table. Shrink-swell potential is high in the Coppock soil. All three soils have fair tilth, and tend to puddle if worked when wet.

Most areas are in pasture or woodland.

These soils are poorly suited to corn, soybeans, and small grain. Water erosion is the major limitation for crop production. These soils are moderately well suited to grasses and legumes for hay and pasture. Areas of these soils are dissected by gullies and uncrossable waterways. Maintaining permanent pasture or woodland vegetation helps to prevent further gully erosion.

This soil is suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is fairly suited to growing trees, and many areas remain in native hardwoods. There are no

particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is IIIe.

792C—Armstrong loam, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on short, convex side slopes, narrow, convex ridgetops, and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. The subsurface layer is brown, friable loam about 5 inches thick. The subsoil extends to a depth of about 60 inches. It is mottled, firm clay loam or clay. In the upper part it is brown, in the next part it is grayish brown, and in the lower part it is strong brown.

Included with this soil in mapping are small areas of poorly drained Rinda soils on the upper parts of slopes. These soils contain more clay than the Armstrong soil. They make up 5 to 15 percent of the unit.

Permeability of this Armstrong soil is slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is moderate. The organic matter content is 2.5 to 3.5 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture and woodland. This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion is a severe hazard. In intensively row cropped areas it can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling water erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IIIe.

792C2—Armstrong clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on narrow convex ridgetops and nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. It is mixed with some streaks and pockets of subsoil material of dark yellowish brown clay loam. The subsoil extends to a depth of 60 inches. It is mottled, firm clay loam or clay. In the upper part it is dark yellowish brown. In the next part it is grayish brown and brown. In the lower part it is strong brown.

Included with this soil in mapping are small areas of Rinda soils on the upper parts of slopes. These soils are poorly drained, and contain more clay than the Armstrong soil. They make up 5 to 15 percent of the unit.

Permeability of this Armstrong soil is slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is moderate. The organic matter content is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. It can be controlled in intensively row cropped areas by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet

causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to growing trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IIIe.

792D—Armstrong loam, 9 to 14 percent slopes. This is a strongly sloping, somewhat poorly drained soil on short, convex side slopes, narrow, convex ridgetops, and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 8 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil extends to a depth of about 60 inches. It is mottled, firm clay loam or clay. In the upper part it is brown, in the next part it is grayish brown, and in the lower part it is strong brown.

Included with this soil in mapping are small areas of Rinda soils on the upper parts of slopes. Rinda soils are poorly drained, and contain more clay than the Armstrong soil. They make up 5 to 15 percent of the unit.

Permeability of this Armstrong soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The organic matter content is 2.5 to 3.5 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are used for pasture and woodland.

This soil is poorly suited to intensive row cropping. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to growing trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVe.

792D2—Armstrong clay loam, 9 to 14 percent slopes, moderately eroded. This is a strongly sloping, somewhat poorly drained soil on short, convex side slopes, narrow, convex ridgetops, side slopes, and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 6 inches thick. It is mixed with some streaks and pockets of subsoil material of dark yellowish brown clay loam. The subsoil is mottled, firm clay loam or clay about 36 inches thick. In the upper part it is dark yellowish brown. In the next part it is grayish brown. In the lower part it is strong brown. The substratum to a depth of about 60 inches is mottled, grayish brown and brown clay loam.

Included with this soil in mapping are small areas of Rinda soils on the upper parts of slopes. Rinda soils are poorly drained, and contain more clay than the Armstrong soil. They make up 5 to 15 percent of the unit.

Permeability of this Armstrong soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The organic matter content is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust

after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is poorly suited to intensive row cropping. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards to be concerned about when planting or harvesting trees. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IVe.

792D3—Armstrong clay, 9 to 14 percent slopes, severely eroded. This is a strongly sloping, somewhat poorly drained soil on short, convex side slopes, narrow, convex ridgetops, and convex nose slopes on uplands. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 20 acres in size.

Typically, the surface layer is dark yellowish brown, firm clay about 3 inches thick. Erosion has removed most of the original surface layer, and plowing has mixed the rest with material from the subsoil. The subsoil is firm clay loam and clay about 37 inches thick. It is mottled. In the upper part it is dark yellowish brown, in the next part it is grayish brown, and in the lower part it is strong brown. The substratum to a depth of about 60 inches is grayish brown and strong brown, mottled clay loam.

Included with this soil in mapping are small areas of Rinda soils on the upper parts of slopes. Rinda soils are poorly drained, and contain more clay than the Armstrong soil. They make up 5 to 15 percent of the unit.

Permeability of this Armstrong soil is slow. The soil has a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The organic matter content is 1.5 to 2.5 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and available potassium. Tilth is very poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is not suited to intensive row cropping. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

This soil is fairly suited to trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. There are no other hazards or limitations when planting or harvesting trees. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is VIe.

822C2—Lamoni clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on the lower side slopes along drainageways that extend into uplands. Areas are long and irregularly shaped, and commonly range from 5 to more than 25 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. It is mixed with streaks and pockets of olive brown subsoil material. The subsoil is about 52 inches thick. In the upper part it is

olive brown mottled, firm clay. In the next part it is mottled, grayish brown and yellowish brown, firm clay. In the lower part it is mottled, grayish brown, yellowish brown, and strong brown, very firm clay loam.

Included with this soil in mapping are small areas of Arispe and Shelby soils. Arispe soils are upslope on narrow ridgecrests and Shelby soils are on the lower side slopes. Arispe soils formed in loess, and are more fertile than the Lamoni soil. Shelby soils are better drained and contain less clay in the subsoil than the Lamoni soil. Included soils make up 5 to 15 percent of the unit.

Permeability of this Lamoni soil is slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is moderate. The organic matter content is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and low amounts of available potassium. Tilth is fair, and the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is fairly suited to intensive row cropping. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IIIe.

822D2—Lamoni clay loam, 9 to 14 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on the lower side slopes along drainageways that extend into the uplands. Areas are long and irregularly shaped, and commonly range from 10 to more than 60 acres in size.

Typically, the surface layer is very dark grayish brown, friable clay loam about 8 inches thick. It is mixed with streaks and pockets of subsoil material of olive brown clay. The subsoil is about 52 inches thick. In the upper part it is olive brown, mottled, firm clay. In the next part it is mottled, grayish brown and yellowish brown, firm clay. In the lower part it is mottled, grayish brown, yellowish brown, and strong brown, very firm clay loam.

Included with this soil in mapping are small areas of Arispe and Shelby soils. Arispe soils are upslope on narrow ridgecrests, and Shelby soils are on the lower side slopes. Arispe soils are more fertile and formed in loess. Shelby soils are better drained and contain less clay in the subsoil than the Lamoni soil. Included soils make up 5 to 15 percent of the unit.

Permeability of this Lamoni soil is slow. The soil has a seasonal high water table. Surface runoff is medium. Available water capacity is moderate. The organic matter content is 2 to 3 percent. Shrink-swell potential is high. The soil generally has very low amounts of available phosphorus and low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is fairly suited to intensive row cropping. It is best suited to small grain and to grasses and legumes for hay and pasture. If row crops are grown, further water erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, in combination with contour farming, grassed waterways, and a cropping sequence that includes grasses and legumes.

This soil is suited to grasses and legumes for hay and pasture, and is effective in controlling water erosion. However, management may be difficult because this soil is wet and seepy during wet periods. Forage species that tolerate wetness will help to maintain productivity. Proper tile drainage placement on adjacent soils above the seep line will also improve legumes for hay and grasses for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour or interseeding helps to control erosion.

The land capability classification is IVe.

831C2—Pershing silty clay loam, benches, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and short, convex side slopes on loess-covered stream benches. Areas are irregular in shape, and commonly are 5 to more than 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. It is mixed with some streaks and pockets of brown subsoil material. The subsoil extends to a depth of 60 inches. In the upper part it is brown, mottled, friable silty clay loam. In the middle part it is brown, grayish brown and strong brown, mottled, firm silty clay. In the lower part it is mottled, grayish brown and strong brown, firm and friable silty clay loam and silt loam. Brown, loamy or clayey, stratified alluvium is at a depth of 60 to 84 inches.

Included with this soil in mapping are small areas of Caleb and Mystic soils. These soils contain more sand than the Pershing soil, and are in the more sloping areas. They make up 5 to 10 percent of the unit.

Permeability of this Pershing soil is slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The organic matter content is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated. This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, further erosion is a severe hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, terraces, contour farming, contour stripcropping, grassed waterways, and a cropping sequence that includes grasses and legumes. Slopes are short and irregular, and in some areas terraces are difficult to install. However, if terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Seepy terrace channels generally result if cuts are made too deep.

This soil is suited to grasses and legumes for hay and pastures, and these uses are also effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, but most areas are cultivated. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

832C2—Weller silty clay loam, benches, 5 to 9 percent slopes, moderately eroded. This is a moderately sloping, moderately well drained soil on the tops of ridges and on short, convex side slopes on loess-covered stream benches. Areas are long and narrow and irregularly shaped, and range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 7 inches thick. It is mixed with some streaks and pockets of yellowish brown subsoil material. The subsoil extends to a depth of 60 inches. In the upper part it is yellowish brown, friable silty clay loam. In the next part it is mottled, yellowish brown, strong brown, and grayish brown, very firm silty clay. In the lower part it is grayish brown, mottled, firm silty clay loam. Multicolored, loamy, stratified alluvium is at a depth of about 60 to 84 inches.

Included with this soil in mapping are small areas of Galland and Douds soils. These areas contain more sand than the Weller soil, and are in the more sloping areas. They make up about 5 to 10 percent of the unit.

Permeability of this Weller soil is slow. Runoff is medium. Available water capacity is high. The organic matter content is 1.5 to 2.5 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet. Seedling development is limited if crusting occurs before seedling emergence.

Most areas are cultivated or are used for pasture and hay. A few support trees. Many of the pastured and wooded areas have been cropped in the past.

This soil is fairly suited to corn and soybeans. It is best suited to small grain and to grasses and legumes for hay or pasture. If cultivated crops are grown, further erosion is a hazard. A conservation tillage system that leaves crop residue on the surface, contour farming, and terraces help to control erosion. In places, however, contour farming or terracing is difficult because of irregular or short slopes. If terraces are built, cuts should not expose the clayey subsoil. Exposing the subsoil may result in seepy terrace channels. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good

condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and most areas are in trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

994E—Douds-Galland loams, 9 to 18 percent slopes. This map unit consists of strongly sloping and moderately steep, moderately well drained and somewhat poorly drained soils on convex ridgetops and side slopes of high stream benches along the major streams and rivers. It is about 65 percent Douds soil and 35 percent Galland soil. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 30 acres in size. The two soils are in areas so intricately mixed or so small that they could not be separated at the scale used for mapping.

Typically, the surface layer of the Douds soil is very dark grayish brown, friable loam about 5 inches thick. The subsurface layer is dark grayish brown and dark yellowish brown, friable sandy loam about 10 inches thick. The subsoil is about 36 inches thick. In the upper part it is dark brown, friable and firm sandy clay loam. In the next part it is dark brown, firm clay and clay loam. In the lower part it is mottled, strong brown and yellowish brown, friable sandy clay loam. The substratum to a depth of 60 inches is friable, stratified, strong brown and yellowish brown sandy clay loam.

Typically, the surface layer of the Galland soil is very dark grayish brown, friable loam about 4 inches thick. The subsurface layer is grayish brown, friable loam about 6 inches thick. The subsoil is firm and friable, clay loam, clay, and sandy clay loam about 47 inches thick. It is mottled. In the upper part it is strong brown, in the next part it is brown and strong brown, and in the lower part it is brown and strong brown. The substratum to a depth of about 60 inches is pale brown and strong brown, stratified loam and sandy loam.

Permeability is moderate in the Douds soil and slow in the Galland soil. Both soils have a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The organic matter content is 2 to 3 percent. Shrink-swell potential is high in the Galland soil. Both soils have fair tilth but tend to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of these soils are used for pasture or as woodland. These soils generally are not suited to corn and soybeans because of slope and the severe hazard of further erosion. Managing areas that have been cleared for pasture is difficult because of slope. Erosion is a severe hazard in these areas because of the difficulty in reestablishing a plant cover.

These soils are well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soils are too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soils in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

Some areas support native hardwoods. These soils are suited to trees. Further erosion is a hazard, and slope is a limitation. Laying out logging roads and trails on or nearly on the contour helps to control erosion. Because of slope, operating logging equipment is somewhat hazardous. Special equipment and caution in its use are needed. Seedling mortality and competition from undesirable plants are not likely to be problems on these soils. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

This soil is suited to use as habitat for woodland wildlife. Excluding livestock from wooded areas, constructing water impoundment reservoirs, planting trees and shrubs, and establishing food plots adjacent to wooded areas maintain or improve the habitat.

The land capability classification is VIe.

994E2—Douds-Galland complex, 9 to 18 percent slopes, moderately eroded. This map unit consists of strongly sloping and moderately steep, moderately well drained and somewhat poorly drained soils on convex ridgetops and side slopes of high stream benches along the major streams and rivers. It is about 65 percent Douds soil and 35 percent Galland soil. Areas are long and narrow or irregularly shaped, and commonly range from 5 to more than 30 acres in size. The two soils are in areas so intricately mixed or so small that they could not be separated at the scale used for mapping.

Typically, the surface layer of the Douds soil is very dark grayish brown, friable loam about 6 inches thick. It is mixed with streaks and pockets of subsoil material of brown sandy clay loam. The subsoil is about 35 inches thick. In the upper part it is brown, friable and firm sandy clay loam. In the next part it is yellowish brown, firm sandy clay loam and clay loam. In the lower part it is mottled, strong brown and yellowish brown, friable sandy clay loam. The substratum to a depth of 60 inches is

stratified, strong brown and yellowish brown sandy clay loam.

Typically, the surface layer of the Galland soil is very dark grayish brown, friable clay loam about 6 inches thick. The subsoil is mottled, firm and friable clay loam, clay, and sandy clay loam about 47 inches thick. In the upper part it is strong brown, in the next part it is brown and strong brown, and in the lower part it is brown and strong brown. The substratum to a depth of about 60 inches is pale brown and strong brown, stratified loam and sandy loam.

Permeability is moderate in the Douds soil and slow in the Galland soil. Both soils have a seasonal high water table. Surface runoff is rapid. Available water capacity is moderate. The organic matter content is 1.5 to 2.5 percent. Shrink-swell potential is high in the Galland soil. Both soils have fair tilth, but tend to puddle if worked when wet and to crust after hard rains. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of these soils are used for pasture or hayland.

These soils generally are not suited to cultivated crops because of slope and the severe hazard of further erosion. Managing areas that have been cleared for pasture is difficult because of slope. In these areas erosion is a severe hazard because reestablishing a plant cover is difficult.

These soils are well suited to grasses and legumes for hay and pasture. However, overgrazing or grazing when the soils are too wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating and preparing a seedbed on the contour help to control erosion. In some places, terraces and diversions are needed to protect critically seeded areas.

Some areas support native hardwoods. These soils are suited to trees. Further erosion is a hazard, and slope is a limitation. Laying out logging roads and trails on or nearly on the contour helps to control erosion. Because of the slope, operating logging equipment is somewhat hazardous. Special equipment and caution in its use are needed. Seedling mortality and competition from undesirable plants are not likely to be problems on these soils. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

These soils are suited to use as habitat for woodland wildlife. Excluding livestock from wooded areas, constructing water impoundment reservoirs, planting trees and shrubs, and establishing food plots adjacent to the wooded areas maintain or improve the habitat.

The land capability classification is VIe.

1130—Belinda silt loam, benches, 0 to 2 percent slopes. This is a nearly level, poorly drained soil on moderately broad flats on loess-covered stream benches. Areas are irregular in shape, and commonly are 5 to more than 150 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 5 inches thick. The subsurface layer is very dark grayish brown and grayish brown, friable silt loam about 7 inches thick. The subsoil is mottled, and extends to a depth of more than 60 inches. In the upper part it is dark grayish brown, firm silty clay. In the next part it is dark grayish brown and brown, firm and very firm silty clay. In the lower part it is grayish brown, firm silty clay loam. Grayish brown, loamy, stratified alluvium is at a depth of about 60 to 96 inches.

Included with this soil in mapping are small areas of Weller and Pershing soils on the more sloping parts of the landscape. Weller soils are moderately well drained, and Pershing soils are somewhat poorly drained. These soils make up 5 to 10 percent of the unit.

Permeability of this Belinda soil is very slow. Surface runoff is very slow. The soil has a seasonal high water table. Available water capacity is high. The organic matter content is 2 to 3 percent. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is fair, but the soil tends to puddle if worked when wet.

Most areas are used for cultivated crops or for hay and pasture. This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. The seasonal high water table is the major limitation for crop production. Row crops can be grown in many years if the soil is adequately drained. Because of permeability, tile drains generally do not function satisfactorily. A surface drainage system or tile intakes will help to remove surface water. The soil warms slowly in spring, and dries slowly after rains. In years when rainfall is heavy, planting is delayed.

Ridge planting, in which the soil is ridged and row crops are planted on the ridges, helps to overcome the wetness and to raise the soil temperature. However, ridge planting is needed to make water run off this soil. Fall plowing improves the timeliness of fieldwork, but increases the susceptibility to wind erosion. Leaving a rough plowed surface, and alternating plowed and unplowed strips help to control wind erosion. Chisel planting areas where crop residue has been left on the surface also is helpful. Returning crop residue to the soil or regularly adding other organic material improves fertility and helps to maintain good tilth.

This soil is suited to grasses and legumes for hay and pasture. However, management may be difficult because

this soil is poorly drained and ponds water for brief periods. Forage species that tolerate wetness will help to maintain productivity. Surface drainage is needed for alfalfa crops. Overgrazing or grazing when the soil is too wet causes surface compaction, which restricts root development and increases ponding. Proper stocking rates, rotation grazing, timely deferred grazing, and restricted equipment use during wet periods help to keep the pasture and the soil in good condition. In addition, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture and hayland.

This soil is fairly suited to trees, and few areas remain in native hardwoods. The seasonal high water table restricts use of equipment to drier periods or winter when the ground is frozen. During wet periods special high flotation equipment may be needed for harvesting or management. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can be thinned later to achieve the desired stand density. Logging and related road construction on this soil are not erosive. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard.

The land capability classification is IIIw.

1131B—Pershing silt loam, benches, 2 to 5 percent slopes. This is a gently sloping, somewhat poorly drained soil on convex ridgetops on loess-covered stream benches. Areas are irregular in shape, and commonly range from 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is brown, friable silty clay loam. In the middle part it is brown, grayish brown and strong brown, firm silty clay. In the lower part it is grayish brown and strong brown, firm and friable silty clay loam and silt loam. Brown, loamy, stratified alluvium is at a depth of 60 to 84 inches.

Included with this soil in mapping are small areas of the Belinda soils on the less sloping parts of the landscape. Belinda soils are poorly drained, and make up about 5 to 10 percent of the unit.

Permeability of this Pershing soil is slow. Surface runoff is slow. The soil has a seasonal high water table. Available water capacity is high. The organic matter content is 2.5 to 3.5 percent. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is good, but the soil tends to puddle if worked when wet.

Most areas are cultivated. This soil is moderately well suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, water erosion and soil blowing are moderate hazards. They can be controlled by a conservation tillage system that leaves crop residue on the surface, terraces, contour farming, contour stripcropping, grassed waterways, and a cropping sequence that includes grasses and legumes. In some areas a combination of these measures is needed. If terraces are built, minimizing cuts prevents exposure of the clayey subsoil. Seepy terrace channels generally result if cuts are made too deep. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling water erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture or hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and many areas are in trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

1131C—Pershing silt loam, benches, 5 to 9 percent slopes. This is a moderately sloping, somewhat poorly drained soil on convex ridgetops and short, convex side slopes on loess-covered stream benches. Areas are irregular in shape, and commonly are 5 to more than 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is brown, friable silty clay loam. In the middle part it is brown, grayish brown and strong brown, firm silty clay. In the lower part it is grayish brown and strong brown, firm and friable silty clay loam and silt loam. Brown, loamy, stratified alluvium is at a depth of 60 to 84 inches.

Included with this soil in mapping are small areas of Caleb and Mystic soils. These soils contain more sand, and are in the more sloping areas. They make up 5 to 10 percent of the map unit.

Permeability of this Pershing soil is slow. Surface runoff is medium. The soil has a seasonal high water table. Available water capacity is high. The organic

matter content is 2.5 to 3.5 percent. Shrink-swell potential also is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is good, but the soil tends to puddle when wet.

Most areas are in pasture or hayland.

This soil is fairly suited to corn, soybeans, and small grain and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. It can be controlled by a conservation tillage system that leaves crop residue on the surface, terraces, contour farming, contour stripcropping, grassed waterways, and a cropping rotation that includes grasses and legumes. Because of irregular and short slopes, terraces may be difficult to install.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and many areas are in trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

1132C—Weller silt loam, benches, 5 to 9 percent slopes. This is a moderately sloping, moderately well drained soil on the tops of ridges and on short, convex side slopes on loess-covered stream benches. Areas are long and narrow or irregularly shaped, and range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 3 inches thick. The subsurface layer is brown and dark yellowish brown, friable silt loam about 9 inches thick. The subsoil is mottled, and extends to a depth of 60 inches. In the upper part it is yellowish brown, friable silty clay loam. In the next part it is yellowish brown, strong brown, and grayish brown, very firm silty clay. In the lower part it is grayish brown, firm silty clay loam. Multicolored, loamy, stratified alluvium is at a depth of about 60 to 84 inches.

Included with this soil in mapping are small areas of Galland and Douds soils. These soils contain more sand, and are in the more sloping areas. They make up about 5 to 10 percent of the unit.

Permeability of this Weller soil is slow. Runoff is medium. Available water capacity is high. The organic matter content is 2 to 3 percent. The soil has a seasonal high water table. Shrink-swell potential is high. The soil generally has medium amounts of available phosphorus and very low amounts of available potassium. Tilth is poor, and the soil tends to puddle if worked when wet. Seedling development is limited if crusting occurs before seedling emergence.

Most areas of this soil are used as woodland or pasture. Some areas are cultivated.

This soil is fairly suited to corn and soybeans. It is best suited to small grains and to grasses and legumes for hay or pasture. If cultivated crops are grown, erosion is a hazard. A conservation tillage system that leaves crop residue on the surface, contour farming, and terraces help to control erosion. In places, however, contour farming or terracing is difficult because of irregular or short slopes. If terraces are built, cuts should not expose the clayey subsoil. Exposing the subsoil generally results in seepy terrace channels. Grassed waterways help to prevent gully erosion. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth.

This soil is suited to grasses and legumes for hay and pasture. Forages are effective in controlling erosion. However, overgrazing or grazing when the soil is wet causes surface compaction, which restricts root development and increases runoff. Proper stocking rates, rotation grazing, and timely deferred grazing during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed and brush control, and timely applications of lime help to improve productivity of pasture and hayland. When renovating pasture and hayland, cultivating, preparing a seedbed, and interseeding on the contour help to control erosion.

This soil is fairly suited to trees, and most areas are in trees. Natural and planted seedlings do not survive well, and seedlings can be spaced closer together when planting. The surviving trees can then be thinned later to achieve the desired stand density. Silvicultural practices that do not leave widely spaced individual trees will reduce the windthrow hazard. There are no other hazards or limitations when planting or harvesting trees.

The land capability classification is IIIe.

1715—Nodaway-Klum-Lawson complex, channeled, 0 to 3 percent slopes. This map unit consists of nearly level and very gently sloping soils on flood plains near the major rivers and streams. It is about 40 percent Nodaway soil, 30 percent Klum soil, 20 percent Lawson soil, and 10 percent other soils.

Nodaway soil is moderately well drained, and the Lawson soil is somewhat poorly drained. These soils are

Figure 10.—These nearly vertical streambanks on the outer perimeter of the stream meander are in an area of Nodaway-Klum-Lawson complex, channeled, 0 to 3 percent slopes.

commonly next to stream channels on flood plains that have recently received sediments. The Klum soil is moderately well drained, and in and around old bayous and oxbows. The soils in this unit are dissected by many old stream channels that are filled with water part of the time. They are subject to frequent flooding for very brief to long periods. Areas are long and narrow or irregularly shaped, extend for several miles, and commonly range from 5 to 300 acres in size.

Typically, the surface layer of the Nodaway soil is very dark grayish brown, friable silt loam about 8 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, dark grayish brown, and grayish brown, friable silt loam. In some areas the surface layer is loam, silty clay loam, or sandy loam.

Typically, the surface layer of the Klum soil is very dark grayish brown, friable fine sandy loam about 10 inches thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown, brown, and pale brown loam, silt loam, and loamy fine sand.

Typically, the surface layer of the Lawson soil is very dark grayish brown, friable silt loam about 10 inches thick. The subsurface layer is very dark grayish brown and dark grayish brown, friable silt loam about 38 inches

thick. The substratum to a depth of about 60 inches is stratified, very dark grayish brown and dark grayish brown, friable silt loam.

Included with these soils in mapping are small areas of poorly drained Zook and Chequest soils. These soils are in similar landscape positions, and contain more clay in the subsoil.

Permeability is moderate in the Lawson and Nodaway soils and moderately rapid in the Klum soil. Surface runoff is slow on all three soils. The soils have a seasonal high water table. Available water capacity is high in the Lawson and Nodaway soils and moderate in the Klum soil. The organic matter content is 1 to 6 percent. The amounts of available phosphorus and available potassium range from medium to very low in the three soils. Tilth is good, but the soils generally are not tilled.

Most areas of these soils are used as pasture and woodland. This unit is not suited to corn, soybeans, and small grains without major clearing and landscaping. The seasonal high water table and frequent flooding are major limitations to crop production. It is best suited to use as woodland, pasture, and habitat for wildlife. Streambank erosion is a common problem along the meandering channels (fig. 10).

This soil is suited to pasture or hay. Most areas are flooded and are in permanent pasture. However, overgrazing or grazing during wet periods after flooding causes surface compaction and puddling of the soil. Rotation grazing, timely deferred grazing, and restricted use during wet periods help to keep the pasture and the soil in good condition. In addition, suitable forage selection, fertility maintenance, weed control, and timely applications of lime help to improve productivity of pasture.

This soil is moderately well suited to trees, and many areas remain in native hardwoods. There are no particular problems in planting new stands of trees if proper species are selected and carefully managed.

The land capability classification is Vw.

5030—Pits, limestone quarries. This map unit consists of pits from which limestone has been quarried, mainly for use in road construction and as agricultural lime (fig. 11). The pits are 40 feet deep or more, and are surrounded by piles of spoil 15 feet high or more. They range from a few acres to 40 acres in size, and are irregularly shaped. Some pits contain water a few to several feet deep, and have steep sides.

The spoil surrounding the pits varies in texture, but generally is loamy and contains differing amounts of limestone fragments. It is derived from glacial till, loess alluvium, or a mixture of these materials. In some areas it has been leveled and smoothed, but in other areas it is very uneven. In the level areas it supports grasses and trees fairly well. It ranges from medium acid to mildly alkaline.

The quarries are well suited to use as habitat for wildlife. Those containing water can support fish. Because of the steepness of the sides and the variable depth of the water, however, they may be dangerous as sites for recreation use and as habitat for wildlife. Onsite investigation is needed to determine the hazard for any use.

This unit does not have a land capability classification.

5040—Orthents, loamy. These soils are nearly level to strongly sloping, and are used as borrow areas for construction. In some areas the original soils have been removed to a depth of 5 to 20 feet or more. In other areas 4 to 10 inches of topsoil have been redistributed, commonly in an uneven pattern. The soils range from excessively drained to somewhat poorly drained, depending on the kind of material from which the soils were derived and the extent to which the borrow area has been restored. Areas typically range from 6 to 50 acres in size.

Typically, the uppermost 60 inches is yellowish brown, friable and firm clay loam. In many places cobbles and pebbles are common on the surface. In some places the texture is sandy loam. The surface ranges from very dark gray to dark brown.

Permeability in Orthents, loamy, varies, depending on texture and density. Runoff is slow to rapid. Available water capacity is moderate or low. Soil that was at a depth of 5 to 20 feet or more beneath the surface has less pore space and a higher density than the original surface layer. It has not been appreciably affected by the processes of soil formation, such as freezing and thawing. Unless the topsoil has been redistributed throughout the area, the content of organic matter is very low, preparing a good seedbed is difficult, and drought is a hazard. Reaction typically is medium acid to moderately alkaline. In most areas these soils have very low amounts of available phosphorus and available potassium.

These soils are better suited to small grain and to grasses and legumes for hay and pasture, than to row crops. They are suited to row crops only in those areas where the topsoil has been redistributed. Corn and soybeans are grown in these areas. If cultivated crops are grown, in the more sloping areas water erosion is a moderate or severe hazard. A conservation tillage system that turns over as little soil as possible and leaves crop residue on the surface helps to stabilize the soils and to control erosion.

These soils do not have a land capability classification.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture.

Figure 11.—This area of Pits, limestone quarries, is mined for limestone. This important natural resource is along the Grand River in Decatur County.

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 to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs

of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 63,000 acres in the survey area, or nearly 18 percent of the total acreage, meets the soil requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the southern part, mainly in associations 1 and 4, which are described under the heading "General Soil Map Units." About 60,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn and soybeans, account for an estimated one-third of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations or hazards, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations or hazards have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

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 the 1985 Iowa Agricultural Statistics, about 175,000 acres in Decatur County, or 51 percent of the total acreage, is cropland (*14*). The main crops are corn and soybeans. Legume-grass mixtures are the major hay crop. The acreage used for row crops has increased in recent years, but the extent of other land uses has been reduced. Many of the field crops suited to the soils and climate in Decatur County are not commonly grown. These include sorghum and milo, used mainly for silage; wheat; barley; various pasture grasses; various native grasses, such as bluestem, switchgrass, and indiangrass; sweet corn; nursery stock; early vegetables; and certain orchard crops. Productivity can be increased and soil conservation enhanced by application of crop production technology to all cropland in the county. The latest information about managing the soils for these crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service. This soil survey gives the basis characteristics of each kind of soil, and can greatly aid in the application of this technology.

The main management needs on cropland and pasture in Decatur County are controlling soil erosion, draining naturally wet soils and seepy areas, and maintaining or improving fertility and tilth.

Water erosion is the major problem on about two-thirds of the cropland and pasture in Decatur County. It is a hazard if the slope is more than 2 percent. Loss of the surface layer through water erosion reduces productivity of soils, and results in sedimentation of streams. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a subsoil that is low in fertility, such as Shelby and Gara soils, and on soils that have a clayey subsoil, such as Adair, Bucknell, and Clarinda soils. The Erosion Productivity Study currently being conducted in Iowa has shown that corn yields on these soils may be reduced an average of 10 to 15 bushels per acre if the topsoil has been lost.

Figure 12.—A contour buffer strip between corn and soybeans helps to control erosion on Pershing soils.

On eroding soils, preparing a good seedbed and tilling are difficult for two reasons. The original, friable surface layer has been removed or thinned. The more strongly structured subsoil commonly is hard and cloddy after rains or after it has been tilled when wet. Runoff from eroding soils commonly deposits sediment in streams, drainageways, and road ditches. Controlling water erosion not only helps to maintain the productivity of soils, but, by minimizing the pollution of streams, also improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Because of the great variety of soils and landscape features in Decatur County, a variety of erosion control measures are needed. The best measures are those that provide a protective cover of plants or crop residue, reduce the runoff rate, and increase the rate of water infiltration. Examples of these measures are cover crops, contour stripcropping (fig. 12), contour tillage, terraces, diversions, field borders, grassed waterways, and conservation tillage. Generally, a combination of several measures is most effective.

A cropping system that keeps a plant cover on the surface for extended periods can hold soil losses to an amount that will not reduce the productive capacity of the soils. On steep and very steep slopes, the soils are not suitable for row crops, and should remain under a protective cover of grasses. On livestock farms, where part of the acreage is hayland or pasture, forage crops of grasses and legumes not only provide nitrogen and improve tilth for the next cropping season, but also provide a protective plant cover (fig. 13).

A conservation tillage system that leaves a protective amount of crop residue on the surface after planting is effective in controlling water erosion, especially on sloping soils. Following are examples of major kinds of conservation tillage. No-till is a system in which the seedbed is prepared and the seed is planted in one operation. The surface is disturbed only in the immediate area of planted seed rows. A protective cover of crop residue is left undisturbed on the rest of the surface. Strip-till also is a system in which the seedbed is prepared and the seed is planted in one operation. Tillage is limited to a strip not wider than one-third of the row width. A protective cover of crop residue is left on two-thirds of the surface. Mulch-till is a system in which the soil is loosened throughout the field, and as much as 70 percent of the crop residue is incorporated into the soil. Seedbed preparation and planting can be in one or several operations.

Terraces control runoff and water erosion by reducing the length of slope. They are most effective on well drained or moderately well drained, gently sloping or moderately sloping soils that have smooth slopes, such

Figure 13.—Hayland provides a protective cover and helps to maintain soil fertility on Pershing and Rinda soils.

as Pershing soils. They are less effective in areas where slopes are irregular or too steep. Tile-intake terraces help to prevent the accumulation of runoff. If terraces are constructed on soils that formed in loess, such as Arispe, Grundy, and Seymour soils, incorporating the more slowly permeable adjacent soils, such as Adair, Clarinda, and Lamoni soils, should be avoided or minimized.

In the more slowly permeable soils, the high content of clay causes some problems. Designing and constructing the terraces and revegetating the terrace slope are difficult. Also, seepage can be a problem following construction. In areas of soils that have a subsoil that formed partly or entirely in glacial till, such as Shelby soils, special practices are needed. The topsoil can be stockpiled when the terraces are constructed. Then, after construction is complete, it can be used to cover the subsoil. Diversions commonly are constructed on foot slopes upslope from Olmitz soils. They help to control runoff from adjacent uplands.

Contour farming and contour stripcropping effectively control water erosion. They are most effective on soils that have smooth, uniform slopes, such as Arispe, Grundy, Kniffin, Pershing, and Seymour soils. Gully-control structures, grassed waterways, and farm ponds help to control erosion in watercourses. The farm ponds also provide a supply of water for both livestock and recreation.

Information about conservation measures to control soil erosion is available at the Decatur Soil Conservation Service office.

Drainage is a major management concern on about 7 percent of the acreage in Decatur County. Artificial drainage typically is needed on Bremer, Chequest, Coppock, Humeston, Tuskeego, Vesser, Wabash, and Zook soils on flood plains, Belinda soils on benches, and Haig and Edina soils on uplands.

Artificial drainage on poorly drained or very poorly drained soils generally increases productivity. The drains should be more closely spaced in the moderately slowly permeable soils than in the more rapidly permeable soils. Permeability is slow or very slow in Adair, Clarinda, Lamoni, and other soils that formed in a paleosol on uplands. This commonly results in seepy areas within the surrounding soils. Installing lateral interceptor tile drains upslope from the slowly permeable or very slowly permeable soils helps to intercept and drain excess moisture at the point where loess is in contact with glacial till.

Fertility is affected by the amount of available phosphorus and available potassium in the subsoil, by reaction, and by the content of organic matter in the surface layer. The fertility level differs widely in the soils of Decatur County. In most of the soils, the supply of available phosphorus and available potassium is low or very low and pH is neutral to strongly acid.

On acid soils, ground limestone needs to be applied to promote good plant growth. On all soils, applications of lime and fertilizer should be determined by the results of soil tests, the needs of the crop, and the expected level of yields. Soil tests generally provide the most beneficial information. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth generally have a high content of organic matter and are granular and porous. In most of the uneroded upland soils that formed under prairie grasses, such as Grundy and Shelby soils, the content of organic matter in the surface layer is about 3.0 to 4.0 percent. In the eroded upland soils that formed under prairie grasses, it is less than 1 to 3 percent, depending on the degree of erosion. It also is less than 1 to 3 percent in Gara and Pershing soils, which formed under mixed prairie grasses and deciduous trees. Most of the soils on bottom land have the highest content of organic matter. In those that have a surface layer of silty clay loam, content of organic matter is 4 to 7 percent. It is lower in the stratified soils that have a surface layer of silt loam, such as Nodaway soils. On all soils, regular additions of crop residue, manure, and other organic material improve soil structure and tilth, and help to prevent the formation of a surface crust.

On soils that formed in glacial till, such as Adair, Armstrong, Gara, Keswick, Lindley, and Shelby soils, large stones commonly have accumulated on the surface. These stones can hinder fieldwork unless they are removed (fig. 14).

Most pasture in the county supports bluegrass. Some of the pasture has been renovated and supports birdsfoot trefoil or crownvetch. Other common, suitable species in the pastured areas are bromegrass, reed canarygrass, orchardgrass, switchgrass, big bluestem, indiangrass, alfalfa, red clover, and ladino clover. Most of the bluegrass pastures are not also used as cropland because the soils are too steep for cultivation. Measures that prevent overgrazing are needed, especially on steep slopes, to prevent surface compaction and to control gully erosion. Grasses and legumes have best yields if the pasture is properly managed. Applications of fertilizer, weed and brush control, rotation grazing, deferred grazing, proper stocking rates, and adequate livestock watering facilities help to keep the pasture in good condition.

Water erosion is a severe hazard if the plant cover is destroyed by tillage when the more sloping pastures are renovated. Interseeding the grasses and legumes, or planting into the existing sod, eliminates the need for destroying the plant cover during seedbed preparation.

Figure 14.—Stones are plentiful on the surface of Armstrong clay, 9 to 14 percent slopes, severely eroded.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion

control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for 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 or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards 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 or hazards, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards 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 hazard 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 capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

The original land survey of Iowa was made during the period 1832-59. It showed that about 133,760 acres, or nearly half of the total acreage in Decatur County, was woodland when the first settlers arrived. The early settlers felled a large part of the timber when they cleared the land, mainly for farming. Some of the timber was felled for construction, firewood, and fenceposts. According to estimates made in 1875, the acreage of woodland declined to 63,340 acres. According to surveys by the Forest Service, this acreage further declined to about 56,000 acres by 1954 and 30,500 acres by 1974. Most of the timber removed during the last 30 years was taken from moderately steep and steep, highly erodible soils that were converted from woodland use to agricultural uses.

The principal species on the upland slopes in the county are white oak, northern red oak, black oak, bur oak, shagbark hickory, bitternut hickory, white ash, and green ash (fig. 15). Those in the lowlands and along drainageways include eastern cottonwood, silver maple, green ash, white ash, basswood, and black walnut. Black cherry, though common, is not plentiful, and river birch is in scattered areas along a number of streams. American

elm and red elm are abundant, but they generally are small because of the effects of Dutch elm disease. Most of the upland timber grows on Lindley, Weller, Gara, and Armstrong soils. Most of the bottom land timber is grown in areas of the Nodaway-Lawson-Zook association, which is described under the section "General Soil Map Units."

Woodland owners tend to cut the better specimens or the desirable species for lumber and furniture. After this "high-grading," the woodland is of poorer quality because it is regenerated by the poorer trees and less desirable species left behind. However, scientific management of a stand of trees can result in the production of an increased volume of more valuable wood and in yields of a consistent amount of firewood from year to year. It also can greatly reduce soil losses and improve the habitat for wildlife.

Woodland can produce the best wood crop only if it is well managed. It should be protected from fire and from destructive grazing. The best potential trees should be allowed to grow. The undesirable trees and vines that compete with the best trees for moisture, nutrients, and light should be removed. After some of the best trees are harvested, their growing space can be occupied by younger trees. The volume harvested during a designated period should not exceed the growth of the remaining trees during the same period.

Most of the woodland in the county is in light to heavy use as pasture. When livestock graze in a stand of timber, their hooves damage the base of the larger trees,

Figure 15.—Wooded areas of native oak and hickory trees are common on Lindley and Keswick soils.

damage or destroy young trees, and compact the soil. Also, the animals selectively browse on certain young trees.

The suitability of different kinds of soil for trees differs greatly. The soil conditions under which different species can grow also vary greatly. Green ash, for example, can grow in poorly drained soils and in droughty soils on south-facing slopes. Most species, however, cannot grow under such a wide range of soil conditions. Soils on north- and east-facing slopes are better suited to trees than are soils on south- and west-facing slopes. Generally, the deep, well drained or moderately well drained soils that are moderately fertile or highly fertile are well suited to trees. If the subsoil is slowly permeable, root development is restricted.

Further information about woodland management, tree planting, and insect and disease control can be obtained from the Decatur County Soil Conservation District and from the district forester of the Iowa Conservation Commission.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil, and *L*, low strength. 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, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged

stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

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

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, reduces energy requirements, 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 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 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 9 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 9, 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 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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 are gently sloping 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 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

Decatur County supports many kinds of wildlife. These wildlife resources, depending on the kind and abundance, have a positive effect on the local economy, mainly by providing opportunities for hunting and fishing. Also, songbirds and hawks, owls, snakes, and other predators are beneficial because they control rodents and undesirable insects.

The soils, through their effect on vegetation and land use, indirectly affect the kind and abundance of wildlife in the county. Topography affects wildlife through the effect on land use. In moderately steep and steep areas, such as areas of Lindley soils, the undisturbed vegetation is valuable to wildlife. On the more sloping prairie soils, such as Shelby soils, planting suitable vegetation where needed can improve the habitat for the desirable kinds of wildlife. The nearly level Edina and Haig soils generally are intensively cropped. They provide only limited shelter and nesting areas for wildlife, but they also provide corn and small grain for feed. Much of the wildlife in the county inhabits the strongly sloping to steep areas of Gara, Lindley, Shelby, Bucknell, Lamoni, Armstrong, Adair, and Keswick soils on uplands. Because these soils are along the streams throughout the county, the wildlife is well distributed.

Raccoon, coyote, skunk, opossum, squirrel, and cottontail generally are abundant on uplands. White-tailed deer frequent all areas of the county, and are especially abundant on the Seymour-Kniffin-Bucknell, Gara-Armstrong-Lineville, and Nodaway-Lawson-Zook associations, which are described in the section "General Soil Map Units." They also frequent the adjacent wooded areas. Muskrat, mink, and beaver frequent the creeks throughout the county. They probably are most numerous in areas of the Nodaway-Lawson-Zook association.

Quail and pheasant are plentiful throughout the county. Quail are most abundant in the Gara-Armstrong-Lineville and Seymour-Kniffin-Bucknell associations, and the number of pheasants is highest in areas of the Arispe-Clarinda-Lamoni and Seymour-Kniffin-Bucknell associations. Wild turkeys are increasing in the county, and the highest number is found in the Lindley-Keswick association and the wooded portions of the Gara-Armstrong-Lineville and Seymour-Kniffin-Bucknell associations. All three species provide excellent hunting during years of favorable weather and habitat conditions.

Ponds and reservoirs provide good habitat for waterfowl, particularly mallard, teal, and Canada geese, while the larger streams support a good population of wood ducks. Zook and Nodaway soils provide potential sites for dikes and impoundments, which would improve the habitat for waterfowl. These soils are suitable for use as sites for hunting blinds. They also provide food and cover.

Fish, mainly catfish, bullheads, carp, and various minnows are fairly plentiful in the major streams. Many privately owned artificial ponds, ranging in size from 0.5 acre to 15 acres, are well distributed throughout the county. Those that are well managed provide excellent fishing for bass, bluegill, and catfish. Internal drainage, available water capacity, texture of the subsoil, and permeability are important factors affecting the selection of sites for stocked farm ponds and the development of habitat for waterfowl. City water supply reservoirs provide excellent fishing, and enhance the habitat for wildlife. Many areas of the Arispe-Clarinda-Lamoni and Gara-Armstrong-Lineville associations adjacent to the reservoirs are suitable for plantings that increase the food supply in habitat for waterfowl.

Although many areas in the county are suitable to use as habitat for wildlife, many more can be improved or developed. Generally, some soils on every farm, if they are properly managed, support good habitat for wildlife. Small, irregularly shaped areas of limited value for other uses can be developed as wildlife habitat. Examples of these are many areas of the strongly sloping to steep Adair, Armstrong, Gara, and Lindley soils. Fencing in brushy or wooded areas prevents damage to or destruction of food and cover by livestock. The borders of fields can be planted to grasses and legumes. These border areas should not be clipped, especially during the nesting season for upland birds.

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 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places.

Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

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

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

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, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and elderberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse 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, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 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 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, 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, 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, the available water capacity in the upper 40 inches, and the content of calcium carbonate 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 12 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 12 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, and flooding affect absorption of the effluent. Large stones and bedrock 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 12 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, 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 and bedrock 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 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction 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 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 13 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 13 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 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, and bedrock.

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 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 or stones, 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 14 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, or organic matter. 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 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, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. 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 water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock 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 affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

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Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

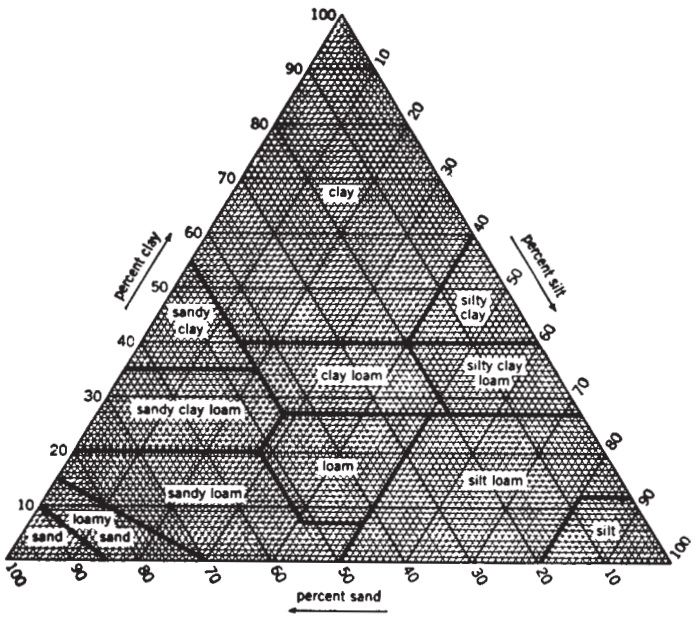

Figure 16.—Percentages of clay, silt, and sand in the USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 16). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of

grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 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 (fig. 17). 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

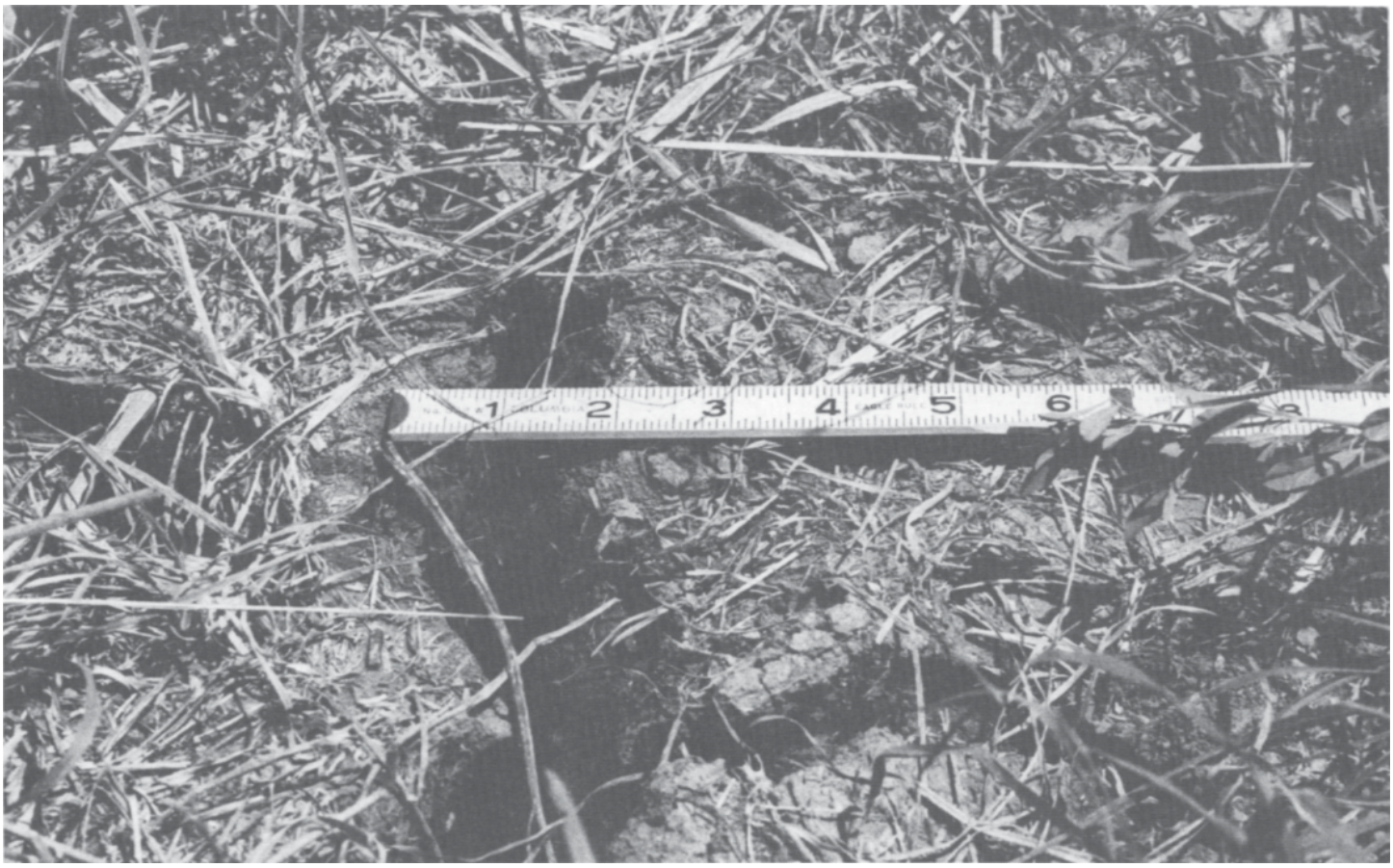

Figure 17.—This crack opened during a hot dry summer, and shows high shrinking and swelling of Clarinda soils.

erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

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

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

Soil and Water Features

Table 17 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 17, 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 and 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 17 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 17 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 17.

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.

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Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*18*). 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 18 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 Mollisol.

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 Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

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 Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic 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 Haplaquolls.

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, montmorillonitic, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*16*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*18*). Unless otherwise stated, matrix 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."

Adair Series

The Adair series consists of somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a thin mantle of loess or sediments and a reddish paleosol that weathered from glacial till. Native vegetation is prairie grasses. Slopes range from 5 to 14 percent.

Typical pedon of Adair clay loam, 5 to 9 percent slopes, 590 feet west and 2,225 feet north of the southeast corner of sec. 9, T. 70 N., R. 25 W., in cropland:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) clay loam (29 percent clay), dark grayish brown (10YR 4/2) dry; moderate medium and fine subangular blocky structure; friable; common very fine roots; neutral; abrupt smooth boundary.

A—8 to 12 inches; dark brown (10YR 3/3) clay loam (30 percent clay), brown (10YR 5/3) dry; common streaks and pockets of dark yellowish brown (10YR 4/4); common faint very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderate fine and very fine subangular blocky structure; friable; common very fine roots; strongly acid; clear smooth boundary.

BA—12 to 16 inches; dark yellowish brown (10YR 4/4) clay loam (32 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; few fine prominent strong brown (7.5YR 5/6) mottles; strong very fine subangular blocky structure; friable; few faint dark grayish brown (10YR 4/2) clay films on faces of peds; common very fine roots; strongly acid; clear smooth boundary.

2Bt1—16 to 19 inches; dark yellowish brown (10YR 4/4) clay loam (34 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; few fine prominent yellowish red (5YR 4/6) and common fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine and very fine subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; light brownish gray (10YR 6/2) silt coatings on faces of peds; common very fine roots; strongly acid; clear smooth boundary.

2Bt2—19 to 23 inches; yellowish brown (10YR 5/4) clay (53 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine prominent yellowish red (5YR 4/6) and many fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; common fine rounded dark reddish brown concretions (iron and manganese oxides); few pebbles; medium acid; clear smooth boundary.

2Bt3—23 to 27 inches; yellowish brown (10YR 5/4) clay (57 percent clay); many fine distinct strong brown (7.5YR 5/6) and few fine prominent yellowish red (5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; common fine rounded dark concretions (iron and manganese oxides); few pebbles; medium acid; clear smooth boundary.

2Bt4—27 to 36 inches; strong brown (7.5YR 5/6) clay (53 percent clay); few fine faint strong brown (7.5YR 4/6) and common fine prominent gray (10YR 5/1) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; common fine rounded dark concretions (iron and manganese oxides); few pebbles; neutral; clear smooth boundary.

2Bt5—36 to 51 inches; strong brown (7.5YR 5/6) clay loam (36 percent clay); many medium prominent grayish brown (2.5Y 5/2) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; firm; few distinct dark gray (10YR 4/1) clay films on ped faces and in root channels; few very fine roots; common fine platelike and rounded dark accumulations (iron and manganese oxides); neutral; gradual smooth boundary.

2BC—51 to 60 inches; strong brown (7.5YR 5/6 and 5/8) clay loam (32 percent clay); common medium prominent grayish brown (2.5Y 5/2) mottles; strong medium prismatic structure parting to moderate coarse angular blocky; firm; very few distinct dark gray (10YR 4/1) clay films in root channels; few very fine roots; common coarse platelike and common fine rounded dark concretions (iron and manganese oxides); few caliche concretions; neutral.

The solum ranges from 40 to 65 inches or more in thickness. Carbonates are leached to a depth of at least 48 inches and typically to a depth of about 60 inches or more.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 to 3. Its texture includes silt loam, loam, clay loam, and silty clay loam. In the upper part the 2Bt horizon dominantly has hue of 2.5YR to 10YR, value of 3 to 5, and chroma of 3 to 6 as matrix and mottle colors. Content of clay typically is 34 to 60 percent. The lower part of the 2Bt and 2BC horizons have hue of 10YR and 7.5YR in the matrix.

Adair clay loam, 5 to 9 percent slopes, moderately eroded, and Adair clay loam, 9 to 14 percent slopes, moderately eroded, are taxadjuncts to the Adair series because they do not have a mollic epipedon as defined for the series.

Arispe Series

The Arispe series consists of somewhat poorly drained, moderately slowly permeable soils on uplands. These soils formed in loess. Native vegetation is prairie grasses. Slopes range from 5 to 9 percent.

Typical pedon of Arispe silty clay loam, 5 to 9 percent slopes, 1,710 feet south and 460 feet west of the northeast corner of sec. 17, T. 70 N., R. 25. W., in a cultivated field:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam (32 percent clay), dark gray (10YR 4/1) dry;

mixed with some streaks and pockets of dark grayish brown (2.5Y 4/2) subsoil material; weak medium subangular blocky structure parting to weak medium granular; friable; common very fine roots; slightly acid; abrupt smooth boundary.

BA—8 to 13 inches; very dark grayish brown (10YR 3/2) silty clay loam (39 percent clay), grayish brown (10YR 5/2) dry; very dark grayish brown (2.5Y 3/2) kneaded; many faint very dark gray (10YR 3/1) and common fine distinct yellowish brown (10YR 5/6) mottles; organic coatings on faces of peds; moderate very fine subangular blocky structure parting to moderate fine granular; friable; common very fine roots; medium acid; clear smooth boundary.

Btg1—13 to 17 inches; olive brown (2.5Y 4/4) silty clay (42 percent clay), dark grayish brown (2.5Y 4/2) kneaded; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; many prominent dark grayish brown (2.5Y 4/2) clay films on faces of peds; common very fine roots; medium acid; clear smooth boundary.

Btg2—17 to 20 inches; olive brown (2.5Y 4/4) silty clay (42 percent clay), dark grayish brown (2.5Y 4/2) kneaded; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; common medium rounded dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg3—20 to 23 inches; grayish brown (2.5Y 5/2) silty clay (40 percent clay); common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; friable; common distinct dark gray (N 4/0) clay films on faces of peds; few very fine roots; common medium rounded dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Btg4—23 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam (38 percent clay), olive brown (2.5Y 4/4) kneaded; few prominent black (N 2/0) organic coatings in root channels; common medium prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure; friable; common faint grayish brown (2.5Y 5/2) clay films on faces of prisms; few very fine roots; common medium rounded dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Btg5—30 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam (35 percent clay); few prominent very dark gray (N 3/0) organic coatings in root channels; common medium prominent strong brown (7.5YR 4/6) mottles; weak coarse prismatic; firm; common faint very fine roots; few fine rounded dark concretions (iron and manganese oxides); neutral; gradual smooth boundary.

BCg—44 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam (32 percent clay); common medium prominent strong brown (7.5YR 4/6) mottles; weak coarse prismatic structure; firm; few faint gray (N 5/0) clay films in root channels; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); neutral.

The solum ranges from 36 to 60 inches or more in thickness. The solum is leached of free carbonates. The mollic epipedon is 10 to 14 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Btg horizon has hue of 10YR or 2.5Y and value of 4 to 6. The BCg horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 or 2. The clay maximum is at a depth of 10 to 18 inches and typically ranges from 35 to 42 percent.

Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded, is a taxadjunct to the Arispe series because it does not have a mollic epipedon as defined for the series.

Armstrong Series

The Armstrong series consists of somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a thin mantle of sediments or loess and the underlying paleosol developed in glacial till. Native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 5 to 14 percent.

Typical pedon of Armstrong clay loam, 9 to 14 percent slopes, moderately eroded, 2,425 feet east and 2,300 feet south of the center of sec. 35, T. 69 N., R. 24 W., in pasture:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam (30 percent clay); mixed with some streaks and pockets of dark yellowish brown (10YR 4/4) subsoil material; moderate fine and very fine subangular blocky structure; friable; common very fine roots; few pebbles; strongly acid; abrupt smooth boundary.

Bt1—6 to 9 inches; dark yellowish brown (10YR 4/4) clay loam (37 percent clay); very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; few fine prominent yellowish red (5YR 4/6) mottles; strong fine and very fine subangular blocky structure; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds;

common very fine roots; few pebbles; very strongly acid; clear smooth boundary.

2Bt2—9 to 13 inches; dark yellowish brown (10YR 4/4) clay (44 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine prominent yellowish red (5YR 5/6) mottles; weak medium prismatic structure parting to strong fine subangular blocky; firm; common prominent dark grayish brown (10YR 4/2) clay films on faces of peds; common very fine roots; few pebbles; very strongly acid; clear smooth boundary.

2Bt3—13 to 17 inches; grayish brown (10YR 5/2) clay (46 percent clay); very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine prominent yellowish red (5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common very fine roots; few pebbles; very strongly acid; clear smooth boundary.

2Bt4—17 to 26 inches; strong brown (7.5YR 5/6) clay (41 percent clay); very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; many fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate fine and very fine subangular blocky; firm; few very fine roots; few dark concretions (iron and manganese oxides); few pebbles; medium acid; clear smooth boundary.

2Bt5—26 to 42 inches; mottled strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) clay loam (33 percent clay); moderate medium prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); few pebbles; slightly acid; clear wavy boundary.

2BC—42 to 60 inches; mottled grayish brown (2.5Y 5/2) and brown (7.5YR 5/2) clay loam (31 percent clay); moderate coarse prismatic structure parting to moderate coarse and medium angular blocky; firm; few faint grayish brown (2.5Y 5/2) clay films on faces of peds; few very fine roots; few dark reddish brown concretions (iron and manganese oxides); few soft accumulations (calcium carbonates); few pebbles; strongly effervescent; mildly alkaline.

Solum thickness and depth to free carbonates range from about 42 to 80 inches.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. It includes loam, silt loam, silty clay loam, and clay loam. Some pedons have an E horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam or silt loam. The 2Bt horizon has a clay content of 33 to 48 percent. The 2Bt horizon typically has hue of 10YR, 7.5YR, or 5YR and chroma of 2 to 6. The 2BC horizon and, in some pedons, 2C horizon typically have hue of 2.5Y, 7.5YR, or 10YR, value of 4 or 5, and chroma of 2 to 6.

Belinda Series

The Belinda series consists of poorly drained, very slowly permeable soils on stream benches. These soils formed in loess. Native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 0 to 2 percent.

Typical pedon of Belinda silt loam, benches, 0 to 2 percent slopes, 130 feet east and 910 feet north of the southwest corner of sec. 35, T. 68 N., R. 26 W., in a bluegrass pasture:

A—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak thick platy structure; friable; neutral; clear smooth boundary.

E1—5 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium platy structure; friable; slightly acid; abrupt smooth boundary.

E2—8 to 12 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; moderate medium platy structure; friable; neutral; clear smooth boundary.

Bt1—12 to 17 inches; dark grayish brown (10YR 4/2) silty clay; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate fine angular blocky structure; firm; many distinct very dark gray (10YR 3/1) clay films on faces of peds; strongly acid; abrupt smooth boundary.

Bt2—17 to 24 inches; dark grayish brown (10YR 4/2) silty clay; common fine faint dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to weak very fine subangular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt3—24 to 33 inches; dark grayish brown (2.5Y 4/2) silty clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate fine prismatic structure parting to weak very fine subangular blocky; very firm common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt4—33 to 40 inches; brown (10YR 5/3) silty clay; moderate fine prismatic structure parting to weak very fine subangular blocky; very firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common fine rounded concretions (iron oxides); medium acid; clear smooth boundary.

BC—40 to 60 inches; grayish brown (10YR 5/2) silty clay loam; moderate fine prismatic structure parting to weak medium subangular; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces

of peds; common fine rounded concretions (iron oxides); slightly acid; clear smooth boundary.

The solum ranges from 60 to 80 inches in thickness. The A or Ap horizon is 5 to 10 inches thick.

The A or Ap horizon has chroma of 1 or 2. The E horizon has value of 3 to 6 and chroma of 1 or 2.

Bremer Series

The Bremer series consists of poorly drained, moderately slowly permeable soils on bottom lands. These soils formed in alluvium. Native vegetation is tall prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Bremer silty clay loam, 0 to 2 percent slopes, 1,150 feet west and 1,450 feet north of the southeast corner of sec. 19, T. 69 N., R. 26 W., in a cultivated field:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (30 percent clay); weak medium subangular blocky structure; friable; few medium, few fine, and common very fine roots; neutral; abrupt smooth boundary.

A1—8 to 12 inches; black (10YR 2/1) silty clay loam (30 percent clay); few fine prominent dark brown (7.5YR 3/2) mottles; moderate medium and fine subangular blocky structure; friable; few medium, few fine, and common very fine roots; medium acid; clear smooth boundary.

A2—12 to 20 inches; black (10YR 2/1) silty clay loam (33 percent clay); many faint very dark gray (10YR 3/1) organic coatings on faces of peds; few fine prominent dark brown (7.5YR 3/2) mottles; weak fine prismatic structure parting to strong fine subangular blocky; friable; few medium, few fine, and common very fine roots; medium acid; clear smooth boundary.

Bt1—20 to 26 inches; very dark gray (10YR 3/1) silty clay loam (39 percent clay); common fine prominent dark brown (7.5YR 3/2) mottles; moderate fine prismatic structure parting to strong fine subangular blocky; firm; common prominent black (10YR 2/1) clay films on faces of peds; few fine and few very fine roots; medium acid; clear smooth boundary.

Bt2—26 to 32 inches; very dark gray (10YR 3/1) silty clay loam (38 percent clay); common fine distinct dark brown (7.5YR 3/2) mottles; strong fine prismatic structure parting to strong fine subangular blocky; firm; common prominent black (10YR 2/1) clay films on faces of peds; few fine and few very fine roots; medium acid; clear smooth boundary.

Btg3—32 to 39 inches; dark gray (10YR 4/1) silty clay loam (36 percent clay); common fine distinct dark brown (7.5YR 3/2) mottles; strong medium prismatic structure parting to moderate medium and fine subangular blocky; firm; common prominent black (10YR 2/1) clay films on faces of peds; few very fine roots; medium acid; clear smooth boundary.

Btg4—39 to 54 inches; dark gray (10YR 4/1) silty clay loam (33 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in root channels; many fine and medium distinct dark brown (7.5YR 3/2 and 4/4) mottles; moderate medium prismatic structure; firm; few distinct very dark gray (10YR 3/1) clay films on faces of peds; few very fine roots; medium acid; gradual smooth boundary.

Cg—54 to 60 inches; mottled dark grayish brown (2.5Y 4/2) and dark brown (7.5YR 4/4) silty clay loam (32 percent clay); very few prominent very dark gray (10YR 3/1) organic coats in root channels; weak medium prismatic structure; firm; few distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; medium acid.

The solum ranges from 40 to 60 inches in thickness. Carbonates are not within a depth of 60 inches or more. The solum contains less than 15 percent sand. The A horizon has hue of 10YR or is neutral, value of 2 or 3, and chroma of 0 or 1. It contains between 25 and 33 percent clay. The Btg horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. The average clay content in the upper 20 inches of the argillic horizon is 36 to 42 percent clay. The BCg horizon in some pedons or the upper part of the Cg horizon has hue of 7.5YR to 5Y, value of 4 or 5, and chroma of 1 to 4.

Bucknell Series

The Bucknell series consists of somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a paleosol that developed in glacial till. Native vegetation was mixed prairie grasses and deciduous trees. Slopes range from 5 to 14 percent.

These soils are taxadjuncts to the Bucknell series because they do not have chroma of 3 in the upper part of the B horizon.

Typical pedon of Bucknell clay loam, 9 to 14 percent slopes, moderately eroded, 2,065 feet north and 1,638 feet east of southwest corner of sec. 2, T. 68 N., R. 24 W., in a pasture:

Ap—0 to 9 inches; very dark gray (10YR 3/1) clay loam (29 percent clay), dark gray (10YR 4/1) dry; 20 percent streaks and pockets of dark grayish brown (10YR 4/2) subsoil material; weak medium subangular blocky structure parting to moderate fine subangular blocky; friable; common fine and medium roots; neutral; abrupt smooth boundary.

BE—9 to 12 inches; dark grayish brown (10YR 4/2) clay loam (34 percent clay); common distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common medium prominent strong brown (7.5YR 5/6) mottles; moderate fine and medium

subangular blocky structure; friable; few distinct dark grayish brown (10YR 4/2) clay films and light brownish gray (10YR 6/2) silt coatings on faces of peds; common fine roots; slightly acid; clear smooth boundary.

Bt1—12 to 15 inches; dark grayish brown (10YR 4/2) clay (41 percent clay); many fine prominent strong brown (7.5YR 5/6) mottles; strong fine and very fine subangular blocky structure; friable; common distinct dark gray (10YR 4/1) clay films on faces of peds; common fine roots; few pebbles; medium acid; clear smooth boundary.

Bt2—15 to 19 inches; grayish brown (10YR 5/2) clay (42 percent clay), common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; friable; common distinct dark gray (10YR 4/1) clay films on faces of peds; common fine roots; common fine rounded dark concretions (iron and manganese oxides); few pebbles; strongly acid; clear smooth boundary.

Bt3—19 to 24 inches; grayish brown (10YR 5/2) clay (42 percent clay); common fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; common fine roots; common fine rounded dark concretions (iron and manganese oxides); few pebbles; medium acid; clear smooth boundary.

Bt4—24 to 39 inches; grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) clay loam (39 percent clay); common medium prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark gray (10YR 4/1) clay films on faces of peds; few fine roots; common fine rounded dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Bt5—39 to 50 inches; light brownish gray (2.5Y 6/2) clay loam (32 percent clay); many medium prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; firm; few fine roots; common fine rounded dark concretions (iron and manganese); neutral; clear smooth boundary.

BC—50 to 60 inches; light brownish gray (2.5Y 6/2) clay loam (30 percent clay); many medium prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; firm; few very fine roots; common medium platelike dark accumulations (iron and manganese oxides); neutral.

The solum ranges from 40 to 60 inches or more in thickness. No carbonates are above a depth of 60 inches.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The A or Ap horizon typically is clay loam, but includes silty clay loam and loam. Some pedons have an E horizon that has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR, 2.5Y, or 5Y, and chroma of 1 to 8. The part of the Bt horizon that is clay in texture typically is 12 to 24 inches thick. The maximum clay content is about 50 percent, and is generally within 10 to 18 inches of the surface.

Caleb Series

The Caleb series consists of moderately well drained, moderately permeable soils on high stream structural benches. These soils formed in alluvial sediments derived from glacial till. Native vegetation is mixed prairie grasses and deciduous trees. Slope ranges from 5 to 18 percent.

Typical pedon of Caleb loam, in an area of Caleb-Mystic complex, 9 to 18 percent slopes, 205 feet west and 2,015 feet south of the center of sec. 31, T. 69 N., R. 26 W., in a timbered pasture:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; light gray (10YR 7/2) silt coatings on faces of peds; common very fine roots; strongly acid; clear wavy boundary.

A2—4 to 7 inches; dark brown (10YR 3/3) loam, grayish brown (10YR 5/2) dry; very dark grayish brown (10YR 3/2) kneaded; pockets of brown (10YR 4/3) material; common prominent very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderate thick platy structure parting to weak fine subangular blocky; friable; light gray (10YR 7/2) silt coatings on faces of peds; few very fine roots; strongly acid; clear wavy boundary.

E—7 to 10 inches; brown (10YR 4/3) loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine faint dark yellowish brown (10YR 4/4) mottles; moderate thick platy structure parting to weak fine and very fine subangular blocky; friable; white (10YR 8/2) silt coatings on faces of peds; few very fine roots; medium acid; clear wavy boundary.

BE—10 to 15 inches; dark yellowish brown (10YR 4/4) loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; few fine distinct yellowish brown (10YR 5/6) mottles; weak very thick platy structure parting to weak medium subangular blocky; friable; light gray (10YR 7/2) silt coatings on faces of peds; few very fine and few coarse roots; medium acid; clear wavy boundary.

Bt1—15 to 22 inches; dark yellowish brown (10YR 4/4) sandy clay loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine faint dark yellowish brown (10YR 4/6) mottles; moderate fine prismatic

structure parting to moderate medium subangular blocky; friable; few very fine roots; strongly acid; clear smooth boundary.

Bt2—22 to 30 inches; dark yellowish brown (10YR 4/6) sandy clay loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine faint yellowish brown (10YR 5/4) and few fine distinct dark brown (7.5YR 4/4) mottles; moderate fine prismatic structure parting to moderate coarse subangular blocky; firm; common distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; few very fine and few fine roots; strongly acid; clear smooth boundary.

Bt3—30 to 39 inches; dark yellowish brown (10YR 4/6) sandy clay loam; weak coarse prismatic structure; friable; few faint dark yellowish brown (10YR 3/4) clay films on faces of peds; few very fine roots; strongly acid; clear smooth boundary.

BC—39 to 60 inches; dark yellowish brown (10YR 4/4) sandy clay loam; very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine distinct strong brown (7.5YR 5/6), common fine faint yellowish brown (10YR 5/6), and few medium faint dark grayish brown (10YR 4/2) mottles; sand wedge in the upper part of this horizon; massive; friable; common faint dark yellowish brown (10YR 3/4) clay bridging between sand grains; few very fine roots; common fine rounded dark concretions (iron and manganese oxides); medium acid.

The solum typically is 60 inches or more in thickness, but in some pedons it is as thin as 42 inches. Carbonates are not within a depth of 60 inches.

The A or Ap horizon typically has chroma of 2 or 3. Typically, it is loam, but the range includes silt loam and clay loam. The E horizon has value of 4 or 5 and chroma of 2 or 3. It is silt loam or loam. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. The Bt and C horizons greatly differ in texture over short distances. They are clay loam, loam, or sandy clay loam, and in some pedons thin strata of sandy loam and loamy sand or coarser are below a depth of 36 to 48 inches.

Cantril Series

The Cantril series consists of somewhat poorly drained, moderately permeable soils on foot slopes and alluvial fans. These soils formed in loamy, local alluvium. Native vegetation is deciduous trees and tall prairie grasses. Slopes range from 2 to 9 percent.

Typical pedon of Cantril loam, in an area of Cantril-Coppock-Nodaway complex, 2 to 9 percent slopes, 275 feet west and 260 feet south of the northeast corner of sec. 6, T. 67 N., R. 25 W., in pasture and hayland:

A—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak thick platy structure parting to moderate fine and very fine subangular blocky; friable; common very fine and few fine roots; slightly acid; abrupt smooth boundary.

AE—6 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; mixed with 20 percent pockets of dark grayish brown (10YR 4/2) subsurface material; moderate thick platy structure parting to moderate fine and very fine subangular blocky; friable; light brownish gray (10YR 6/2) dry silt coatings on faces of peds; common very fine roots; medium acid; clear smooth boundary.

E—9 to 13 inches; dark grayish brown (10YR 4/2) loam; common prominent very dark grayish brown (10YR 3/2) organic coatings on faces of peds and in pores and root channels; few fine faint brown (10YR 4/3) mottles; moderate medium platy structure parting to moderate fine and very fine subangular blocky; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; common very fine roots; medium acid; clear smooth boundary.

BE—13 to 17 inches; dark brown (10YR 4/3) loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium subangular blocky structure parting to weak fine subangular blocky; friable; light gray (10YR 7/2) dry silt coatings on faces of peds; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt1—17 to 21 inches; grayish brown (10YR 5/2) clay loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; common fine prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few distinct dark grayish brown (10YR 4/2) clay films and light gray (10YR 7/2) dry silt coatings on faces of peds; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt2—21 to 26 inches; grayish brown (10YR 5/2) clay loam; very few distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; common fine prominent yellowish brown (10YR 5/6) and common fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films and light gray (10YR 7/2) dry silt coatings on faces of peds; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt3—26 to 37 inches; grayish brown (10YR 5/2) clay loam; very few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels;

common fine prominent yellowish brown (10YR 5/6) mottles; strong medium and fine prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films and light gray (10YR 7/2) dry silt coatings on ped faces; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt4—37 to 48 inches; grayish brown (10YR 5/2) clay loam; very few prominent very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine prominent strong brown (7.5YR 5/6) mottles; strong fine prismatic structure parting to moderate medium subangular blocky; firm; many prominent dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; common fine rounded dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt5—48 to 60 inches; mottled grayish brown (10YR 5/2) and strong brown (7.5YR 5/6 and 4/6) clay loam; few faint very dark gray (10YR 3/1) organic coatings in root channels; strong medium prismatic structure; firm; many prominent dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; common fine rounded dark concretions (iron and manganese oxides); strongly acid.

The solum typically is more than 48 inches thick, but ranges from 42 to 60 inches or more. Carbonates are not in the solum.

The Ap or A1 horizon has chroma of 1 or 2. It is loam or silt loam and high in sand. The E horizon has value of 4 or 5. It is loam or silt loam and high in sand. The Bt horizon has value of 4 or 5. The clay content is 28 to 35 percent, but in some pedons thin layers are slightly higher in clay.

Chequest Series

The Chequest series consists of poorly drained, moderately slowly permeable soils on bottom lands. These soils formed in alluvium. Native vegetation is trees and prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Chequest silty clay loam, 0 to 2 percent slopes, 2,150 feet west and 680 feet north of the southeast corner of sec. 20, T. 68 N., R. 25 W., in cropland:

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam (29 percent clay), gray (10YR 5/1) dry; moderate medium and fine subangular blocky structure parting to moderate fine granular; friable; common fine and medium roots; neutral; abrupt smooth boundary.

A1—6 to 12 inches; very dark gray (10YR 3/1) silty clay loam (37 percent clay), gray (10YR 5/1) dry; common fine prominent brown (7.5YR 4/4) mottles; moderate medium and fine subangular blocky structure; friable; common fine roots; medium acid; clear smooth boundary.

A2—12 to 17 inches; very dark gray (10YR 3/1) silty clay (40 percent clay), gray (10YR 5/1) dry; common fine prominent brown (7.5YR 4/4) mottles; moderate medium and fine subangular blocky structure; friable; common fine roots; medium acid; clear smooth boundary.

Btg1—17 to 23 inches; dark gray (10YR 4/1) silty clay (43 percent clay); common fine prominent brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; many distinct very dark gray (10YR 3/1) clay films on faces of peds and in pores and root channels; few fine roots; medium acid; gradual smooth boundary.

Btg2—23 to 32 inches; dark gray (10YR 4/1) silty clay (41 percent clay); common fine prominent brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds; few fine roots; medium acid; clear smooth boundary.

Btg3—32 to 40 inches; dark gray (10YR 4/1) silty clay loam (38 percent clay); common fine and medium prominent brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds and in pores and root channels; few fine roots; strongly acid; gradual smooth boundary.

Btg4—40 to 50 inches; dark gray (10YR 4/1) silty clay (40 percent clay); common fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) and dark gray (10YR 4/1) clay films on faces of peds and in pores and root channels; few fine roots; strongly acid; clear smooth boundary.

Btg5—50 to 60 inches; dark gray (10YR 4/1) silty clay loam (39 percent clay); many fine and medium prominent brown (7.5YR 4/4) and strong brown (7.5YR 5/6) mottles; weak medium prismatic parting to moderate medium subangular blocky; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds and in pores and root channels; few fine roots; strongly acid.

The solum ranges from 42 to 70 inches in thickness. The solum is between 5 and 15 percent sand, much of which is very fine sand. The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The Btg horizon has hue of 10YR, 2.5Y, or 5Y and value of 4 to 6. This horizon and the control section average between 35 and 42

percent clay, but subhorizons range from 30 to 55 percent clay.

Clarinda Series

The Clarinda series consists of poorly drained, very slowly permeable soils on convex side slopes and in coves at the heads of drainageways. These soils formed mainly in an exhumed gray paleosol that weathered from glacial till. Native vegetation is prairie grasses. Slopes range from 5 to 14 percent.

Typical pedon of Clarinda silty clay loam, 5 to 9 percent slopes, 2,000 feet south and 220 feet west of the northeast corner of sec. 18, T. 70 N., R. 25 W., in pasture:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam (33 percent clay), dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure parting to moderate fine granular; friable; slightly acid; clear smooth boundary.

A—8 to 11 inches; very dark gray (10YR 3/1) silty clay loam (34 percent clay), dark grayish brown (10YR 4/2) dry; common faint black (10YR 2/1) organic coatings on faces of peds; many fine distinct dark grayish brown (10YR 4/2) mottles; moderate fine and very fine subangular blocky structure; few fine roots; friable; medium acid; clear smooth boundary.

BA—11 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam (35 percent clay); common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine distinct yellowish brown (10YR 5/4) mottles; moderate fine and very fine subangular blocky structure; few fine roots; friable; strongly acid; clear smooth boundary.

2Btg1—14 to 17 inches; dark grayish brown (10YR 4/2) silty clay (41 percent clay); common fine distinct yellowish brown (10YR 5/4) mottles and few fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure parting to strong very fine subangular blocky; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

2Btg2—17 to 23 inches; dark gray (5Y 4/1) silty clay (46 percent clay); common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; many distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

2Btg3—23 to 33 inches; dark gray (5Y 4/1) silty clay (46 percent clay); many fine prominent yellowish brown (10YR 5/6) and few fine prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very firm; common distinct dark gray (10YR 4/1) and gray (10YR 5/1) clay films on faces of peds. Few fine rounded dark concretions (iron and manganese oxides); few very fine roots; strongly acid; clear smooth boundary.

2Btg4—33 to 37 inches; grayish brown (10YR 5/2) silty clay (46 percent clay); common fine prominent dark brown (7.5YR 4/2) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very firm; common distinct dark gray (10YR 4/1) and gray (10YR 5/1) clay films on faces of peds; few fine rounded dark concretions (iron and manganese oxides); few pebbles; strongly acid; abrupt smooth boundary.

2Btg5—37 to 43 inches; grayish brown (10YR 5/2) silty clay (51 percent clay); common fine prominent dark yellowish brown (10YR 3/4) mottles; many medium prominent yellowish red (5YR 5/8) mottles; moderate coarse prismatic structure; extremely firm; common distinct dark gray (10YR 4/1) and gray (10YR 5/1) clay films on faces of peds; few fine rounded dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

2Btg6—43 to 60 inches; grayish brown (10YR 5/2) silty clay (50 percent clay); few fine prominent brown (7.5YR 4/2) mottles; common fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate coarse prismatic structure; extremely firm; common distinct dark gray (10YR 4/1) and gray (10YR 5/1) clay films on faces of peds; few fine rounded dark concretions (iron and manganese oxides); medium acid.

Solum thickness and depth to carbonates are commonly more than 60 inches.

The 2Btg horizon has hue of 10YR, 2.5Y, or 5Y. The horizon is silty clay or clay, and maximum clay content ranges between 45 and 60 percent.

Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded, and Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded, are taxadjuncts to the Clarinda series because they do not have a mollic epipedon as defined for the series.

Coppock Series

The Coppock series consists of somewhat poorly drained, moderately permeable soils on flood plains, foot slopes, and alluvial fans. These soils formed in silty alluvium. Native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 0 to 5 percent.

Typical pedon of Coppock silt loam, 2 to 5 percent slopes, 400 feet south and 1,200 feet east of the center of sec. 18, T. 70 N., R. 27 W., in a cultivated field:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam (19 percent clay), dark grayish brown (10YR 4/2) dry; weak thick platy structure parting to moderate fine subangular blocky; friable; light brownish gray (10YR 6/2) silt coats; common very fine roots; neutral; abrupt smooth boundary.

AE—7 to 11 inches; very dark grayish brown (10YR 3/2) silt loam (20 percent clay), light brownish gray (10YR 6/2) dry; weak thick platy structure parting to moderate fine subangular blocky; friable; light brownish gray (10YR 6/2) silt coats; common very fine roots; few fine dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

E1—11 to 16 inches; very dark grayish brown (10YR 3/2) silt loam (21 percent clay); light brownish gray (10YR 6/2) dry; moderate medium platy structure parting to moderate fine subangular blocky; friable; common very fine roots; few fine dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

E2—16 to 24 inches; dark grayish brown (10YR 4/2) silt loam (24 percent clay); grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) dry; common fine distinct dark yellowish brown (10YR 3/4) mottles; moderate thick platy structure parting to moderate fine subangular blocky; friable; common very fine roots; few fine dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

EB—24 to 29 inches; dark grayish brown (10YR 4/2) silty clay loam (29 percent clay); common fine distinct yellowish brown (10YR 5/4) mottles; weak thick platy structure parting to moderate fine subangular; friable; few very fine roots; few fine dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt1—29 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam (31 percent clay); common distinct very dark gray (10YR 3/1) organic coats in pores and root channels; common fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few very fine roots; few fine dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt2—34 to 41 inches; dark grayish brown (10YR 4/2) silty clay loam (32 percent clay); common distinct very dark gray (10YR 3/1) organic coats in pores and root channels; common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few very fine roots; few fine dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt3—41 to 51 inches; dark grayish brown (10YR 4/2) silty clay loam (32 percent clay); common distinct very dark gray (10YR 3/1) organic coats in pores and root channels; common fine distinct dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds, and in root channels; few very fine roots; few fine dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt4—51 to 60 inches; mottled grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) silty clay loam (27 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coats in pores and root channels; weak medium prismatic structure; firm; few very fine roots; few fine dark concretions (iron and manganese oxides); medium acid.

The solum ranges from 40 to 70 inches in thickness. The dark epipedon is 6 to 10 inches thick.

The A horizon has chroma of 1 or 2. The E horizon has value of 3 to 6 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Douds Series

The Douds series consists of moderately well drained, moderately permeable soils on high stream benches. These soils formed in mixed alluvium of pre-Sangamon age. Native vegetation is deciduous trees. Slope ranges from 9 to 18 percent.

Typical pedon of Douds loam, in an area of Douds-Galland loams, 9 to 18 percent slopes, 840 feet north and 40 feet east of the center of sec. 28, T. 70 N., R. 26 W., in a forested state park:

A—0 to 5 inches; very dark grayish brown (10YR 3/2) loam; light brownish gray (10YR 6/2) dry; weak thick platy structure parting to moderate fine subangular blocky; friable; common very fine and fine roots; very strongly acid; clear smooth boundary.

E1—5 to 9 inches; dark grayish brown (10YR 4/2) loam; light brownish gray (10YR 6/2) dry; few distinct brown (10YR 4/3) streaks and pockets; weak thick platy structure parting to moderate fine subangular blocky; friable; common very fine to coarse roots; strongly acid; clear smooth boundary.

E2—9 to 15 inches; dark yellowish brown (10YR 4/4) loam; pale brown (10YR 6/3) dry; few distinct yellowish brown (10YR 5/6) streaks and pockets; moderate thick platy structure parting to moderate fine subangular blocky; friable; few very fine and fine roots; strongly acid; clear and smooth boundary.

BE—15 to 20 inches; dark brown (7.5YR 4/4) sandy clay loam (27 percent clay); common distinct dark grayish brown (10YR 4/2) organic coatings on faces of peds; moderate medium and fine subangular blocky structure; friable; common distinct brown (10YR 4/3) clay films on faces of peds; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); few pebbles; strongly acid; clear smooth boundary.

Bt1—20 to 27 inches; dark brown (7.5YR 4/4) sandy clay loam; few fine distinct strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; firm; very few distinct very dark gray (10YR 3/1) organic coatings in root channels; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; few fine and very fine roots; few fine rounded dark concretions (iron and manganese oxides); few pebbles; strongly acid; clear smooth boundary.

Bt2—27 to 32 inches; dark brown (7.5YR 4/4) clay loam; few fine distinct strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; firm; very few distinct very dark gray (10YR 3/1) organic coatings in root channels; common distinct dark brown (7.5YR 3/4) clay films on faces of peds; few fine and very fine roots; few fine rounded dark concretions (iron and manganese oxides); few pebbles; strongly acid; clear smooth boundary.

Bt3—32 to 39 inches; yellowish brown (10YR 5/6) sandy clay loam; few fine prominent red (2.5YR 4/6) root channels; moderate medium prismatic structure; firm; few fine distinct very dark gray (10YR 3/1) organic coatings in root channels; few distinct dark brown (7.5YR 3/4) clay films on faces of peds; light gray (10YR 7/2) dry silt coatings along root channels; few very fine to coarse roots; few fine rounded dark reddish brown (5YR 2.5/2) concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt4—39 to 46 inches; yellowish brown (10YR 5/6) clay loam; very few distinct very dark gray (10YR 3/1) organic coatings in root channels; very few prominent red (2.5YR 4/6) root channels; common fine prominent yellowish red (5YR 4/6) mottles; strong medium prismatic structure; firm; few distinct dark brown (7.5YR 3/4) and brown (10YR 4/3) clay films on faces of peds; very few fine roots; few fine rounded dark concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

BC—46 to 51 inches; mottled strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) sandy clay loam; weak coarse prismatic structure; friable; few distinct dark brown (7.5YR 4/4) clay films on faces of peds; common pebbles; very strongly acid; clear smooth boundary.

C—51 to 60 inches; stratified strong brown (7.5YR 4/6 and 5/8) and yellowish brown (10YR 5/6) sandy clay loam; few fine distinct yellowish red (5YR 5/8) mottles; weak thick platy structure; friable; common fine rounded dark concretions (iron and manganese oxides); strongly acid.

The solum ranges from 36 to 72 inches in thickness. Carbonates are not in the solum or to a depth of several feet in the C horizon.

The A horizon has value of 3 to 5 and chroma of 1 to 3. It is dominantly silt loam or loam. The Bt horizon has chroma of 4 to 8. The Bt horizon is loam, clay loam, or sandy clay loam.

Edina Series

The Edina series consists of poorly drained, very slowly permeable soils on ridgetops and in upland, depressional areas. These soils formed in loess. Native vegetation is prairie grasses. Slopes are 0 or 1 percent.

Typical pedon of Edina silt loam, 0 to 1 percent slopes, 1,610 feet north and 216 feet east of the center of sec. 24, T. 68 N., R. 25 W., in a cultivated field:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam (20 percent clay), dark grayish brown (10YR 4/2) dry; moderate medium platy structure parting to moderate fine subangular blocky; friable; common very fine roots; neutral; abrupt smooth boundary.

A—7 to 11 inches; very dark gray (10YR 3/1) silt loam (21 percent clay), grayish brown (10YR 5/2) dry; moderate thick platy structure parting to moderate fine subangular blocky; friable; common very fine roots; neutral; abrupt smooth boundary.

E—11 to 15 inches; dark gray (10YR 4/1) silt loam (25 percent clay), grayish brown (10YR 5/2) dry; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; few fine distinct strong brown (7.5YR 4/6) mottles; moderate medium platy structure parting to moderate fine subangular blocky; friable; few very fine roots; medium acid; clear smooth boundary.

BE—15 to 18 inches; dark gray (10YR 4/1) silty clay loam (33 percent clay), grayish brown (10YR 5/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; common distinct very dark gray (10YR 3/1) clay films on faces of peds; few very fine roots; strongly acid; clear smooth boundary.

Bt—18 to 21 inches; very dark gray (10YR 3/1) silty clay (53 percent clay), very dark gray (10YR 3/1) kneaded; common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and very fine subangular blocky structure; firm; many distinct very dark gray (10YR 3/1) clay films on faces of peds; few very fine roots; medium acid; clear smooth boundary.

Btg1—21 to 24 inches; dark gray (10YR 4/1) silty clay (56 percent clay), very dark gray (10YR 3/1)

kneaded; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark gray (10YR 3/1) clay films on faces of peds; few very fine roots; medium acid; clear smooth boundary.

Btg2—24 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay (54 percent clay), very dark grayish brown (2.5Y 3/2) kneaded; few distinct very dark gray (10YR 3/1) organic coatings in root channels; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg3—29 to 34 inches; grayish brown (2.5Y 5/2) silty clay (52 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in root channels; few fine prominent yellowish brown (10YR 5/6) and common fine distinct olive brown (2.5Y 4/4) mottles; moderate medium prismatic structure; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg4—34 to 42 inches; olive gray (5Y 5/2) silty clay (45 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in root channels; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; common faint dark gray (5Y 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Btg5—42 to 50 inches; olive gray (5Y 5/2) silty clay (41 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in root channels; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; firm; dark gray (5Y 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

Btg6—50 to 60 inches; olive gray (5Y 5/2) silty clay loam (39 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in root channels; many medium prominent strong brown (7.5YR 5/8) and common medium prominent strong brown (7.5YR 4/6) mottles; weak medium platy structure; firm; few faint dark gray (5Y 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral.

The solum ranges from 40 to 60 inches or more in thickness. The control section averages 45 to 60 percent clay.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. In the upper part the Bt horizon has hue of 2.5Y or 10YR and value of 2 to 4. In the lower part it has hue of 2.5Y, 10YR, or 5Y and value of 3 to 5.

Galland Series

The Galland series consists of somewhat poorly drained, slowly permeable soils on high stream benches. These soils formed in Late Sangamon paleosols derived from alluvial sediments. Native vegetation is deciduous trees. Slopes range from 9 to 18 percent.

Typical pedon of Galland loam, in an area of Douds-Galland loams, 9 to 18 percent slopes, 820 feet north and 120 feet east of the center of sec. 28, T. 70 N., R. 26 W., in a forested state park:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; few pockets of yellowish brown (10YR 5/4); moderate medium and fine subangular blocky structure; friable; common fine and very fine roots; strongly acid; clear smooth boundary.

E1—4 to 7 inches; grayish brown (10YR 5/2) loam, light gray (10YR 7/2) dry; moderate thick platy structure; friable; very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; few fine and very fine roots; strongly acid; clear smooth boundary.

E2—7 to 10 inches; grayish brown (10YR 5/2) loam, light gray (10YR 7/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure; friable; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; few fine and very fine roots; few fine rounded dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

BE—10 to 13 inches; strong brown (7.5YR 4/6) clay loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; moderate medium and fine subangular blocky structure; friable; common faint dark brown (7.5YR 3/4) clay films on ped faces; grayish brown (10YR 5/2) silt coats; light gray (10YR 7/2) dry; few fine and very fine roots; few fine rounded dark concretions (iron and manganese oxides); strongly acid; clear wavy boundary.

2Bt1—13 to 17 inches; strong brown (7.5YR 4/6) clay loam; common distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; moderate medium and fine subangular blocky structure; firm; common faint brown (7.5YR 4/4) clay films on ped faces; few distinct grayish brown (10YR 5/2) silt coats in pores and root channels; few fine and very fine roots; few fine rounded dark concretions (iron and manganese oxides); few pebbles; very strongly acid; clear smooth boundary.

2Bt2—17 to 21 inches; strong brown (7.5YR 4/6) clay loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; common fine prominent yellowish red (5YR 5/8) mottles and few fine prominent red (2.5YR 4/8) mottles; moderate medium and fine subangular blocky structure; firm; many distinct dark brown (7.5YR 3/4) clay films on ped faces; few fine and very fine roots; few fine rounded dark concretions (iron and manganese oxides); few pebbles; very strongly acid; clear smooth boundary.

2Bt3—21 to 26 inches; strong brown (7.5YR 4/6) clay loam; few fine distinct brown (7.5YR 5/2) mottles and common fine and medium prominent yellowish red (2.5YR 5/8) mottles; moderate medium and fine subangular blocky structure; firm; common distinct dark brown (7.5YR 3/4) clay films on ped faces; few fine and very fine roots; few fine rounded dark concretions (iron and manganese); very strongly acid; clear smooth boundary.

2Bt4—26 to 32 inches; strong brown (7.5YR 4/6) clay; common fine distinct brown (7.5YR 4/2) mottles; common fine prominent dark red (2.5YR 3/6) and red (2.5YR 5/8) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; many distinct dark brown (7.5YR 3/4) clay films on ped faces; few fine and very fine roots; few fine rounded dark concretions (iron and manganese); few pebbles; very strongly acid; clear smooth boundary.

2Bt5—32 to 38 inches; mottled brown (10YR 5/3) strong brown (7.5YR 5/6) clay; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; common fine and medium prominent dark red (2.5YR 3/6) and red (2.5YR 5/8) mottles; moderate medium prismatic structure; firm; common distinct dark brown (7.5YR 3/4) clay films on ped faces; few very fine roots; few fine rounded dark concretions (iron and manganese); few pebbles; very strongly acid; clear smooth boundary.

2Bt6—38 to 44 inches; mottled brown (10YR 5/3) strong brown (7.5YR 5/6) sandy clay loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; few fine distinct reddish yellow (7.5YR 6/8) mottles; moderate medium prismatic structure; friable; common distinct dark brown (7.5YR 3/4) clay films on ped faces; few fine rounded dark concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

2BC—44 to 57 inches; pale brown (10YR 6/3) and strong brown (7.5YR 5/8) clay loam; few distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; weak medium prismatic structure; friable; few distinct dark brown (7.5YR 3/4) clay films on ped faces and in root channels; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); very strongly acid; gradual smooth boundary.

2C—57 to 60 inches; pale brown (10YR 6/3) and strong brown (7.5YR 5/8) stratified loam and sandy loam; very few fine distinct very dark grayish brown (10YR 3/2) organic coatings in root channels; weak coarse prismatic structure; friable; very few distinct dark brown (7.5YR 3/4) clay films on ped faces and root channels; few very fine roots; few medium rounded dark concretions (iron and manganese); very strongly acid.

The solum ranges from 36 to 72 inches in thickness. Carbonates are not in the solum or within a depth of several feet in the C horizon.

The A horizon has value of 3 to 5 and chroma of 1 to 3. Typically, it is clay loam or loam, but in some pedons it is silt loam. The E horizon typically has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. The 2Bt horizon has hue of 10YR, 7.5YR, or 5YR, value of 3 to 5, and chroma of 2 to 6. Clay content of the Bt horizon averages about 38 to 45 percent, but ranges from 35 to 48 percent. The 2BC and 2C horizons have hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6, and chroma of 2 to 8.

Gara Series

The Gara series consists of moderately well drained, moderately slowly permeable soils on uplands. These soils formed in glacial till. Native vegetation is grasses and trees. Slopes range from 9 to 25 percent.

These Gara soils are taxadjuncts to the Gara series because they contain more clay in the control section than is allowed for the series.

Typical pedon of Gara loam, 14 to 18 percent slopes, 1,900 feet north and 1,400 feet east of the southwest corner of sec. 3, T. 67 N., R. 26 W., in timber:

A—0 to 8 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; weak thick platy structure parting to moderate fine granular; friable; light brownish gray (10YR 6/2) silt coatings on faces of peds; few medium, few fine, and common very fine roots; medium acid; clear smooth boundary.

E1—8 to 11 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; moderate medium platy structure; friable; few medium, few fine, and common very fine roots; strongly acid; clear smooth boundary.

E2—11 to 14 inches; brown (10YR 4/3) loam, light brownish gray (10YR 6/2) dry; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; weak thick platy structure parting to weak medium subangular blocky; friable; few

distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few medium, few fine, and common very fine roots; few pebbles; strongly acid; clear smooth boundary.

Bt1—14 to 19 inches; dark yellowish brown (10YR 4/4) clay loam (29 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; distinct dark yellowish brown (10YR 4/4) dry silt coatings on faces of peds; few medium, few fine, and few very fine roots; few pebbles; very strongly acid; clear smooth boundary.

Bt2—19 to 26 inches; dark yellowish brown (10YR 4/4) clay (45 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine and few very fine roots; few pebbles; very strongly acid; clear smooth boundary.

Bt3—26 to 31 inches; yellowish brown (10YR 5/6) clay (43 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine prominent strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); few pebbles; strongly acid; clear smooth boundary.

Bt4—31 to 41 inches; yellowish brown (10YR 5/6) clay loam (35 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and in root channels; few fine prominent strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); few pebbles; neutral; clear wavy boundary.

BC—41 to 46 inches; yellowish brown (10YR 5/6) clay loam (33 percent clay); very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine prominent strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); few soft accumulations (calcium carbonates); few pebbles; strong effervescence; moderately alkaline; clear smooth boundary.

C—46 to 60 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) clay loam; moderate coarse prismatic structure; very firm; common fine distinct very dark gray (10YR 3/1) clay films in root channels; few very fine roots; few soft accumulations (calcium carbonates); few pebbles; strong effervescence; moderately alkaline; clear smooth boundary.

The solum is typically 40 to 48 inches thick, and ranges from 36 to 70 inches in thickness. Solum thickness typically is the same as depth to carbonates.

The A or Ap horizon has chroma of 1 or 2, and is loam, silt loam, or clay loam. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 to 6. The BC and C horizons typically have hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 6.

Gasconade Series

The Gasconade series consists of somewhat excessively drained, moderately slowly permeable soils on side slopes and escarpments of uplands and stream benches. These soils formed in thin, clayey layers with considerable amounts of coarse fragments from residuum weathered from the underlying bedrock. Native vegetation is grasses and a sparse population of deciduous trees. Slopes range from 18 to 50 percent.

These soils are taxadjuncts to the Gasconade series because they do not have a mollic epipedon.

Typical pedon of Gasconade flaggy silty clay, in an area of Gasconade-Rock outcrop complex, 18 to 50 percent slopes, 1,300 feet west and 1,650 feet south of the northeast corner of sec. 7, T. 68 N., R. 26 W., in a timbered area:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) flaggy silty clay, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many very fine and common fine roots; 20 percent channers; slight effervescence; mildly alkaline; clear wavy boundary.

Bw—4 to 12 inches; olive brown (2.5Y 4/4) very flaggy clay; strong medium subangular blocky structure; firm; common very fine and fine roots and few medium and coarse roots; 50 percent channers; slight effervescence; mildly alkaline; abrupt wavy boundary.

R—12 inches; limestone bedrock with weather cracks containing clayey materials in the upper part.

The solum ranges from about 4 to 20 inches in thickness, and commonly is the same as depth to limestone bedrock.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is flaggy or channery silty clay loam, silty clay, clay loam, or clay, but in some pedons the amount of coarse

fragments is less than 15 percent. The Bw horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 3 or 4, and chroma of 2 or 4. It is very flaggy or very channery clay, silty clay, clay loam, or silty clay loam.

Grundy Series

The Grundy series consists of somewhat poorly drained, slowly permeable soils on upland ridgetops. These soils formed in loess. Native vegetation is tall prairie grasses. Slopes range from 2 to 5 percent.

Typical pedon of Grundy silty clay loam, 2 to 5 percent slopes, 1,630 feet south and 265 feet west of the northeast corner of sec. 17, T. 70 N., R. 25 W., in a cultivated field:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam (29 percent clay), dark grayish brown (10YR 4/2) dry; moderate medium angular blocky structure parting to moderate fine granular; friable; common very fine and few fine roots; slightly acid; abrupt smooth boundary.

A—7 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam (31 percent clay), grayish brown (10YR 5/2) dry, very dark gray (10YR 3/1) kneaded; many distinct black (10YR 2/1) organic coatings on faces of peds; common fine faint dark brown (10YR 3/3) mottles; moderate fine and very fine subangular blocky structure; friable; common very fine roots; medium acid; clear smooth boundary.

BA—11 to 15 inches; dark brown (10YR 3/3) silty clay loam (34 percent clay), brown (10YR 5/3) dry; very dark gray (10YR 3/1) organic coatings on faces of peds; moderate fine and very fine subangular blocky structure; friable; few very fine roots; strongly acid; clear smooth boundary.

Bt1—15 to 19 inches; dark grayish brown (2.5Y 4/2) silty clay loam (36 percent clay); common distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; many fine prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; many distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt2—19 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay (40 percent clay); very dark gray (10YR 3/1) organic coatings in pores and root channels; many fine prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; many distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few fine rounded dark reddish brown concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt3—25 to 29 inches; grayish brown (2.5Y 5/2) silty clay (44 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine prominent yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt4—29 to 40 inches; grayish brown (2.5Y 5/2) silty clay (40 percent clay); common distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine prominent yellowish brown (10YR 5/6) and common fine prominent yellowish red (5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Bt5—40 to 50 inches; grayish brown (2.5Y 5/2) silty clay loam (36 percent clay); common distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine prominent yellowish brown (10YR 5/6) and common fine prominent yellowish red (5YR 4/6) mottles; moderate medium prismatic structure; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; gradual smooth boundary.

BC—50 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam (34 percent clay); common prominent very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak medium prismatic structure; firm; few faint dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid.

The solum typically ranges from 40 to about 72 inches in thickness, and generally free carbonates are not in the entire mantle of loess. The mollic epipedon is 11 to 18 inches thick.

The A horizon is silt loam or silty clay loam. In the upper part the Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 3. In the lower part it has hue of 10YR, 2.5Y, and 5Y, value of 4 or 5, and chroma of 1 or 2. Some pedons have a C horizon that has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2.

Haig Series

The Haig series consists of poorly drained, slowly permeable soils on uplands. These soils formed in loess under native grasses. Slopes range from 0 to 2 percent.

Typical pedon of Haig silty clay loam, 0 to 2 percent slopes, 1,258 feet south and 240 feet west of the northeast corner of sec. 17, T. 70 N., R. 25 W., in a cultivated field:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to moderate fine granular; friable; neutral; clear smooth boundary.

A1—7 to 10 inches; black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; friable; common distinct dark grayish brown (2.5Y 4/2) dry silt coatings on faces of peds; neutral; clear smooth boundary.

A2—10 to 13 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium platy structure parting to moderate fine subangular blocky; friable; many distinct dark grayish brown (2.5Y 4/2) dry silt coatings on faces of peds; neutral; clear smooth boundary.

Bt—13 to 17 inches; very dark gray (10YR 3/1) silty clay loam; common fine prominent dark grayish brown (2.5Y 4/2) mottles; moderate fine and very fine subangular blocky structure; friable; common distinct very dark gray (10YR 3/1) clay films on faces of peds; medium acid; clear smooth boundary.

Btg1—17 to 21 inches; very dark grayish brown (2.5Y 3/2) silty clay loam; common fine faint dark grayish brown (2.5Y 4/2) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine and very fine subangular blocky structure; friable; common distinct dark gray (10YR 4/1) clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—21 to 24 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine and very fine subangular blocky structure; friable; common distinct dark gray (10YR 4/1) clay films on faces of peds and root channels; few fine rounded dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg3—24 to 30 inches; dark grayish brown (2.5Y 4/2) silty clay; common distinct very dark gray (10YR 3/1) organic coats in root channels; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; many prominent dark gray (10YR 4/1) clay films on faces of peds; common fine rounded dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg4—30 to 34 inches; grayish brown (2.5Y 5/2) silty clay; common prominent very dark gray (10YR 3/1) organic coats in root channels; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; common distinct very dark grayish brown (2.5Y 3/2) clay films on faces of peds; common fine rounded dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg5—34 to 41 inches; grayish brown (2.5Y 5/2) silty clay; common distinct very dark gray (10YR 3/1) organic coats in root channels; common fine prominent yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 4/6) mottles; moderate coarse prismatic structure; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; common fine rounded dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Btg6—41 to 51 inches; grayish brown (2.5Y 5/2) silty clay; common distinct very dark gray (10YR 3/1) organic coats in root channels; common fine prominent yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; common fine rounded dark concretions (iron and manganese oxides); common medium irregular strong brown (7.5YR 4/6) accumulations; slightly acid; gradual smooth boundary.

BCg—51 to 60 inches; olive gray (5Y 5/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; firm; few faint dark grayish brown (2.5Y 4/2) clay films on faces of peds; few fine and medium dark concretions (iron and manganese oxides); slightly acid.

The solum ranges from 52 to 72 inches in thickness. The mollic epipedon ranges from 20 to 28 inches in thickness.

The A horizon has chroma of 0 or 1. It is silt loam or silty clay loam. The Bt horizon has hue of 10YR or 2.5Y and value of 3 or 4. The Btg horizon ranges from 10YR to 5Y in hue and has chroma of 1 or 2.

Humeston Series

The Humeston series consists of poorly drained, very slowly permeable soils on bottom lands. These soils formed in alluvium under native vegetation of prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Humeston silt loam, 0 to 2 percent slopes, 2,400 feet west and 700 feet south of the northeast corner of sec. 3, T. 67 N., R. 24 W., in hayland:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam (26 percent clay), grayish brown (10YR 5/2) dry; moderate fine and very fine subangular blocky structure; friable; common very fine and few fine roots; medium acid; clear smooth boundary.

A—7 to 10 inches; very dark grayish brown (10YR 3/2) silt loam (22 percent clay), grayish brown (10YR 5/2) dry, very dark grayish brown (10YR 3/2) kneaded; many distinct very dark gray (10YR 3/1) organic coatings on faces of peds; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium platy structure parting to moderate very fine subangular blocky; friable; common prominent light gray (10YR 7/2) silt coatings on faces of peds; common very fine roots; strongly acid; clear smooth boundary.

E—10 to 14 inches; grayish brown (10YR 5/2) silt loam (18 percent clay), gray (10YR 5/1) dry; few distinct dark gray (10YR 4/1) organic coatings on faces of peds; common fine prominent strong brown (7.5YR 4/6) mottles; strong medium platy structure parting to moderate very fine subangular blocky; friable; many prominent white (10YR 8/1) silt coatings on faces of peds; common very fine roots; strongly acid; clear wavy boundary.

BE—14 to 17 inches; very dark gray (10YR 3/1) silty clay loam (31 percent clay); common fine prominent strong brown (7.5YR 4/6) mottles; weak thick platy structure parting to moderate fine and very fine subangular blocky; firm; few prominent light gray (10YR 7/1) silt coatings on faces of peds; common very fine roots; strongly acid; clear wavy boundary.

Bt—17 to 23 inches; very dark gray (10YR 3/1) silty clay (43 percent clay); many fine prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; many prominent very dark gray (10YR 3/1) clay films and light brownish gray (10YR 6/2) silt coatings on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg1—23 to 31 inches; very dark grayish brown (2.5Y 3/2) silty clay (44 percent clay); common fine prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to weak medium and fine subangular blocky; firm; common prominent very dark gray (10YR 3/1) clay films and very few prominent light brownish gray (10YR 6/2) silt coatings on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Btg2—31 to 36 inches; grayish brown (2.5Y 5/2) silty clay (43 percent clay); few prominent very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine distinct light olive brown (2.5Y 5/6) and prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Btg3—36 to 50 inches; grayish brown (2.5Y 5/2) silty clay (42 percent clay); few prominent very dark gray (10YR 3/1) organic coatings in pores and root channels; few fine distinct yellowish brown (10YR 5/4) and many fine prominent strong brown (7.5YR 4/6 or 5/6) mottles; moderate medium prismatic structure; firm; few prominent dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

BCg—50 to 60 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) silty clay loam (36 percent clay); few prominent very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure; firm; very few distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral.

The solum typically is 48 to 96 inches thick.

The A or Ap horizon has a value of 2 or 3. It is silt loam or silty clay loam. The E horizon has value of 4 or 5 and value of 1 or 2. The Btg horizon has value of 2 to 5 and chroma of 0 to 2. It is silty clay loam or silty clay, and has a clay maximum of 35 to 48 percent.

Keswick Series

The Keswick series consists of moderately well drained, slowly permeable soils on short, convex shoulder slopes and nose slopes on uplands. These soils formed in a thin mantle of loess or sediments, a paleosol, and the underlying glacial till. Native vegetation is deciduous trees. Slopes range from 5 to 14 percent.

Typical pedon of Keswick loam, 5 to 9 percent slopes (fig. 18), 210 feet south and 350 feet west of the northeast corner of sec. 19, T. 67 N., R. 25 W., in an oak-hickory type forest:

A—0 to 4 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; very strongly acid; abrupt smooth boundary.

E—4 to 7 inches; yellowish brown (10YR 5/4) loam; light gray (10YR 6/1) dry; weak medium platy structure parting to moderate fine subangular blocky; friable; very strongly acid; clear smooth boundary.

EB—7 to 12 inches; brown (7.5YR 5/4) loam; few fine faint strong brown (7.5YR 5/6) mottles; moderate medium platy structure parting to moderate fine subangular blocky; friable; few faint dark brown (7.5YR 4/4) clay films on ped faces; very strongly acid; clear smooth boundary.

2Bt1—12 to 20 inches; brown (7.5YR 5/4) clay (48 percent clay); many fine prominent red (2.5YR 4/6

Figure 18.—Profile of a Keswick loam.

and 4/8) mottles; common fine distinct brown (10YR 5/3) mottles; moderate fine and very fine subangular blocky structure; very firm; common faint dark brown (7.5YR 4/4) clay films on ped faces; few pebbles greater than 2 mm; very strongly acid; clear smooth boundary.

2Bt2—20 to 31 inches; strong brown (7.5YR 5/6) clay (47 percent clay); common fine prominent yellowish red (5YR 5/8) mottles; many fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to weak medium prismatic structure parting to weak medium subangular blocky; very firm; common faint brown (10YR 5/3) clay films on ped faces; few fine rounded soft dark concretions (iron and manganese); few pebbles greater than 2 mm; very strongly acid; clear smooth boundary.

2Bt3—31 to 41 inches; strong brown (7.5YR 5/6) clay loam (35 percent clay); few fine prominent yellowish red (5YR 5/8) and common fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to weak fine subangular blocky; very firm; common faint brown (10YR 5/3) clay films on ped faces; few fine rounded dark concretions (iron and manganese); few pebbles greater than 2 mm; strongly acid; clear smooth boundary.

2Bt4—41 to 48 inches; strong brown (7.5YR 5/6) clay loam (37 percent clay); common fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; common distinct dark brown (7.5YR 4/4) clay films on ped faces; common fine rounded dark concretions (iron and manganese); few pebbles greater than 2 mm; neutral; clear smooth boundary.

2BC—48 to 60 inches; yellowish brown (10YR 5/4 and 5/6) clay loam (31 percent clay); common fine distinct grayish brown (10YR 5/2) mottles; common medium distinct strong brown (7.5YR 5/6) mottles; few fine prominent reddish brown (2.5YR 4/4) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; extremely firm; common distinct dark brown (7.5YR 4/4) clay films on ped faces; brown (10YR 5/3) silt coats on ped faces; common soft white (10YR 8/2) accumulations (calcium carbonate); few fine rounded dark concretions (iron and manganese); few pebbles greater than 2 mm; slight effervescence; mildly alkaline.

Solum thickness and depth to carbonates range from 42 to 75 inches.

The A or Ap horizon has value of 3 or 4 and chroma of 1 or 2. The E horizon has value of 4 or 5 and chroma of 2 to 4. The 2Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The BC horizon has value of 4 or 5.

Klum Series

The Klum series consists of moderately well drained, moderately rapidly permeable soils on flood plains. These soils formed in stratified, silty and loamy alluvium. Native vegetation is prairie grasses and scattered deciduous trees. Slopes range from 0 to 3 percent.

Typical pedon of Klum fine sandy loam, 0 to 3 percent slopes, 740 feet south and 440 feet east of the center of sec. 28, T. 68 N., R. 26 W., in hayland:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; common very fine roots; medium acid; abrupt smooth boundary.

C1—10 to 22 inches; stratified very dark grayish brown (10YR 3/2) and brown (10YR 4/3) loam and silt loam, pale brown (10YR 6/3) dry; massive with horizontal cleavage planes; friable; few very fine roots; slightly acid; abrupt wavy boundary.

C2—22 to 35 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; single grain; loose; few very fine roots; neutral; abrupt wavy boundary.

C3—35 to 44 inches; stratified dark brown (10YR 3/3) and brown (10YR 4/3) silt loam and loam; pale brown (10YR 6/3) dry; common fine faint dark yellowish brown (10YR 4/4) mottles; massive with horizontal cleavage planes; friable; few very fine roots; neutral; abrupt wavy boundary.

C4—44 to 60 inches; stratified dark brown (10YR 3/3) and brown (10YR 4/3) silt loam and loam, pale brown (10YR 6/3) dry; common fine faint dark yellowish brown (10YR 4/4) mottles; massive with horizontal cleavage planes; friable; few very fine roots; neutral.

The solum and the A horizon both range from 6 to 10 inches thick.

The A horizon has value of 2 or 3 and chroma of 2 or 3. The C horizon is stratified, and has hue of 7.5YR, 10YR, or 2.5Y but typically is 10YR. It has value of 3 to 5 and chroma of 2 or more. It is fine sandy loam, sandy loam, silt loam, loam, or loamy fine sand.

Kniffin Series

The Kniffin series consists of somewhat poorly drained, very slowly permeable soils on uplands. These soils formed in loess. Native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

These soils are taxadjuncts to the Kniffin series because they do not have chroma of 3 in the upper part of the B horizon.

Typical pedon of Kniffin silt loam, 2 to 5 percent slopes, 66 feet west and 1,780 feet north of the southeast corner of sec. 36, T. 68 N., R. 25 W., in a cultivated field:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; mixed with some streaks and pockets of dark grayish brown (10YR 4/2) subsurface material; moderate fine granular structure; very friable; common very fine roots; mildly alkaline; abrupt smooth boundary.

E—7 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, grayish brown (10YR 5/2) dry; many prominent very dark gray (10YR 3/1) organic coatings on faces of peds; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium platy structure parting to moderate fine and very fine subangular blocky; friable; light gray (10YR 7/2) silt coatings on faces of peds; common very fine roots; medium acid; clear smooth boundary.

BE—10 to 13 inches; dark grayish brown (10YR 4/2) silty clay (44 percent clay), light brownish gray (10YR 6/2) dry; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium platy structure parting to moderate fine subangular blocky; friable; few distinct very dark gray (10YR 3/1) clay films and light gray (10YR 7/2) silt coatings on faces of peds; common very fine roots; medium acid; clear smooth boundary.

Bt1—13 to 19 inches; dark grayish brown (2.5Y 4/2) silty clay (51 percent clay); few distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine and very fine subangular blocky structure; firm; common prominent dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt2—19 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay (49 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; many fine prominent yellowish brown (10YR 5/4 and 5/6) mottles; moderate fine subangular blocky structure; firm; common prominent dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt3—23 to 33 inches; grayish brown (2.5Y 5/2) silty clay (47 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; many fine prominent yellowish brown (10YR 5/4 and 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few fine dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt4—33 to 40 inches; grayish brown (2.5Y 5/2) silty clay (41 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Bt5—40 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam (39 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral; clear smooth boundary.

Bt6—48 to 55 inches; grayish brown (2.5Y 5/2) silty clay loam (37 percent clay); few distinct very dark gray (10YR 3/1) organic coats in pores and root channels; many medium prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; friable; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral; gradual smooth boundary.

BC—55 to 60 inches; light brownish gray (10YR 6/2) silty clay loam (37 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; many medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; friable; few distinct grayish brown (2.5Y 5/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral.

The solum is typically more than 60 inches in thickness.

The A or Ap horizon has chroma of 1 or 2. It is silt loam or silty clay loam. The E horizon has value of 4 or 5. It is silt loam or silty clay loam. In the upper part the Bt horizon has hue of 10YR or 2.5Y. The clay maximum in the Bt horizon is between 48 and 56 percent.

Lamoni Series

The Lamoni series consists of somewhat poorly drained, slowly permeable soils on uplands. These soils formed in a paleosol that developed in glacial till. Native vegetation is prairie grasses. Slopes range from 5 to 14 percent.

These soils are taxadjuncts to the Lamoni series because they do not have a mollic epipedon.

Typical pedon of Lamoni clay loam, 9 to 14 percent slopes, moderately eroded, 1,074 feet south and 580 feet east of the northwest corner of sec. 30, T. 70 N., R. 25 W., in a bluegrass pasture:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) clay loam (36 percent clay), dark grayish brown (10YR 4/2) dry; mixed with streaks and pockets of olive brown (2.5Y 4/4) subsoil material; weak medium subangular blocky structure parting to moderate fine granular; friable; grayish brown (10YR 5/2) silt coatings on faces of peds; common very fine roots; neutral; abrupt smooth boundary.

2Bt1—8 to 12 inches; olive brown (2.5Y 4/4) clay (40 percent clay); common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds and in pores and root channels; common fine prominent yellowish brown (10YR 5/6) mottles and few fine prominent strong brown (7.5YR 4/6) mottles; moderate fine and very fine subangular blocky structure; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common very fine roots; few pebbles; strongly acid; clear smooth boundary.

2Bt2—12 to 15 inches; olive brown (2.5Y 4/4) clay (45 percent clay); common distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common medium distinct grayish brown (2.5Y 5/2) mottles; few fine prominent strong brown (7.5YR 4/6) mottles and common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine and very fine subangular blocky structure; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few pebbles; medium acid; clear smooth boundary.

2Bt3—15 to 19 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6), clay (43 percent clay), olive brown (2.5Y 4/4) kneaded; few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; weak medium prismatic structure parting to moderate fine angular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few pebbles; medium acid; clear smooth boundary.

2Bt4—19 to 25 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) clay (41 percent clay); common prominent very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; moderate medium prismatic structure parting to moderate medium and fine angular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few pebbles; medium acid; clear smooth boundary.

2Bt5—25 to 31 inches; grayish brown (2.5Y 5/2) clay loam (35 percent clay); many fine prominent strong brown (7.5YR 5/6) mottles; medium prismatic structure parting to moderate medium angular

blocky; very firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; common distinct rounded dark concretions (iron and manganese oxides); few pebbles; medium acid; gradual smooth boundary.

2Bt6—31 to 42 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) clay loam (31 percent clay); moderate medium prismatic structure; very firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; very few very fine roots; common medium rounded dark concretions (iron and manganese oxides); few pebbles; slightly acid; gradual smooth boundary.

BC—42 to 60 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/6) clay loam; moderate coarse prismatic structure; very firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; white (10YR 8/1) silt coatings on faces of prisms; very few very fine roots; common medium rounded dark concretions (iron and manganese oxides); common medium irregular white (10YR 8/2) soft accumulations (calcium carbonates); few pebbles; violent effervescence; mildly alkaline.

The solum typically ranges from 48 to 72 inches in thickness. Depth to carbonates is generally more than 48 inches. Color and texture of the 2Bt horizon are variable, and are related principally to the rest of a truncated paleosol.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is typically clay loam, but the range includes loam, silt loam, silty clay loam, and clay. The 2Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 6. The part of the 2Bt horizon of clay texture is typically 6 to 24 inches thick, and the finest part contains between 40 and 50 percent clay. In the upper part the solum contains between 15 and 30 percent sand. Some pedons have a C horizon that is 30 to 45 percent sand.

Lawson Series

The Lawson series consists of somewhat poorly drained, moderately permeable soils on bottom lands. These soils formed in silty alluvium. Native vegetation is scattered trees, tall grasses, and forbs. Slopes range from 0 to 3 percent.

Typical pedon of Lawson silt loam, 0 to 2 percent slopes, 2,430 feet west and 190 feet north of the southeast corner of sec. 26, T. 68 N., R. 26 W., in a cultivated field:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to moderate very fine granular; friable; slightly acid; clear smooth boundary.

A—10 to 27 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; neutral; clear smooth boundary.

AC—27 to 48 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; friable; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; brown (10YR 5/3) silt coats; neutral; diffuse wavy boundary.

C—48 to 60 inches; stratified dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; massive, but has weak bedding planes; friable; brown (10YR 5/3) silt coats; neutral.

The solum and the A horizon both range from 24 to 48 inches in thickness.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The C horizon has value of 3 to 6 and chroma of 1 to 3.

Lindley Series

The Lindley series consists of well drained, moderately slowly permeable soils on convex ridgetops and side slopes on uplands. These soils formed in glacial till. Native vegetation is deciduous trees. Slopes range from 9 to 40 percent.

These soils are a taxadjunct to the Lindley series because they contain more clay in the control section than is defined for the series.

Typical pedon of Lindley loam, 18 to 40 percent slopes, 1,400 feet south and 850 feet west of the center of sec. 17, T. 67 N., R. 25 W., in deciduous trees:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam (18 percent clay), gray (10YR 5/1) dry; weak medium subangular blocky structure parting to moderate very fine granular; friable; very strongly acid; abrupt smooth boundary.

E—3 to 6 inches; dark brown (10YR 4/3) loam (19 percent clay), light brownish gray (10YR 6/2) dry; very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium platy structure parting to moderate fine and very fine subangular blocky; friable; very strongly acid; abrupt smooth boundary.

BE—6 to 11 inches; yellowish brown (10YR 5/4 and 5/6) clay loam (28 percent clay); moderate fine and very fine subangular blocky structure; firm; very strongly acid; clear smooth boundary.

Bt1—11 to 15 inches; yellowish brown (10YR 5/6) clay loam (39 percent clay); weak medium prismatic structure parting to weak fine subangular blocky; firm; very strongly acid; clear smooth boundary.

Bt2—15 to 23 inches; yellowish brown (10YR 5/6) clay loam (39 percent clay); moderate medium prismatic structure parting to moderate very fine subangular

blocky; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—23 to 30 inches; yellowish brown (10YR 5/6) clay loam (37 percent clay); few fine distinct strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; common faint yellowish brown (10YR 5/4) clay films on faces of peds; common fine roots; few dark manganese oxide concretions; medium acid; clear smooth boundary.

BC—30 to 39 inches; yellowish brown (10YR 5/6) clay loam (32 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to strong very fine subangular blocky; very firm; common faint brown (10YR 4/3) clay films on faces of peds; few fine roots; few dark manganese oxide concretions; common fine soft accumulations (calcium carbonate); mildly alkaline; clear smooth boundary.

'C1—39 to 52 inches; yellowish brown (10YR 5/6) clay loam (30 percent clay); few fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to strong medium subangular blocky; very firm; brown (10YR 5/3) sheen on faces of peds; few fine roots; few dark manganese oxide concretions; common fine soft accumulations (calcium carbonate); mildly alkaline; clear smooth boundary.

C2—52 to 60 inches; yellowish brown (10YR 5/6) clay loam (30 percent clay); many fine distinct grayish brown (2.5Y 5/2 and 10YR 5/2) mottles; strong medium prismatic structure parting to strong coarse subangular blocky; very firm; brown (10YR 5/3) sheen on faces of peds; few fine roots; few dark manganese oxide concretions; common fine and medium soft accumulations (calcium carbonate); mildly alkaline.

The solum ranges from 30 to 50 inches in thickness. The A or Ap horizon is 1 to 5 inches thick. The E horizon is 0 to 10 inches thick.

The A horizon has value of 3 or 4 and chroma of 1 or 2. The Ap has a value of 4 or 5 and chroma of 2 to 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. Its texture is typically clay loam, but also includes loam. The C horizon has chroma of 4 to 6.

Lineville Series

The Lineville series consists of moderately well drained, slowly permeable soils on convex ridgetops and nose slopes. These soils formed in a thin mantle of loess or sediments over a paleosol that formed in glacial till. Native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 5 to 9 percent.

Typical pedon of Lineville silt loam, 5 to 9 percent slopes, 700 feet east and 2,225 feet south of the center of sec. 14, T. 68 N., R. 27 W., in pasture:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam (26 percent clay), grayish brown (10YR 5/2) dry; mixed with streaks and pockets of brown (10YR 4/3) subsurface material; weak fine granular structure; friable; neutral; abrupt smooth boundary.

BE—7 to 10 inches; brown (10YR 4/3) silty clay loam (35 percent clay), light yellowish brown (10YR 6/4) dry; weak thin platy structure parting to moderate fine granular; friable; few distinct dark grayish brown (10YR 4/2) clay films lining pores; slightly acid; clear smooth boundary.

Bt1—10 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam (36 percent clay), light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; friable; few distinct brown (10YR 4/3) clay films on faces of peds; common distinct grayish brown (10YR 5/2) silt coats on faces of peds; medium acid; clear smooth boundary.

Bt2—14 to 20 inches; brown (10YR 5/3) silty clay loam (33 percent clay); moderate medium and coarse subangular blocky structure; friable; few distinct brown (10YR 4/3) clay films on faces of peds; common distinct very dark grayish brown (10YR 3/2) organic clay films lining pores; common distinct grayish brown (10YR 5/2) silt coats on faces of peds; few fine black manganese accumulations; medium acid; clear smooth boundary.

2Bt3—20 to 25 inches; brown (10YR 5/3) loam (23 percent clay); common fine faint yellowish brown (10YR 5/4) mottles; moderate thick platy structure; friable; common distinct brown (10YR 4/3) clay films on faces of peds; common distinct very dark gray (10YR 3/1) clay films lining pores; many distinct grayish brown (10YR 5/2) silt coats on faces of peds; common fine black manganese accumulations; medium acid; clear smooth boundary.

2Bt4—25 to 31 inches; brown (10YR 5/3) loam (22 percent clay); moderate thick platy structure; friable; few distinct brown (10YR 4/3) clay films on faces of peds; few distinct very dark gray (10YR 3/1) clay films lining pores; many distinct grayish brown (10YR 5/2) silt coats on faces of peds; few fine black manganese accumulations; slightly acid; gradual smooth boundary.

2Bt5—31 to 38 inches; yellowish brown (10YR 5/4) clay loam (27 percent clay); common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; friable; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; many distinct grayish brown (10YR 5/2) silt coats on faces

of peds; few fine black manganese accumulations; slightly acid; abrupt wavy boundary.

3Bt6—38 to 44 inches; yellowish brown (10YR 5/4) clay (40 percent clay); common prominent very dark grayish brown (10YR 3/2) organic coats in root channels; common fine distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate fine angular blocky; very firm; common distinct dark brown (10YR 3/3) clay films on faces of peds; common distinct grayish brown (10YR 5/2) silt coats on faces of peds; few pebbles; slightly acid; clear smooth boundary.

3Bt7—44 to 54 inches; yellowish brown (10YR 5/4) clay (45 percent clay); many fine distinct strong brown (7.5YR 5/6) mottles; strong medium prismatic structure parting to strong medium angular blocky; firm; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; many pebbles; neutral; clear smooth boundary.

3Bt8—54 to 60 inches; yellowish brown (10YR 5/4) clay (44 percent clay); common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to strong medium angular blocky; firm; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common pebbles; neutral.

The solum ranges from about 60 to 72 inches. The Ap horizon ranges from 6 to 10 inches thick.

The Ap horizon has color value of 2 or 3. Some pedons have an E horizon that has value of 4 or 5. The 2Bt horizon has value of 4 or 5 and chroma of 2 to 4. Its texture is loam or clay loam. The 3Bt horizon has hue of 10YR, 5YR, or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is clay loam or clay.

Mystic Series

The Mystic series consists of somewhat poorly drained, slowly permeable soils on high stream benches. These soils formed in Late Sangamon paleosols derived from alluvial sediments. Native vegetation is mixed prairie and deciduous trees. Slopes range from 5 to 14 percent.

Typical pedon of Mystic clay loam, 9 to 14 percent slopes, moderately eroded, 120 feet east and 425 feet south of the northwest corner of sec. 10, T. 67 N., R. 26 W., in hayland:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) clay loam, dark brown (10YR 4/3) dry; mixed with streaks and pockets of brown (7.5YR 4/4) subsoil material; few fine prominent yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure parting to weak fine granular; friable; slightly acid; abrupt smooth boundary.

Bt1—8 to 18 inches; grayish brown (10YR 5/2) clay; common fine prominent red (2.5YR 5/8) and yellowish red (5YR 4/6) mottles; strong fine subangular blocky structure; firm; common distinct brown (10YR 4/3) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—18 to 28 inches; grayish brown (10YR 5/2) clay loam; common fine prominent strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; firm; common distinct brown (10YR 4/3) clay films on faces of peds; medium acid; gradual smooth boundary.

Bt3—28 to 40 inches; brown (7.5YR 5/4) clay loam; common medium distinct grayish brown (10YR 5/2) and common fine distinct strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common medium irregular black (N 2/0) manganese accumulations; medium acid; clear wavy boundary.

Bt4—40 to 60 inches; brown (7.5YR 5/4) clay loam; few prominent black (N 2/0) organic coats in root channels; common medium distinct grayish brown (10YR 5/2) and common fine faint strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine irregular black (N 2/0) manganese accumulations; medium acid.

The solum commonly ranges from 48 to 72 inches in thickness. The Ap horizon is 6 to 10 inches thick.

The Ap horizon has value of 3 and chroma of 1 or 2. It is dominantly clay loam or silt loam, but ranges to loam. Some pedons have an E horizon that has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is silt loam or loam. The Bt horizon typically has hue of 2.5YR to 2.5Y, value of 3 to 5, and chroma 2 to 4.

Nevin Series

The Nevin series consists of somewhat poorly drained, moderately permeable soils. These soils formed in silty alluvium on bottom lands. Native vegetation is tall prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Nevin silty clay loam, 0 to 2 percent slopes, 576 feet west and 2,500 feet north of the southeast corner of sec. 11, T. 67 N., R. 26 W., in a cultivated field:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam; moderate fine and very fine subangular blocky structure; friable; common very fine roots; neutral; abrupt smooth boundary.

A1—8 to 12 inches; very dark gray (10YR 3/1) silty clay loam; strong fine and very fine subangular blocky

structure; friable; common very fine roots; neutral; clear smooth boundary.

A2—12 to 18 inches; very dark grayish brown (10YR 3/2) silty clay loam; many prominent very dark gray (10YR 3/1) organic coatings on faces of peds; moderate fine and very fine subangular blocky structure; friable; few very fine roots; neutral; clear smooth boundary.

BA—18 to 23 inches; very dark grayish brown (10YR 3/2) silty clay loam; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; few fine faint dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) mottles; weak medium prismatic structure parting to moderate fine and very fine subangular blocky; friable; few very fine roots; medium acid; clear smooth boundary.

Bt1—23 to 29 inches; dark grayish brown (10YR 4/2) silty clay loam; few distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine faint dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt2—29 to 38 inches; dark grayish brown (10YR 4/2) silty clay loam; few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine distinct dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to weak medium subangular blocky; firm; few faint dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid; gradual smooth boundary.

Bt3—38 to 48 inches; dark grayish brown (2.5Y 4/2) silty clay loam; very few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine faint grayish brown (2.5Y 5/2) and common fine prominent strong brown (7.5YR 4/6 and 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; firm; few distinct dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

BC—48 to 60 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine faint grayish brown (2.5Y 5/2) and common fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure; firm; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid.

The solum typically is more than 40 inches in thickness, and ranges from 36 to 60 inches or more. Carbonates are lacking to a depth of 60 inches or more. The solum contains 5 to 15 percent sand.

The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or silty clay loam.

The Bt horizon has value of 4 or 5 and chroma of 2 to 4.

Nodaway Series

The Nodaway series consists of moderately well drained, moderately permeable soils. These soils formed in alluvium on flood plains. Native vegetation is scattered trees, tall prairie grasses, and forbs. Slopes range from 0 to 2 percent.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, 20 feet east and 660 feet south of the northwest corner of sec. 8, T. 70 N., R. 27 W., in a cultivated field:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam (22 percent clay); weak medium and thick platy structure parting to moderate fine subangular blocky; friable; common very fine roots; neutral; abrupt smooth boundary.

C1—8 to 20 inches; stratified very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam (22 percent clay); common distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine faint dark yellowish brown (10YR 4/4) mottles; massive but tending to be thick and very thick platy because of stratification; friable; light brownish gray (10YR 6/2) silt coatings on faces of peds; common very fine roots; neutral; abrupt smooth boundary.

C2—20 to 37 inches; stratified dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam (24 percent clay); common distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; few fine faint dark yellowish brown (10YR 4/4) mottles; massive but tending to be thick and very thick platy because of stratification; friable; pale brown (10YR 6/3) silt coatings on faces of peds; few very fine roots; neutral; gradual smooth boundary.

C3—37 to 60 inches; stratified very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam (23 percent clay); common distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; few fine faint dark yellowish brown (10YR 4/4) mottles; massive but tending to be thick and very thick platy because of stratification; friable; pale brown (10YR 6/3) silt coatings on faces of peds; few very fine roots; neutral.

The Ap horizon has chroma of 1 or 2. Matrix colors in the underlying C horizon have value of 3 or 4 and

chroma of 1 or 2. The mollic colors are within the range if in a sequence of stratified sediments. In some pedons strata have hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

Olmitz Series

The Olmitz series consists of moderately well drained, moderately permeable soils on foot slopes or alluvial fans. These soils formed in loamy, local alluvium. Native vegetation is tall prairie grasses. Slopes range from 2 to 9 percent.

Typical pedon of Olmitz loam, 5 to 9 percent slopes, 700 feet south and 1,250 feet west of the northeast corner of sec. 12, T. 68 N., R. 24 W., in a hayfield:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam (23 percent clay), dark grayish brown (10YR 4/2) dry; moderate medium and fine subangular blocky structure; friable; few fine and common very fine roots; neutral; abrupt smooth boundary.

A1—7 to 16 inches; very dark grayish brown (10YR 3/2) loam (23 percent clay), dark grayish brown (10YR 4/2) dry; common distinct very dark gray (10YR 3/1) coatings on faces of peds; weak medium and fine subangular blocky; friable; common very fine roots; neutral; abrupt smooth boundary.

A2—16 to 24 inches; black (10YR 2/1) clay loam (28 percent clay), very dark grayish brown (10YR 3/2) dry; common fine distinct dark yellowish brown (10YR 3/4) mottles; strong medium subangular blocky structure parting to moderate fine and medium angular blocky; friable; few very fine roots; neutral; clear smooth boundary.

A3—24 to 28 inches; black (10YR 2/1) clay loam (27 percent clay); common fine faint dark brown (10YR 3/3) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; neutral; clear smooth boundary.

A4—28 to 34 inches; dark brown (10YR 3/3) clay loam (28 percent clay); many prominent black (10YR 2/1) coatings on faces of peds; common fine faint dark yellowish brown (10YR 4/4) and few fine prominent strong brown (7.5YR 4/6) mottles; weak medium prismatic structure parting to moderate medium and fine subangular blocky; firm; few very fine roots; neutral; clear smooth boundary.

Bw1—34 to 43 inches; brown (10YR 4/3) clay loam (30 percent clay); many prominent very dark gray (10YR 3/1) coatings on faces of peds; common fine distinct dark yellowish brown (10YR 4/6) and prominent strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; neutral; clear smooth boundary.

Bw2—43 to 50 inches; brown (10YR 4/3) clay loam (31 percent clay); many prominent very dark gray (10YR 3/1) clay films on faces of peds; common fine distinct dark yellowish brown (10YR 4/6) and common fine prominent strong brown (7.5YR 4/6) mottles; moderate medium prismatic structure; firm; few very fine roots; neutral; clear smooth boundary.

BC—50 to 60 inches; brown (10YR 4/3) clay loam (32 percent clay); common prominent very dark gray (10YR 3/1) clay films on faces of peds; common fine prominent strong brown (7.5YR 4/6) and moderate medium distinct dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure; firm; few very fine roots; neutral.

The solum ranges from 36 to 65 inches in thickness. The solum has no stones. Carbonates typically are leached to a depth of 72 inches or more.

The B horizon has a clay maximum ranging from 28 to 34 percent.

Pershing Series

The Pershing series consists of somewhat poorly drained, slowly permeable soils on upland ridgetops and stream benches. These soils formed in loess. Native vegetation is mixed prairie grasses and deciduous trees. Slopes range from 2 to 9 percent.

Typical pedon of Pershing silt loam, 5 to 9 percent slopes, 315 feet south and 2,100 feet west of the northeast corner of sec. 10, T. 70 N., R. 27 W., in a wooded pasture:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam (21 percent clay); mixed with some streaks and pockets of brown (10YR 4/3) subsurface material; moderate fine and very fine subangular blocky structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.

E—7 to 10 inches; brown (10YR 4/3) silty clay loam (32 percent clay), brown (10YR 5/3) dry; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds and in pores and root channels; moderate thick platy structure parting to moderate fine subangular blocky; friable; pale brown (10YR 6/3) silt coatings on faces of peds; common very fine roots; medium acid; clear smooth boundary.

BE—10 to 13 inches; brown (10YR 5/3) silty clay loam (36 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; weak thick platy structure parting to strong fine and very fine subangular blocky; friable; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt1—13 to 16 inches; brown (10YR 5/3) silty clay loam (35 percent clay); few distinct very dark grayish

brown (10YR 3/2) coatings in pores and root channels; few fine distinct yellowish brown (10YR 5/6) mottles; strong fine subangular blocky structure; friable; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt2—16 to 20 inches; brown (10YR 5/3) silty clay (42 percent clay); few distinct very dark grayish brown (10YR 3/2) coatings in pores and root channels; few fine faint yellowish brown (10YR 5/4) and common fine distinct yellowish brown (10YR 5/6) mottles; strong medium prismatic structure parting to strong fine and very fine subangular blocky; firm; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt3—20 to 25 inches; grayish brown (2.5Y 5/2) silty clay (42 percent clay); very few distinct very dark grayish brown (10YR 3/2) coatings in pores and root channels; few fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt4—25 to 32 inches; grayish brown (2.5Y 5/2) silty clay loam (39 percent clay); very few distinct very dark grayish brown (10YR 3/2) coatings in pores and root channels; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt5—32 to 38 inches; grayish brown (2.5Y 5/2) silty clay loam (35 percent clay); very few distinct very dark gray (10YR 3/1) coatings in pores and root channels; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt6—38 to 52 inches; grayish brown (2.5Y 5/2) silty clay loam (32 percent clay); few distinct very dark gray (10YR 3/1) coatings in pores and root channels; common fine and medium prominent strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure; firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds and in pores and root channels; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear wavy boundary.

2Bt7—52 to 60 inches; grayish brown (2.5Y 5/2) silt loam (24 percent clay); very few distinct very dark gray (10YR 3/1) coatings in pores and root channels; common fine prominent strong brown (7.5YR 5/6) mottles; strong medium platy structure; friable; many prominent dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); medium acid.

The solum typically is 72 inches or more in thickness, but ranges from 48 to 96 inches.

The A or Ap horizon has chroma of 1 or 2. It is silt loam or silty clay loam. The E horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. In the upper part the Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 8. It is silty clay or silty clay loam. In the lower part it has hue 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 6.

Rathbun Series

The Rathbun series consists of somewhat poorly drained, very slowly permeable soils. These soils formed in loess on convex ridgetops. Native vegetation is deciduous trees. Slopes range from 5 to 9 percent.

Typical pedon of Rathbun silt loam, 5 to 9 percent slopes, 570 feet east and 1,820 feet south of the northwest corner of sec. 5, T. 67 N., R. 24 W., in pasture:

A—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium platy structure parting to moderate fine subangular; friable; common very fine roots; neutral; abrupt smooth boundary.

E—4 to 7 inches; yellowish brown (10YR 5/4) silty clay loam, pale brown (10YR 6/3) dry; moderate fine platy structure parting to moderate fine subangular blocky; friable; light gray (10YR 7/2) silt coatings on faces of peds; common very fine roots; few dark reddish brown concretions (iron and manganese oxides); medium acid; abrupt smooth boundary.

BE—7 to 10 inches; yellowish brown (10YR 5/4) silty clay, pale brown (10YR 6/3) dry; common fine distinct dark grayish brown (10YR 4/2) and common fine distinct strong brown (7.5YR 5/6) mottles; weak medium platy structure parting to moderate fine subangular blocky; firm; few very fine roots; few dark concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt1—10 to 17 inches; yellowish brown (10YR 5/4) silty clay; light yellowish brown (10YR 6/4) dry; common fine faint dark grayish brown (10YR 4/2) mottles; weak coarse prismatic structure parting to moderate

fine subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt2—17 to 25 inches; dark grayish brown (10YR 4/2) silty clay; few fine distinct dark brown (7.5YR 4/4) mottles; moderate fine prismatic structure parting to moderate fine angular blocky; firm; dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.

Bt3—25 to 35 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent dark brown (7.5YR 4/4) mottles; moderate coarse prismatic structure parting to moderate fine angular blocky; very firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Bt4—35 to 44 inches; olive gray (5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 4/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.

Bt5—44 to 58 inches; olive gray (5Y 5/2) silty clay loam; common medium faint strong brown (7.5YR 4/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; very dark grayish brown (10YR 3/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral; clear wavy boundary.

2Bt6—58 to 60 inches; dark grayish brown (10YR 4/2) silt loam; common medium distinct dark yellowish brown (10YR 4/4) mottles; strong medium platy structure parting to moderate fine angular blocky; friable; few very fine roots; few dark concretions (iron and manganese oxides); neutral.

The solum typically exceeds 60 inches in thickness. The A horizon has value of 3 or 4 and chroma of 1 or 2. The Ap horizon has value of 4 or 5 and chroma of 1 to 3. It is silt loam or silty clay loam. The E horizon has chroma of 2 to 4. In some eroded areas it is incorporated into the Ap horizon. In the upper part the Bt horizon has hue of 10YR or 2.5Y. In the lower part it has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 2 or 3.

Rinda Series

The Rinda series consists of poorly drained, very slowly permeable soils. These soils are on short, convex side slopes and on head slopes in coves at the upper end of drainageways in the uplands. They formed mainly in exhumed, gray clayey paleosols weathered from glacial till. Native vegetation is mixed trees and prairie grasses. Slopes range from 5 to 14 percent.

Typical pedon of Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded, 510 feet west and 400 feet north of the southeast corner of sec. 24, T. 67 N., R. 27 W., in a cultivated field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay loam (29 percent clay), grayish brown (10YR 5/2) dry; mixed with some streaks and pockets of dark grayish brown (10YR 4/2) subsoil material; moderate fine subangular blocky structure parting to moderate fine granular; friable; slightly acid; abrupt smooth boundary.

BE—6 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam (33 percent clay), light brownish gray (10YR 6/2) dry, very dark grayish brown (10YR 3/2) kneaded; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure parting to moderate very fine subangular blocky; friable; many distinct very dark gray (10YR 3/1) organic coatings on ped faces and in root channels; medium acid; clear smooth boundary.

Bt1—9 to 13 inches; dark grayish brown (2.5Y 4/2) silty clay loam (34 percent clay); common distinct very dark gray (10YR 3/1) organic coats in root channels; few fine prominent yellowish red (5YR 4/6) mottles and common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium and fine subangular blocky structure; friable; common distinct dark gray (N 4/0) clay films on ped faces; medium acid; clear smooth boundary.

Bt2—13 to 16 inches; dark grayish brown (2.5Y 4/2) silty clay loam (37 percent clay); common distinct very dark gray (10YR 3/1) organic coats in root channels; few fine prominent yellowish red (5YR 4/6) mottles and common fine prominent yellowish brown (10YR 5/6) mottles; many fine prominent strong brown (7.5YR 4/6) mottles; moderate medium and fine subangular blocky structure; firm; many distinct dark gray (N 4/0) clay films on ped faces; strongly acid; clear smooth boundary.

2Bt3—16 to 20 inches; mottled dark gray (5Y 4/1) and strong brown (7.5YR 5/6) silty clay (51 percent clay); moderate medium prismatic structure; very firm; many prominent dark gray (N 4/0) clay films on ped faces; many distinct very dark gray (N 3/0) clay films in root channels; strongly acid; clear smooth boundary.

2Bt4—20 to 23 inches; mottled dark gray (5Y 4/1), strong brown (7.5YR 5/6), and yellowish brown (10YR 5/4) silty clay (49 percent clay); moderate medium prismatic structure; very firm; many distinct dark gray (N 4/0) clay films on ped faces; common

distinct very dark gray (N 3/0) clay films in root channels; strongly acid; abrupt smooth boundary.
2Bt5—23 to 30 inches; dark gray (5Y 4/1) silty clay (57 percent clay); common fine prominent strong brown (7.5YR 5/8 and 4/6) mottles; moderate coarse prismatic structure; very firm; common prominent very dark gray (10YR 3/1) clay films on ped faces; strongly acid; gradual smooth boundary.
2Bt6—30 to 41 inches; dark gray (5Y 4/1) silty clay (54 percent clay); common fine prominent strong brown (7.5YR 4.6) mottles; weak coarse prismatic structure; very firm; few faint very dark gray (10YR 3/1) clay films on ped faces; common fine irregular strong brown (7.5YR 4/6) iron accumulations; strongly acid; gradual smooth boundary.
2Bt7—41 to 60 inches; dark gray (5Y 4/1) silty clay (53 percent clay); weak coarse prismatic structure; extremely firm; common fine irregular strong brown (7.5YR 4/6) iron accumulations; strongly acid.

The solum ranges from 48 to more than 60 inches in thickness. The A or Ap horizon has chroma of 1 or 2. The A or Ap horizon has dark colors, and is 6 to 10 inches thick. Some pedons have an E horizon that is silt loam or silty clay loam, and that has value of 4 or 5. The 2Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2. Its texture is silty clay or clay.

Seymour Series

The Seymour series consists of somewhat poorly drained, very slowly permeable soils on upland ridgetops. These soils formed in loess. Native vegetation is tall prairie grasses. Slopes range from 2 to 9 percent.

Typical pedon of Seymour silty clay loam, 2 to 5 percent slopes, 150 feet west and 1,100 feet north of center of sec. 11, T. 68 N., R. 25 W., in a grass pasture:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam (27 percent clay); moderate fine granular structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.
A—8 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam (30 percent clay); many distinct very dark gray (10YR 3/1) organic coatings on faces of peds; few fine faint brown (10YR 4/3) mottles; weak fine subangular blocky structure parting to moderate fine and very fine granular; friable; few very fine roots; medium acid; clear smooth boundary.
Bt1—12 to 17 inches; dark grayish brown (10YR 4/2) silty clay (47 percent clay); very dark grayish brown (10YR 3/2) organic coatings on faces of peds; common fine faint brown (10YR 4/3) mottles; moderate fine subangular blocky structure; firm; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); strongly acid; clear smooth boundary.
Bt2—17 to 20 inches; dark grayish brown (10YR 4/2) silty clay (52 percent clay); very dark gray (10YR 3/1) organic coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; common prominent dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.
Bt3—20 to 23 inches; dark grayish brown (2.5Y 4/2) silty clay (50 percent clay); very dark gray (10YR 3/1) organic coatings in pores and root channels; common fine prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm; common prominent dark gray (10YR 4/1) clay films on faces of peds; few very fine roots; few fine rounded dark concretions (iron and manganese oxides); slightly acid; clear smooth boundary.
Bt4—23 to 30 inches; grayish brown (2.5Y 5/2) silty clay (47 percent clay); very dark gray (10YR 3/1) organic coatings on pores and root channels; few fine distinct yellowish brown (10YR 5/6) mottles; common fine faint olive brown (2.5Y 4/4) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; dark grayish brown (10YR 4/2) clay films on faces of peds; common fine rounded dark concretions (iron and manganese oxides); neutral; clear smooth boundary.
Bt5—30 to 35 inches; grayish brown (2.5Y 5/2) silty clay (42 percent clay); many fine faint olive brown (2.5Y 4/4) mottles and few fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common fine rounded dark concretions (iron and manganese oxides); neutral; clear smooth boundary.
Bt6—35 to 42 inches; grayish brown (2.5Y 5/2) silty clay loam (38 percent clay); common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; very firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; common medium rounded dark concretions (iron and manganese oxides); neutral; clear smooth boundary.
BC—42 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam (36 percent clay); very dark gray (10YR 3/1) organic coatings in pores and root channels; common medium prominent strong brown (7.5YR 5/6 and 5/8) mottles; strong medium prismatic structure; very firm; silt coatings, light gray (10YR 7/2) dry; neutral.

The solum commonly is 60 inches or more in thickness, and generally the loess does not have

carbonates throughout. These soils are underlain by paleosols at a depth of 48 to 96 inches.

The A or Ap horizon has value of 2 or 3. It is silt loam or silty clay loam. The matrix of the upper part of the Bt horizon has hue of 10YR or 2.5Y and value of 4 or 5. Maximum clay content of the Bt horizon in the upper part ranges from 48 to 55 percent. The Bt horizon in the lower part and the C horizon have hue of 2.5Y or 5Y and value of 5 or 6.

Seymour silty clay loam, 5 to 9 percent slopes, moderately eroded, is a taxadjunct to the series because it does not have a mollic epipedon.

Shelby Series

The Shelby series consists of moderately well drained, moderately slowly permeable soils on convex side slopes on uplands. These soils formed in glacial till. Native vegetation is mixed prairie grasses. Slopes range from 9 to 25 percent.

Typical pedon of Shelby clay loam, 18 to 25 percent slopes, moderately eroded, 280 feet east and 225 feet north of the southwest corner of sec. 17, T. 67 N., R. 26 W., in a grass pasture:

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay loam (27 percent clay), dark grayish brown (10YR 4/2) dry; mixed with some streaks and pockets of dark brown (10YR 3/3); common faint very dark gray (10YR 3/1) organic coats on faces of peds; weak coarse granular structure parting to moderate fine and medium granular; friable; neutral; abrupt smooth boundary.

AB—8 to 13 inches; dark brown (10YR 3/3) clay loam (31 percent clay), dark grayish brown (10YR 4/2) dry; very dark gray (10YR 3/1) organic coats on faces of peds; moderate fine subangular blocky structure parting to moderate fine granular; friable; neutral; clear smooth boundary.

Bt1—13 to 18 inches; dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) clay loam (31 percent clay); very dark gray (10YR 3/1) organic coats lining pores; weak medium subangular blocky structure parting to moderate fine subangular blocky; firm; few faint dark grayish brown (10YR 4/2) clay films on ped faces; stone line in top inch of horizon; slightly acid; clear smooth boundary.

Bt2—18 to 28 inches; dark yellowish brown (10YR 4/4) clay loam (32 percent clay); weak medium prismatic structure parting to weak medium subangular blocky parting to weak fine subangular blocky; clear smooth boundary; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; few stones and pebbles; slightly acid; clear smooth boundary.

Bt3—28 to 34 inches; dark yellowish brown (10YR 4/4) clay loam (29 percent clay); moderate medium prismatic structure parting to weak coarse subangular blocky; firm; common faint dark brown (10YR 4/3) clay films on faces of peds; few stones and pebbles; neutral; clear smooth boundary.

BC—34 to 60 inches; yellowish brown (10YR 5/4) clay loam (29 percent clay); moderate coarse prismatic structure parting to weak fine angular blocky; firm common faint brown (10YR 5/3) sheen on faces of peds; common fine rounded soft very pale brown soft accumulations (calcium carbonate); few stones and pebbles; strongly effervescent; moderately alkaline.

The solum ranges from 30 to 60 inches or more in thickness. The A horizon is 6 to 12 inches thick.

The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has a value of 3 or 4 and chroma of 3 or 4 in the upper part and value of 4 or 5 and chroma of 3 or 4 in the lower part.

Tuskeego Series

The Tuskeego series consists of poorly drained, very slowly permeable soils on low stream terraces and foot slopes. These soils formed in alluvium. Native vegetation ranges from mixed prairie grasses to deciduous trees. Slopes range from 0 to 2 percent.

Typical pedon of Tuskeego silt loam, 0 to 2 percent slopes, 1,975 feet west and 445 feet south of the northeast corner of sec. 3, T. 67 N., R. 24 W., in a cultivated field:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam (18 percent clay); moderate fine and very fine subangular blocky structure; friable; common very fine roots; strongly acid; abrupt smooth boundary.

E—6 to 9 inches; dark grayish brown (10YR 4/2) silt loam (20 percent clay), very dark grayish brown (10YR 3/2) kneaded; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine faint dark yellowish brown (10YR 3/4) mottles; moderate thick platy structure parting to moderate fine and very fine subangular; friable; light gray (10YR 7/2) silt coatings on faces of peds; common very fine roots; strongly acid; clear smooth boundary.

BE—9 to 13 inches; dark grayish brown (10YR 4/2) silt loam (23 percent clay); common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate fine and very fine subangular blocky structure; firm; few faint very dark grayish brown (10YR 3/2) clay films and light gray (10YR 7/2) silt coatings on faces of peds; common very fine roots; strongly acid; clear smooth boundary.

Bt1—13 to 17 inches; dark grayish brown (10YR 4/2) silty clay loam (36 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in root

channels; few fine distinct dark yellowish brown (10YR 4/4) mottles; moderate medium and fine subangular blocky structure; firm; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; common very fine roots; few dark concretions (iron and manganese oxides); medium acid; clear smooth boundary.

Bt2—17 to 23 inches; dark grayish brown (10YR 4/2) silty clay (43 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in root channels; weak medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); slightly acid, clear smooth boundary.

Bt3—23 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay (46 percent clay); few distinct very dark gray (10YR 3/1) organic coatings in root channels; many fine distinct olive brown (2.5Y 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral; clear smooth boundary.

Bt4—29 to 35 inches; dark grayish brown (2.5Y 4/2) silty clay (42 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in root channels; many fine prominent dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark reddish brown concretions (iron and manganese oxides); neutral; clear smooth boundary.

Bt5—35 to 46 inches; dark grayish brown (2.5Y 4/2) silty clay loam (38 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in root channels; many fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral; clear smooth boundary.

BC—46 to 57 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) silty clay loam (39 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in root channels; weak very thick platy structure; friable; very few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine roots; few dark concretions (iron and manganese oxides); neutral; clear smooth boundary.

C—57 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam (31 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in root channels; many medium prominent strong brown (7.5YR 5/6) mottles; weak very thick platy structure; friable; few very fine roots; few fine dark concretions (iron and manganese oxides); medium acid.

The solum ranges from 48 to 72 inches in thickness. The A or Ap horizon has chroma of 1 or 2. The E horizon has value of 4 to 6 and chroma of 1 or 2. The Bt horizon has value of 3 to 5 and chroma of 1 or 2. It has a maximum clay content of 38 to 48 percent.

Vesser Series

The Vesser series consists of somewhat poorly drained, moderately permeable soils on high bottom lands, foot slopes, and alluvial fans. These soils formed in silty alluvium. Native vegetation is tall prairie grasses. Slopes range from 0 to 5 percent.

Typical pedon of Vesser silt loam, 0 to 2 percent slopes, 2,500 feet east and 320 feet south of the center of sec. 9, T. 70 N., R. 26 W., in cropland:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) dry; mixed with some streaks and pockets of brown (10YR 4/3) subsurface material; moderate fine and very fine subangular blocky structure; friable; few fine and common very fine roots; neutral; abrupt smooth boundary.

A—7 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) dry; mixed with some streaks and pockets of brown (10YR 4/3) subsurface material; weak thick platy structure parting to moderate fine subangular blocky; friable; few very fine roots; neutral; clear smooth boundary.

E1—10 to 14 inches; dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) dry; moderate thick platy structure parting to moderate fine subangular blocky; friable; few very fine roots; neutral; clear smooth boundary.

E2—14 to 18 inches; dark grayish brown (10YR 4/2) silt loam, few distinct very dark grayish brown (10YR 3/2) organic coats on faces of peds; few fine faint brown (10YR 5/3) mottles; moderate medium platy structure parting to moderate fine subangular blocky; friable; light gray (10YR 7/2) silt coatings on faces of peds; few very fine roots; medium acid; clear smooth boundary.

E3—18 to 26 inches; dark grayish brown (10YR 4/2) silt loam; few distinct very dark grayish brown (10YR 3/2) organic coats in pores and root channels; few fine faint brown (10YR 5/3) mottles; weak thick platy structure parting to moderate fine subangular blocky; friable; light gray (10YR 7/2) silt coatings on faces

of peds; few very fine roots; strongly acid; clear smooth boundary.

Bt1—26 to 31 inches; dark grayish brown (10YR 4/2) silty clay loam; very dark grayish brown (10YR 3/2) organic coats in pores and root channels; common fine faint brown (10YR 4/3) and few fine faint brown (10YR 5/3) mottles; moderate fine subangular blocky structure; firm; few faint very dark grayish brown (10YR 3/2) clay films on faces of peds; light gray (10YR 7/2) silt coatings on faces of peds; few very fine roots; strongly acid; clear smooth boundary.

Bt2—31 to 38 inches; very dark grayish brown (10YR 3/2) silty clay loam; few distinct very dark grayish brown (10YR 3/2) organic coats in pores and root channels; common fine faint dark brown (10YR 3/3) mottles; moderate medium and fine prismatic structure parting to moderate medium and fine subangular blocky; firm; few faint very dark grayish brown (10YR 3/2) clay films on faces of peds; light gray (10YR 7/2) silt coatings; few very fine roots; strongly acid; clear smooth boundary.

Bt3—38 to 46 inches; very dark grayish brown (10YR 3/2) silty clay loam; few distinct very dark grayish brown (10YR 3/2) organic coats in pores and root channels; few fine faint dark yellowish brown (10YR 3/4) mottles; moderate medium prismatic structure parting to moderate fine prismatic parting to moderate fine subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; light gray (10YR 7/2) silt coatings; few very fine roots; strongly acid; clear smooth boundary.

Bt4—46 to 60 inches; very dark grayish brown (10YR 3/2) silty clay loam; few distinct very dark grayish brown (10YR 3/2) organic coats in pores and root channels; few fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine prismatic structure parting to weak fine subangular blocky; firm; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; light gray (10YR 7/2) silt coatings on faces of peds; medium acid.

The solum typically exceeds 60 inches in thickness. The surface layer is 6 to 10 inches thick.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 3 to 5 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2.

Wabash Series

The Wabash series consists of very poorly drained, very slowly permeable soils on level flood plains. These soils formed in clayey alluvium. Native vegetation is swamp grass, sedges, and prairie grasses that tolerate wetness. Slopes are 0 or 1 percent.

Typical pedon of Wabash silty clay, 0 to 1 percent slopes, 2,400 feet east and 560 feet north of the southwest corner of sec. 12, T. 67 N., R. 26 W., in a cultivated field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) silty clay (44 percent clay); moderate fine angular blocky structure parting to moderate fine granular; firm; slightly acid; abrupt smooth boundary.

A1—6 to 11 inches; black (5Y 2.5/1) silty clay (43 percent clay); few fine prominent strong brown (7.5YR 4/6) mottles; moderate medium angular blocky structure; firm; neutral; clear smooth boundary.

A2—11 to 21 inches; black (5Y 2.5/1) silty clay (43 percent clay); few fine prominent strong brown (7.5YR 4/6) mottles; weak medium subangular blocky structure parting to moderate very fine subangular blocky; firm; medium acid; clear smooth boundary.

BA—21 to 25 inches; black (5Y 2.5/1) silty clay (59 percent clay); few fine prominent strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; very firm; common distinct black (N 2/0) clay films on faces of peds; slightly acid; clear smooth boundary.

Bg1—25 to 37 inches; black (5Y 2.5/1) silty clay (55 percent clay); common fine prominent strong brown (7.5YR 4/6) mottles; weak coarse prismatic structure parting to moderate very fine subangular blocky; very firm; many prominent black (N 2/0) slickensides on faces of peds; slightly acid; gradual smooth boundary.

Bg2—37 to 52 inches; very dark gray (5Y 3/1) clay (56 percent clay); common fine prominent strong brown (7.5Y 4/6) mottles; weak coarse prismatic structure parting to moderate fine subangular; very firm; common distinct black (N 2/0) slickensides on faces of peds; neutral; gradual smooth boundary.

Cg—52 to 60 inches; very dark gray (5Y 3/1) clay (63 percent clay); massive; very firm; neutral.

The solum ranges from 40 to 60 inches or more. The A horizon ranges from 19 to 28 inches in thickness.

The A horizon has hue of 10YR, 2.5Y, and 5Y and chroma of 2 or less. It is dominantly silty clay, but the range includes silty clay loam. The BA, Bg, and Cg horizons have hue of 10YR, 2.5Y, and 5Y, value of 2 to 5, and chroma of 0 to 2. It is silty clay or clay, and averages between 46 and 60 percent clay.

Weller Series

The Weller series consists of moderately well drained, slowly permeable soils on uplands and high stream benches. These soils formed in loess. Native vegetation is deciduous trees. Slopes range from 2 to 9 percent.

Typical pedon of Weller silt loam, 5 to 9 percent slopes, 1,880 feet north and 440 feet east of the southwest corner of sec. 27, T. 70 N., R. 26 W., in a woodland wildlife preserve:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam (26 percent clay), grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to moderate fine granular; very friable; common very fine, few fine, and few medium roots; neutral; abrupt smooth boundary.

E1—3 to 8 inches; dark grayish brown (10YR 4/2) silt loam (24 percent clay), light brownish gray (10YR 6/2) dry; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine faint dark yellowish brown (10YR 4/4) mottles; strong very thin and thin platy structure; friable; light gray (10YR 7/2) silt coatings on faces of peds; common very fine and few medium roots; strongly acid; clear smooth boundary.

E2—8 to 12 inches; dark brown (10YR 5/3) silt loam (26 percent clay); few distinct very dark grayish brown (10YR 3/2) organic coatings on pores and root channels; strong medium platy structure; friable; light gray (10YR 7/2) and very pale brown (10YR 7/3) silt coatings on faces of peds; common very fine, few fine and medium, and few coarse roots; few fine rounded dark concretions (iron and manganese); strongly acid; clear smooth boundary.

E3—12 to 16 inches; brown (10YR 5/3) silty clay loam (29 percent clay); very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; moderate thick and medium platy structure; friable; light gray (10YR 7/2) and vary pale brown (10YR 7/3) silt coatings on faces of peds; common fine rounded dark concretions (iron and manganese oxides); few very fine, few fine, and few medium roots; very strongly acid; clear smooth boundary.

EB—16 to 22 inches; yellowish brown (10YR 5/4) silty clay loam (35 percent clay); very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; strong medium and fine subangular blocky structure; friable; few distinct brown (10YR 4/3) clay films on faces of peds; light gray (10YR 7/2) and very pale brown (10YR 7/3) silt coatings on faces of peds; few very fine and fine roots; common fine rounded dark concretions (iron and manganese oxides); very strongly acid; clear smooth boundary.

Bt1—22 to 30 inches; yellowish brown (10YR 5/4) silty clay (46 percent clay); very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; common fine faint grayish brown (10YR 5/2) mottles; common fine distinct mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very firm; common distinct brown (10YR 4/3) clay films on faces of peds; few very fine, fine, and coarse roots; common fine rounded dark concretions (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt2—30 to 43 inches; grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) silty clay (44 percent clay); very few distinct very dark grayish brown (10YR 3/2) organic coatings in pores and root channels; few fine faint strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very firm; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few very fine, fine, medium, and coarse roots; few fine rounded dark concretions (iron and manganese oxides); very strongly acid; gradual smooth boundary.

Bt3—43 to 54 inches; grayish brown (2.5Y 5/2) silty clay loam (38 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; many fine prominent strong brown (7.5YR 5/6 and 5/8) mottles; moderate medium prismatic structure; firm; few distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; few very fine, fine, and medium roots; common fine rounded dark concretions (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt4—54 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam (36 percent clay); very few distinct very dark gray (10YR 3/1) organic coatings in pores and root channels; many fine prominent strong brown (7.5YR 5/6 and 5/8) mottles; weak medium prismatic structure; firm; very few distinct grayish brown (2.5Y 5/2) clay films on faces of peds; few very fine and fine roots; common fine rounded dark concretions (iron and manganese oxides); strongly acid.

The solum is typically 48 inches or more thick. In upland areas, a paleosol commonly overlies carbonates.

The A or Ap horizon has value of 3 to 5 and chroma of 1 to 3. Where the B horizon has been mixed with the Ap horizon, the Ap horizon is silt loam or silty clay loam. The E horizon has value of 4 or 5 and chroma of 2 to 4. The Bt horizon in the upper part has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 6. In the Bt horizon the clay maximum is 42 to 48 percent.

Zook Series

The Zook series consists of poorly drained, slowly permeable soils on bottom lands. These soils formed in alluvium. Native vegetation is tall prairie grasses. Slopes range from 0 to 2 percent.

Typical pedon of Zook silty clay loam, 0 to 2 percent slopes, 880 feet north and 700 feet west of the center of sec. 9, T. 70 N., R. 27 W., in a hayfield:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam (36 percent clay); strong medium and fine subangular blocky structure; friable; few prominent light brownish gray (10YR 6/2) silt coatings on faces of peds; common very fine roots; neutral; abrupt smooth boundary.

A1—7 to 11 inches; very dark gray (10YR 3/1) silty clay (41 percent clay); many distinct black (10YR 2/1) organic coats on faces of peds; strong medium subangular blocky structure parting to moderate fine subangular blocky; friable; few distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; common very fine roots; slightly acid; clear smooth boundary.

A2—11 to 16 inches; black (10YR 2/1) silty clay (42 percent clay); many distinct black (N 2/0) organic coats on faces of peds; weak medium prismatic structure parting to moderate fine subangular blocky; firm; few very fine roots; medium acid; clear smooth boundary.

A3—16 to 20 inches; black (N 2/0) silty clay (41 percent clay); few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; firm; few very fine roots; slightly acid; clear smooth boundary.

A4—20 to 25 inches; black (N 2/0) silty clay (44 percent clay); few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; slightly acid; clear smooth boundary.

A5—25 to 34 inches; black (10YR 2/1) silty clay (47 percent clay); few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; slightly acid; gradual smooth boundary.

Bg—34 to 60 inches; very dark gray (10YR 3/1) silty clay (45 percent clay); few fine prominent dark yellowish brown (10YR 4/6) mottles; weak coarse prismatic structure; firm; few very fine roots; slightly acid.

The solum ranges from about 36 to 60 inches or more in thickness. It typically is silty clay loam or silty clay, anc is about 32 to 44 percent clay to a depth of 16 inches and about 36 to 50 percent clay below that depth.

The A horizon has hue of 10YR or 2.5Y. The Bg horizon has hue of 10YR to 5Y and value of 2 to 5.

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Formation of the Soils

This section discusses the major factors of soil formation, and describes the processes of horizon differentiation.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined mainly by the five factors of soil formation (*5*). These include in part the physical and mineralogical composition of parent material and the climate under which the soil material has accumulated and existed since accumulation. These also include 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. Human activities also affect soil formation.

Climate and plant and animal life are the active factors of soil formation. They act on the parent material and slowly change it into a natural body that has genetically related horizons. Relief conditions the effects of climate and plant and animal life. The parent material affects the kinds of profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for parent material to change to soil. Some time is always needed for horizon differentiation. A long period generally is needed for the development of distinct horizons.

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

Observations made by the Iowa Geological Survey show that the glacial deposits in Decatur County range to a maximum depth of 440 feet (*3*).

Soils developed on the glacial till plain during the Yarmouth and Sangamon interglacial periods before the loess was deposited (*11*). In nearly level areas, the soils were strongly weathered and had a gray, plastic subsoil called gumbotil (*9, 11*). This gumbotil is several feet thick and very slowly permeable. A widespread erosion surface has cut below the Yarmouth-Sangamon paleosol into glacial till and older deposits. The surface is characterized generally by a stoneline, and is overlain with pedisediment (*8, 9, 10*). Paleosols formed in the pedisediment stone line and subadjacent till. This surface is of Late Sangamon age. The paleosols were more reddish, and were not so strongly weathered and not as thick as those in the nearly level areas.

Loess covered the soils that formed on the glacial till during Yarmouth and Sangamon time. Geologic erosion has removed the loess from many slopes, and has exposed these paleosols. In some places the paleosols have been beveled or truncated, so that only the lower part of the strongly weathered paleosol remains. This erosion took place before the loess deposition, more than 25,000 years ago (*11*). In other places, erosion has removed all of the paleosol, and has exposed till that is only slightly weathered at the surface. This erosion mostly took place in postglacial times (*6, 11*).

Parent Material

The accumulation of parent material is the first step in the development of a soil. A few thin layers of soil in the county formed as the result of weathering of bedrock. Most of the soils, however, formed in material that was transported from the site of the parent rock through the action of glacial ice, water, wind, and gravity.

The principal parent materials in Decatur County are glacial till, loess, alluvium, and, to a lesser extent, residuum.

Glacial till is unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Soils that developed in Kansan till cover about 53 percent of Decatur County. This till is exposed in all parts of the county and, on steep slopes, forms an extensive part of the landscape. The unweathered till is a firm, calcareous clay loam. It contains pebbles, boulders, and sand, as well as silt and clay. It is heterogeneous, and shows little sorting or stratification. The mineral composition of its components is also heterogeneous, and is similar to that of particles in unweathered loess.

The Clarinda and Rinda soils formed in the strongly weathered Yarmouth-Sangamon gray clay paleosol. Lamoni and Bucknell soils formed in the truncated Yarmouth-Sangamon paleosol. They have a clay layer that is not as thick as that of Clarinda and Rinda soils. Adair, Armstrong, and Keswick soils formed in outcrops of the less strongly weathered, reddish paleosol. Shelby, Gara, and Lindley soils formed in slightly weathered glacial till.

Mystic, Galland, Caleb, and Douds soils formed in pre-Sangamon erosional sediment of varied texture and glacial origin (valley fill). In many places this material appears to have been angularly truncated. Also in many places it is an irregular mixture of material of contrasting textures. Mystic, Galland, Caleb, and Douds soils are on extended, stepped interfluves above the present drainage system. They owe their landscape configuration partly to valley fill, but their surfaces blend with the present erosional surface of uplands (fig. 19). These areas are distinctly higher than the flood plains of the Grand, Weldon, and Little Rivers, but they are lower than the late Wisconsinan, recently dissected slopes on which Shelby, Gara, and Lindley soils formed. Mystic and Galland soils are on the most stable parts of interfluves, and inherited many of their characteristics from the Late Sangamon paleosol. Caleb and Douds soils are downslope on the parts of interfluves that were truncated in Wisconsinan (recent) time.

Loess, a silty material deposited by wind, covers about 28 percent of Decatur County. It ranges in depth from about 10 feet in the northwest part of the county, to about 6 feet in the southeast part on the more stable ridges, to a thin mantle of 2 or 3 feet on side slopes. It overlies both glacial till and valley fill. According to Ruhe (*12*), the base of Wisconsinan age loess in Iowa ranges in age from 16,500 to 29,000 years. Loess consists mainly of silt and clay. It does not contain coarse sand or gravel, because those materials were too large to be moved by wind. But, it does contain small amounts, generally less than 5 percent, of fine sand and very fine sand.

In Decatur County, Arispe, Belinda, Edina, Grundy, Haig, Kniffin, Pershing, Rathbun, Seymour, and Weller soils formed in loess more than 60 inches thick. Lineville soils formed in 10 to 20 inches of loess over glacial sediments underlain by Late Sangamon paleosols weathered from glacial till.

Alluvium consists of sediments that have been deposited by water. In Decatur County loess and glacial till have been the main sources of alluvium. Alluvial deposits of late Wisconsinan age are on flood plains and on second bottoms. About 20 percent of the soils in the county developed from water-laid materials. The major

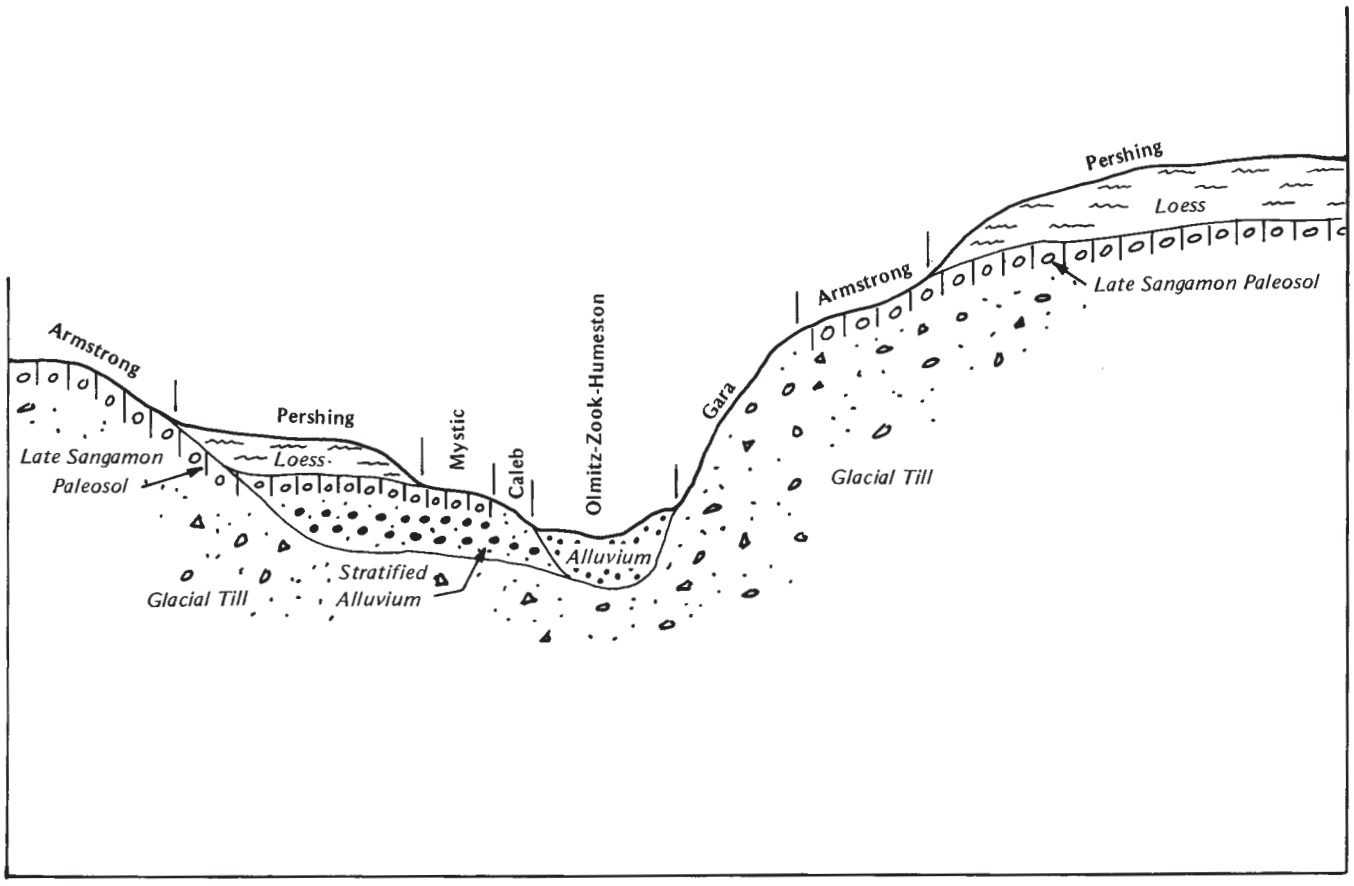

Figure 19.—Geomorphic profile traverse showing the relationship of soils and parent material in Decatur County.

areas in which soils formed in alluvium are along the Grand, Weldon, and Little Rivers, and tributaries of these streams. The alluvium has a maximum thickness of about 55 feet in the valleys of the Grand, Weldon, and Little Rivers, and ranges from 35 to 55 feet in the valleys of their larger tributaries (*3*).

Colluvium, or local alluvium, is alluvial material that has been transported only short distances. It retains many characteristics of the soils from which it has been transported. Generally, silty, alluvial soils are found at the base of slopes below the soils that formed in loess. Examples of these soils are Coppock and Vesser soils. Soils that formed in local alluvium but that are downslope from till-derived soils, are loamy textured and contain more sand than those formed downslope from loess soils. Examples of these loamy alluvial soils are Olmitz and Cantril soils.

As the rivers and streams overflow their channels, the coarse textured sandy and coarse silty material are deposited first, adjacent to the stream. As the water spreads outward across the flood plain, it moves more slowly and deposits the fine silt and clay. As the floods recede, these particles settle, and are mixed with the fine particles washed down by local alluvium.

This pattern is commonly demonstrated on the wider stream bottoms of the Grand River. Klum, Nodaway, and Lawson soils are alluvial, and nearest the streams (fig. 20). Klum soils are coarse-loamy. Nodaway and Lawson soils are fine-silty. Zook and Wabash soils are farther away from the main channel, and are the finest textured and most poorly drained soils. They are somewhat lower in elevation than the other soils.

Second bottoms have formed mainly along the Grand River. They are the location of alluvial soils that are more uniform in texture, that are much less subject to

Figure 20.—Nodaway-Lawson-Zook association on the flood plain of the Grand River.

overflow, and that have more profile development than the first bottom alluvial soils. These soils are the somewhat poorly drained Nevin soils and the poorly drained Bremer, Humeston, and Tuskeego soils.

Residuum is material derived from the weathering of sedimentary rocks in place. In most places loess or glacial till covers the residuum, and in only a few areas does residuum make up the entire solum. In Decatur County, limestone crops out along some escarpments of the Grand and Weldon Rivers.

Climate

The soils in Decatur County have been forming under a midcontinental, subhumid climate for the past 5,000 years. From 6,500 to 16,000 years ago, however, the climate probably was cool and moist, and conducive mainly to the growth of forest vegetation.

The influence of the general climate in a region is modified by local conditions. For example, soils on south-facing slopes formed under a microclimate that is warmed and drier than the average climate in nearby areas. The climate under which the low-lying, poorly drained soils on bottom land have been forming is wetter and colder than that in most of the surrounding areas. These local conditions account for some of the differences among soils in the same climatic region.

Plant and Animal Life

The climate and vegetation in Iowa have frequently changed during the past 28,000 years (*8*). The period from 28,000 to 11,000 years ago was dominated by coniferous forest. Birch and alder were mixed with conifers at the end of this period. Deciduous forest dominated the period from 11,000 to 9,000 years ago. Prairie vegetation dominated the very dry period from 9,000 to 3,200 years ago. It is still dominant, even though trees, especially oaks, have invaded the prairie. Both the trees and the prairie grasses have probably affected soil formation for the past 5,000 years.

The native vegetation on the nearly level and gently rolling uplands was legumes, bluestem, indiangrass, and switchgrass. It grew on the poorly drained and somewhat poorly drained soils in the southwestern, northeastern, and central part of the county. It has been replaced by bluegrass, or eliminated through cultivation in all areas, except for those along the right-of-ways of railroads and the banks of county roads.

Elm, hickory, oak, cedar, and ash grew on the steep side slopes. Cottonwood, walnut, willow, hackberry, basswood, and maple grew along the major streams. When the county was settled, in many areas the trees were removed for lumber and fuel. Gooseberry, sumac, raspberry, blackberry, coralberry, and elderberry invade the cutover areas until the trees are reestablished. Wild plum and honeylocust grow in the open areas throughout the county.

The soils that formed under forest vegetation generally are lighter colored and more acid than the soils that formed under grasses. Also, their surface layer is thinner and has a lower content of organic matter. The soils that formed under mixed grasses and trees have properties that are intermediate between those of soils that formed under grasses and those of soils that formed under forest vegetation. The morphology of Armstrong, Belinda, Gara, and Pershing soils reflects the influence of both trees and grasses. That of Keswick, Lindley, and Weller soils reflects the influence of trees (*7*). That of Arispe, Edina, Grundy, Haig, Shelby, and Zook soils reflects the influence of grasses. The animals living on and in the soil also affect soil formation. Earthworms and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose the vegetation, thus releasing plant nutrients.

Relief

Relief may cause important differences among soils. It indirectly affects soil formation through its effect on drainage. The slope of the soils in Decatur County ranges from nearly level to very steep. Nearly level soils are on the broad upland flats and on bottom land. The steepest soils generally are on upland slopes near the major streams and their tributaries. The nearly level soils in many areas on bottom land are subject to occasional flooding, and permanently or periodically have a high water table. Water soaks into the nearly level soils that are in depressions and that are subject to flooding. In contrast, much of the rainfall runs off the steeper soils on uplands.

Generally, in soils that formed in areas where the seasonal high water table was below a depth of 6 feet, the subsoil is yellowish brown. Examples are Shelby, Gara, and Lindley soils. Grundy, Seymour, and other soils formed in areas where the water table fluctuated and was periodically high. Haig and Zook soils are poorly drained, and they also formed in areas where the water table was periodically high. In Haig soils the subsoil is dominantly grayish. Zook soils formed under prairie grasses. In the surface layer they contain more organic matter than that of the well drained soils that formed under prairie grasses. Clay accumulates in the subsoil of Edina, Humeston, Tuskeego, and other soils that are slightly depressional or nearly level. A large amount of water enters these soils, and carries the clay particles downward. These soils are considered claypan soils because of the hard layer that has the highest content of accumulated clay.

Time

Most of the parent materials in Decatur County are thousands of years old. The present land surface and many of the soils, however, are much younger because of recent geologic erosion (*12*). The older soils have well

defined genetic horizons, and the younger soils have only weakly defined ones. An increase in the content of clay from the surface soil to the subsoil indicates the effects of time. A high content of clay in the subsoil indicates a high degree of profile development.

Most of the soils on flood plains have only weakly defined horizons, because they have not been in place long enough for the formation of distinct horizons. Soil material generally is removed from steep slopes before enough time has passed for the development of a thick profile with strongly expressed horizons. Much of the water runs off the slopes, rather than through the soil material. Even though the material has been in place for a long time, these soils generally exhibit little profile development.

Clarinda and Rinda soils are among the oldest soils in the county. They formed in Kansan glacial till during the Yarmouth-Sangamon period. This parent material is much older than the loess in the county. Edina, Grundy, Haig, and Seymour soils, which formed in loess, might be as much as 14,000 years old. Nevin and other soils on stream terraces are the oldest of the soils that formed in alluvium. Lawson and Nodaway soils, which formed in alluvium on flood plains, are younger than Nevin soils. They are less than 125 years old.

Human Activities

Important changes take place when a soil is cultivated. Some of these changes have little effect on productivity; others have a drastic effect. The changes caused by erosion generally are the most drastic. The soils are eroded on about 54 percent of the acreage in the county. On many of the cultivated soils, especially in the gently rolling to hilly areas, part or all of the original surface layer has been lost through sheet erosion. In some areas shallow to deep gullies have formed. A study of eroded soils in Iowa by the Iowa Cooperative Soil Survey started in 1974. This study showed that the content of organic matter is lower in eroded soils than in uneroded soils. Nodaway soils formed in stratified, silty alluvium on alluvial fans and flood plains. This alluvium has been deposited during the past 125 years, which is the period of cultivation. It was eroded from many of the more sloping adjacent soils, which lost topsoil after they were cultivated.

In many fields that are cultivated year after year, the granular structure that was apparent when the grassland was undisturbed is no longer evident. In these fields the surface tends to form a crust and harden when it dries. Fine textured soils that have been plowed when too wet tend to puddle, and are less permeable than similar soils in uncultivated areas. The puddling and restricted permeability result in poor seedling emergence and poor root penetration.

Some management practices have increased soil productivity or have reclaimed areas not suitable for crops. For example, large areas on bottom land are suitable for cultivation because of installation of drainage ditches, diversions, and dikes. In addition, the suitability of some soils for cultivation has been greatly improved by a drainage system. Applications of commercial fertilizer have countered deficiencies in plant nutrients, and consequently some soils are more productive than they were in their natural state.

Processes of Horizon Differentiation

Horizons are differentiated from each other when four basic kinds of change take place. These are additions, removals, transfers, and transformations (*13*). Each of these kinds of change affects many substances in the soils, such as organic matter, soluble salts, carbonates, sesquioxides, and silicate clay materials. Most of these processes tend to promote horizon differentiation, but some tend to offset or retard it. The processes and the resulting changes occur simultaneously in soils. The ultimate nature of the profile is governed by the balance of these changes within the soil.

An accumulation of organic matter generally is an early phase of horizon differentiation. This has been an important process in the differentiation of horizons in the soils of Decatur County. The amount of organic matter that has accumulated in the surface layer of the soils ranges from high to very low. In some soils the content of organic matter was fairly high, but is now low because of erosion.

The removal of substances from parts of the soil profile is important in horizon differentation. The downward movement of calcium carbonate and other bases is an example. The upper part of nearly all the soils in the county has been leached of calcium carbonates. Many soils have been so strongly leached that they are strongly acid or very strongly acid even in the subsoil.

Phosphorus is removed from the subsoil by plant roots and is transferred to the parts of the plant growing above the ground. It is then returned to the surface layer in the plant residue. This process affects the form and distribution of phosphorus in the profile. The translocation of silicate clay minerals is another important process. The clay minerals in the surface layer are carried downward in suspension by percolating water. They accumulate in the subsoil as fillings in pores and root channels and as clay films. This process has affected many of the soils in the county. In other soils, however, the clay content of the surface layer is not markedly different from that of the underlying layer and other evidence of clay movement is minimal.

Another kind of transfer occurs when cracks form as a result of shrinking and swelling. Because of the cracks, some of the material from the surface layer is transferred to the lower parts of the profile. This transfer is minimal in most soils. It is most common in very clayey soils. It can occur in Clarinda and Wabash soils.

Transformations are physical and chemical. The weathering of soil particles to smaller sizes is an example of a transformation. The reduction of iron, in a process called gleying, is another example. This process occurs when the soil is saturated for long periods. The soil contains enough organic matter for biologic activity to take place during the periods of saturation. Gleying is evidenced by ferrous iron and gray colors in the soil. It is a characteristic of poorly drained soils, such as Haig soils. The content of reductive, extractable iron, or free iron, generally is lower in somewhat poorly drained soils, such as Grundy soils (*17*). Another kind of transformation is the weathering of the primary apatite minerals in the parent material to secondary phosphorus compounds.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; 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.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chisel planting. Seedbed preparation by chiseling without inversion of the soil, leaving a protective cover of crop residue on the surface for erosion control. Seedbed preparation and planting may or may not be in the same operation.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

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.

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.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the

surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

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

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

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.

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.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

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

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

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

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

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

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.

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.

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.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Interseeding. Seeding into an established vegetation without seedbed preparation.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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

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.

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.

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).

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.

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

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

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

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

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

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

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

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

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

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.

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.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

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

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

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

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

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 substratum. 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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stepped interfluve. The land area between two adjacent streams where the long slope is interrupted at several places by distinctly steeper slope gradients.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

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).

Structural bench. A platform-type, nearly level to gently inclined erosional surface developed on resistant strata in areas where valleys are cut in alternating strong and weak layers with an essentially horizontal attitude. Structural benches, in contrast to stream terraces, have no geomorphic implication of former, partial erosion cycles and base-level controls, nor do they represent a stage of flood-plane development following an episode of valley trenching.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (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.

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.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

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.

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Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1962-84 at Lamoni, Iowa)

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-----	29.2	11.0	20.1	56	-18	0	1.03	0.42	1.55	3	6.8
February----	37.0	17.3	27.2	67	-11	6	.95	.37	1.43	3	5.0
March-------	48.3	28.2	38.3	80	3	34	2.68	1.14	3.99	5	5.0
April-------	62.1	40.6	51.4	87	20	127	4.05	2.30	5.59	7	2.0
May---------	72.2	50.9	61.6	90	32	370	3.89	2.35	5.27	7	.1
June--------	81.9	60.7	71.3	95	45	639	4.14	2.33	5.73	7	.0
July--------	87.1	65.5	76.3	99	52	815	4.10	1.61	6.19	5	.0
August------	84.8	62.9	73.9	99	49	741	4.34	1.69	6.55	6	.0
September---	76.0	54.7	65.4	94	36	462	4.28	2.00	6.24	6	.0
October-----	65.2	43.2	54.2	87	23	199	3.05	.80	4.84	5	.3
November----	50.0	31.3	40.7	74	9	0	2.10	.46	3.37	4	2.0
December----	35.7	18.5	27.1	66	-11	12	1.46	.67	2.13	4	5.3
Yearly:											
Average---	60.8	40.4	50.6	---	---	---	---	---	---	---	---
Extreme---	---	---	---	103	-19	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,405	36.07	29.60	41.47	62	26.5

* 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 (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1962-84 at Lamoni, Iowa)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 17	Apr. 22	May 6
2 years in 10 later than--	Apr. 12	Apr. 17	May 1
5 years in 10 later than--	Apr. 2	Apr. 9	Apr. 22
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 17	Oct. 12	Sept. 29
2 years in 10 earlier than--	Oct. 23	Oct. 17	Sept. 5
5 years in 10 earlier than--	Nov. 2	Oct. 28	Oct. 15

TABLE 3.--GROWING SEASON

(Recorded in the period 1962-84 at Lamoni, Iowa)

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	181	154
8 years in 10	200	188	161
5 years in 10	213	201	175
2 years in 10	225	213	189
1 year in 10	232	220	197

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
13B	Olmitz-Zook-Vesser complex, 0 to 5 percent slopes	21,010	6.0
23C	Arispe silty clay loam, 5 to 9 percent slopes	2,320	0.7
23C2	Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded	15,720	4.6
24D	Shelby loam, 9 to 14 percent slopes	230	0.1
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded	3,810	1.1
24E2	Shelby clay loam, 14 to 18 percent slopes, moderately eroded	4,600	1.3
24F2	Shelby clay loam, 18 to 25 percent slopes, moderately eroded	450	0.1
43	Bremer silty clay loam, 0 to 2 percent slopes	520	0.2
51	Vesser silt loam, 0 to 2 percent slopes	3,370	1.0
51B	Vesser silt loam, 2 to 5 percent slopes	3,970	1.2
54	Zook silty clay loam, 0 to 2 percent slopes	2,440	0.7
54+	Zook silt loam, overwash, 0 to 2 percent slopes	2,300	0.7
56B	Cantril loam, 2 to 5 percent slopes	270	0.1
56C	Cantril loam, 5 to 9 percent slopes	1,460	0.4
58E	Douds loam, 14 to 18 percent slopes	300	0.1
58E2	Douds loam, 14 to 18 percent slopes, moderately eroded	860	0.3
65D	Lindley loam, 9 to 14 percent slopes	310	0.1
65E	Lindley loam, 14 to 18 percent slopes	490	0.1
65E2	Lindley clay loam, 14 to 18 percent slopes, moderately eroded	3,400	1.0
65F2	Lindley clay loam, 18 to 25 percent slopes, moderately eroded	17,830	5.1
65G	Lindley loam, 18 to 40 percent slopes	14,720	4.3
88	Nevin silty clay loam, 0 to 2 percent slopes	450	0.1
94E	Caleb-Mystic complex, 9 to 18 percent slopes	300	0.1
94E2	Caleb-Mystic complex, 9 to 18 percent slopes, moderately eroded	3,150	0.9
131B	Pershing silt loam, 2 to 5 percent slopes	480	0.1
131C	Pershing silt loam, 5 to 9 percent slopes	3,040	0.9
131C2	Pershing silty clay loam, 5 to 9 percent slopes, moderately eroded	2,440	0.7
132C	Weller silt loam, 5 to 9 percent slopes	870	0.3
132C2	Weller silty clay loam, 5 to 9 percent slopes, moderately eroded	680	0.2
172	Wabash silty clay, 0 to 1 percent slopes	1,840	0.5
179D2	Gara clay loam, 9 to 14 percent slopes, moderately eroded	3,680	1.1
179E	Gara loam, 14 to 18 percent slopes	240	0.1
179E2	Gara clay loam, 14 to 18 percent slopes, moderately eroded	17,010	4.9
179F	Gara loam, 18 to 25 percent slopes	860	0.3
179F2	Gara clay loam, 18 to 25 percent slopes, moderately eroded	8,740	2.6
192C	Adair clay loam, 5 to 9 percent slopes	520	0.2
192C2	Adair clay loam, 5 to 9 percent slopes, moderately eroded	970	0.3
192D2	Adair clay loam, 9 to 14 percent slopes, moderately eroded	3,340	1.0
208	Klum fine sandy loam, 0 to 3 percent slopes	320	0.1
211	Edina silt loam, 0 to 1 percent slopes	2,660	0.8
220	Nodaway silt loam, 0 to 2 percent slopes	2,740	0.8
222C	Clarinda silty clay loam, 5 to 9 percent slopes	770	0.2
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded	11,540	3.4
222D2	Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded	1,840	0.5
223C2	Rinda silty clay loam, 5 to 9 percent slopes, moderately eroded	980	0.3
223D2	Rinda silty clay loam, 9 to 14 percent slopes, moderately eroded	460	0.1
232C	Keswick silt loam, 5 to 9 percent slopes	2,270	0.7
232C2	Keswick silt loam, 5 to 9 percent slopes, moderately eroded	340	0.1
269	Humeston silt loam, 0 to 2 percent slopes	6,250	1.8
273B	Olmitz loam, 2 to 5 percent slopes	1,170	0.3
273C	Olmitz loam, 5 to 9 percent slopes	740	0.2
312B	Seymour silty clay loam, 2 to 5 percent slopes	2,300	0.7
312C	Seymour silty clay loam, 5 to 9 percent slopes	560	0.2
312C2	Seymour silty clay loam, 5 to 9 percent slopes, moderately eroded	4,900	1.4
362	Haig silty clay loam, 0 to 2 percent slopes	5,040	1.5
364B	Grundy silty clay loam, 2 to 5 percent slopes	8,030	2.3
423C2	Bucknell clay loam, 5 to 9 percent slopes, moderately eroded	780	0.2
423D2	Bucknell clay loam, 9 to 14 percent slopes, moderately eroded	9,180	2.7
425C	Keswick loam, 5 to 9 percent slopes	1,100	0.3
425D	Keswick loam, 9 to 14 percent slopes	6,000	1.8
425D2	Keswick clay loam, 9 to 14 percent slopes, moderately eroded	7,750	2.3
425D3	Keswick clay, 9 to 14 percent slopes, severely eroded	200	0.1
451C2	Caleb loam, 5 to 9 percent slopes, moderately eroded	280	0.1
451D2	Caleb loam, 9 to 14 percent slopes, moderately eroded	2,550	0.7

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
451E2	Caleb loam, 14 to 18 percent slopes, moderately eroded	1,350	0.4
452C	Lineville silt loam, 5 to 9 percent slopes	3,510	1.0
452C2	Lineville silt loam, 5 to 9 percent slopes, moderately eroded	3,120	0.9
453	Tuskeego silt loam, 0 to 2 percent slopes	1,060	0.3
484	Lawson silt loam, 0 to 2 percent slopes	2,600	0.8
520	Coppock silt loam, 0 to 2 percent slopes	400	0.1
520B	Coppock silt loam, 2 to 5 percent slopes	1,730	0.5
531B	Kniffin silt loam, 2 to 5 percent slopes	370	0.1
531C	Kniffin silt loam, 5 to 9 percent slopes	640	0.2
531C2	Kniffin silty clay loam, 5 to 9 percent slopes, moderately eroded	2,090	0.6
532C	Rathbun silt loam, 5 to 9 percent slopes	320	0.1
532C2	Rathbun silty clay loam, 5 to 9 percent slopes, moderately eroded	330	0.1
587	Chequest silty clay loam, 0 to 2 percent slopes	1,400	0.4
592C	Mystic silt loam, 5 to 9 percent slopes	670	0.2
592C2	Mystic clay loam, 5 to 9 percent slopes, moderately eroded	1,540	0.4
592D2	Mystic clay loam, 9 to 14 percent slopes, moderately eroded	5,640	1.6
594D	Galland loam, 9 to 14 percent slopes	470	0.1
594D2	Galland clay loam, 9 to 14 percent slopes, moderately eroded	3,290	1.0
678G	Gasconade-Rock outcrop complex, 18 to 50 percent slopes	220	0.1
715	Nodaway-Lawson-Klum complex, 0 to 3 percent slopes	6,360	1.9
730C	Cantril-Coppock-Nodaway complex, 2 to 9 percent slopes	12,950	3.8
792C	Armstrong loam, 5 to 9 percent slopes	1,100	0.3
792C2	Armstrong clay loam, 5 to 9 percent slopes, moderately eroded	1,150	0.3
792D	Armstrong loam, 9 to 14 percent slopes	880	0.3
792D2	Armstrong clay loam, 9 to 14 percent slopes, moderately eroded	18,190	5.2
792D3	Armstrong clay, 9 to 14 percent slopes, severely eroded	380	0.1
822C2	Lamoni clay loam, 5 to 9 percent slopes, moderately eroded	2,410	0.7
822D2	Lamoni clay loam, 9 to 14 percent slopes, moderately eroded	6,880	2.0
831C2	Pershing silty clay loam, benches, 5 to 9 percent slopes, moderately eroded	5,620	1.6
832C2	Weller silty clay loam, benches, 5 to 9 percent slopes, moderately eroded	940	0.3
994E	Douds-Galland loams, 9 to 18 percent slopes	620	0.2
994E2	Douds-Galland complex, 9 to 18 percent slopes, moderately eroded	3,630	1.1
1130	Belinda silt loam, benches, 0 to 2 percent slopes	1,150	0.3
1131B	Pershing silt loam, benches, 2 to 5 percent slopes	6,380	1.9
1131C	Pershing silt loam, benches, 5 to 9 percent slopes	1,220	0.4
1132C	Weller silt loam, benches, 5 to 9 percent slopes	890	0.3
1715	Nodaway-Klum-Lawson complex, channeled, 0 to 3 percent slopes	10,190	3.0
5030	Pits, limestone quarries	340	0.1
5040	Orthents, loamy	696	0.2
	Water	158	*
	Total	342,624	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
13B	Olmitz-Zook-Vesser complex, 0 to 5 percent slopes (where drained)
43	Bremer silty clay loam, 0 to 2 percent slopes (where drained)
51	Vesser silt loam, 0 to 2 percent slopes (where drained)
51B	Vesser silt loam, 2 to 5 percent slopes (where drained)
54	Zook silty clay loam, 0 to 2 percent slopes (where drained)
54+	Zook silt loam, overwash, 0 to 2 percent slopes (where drained)
56B	Cantril loam, 2 to 5 percent slopes (where drained)
88	Nevin silty clay loam, 0 to 2 percent slopes
131B	Pershing silt loam, 2 to 5 percent slopes
172	Wabash silty clay, 0 to 1 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
208	Klum fine sandy loam, 0 to 3 percent slopes
220	Nodaway silt loam, 0 to 2 percent slopes
269	Humeston silt loam, 0 to 2 percent slopes (where drained)
273B	Olmitz loam, 2 to 5 percent slopes
362	Haig silty clay loam, 0 to 2 percent slopes (where drained)
364B	Grundy silty clay loam, 2 to 5 percent slopes
453	Tuskeego silt loam, 0 to 2 percent slopes (where drained)
484	Lawson silt loam, 0 to 2 percent slopes
520	Coppock silt loam, 0 to 2 percent slopes (where drained)
520B	Coppock silt loam, 2 to 5 percent slopes (where drained)
587	Chequest silty clay loam, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
715	Nodaway-Lawson-Klum complex, 0 to 3 percent slopes
1130	Belinda silt loam, benches, 0 to 2 percent slopes (where drained)
1131B	Pershing silt loam, benches, 2 to 5 percent slopes

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	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
13B---------- Olmitz-Zook-Vesser	IIw	116	39	58	3.5	3.8	4.4	4.5
23C---------- Arispe	IIIe	128	43	64	5.1	3.8	7.3	7.3
23C2---------- Arispe	IIIe	124	42	62	5.0	3.7	7.1	7.1
24D---------- Shelby	IIIe	119	40	60	5.0	3.3	5.0	5.8
24D2---------- Shelby	IIIe	115	39	58	4.8	3.3	4.9	5.6
24E2---------- Shelby	IVe	98	33	49	4.1	2.1	4.0	4.5
24F2---------- Shelby	VIe	---	---	---	2.2	1.7	2.4	3.5
43---------- Bremer	IIw	139	47	83	4.2	4.0	6.3	7.5
51---------- Vesser	IIw	130	44	65	3.9	3.7	5.0	5.6
51B---------- Vesser	IIw	127	43	64	3.8	3.7	4.9	5.5
54, 54+---------- Zook	IIw	126	42	76	3.8	4.0	4.0	6.4
56B---------- Cantril	IIe	113	38	57	4.5	3.3	5.0	6.6
56C---------- Cantril	IIIe	108	35	55	4.3	3.1	4.8	6.4
58E---------- Douds	VIe	---	---	---	2.6	1.7	3.3	3.5
58E2---------- Douds	VIe	---	---	---	2.2	1.5	3.0	2.8
65D---------- Lindley	IVe	101	34	51	4.2	2.6	2.8	3.3
65E---------- Lindley	VIe	---	---	---	3.5	2.0	2.1	2.4
65E2---------- Lindley	VIe	---	---	---	3.4	1.8	1.5	1.7
65F2---------- Lindley	VIIe	---	---	---	2.1	1.6	1.3	1.4

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
65G---------- Lindley	VIIe	---	---	---	---	1.2	2.0	---
88---------- Nevin	I	163	55	98	6.5	4.0	8.0	8.0
94E---------- Caleb-Mystic	VIe	---	---	37	2.7	1.1	3.5	3.6
94E2---------- Caleb-Mystic	VIe	---	---	32	2.3	1.0	3.0	3.2
131B---------- Pershing	IIIe	119	40	60	4.8	3.8	6.0	7.0
131C---------- Pershing	IIIe	114	38	57	4.6	3.5	5.7	6.6
131C2---------- Pershing	IIIe	107	36	54	4.3	3.4	5.4	6.3
132C---------- Weller	IIIe	100	34	50	4.2	3.7	5.4	6.3
132C2---------- Weller	IIIe	93	31	47	3.9	3.5	5.0	5.5
172---------- Wabash	IIIw	65	32	43	2.6	2.0	3.1	3.6
179D2---------- Gara	IVe	106	36	53	4.5	2.5	4.5	5.1
179E---------- Gara	VIe	---	---	---	3.9	1.7	3.3	4.1
179E2---------- Gara	VIe	---	---	---	3.7	1.5	2.9	3.8
179F---------- Gara	VIe	---	---	---	2.4	1.3	2.1	2.5
179F2---------- Gara	VIIe	---	---	---	2.0	1.3	1.7	2.0
192C---------- Adair	IIIe	92	31	46	2.8	2.7	4.0	5.1
192C2---------- Adair	IIIe	85	28	43	2.5	2.3	3.5	4.5
192D2---------- Adair	IVe	76	25	38	2.3	1.9	2.9	3.8
208---------- Klum	IIs	103	35	57	4.3	2.6	5.2	5.5
211---------- Edina	IIIw	86	33	54	3.4	2.6	5.2	6.0

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
220---------- Nodaway	IIw	153	51	92	6.4	4.0	6.5	7.6
222C---------- Clarinda	IVw	82	27	41	2.5	2.7	3.7	4.3
222C2---------- Clarinda	IVw	72	24	36	2.2	2.3	3.3	3.6
222D2---------- Clarinda	IVe	66	22	33	2.0	1.7	2.9	3.0
223C2---------- Rinda	IVw	63	21	32	1.9	2.3	3.3	3.5
223D2---------- Rinda	IVe	57	19	29	1.7	1.7	2.5	2.8
232C---------- Keswick	IIIe	74	25	37	3.6	2.9	4.6	5.9
232C2---------- Keswick	IIIe	71	24	36	3.2	1.9	4.4	5.1
269---------- Humeston	IIIw	110	37	55	3.3	3.3	5.0	6.1
273B---------- Olmitz	IIe	137	46	69	5.8	3.9	6.0	7.0
273C---------- Olmitz	IIIe	132	44	66	5.5	3.7	5.7	6.6
312B---------- Seymour	IIIe	109	37	55	4.4	3.5	5.2	6.1
312C---------- Seymour	IIIe	104	35	52	4.2	3.5	5.0	5.8
312C2---------- Seymour	IIIe	97	32	49	3.9	3.3	4.6	5.0
362---------- Haig	IIw	131	44	66	3.9	3.8	6.2	7.0
364B---------- Grundy	IIe	98	38	67	5.3	3.8	8.8	6.3
423C2---------- Bucknell	IIIe	73	24	37	2.9	2.5	4.0	4.8
423D2---------- Bucknell	IVe	67	22	34	2.7	1.9	3.5	4.1
425C---------- Keswick	IIIe	74	25	37	3.1	2.1	3.7	4.3
425D---------- Keswick	IVe	65	22	33	2.7	1.9	3.1	3.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
425D2---------- Keswick	IVe	62	21	31	2.4	1.3	2.7	3.0
425D3---------- Keswick	VIe	---	---	---	1.5	1.0	1.7	2.0
451C2---------- Caleb	IIIe	92	31	46	3.9	2.7	4.4	5.1
451D2---------- Caleb	IVe	86	29	43	3.6	2.1	4.0	4.6
451E2---------- Caleb	VIe	---	---	---	2.8	1.7	3.3	3.1
452C---------- Lineville	IIIe	92	31	46	3.7	2.5	3.5	4.8
452C2---------- Lineville	IIIe	85	28	43	3.4	2.5	3.3	4.5
453---------- Tuskeego	IIIw	105	35	58	3.2	3.3	4.3	5.5
484---------- Lawson	IIw	130	43	80	6.3	4.6	7.2	8.3
520---------- Coppock	IIw	121	41	61	3.6	3.3	4.7	6.1
520B---------- Coppock	IIw	118	40	59	3.5	3.3	4.3	6.0
531B---------- Kniffin	IIIe	99	33	50	4.0	3.3	4.9	5.8
531C---------- Kniffin	IIIe	94	31	47	3.8	3.0	4.6	5.5
531C2---------- Kniffin	IIIe	87	29	44	3.5	3.0	4.3	5.3
532C---------- Rathbun	IIIe	82	27	41	3.2	3.0	4.1	5.0
532C2---------- Rathbun	IIIe	75	25	38	3.0	2.8	3.9	4.6
587---------- Chequest	IIw	120	40	60	3.6	3.7	5.3	6.5
592C---------- Mystic	IIIe	75	25	38	3.0	2.1	3.0	4.1
592C2---------- Mystic	IIIe	68	23	35	2.6	2.0	2.9	3.9
592D2---------- Mystic	IVe	59	20	30	2.4	1.9	2.3	3.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
594D---------- Galland	IVe	61	20	31	2.4	1.9	3.1	3.8
594D2---------- Galland	IVe	54	18	27	2.2	1.3	2.7	3.0
678G**---------- Gasconade-Rock outcrop	VIIs	---	---	---	---	1.0	2.0	---
715---------- Nodaway-Lawson-Klum	IIw	139	47	84	5.9	2.3	6.0	7.0
730C---------- Cantril-Coppock-Nodaway	IIIe	121	39	63	3.5	2.4	4.9	6.5
792C---------- Armstrong	IIIe	83	28	42	3.3	2.3	3.3	4.5
792C2---------- Armstrong	IIIe	73	24	37	2.9	2.1	3.1	4.1
792D---------- Armstrong	IVe	74	25	37	3.0	2.0	3.1	3.8
792D2---------- Armstrong	IVe	67	22	34	2.7	1.7	2.8	3.3
792D3---------- Armstrong	VIe	---	---	---	1.8	1.3	1.7	2.3
822C2---------- Lamoni	IIIe	82	27	41	3.3	2.7	4.3	5.0
822D2---------- Lamoni	IVe	76	25	38	3.0	2.1	3.7	4.3
831C2---------- Pershing	IIIe	107	36	54	4.3	3.4	5.4	6.3
832C2---------- Weller	IIIe	93	31	47	3.9	3.5	5.0	5.5
994E---------- Douds-Galland	VIe	---	---	---	2.2	1.8	3.2	3.6
994E2---------- Douds-Galland	VIe	---	---	---	1.8	1.5	2.9	2.9
1130---------- Belinda	IIIw	112	38	56	3.4	3.7	5.1	6.1
1131B---------- Pershing	IIIe	119	40	60	4.8	3.8	6.0	7.0
1131C---------- Pershing	IIIe	114	38	57	4.6	3.5	5.7	6.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Oats	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass	Bromegrass-alfalfa
		Bu	Bu	Bu	Tons	AUM*	AUM*	AUM*
1132C---------- Weller	IIIe	105	35	53	4.4	3.8	5.6	6.6
1715---------- Nodaway-Klum-Lawson	Vw	---	---	---	---	3.2	4.2	4.9
5030**. Pits								
5040**. Orthents								

* 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.--WOODLAND MANAGEMENT AND PRODUCTIVITY

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

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
43---------- Bremer	2W	Slight	Severe	Moderate	Moderate	Silver maple--------	80	34	American sycamore, hackberry, green ash, eastern cottonwood, silver maple, northern whitecedar.
						Eastern cottonwood--	90	103	
56B, 56C-------- Cantril	4A	Slight	Slight	Slight	Slight	White oak----------	75	57	Eastern white pine, red pine, white spruce, sugar maple.
58E, 58E2------- Douds	3R	Moderate	Moderate	Slight	Slight	White oak----------	55	38	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
						Northern red oak----	55	38	
65D---------- Lindley	3A	Slight	Slight	Slight	Slight	White oak----------	60	43	White oak, green ash, yellow poplar, northern red oak, black oak.
						Post oak----------	---	---	
						Blackjack oak-------	---	---	
						Black oak----------	---	---	
						White oak----------	---	---	
						Post oak----------	---	---	
65E---------- Lindley	3R	Moderate	Moderate	Slight	Slight	White oak----------	60	43	White oak, green ash, yellow poplar, northern red oak, black oak.
						Post oak----------	---	---	
						Blackjack oak-------	---	---	
						Black oak----------	---	---	
						White oak----------	---	---	
						Post oak----------	---	---	
65E2, 65F2------ Lindley	2R	Moderate	Moderate	Moderate	Slight	Blackjack oak-------	50	34	White oak, green ash, yellow poplar, black oak.
						Black oak----------	---	---	
65G---------- Lindley	3R	Moderate	Moderate	Slight	Slight	White oak----------	60	43	White oak, green ash, yellow poplar, northern red oak, black oak.
						Post oak----------	---	---	
						Blackjack oak-------	---	---	
						Black oak----------	---	---	
						White oak----------	---	---	
						Post oak----------	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
94E**, 94E2**: Caleb	3R	Moderate	Moderate	Slight	Slight	White oak Northern red oak	55 55	38 38	Eastern white pine, red pine, black walnut, sugar maple.
Mystic	3A	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	38 38	Eastern white pine, red pine, black walnut, sugar maple.
131B, 131C, 131C2 Pershing	3C	Slight	Slight	Severe	Severe	White oak	55	38	Eastern white pine, white oak, red pine.
132C, 132C2 Weller	3C	Slight	Slight	Severe	Severe	White oak	55	38	Eastern white pine, red pine, black walnut, sugar maple.
172 Wabash	4W	Slight	Severe	Severe	Moderate	Pin oak	75	57	Pin oak, pecan, eastern cottonwood.
179D2 Gara	3A	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	38 38	Eastern white pine, red pine, white oak, northern red oak.
179E, 179E2, 179F, 179F2 Gara	3R	Moderate	Moderate	Slight	Slight	White oak Northern red oak	55 55	38 38	Eastern white pine, red pine, white oak, northern red oak.
220 Nodaway	3A	Slight	Slight	Slight	Slight	White oak	65	48	Eastern white pine, red pine, black walnut, sugar maple, European larch.
223C2, 223D2 Rinda	2W	Slight	Severe	Moderate	Moderate	White oak Northern red oak	45 45	30 30	Silver maple, American sycamore, green ash, hackberry, eastern redcedar, white spruce, Norway spruce.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
232C, 232C2----- Keswick	3C	Slight	Slight	Slight	Moderate	White oak----------	55	38	Eastern white pine, red pine, sugar maple.
						Northern red oak----	55	38	
423C2, 423D2---- Bucknell	2C	Slight	Slight	Slight	Moderate	White oak----------	50	34	Silver maple, American sycamore, green ash, hackberry, eastern redcedar.
						Northern red oak----	50	34	
425C, 425D, 425D2, 425D3--- Keswick	3C	Slight	Slight	Slight	Moderate	White oak----------	55	38	Eastern white pine, red pine, sugar maple.
						Northern red oak----	55	38	
451C2, 451D2---- Caleb	3A	Slight	Slight	Slight	Slight	White oak----------	55	38	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	55	38	
451E2---------- Caleb	3R	Moderate	Moderate	Slight	Slight	White oak----------	55	38	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	55	38	
452C, 452C2----- Lineville	3A	Slight	Slight	Slight	Slight	White oak----------	55	38	Eastern white pine, red pine, Norway spruce, white spruce, sugar maple.
453---------- Tuskeego	2W	Slight	Severe	Moderate	Moderate	Silver maple--------	80	34	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern whitecedar.
						Eastern cottonwood--	90	103	
520, 520B------- Coppock	3A	Slight	Slight	Slight	Slight	White oak----------	65	48	Eastern white pine, red pine, sugar maple.
						Northern red oak----	65	48	
531B, 531C, 531C2---------- Kniffin	3C	Slight	Moderate	Moderate	Slight	White oak----------	55	38	Eastern white pine, red pine, black walnut, sugar maple.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
532C, 532C2----- Rathbun	3C	Slight	Slight	Moderate	Moderate	White oak----------	55	38	Eastern white pine, red pine, black walnut.
587---------- Chequest	2W	Slight	Severe	Moderate	Moderate	Silver maple--------	80	34	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern whitecedar.
						Eastern cottonwood--	90	103	
592C, 592C2, 592D2---------- Mystic	3A	Slight	Slight	Slight	Slight	White oak----------	55	38	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	55	38	
594D, 594D2----- Galland	3C	Slight	Slight	Severe	Severe	White oak----------	65	48	Eastern white pine, red pine, black walnut, sugar maple.
						Northern red oak----	70	52	
678G**:									
Gasconade------	2R	Slight	Severe	Moderate	Severe	Chinkapin oak-------	40	26	
						Eastern redcedar----	30	---	
						White ash----------	---	---	
						Sugar maple---------	---	---	
						Mockernut hickory---	---	---	
						Post oak-----------	---	---	
						Blackjack oak-------	---	---	
Rock outcrop.									
715**:									
Nodaway--------	3A	Slight	Slight	Slight	Slight	White oak----------	65	48	Eastern white pine, red pine, black walnut, sugar maple, European larch.
Lawson.									
Klum.									
730C**:									
Cantril--------	4A	Slight	Slight	Slight	Slight	White oak----------	75	57	Eastern white pine, red pine, white spruce, sugar maple.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
730C**:									
Coppock	3A	Slight	Slight	Slight	Slight	White oak Northern red oak	65 65	48 48	Eastern white pine, red pine, sugar maple.
Nodaway	3A	Slight	Slight	Slight	Slight	White oak	65	48	Eastern white pine, red pine, black walnut, sugar maple, European larch.
792C, 792C2, 792D, 792D2, 792D3 Armstrong	3C	Slight	Slight	Severe	Severe	White oak Northern red oak	55 55	38 38	Eastern white pine, red pine, European larch, sugar maple.
831C2 Pershing	3C	Slight	Slight	Severe	Severe	White oak	55	38	Eastern white pine, white oak, red pine.
832C2 Weller	3C	Slight	Slight	Severe	Severe	White oak	55	38	Eastern white pine, red pine, black walnut, sugar maple.
994E**, 994E2**:									
Douds	3R	Moderate	Moderate	Slight	Slight	White oak Northern red oak	55 55	38 38	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
Galland	3C	Slight	Slight	Severe	Severe	White oak Northern red oak	65 70	48 52	Eastern white pine, red pine, black walnut, sugar maple.
1130 Belinda	2W	Slight	Severe	Moderate	Moderate	White oak	45	30	Eastern cottonwood, silver maple, golden willow, American sycamore, green ash, northern whitecedar.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
1131B, 1131C---- Pershing	3C	Slight	Slight	Severe	Severe	White oak----------	55	38	Eastern white pine, white oak, red pine.
1132C---------- Weller	3C	Slight	Slight	Severe	Severe	White oak----------	55	38	Eastern white pine, red pine, black walnut, sugar maple.
1715**: Nodaway--------	3A	Slight	Slight	Slight	Slight	White oak----------	65	48	Eastern white pine, red pine, black walnut, sugar maple, European larch.
Klum.									
Lawson.									

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

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

TABLE 8.--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--			
	8-15	16-25	26-35	>35
13B*: Olmitz	Amur honeysuckle, Amur privet, silky dogwood, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
Zook	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Norway spruce, northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
Vesser	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.
23C, 23C2--- Arispe	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
24D, 24D2, 24E2, 24F2--- Shelby	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
43--- Bremer	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, blue spruce, white fir, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
51, 51B--- Vesser	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 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
54, 54+ Zook	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Norway spruce, northern white-cedar, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
56B, 56C Cantril	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce	Pin oak, eastern white pine.
58E, 58E2 Douds	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Blue spruce, white fir, northern whitecedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
65D, 65E, 65E2, 65F2, 65G. Lindley				
88 Nevin	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
94E*, 94E2*: Caleb	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Mystic	American cranberrybush, Amur honeysuckle, eastern redcedar, arrowwood, Amur privet, Washington hawthorn.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
131B, 131C, 131C2- Pershing	Eastern redcedar, Washington hawthorn, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Austrian pine, Osageorange, green ash.	Eastern white pine, pin oak.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
132C, 132C2---- Weller	American cranberrybush, Amur honeysuckle, arrowwood, Washington Hawthorn, Amur privet, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
172---- Wabash	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
179D2, 179E, 179E2, 179F, 179F2---- Gara	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Northern white-cedar, white fir, Washington hawthorn, blue spruce.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
192C, 192C2, 192D2---- Adair	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
208---- Klum	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Norway spruce-----	Pin oak, eastern white pine.
211---- Edina	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, blue spruce, northern white-cedar, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
220---- Nodaway	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
222C, 222C2, 222D2---------- Clarinda	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Green ash, Osageorange.	Eastern white pine, pin oak, Austrian pine.	---
223C2, 223D2------ Rinda	Eastern redcedar, Washington hawthorn, arrowwood, Amur honeysuckle, Amur privet, American cranberrybush.	Green ash, Austrian pine, Osageorange.	Eastern white pine, pin oak.	---
232C, 232C2------- Keswick	Eastern redcedar, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
269---------- Humeston	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.
273B, 273C-------- Olmitz	Amur honeysuckle, Amur privet, silky dogwood, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
312B, 312C, 312C2- Seymour	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
362---------- Haig	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, blue spruce, white fir, northern white-cedar, Washington hawthorn.	Eastern white pine	Pin oak.
364B---------- Grundy	Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush, arrowwood, eastern redcedar.	Austrian pine, Osageorange, green ash.	Pin oak, eastern white pine.	---
423C2, 423D2------ Bucknell	Eastern redcedar, arrowwood, Washington hawthorn, Amur privet, Amur honeysuckle, American cranberrybush.	Green ash, Austrian pine, Osageorange.	Eastern white pine, pin oak.	---
425C, 425D, 425D2, 425D3---------- Keswick	Eastern redcedar, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
451C2, 451D2, 451E2---------- Caleb	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
452C, 452C2------- Lineville	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, Osageorange, green ash.	Eastern white pine, pin oak.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
453---------- Tuskeego	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
484---------- Lawson	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
520, 520B--------- Coppock	Amur privet, silky dogwood, Amur honeysuckle.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
531B, 531C, 531C2- Kniffin	American cranberrybush, Amur honeysuckle, eastern redcedar, Washington hawthorn, Amur privet, arrowwood.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
532C, 532C2------- Rathbun	American cranberrybush, eastern redcedar, Amur honeysuckle, Washington hawthorn, arrowwood, Amur privet.	Osageorange, Austrian pine, green ash.	Eastern white pine, pin oak.	---
587---------- Chequest	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	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 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
592C, 592C2, 592D2---------- Mystic	American cranberrybush, Amur honeysuckle, eastern redcedar, arrowwood, Amur privet, Washington hawthorn.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
594D, 594D2------- Galland	Eastern redcedar, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
678G*: Gasconade.				
Rock outcrop.				
715*: Nodaway.				
Lawson-----------	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Klum----------	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Norway spruce-----	Pin oak, eastern white pine.
730C*: Cantril----------	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce-----	Pin oak, eastern white pine.
Coppock----------	Amur privet, silky dogwood, Amur honeysuckle.	Austrian pine, northern white-cedar, white fir, blue spruce, Washington hawthorn, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
730C*: Nodaway	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
792C, 792C2, 792D, 792D2, 792D3, Armstrong	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
822C2, 822D2, Lamoni	Eastern redcedar, Washington hawthorn, arrowwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
831C2, Pershing	Eastern redcedar, Washington hawthorn, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Austrian pine, Osageorange, green ash.	Eastern white pine, pin oak.	---
832C2, Weller	American cranberrybush, Amur honeysuckle, arrowwood, Washington hawthorn, Amur privet, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
994E*, 994E2*: Douds	Silky dogwood, Amur privet, American cranberrybush, Amur honeysuckle.	Blue spruce, white fir, northern whitecedar, Washington hawthorn.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--			
	8-15	16-25	26-35	>35
994E*, 994E2*: Galland	Eastern redcedar, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
1130 Belinda	Amur privet, silky dogwood, Amur honeysuckle, American cranberrybush.	Austrian pine, Norway spruce, blue spruce, northern white-cedar, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
1131B, 1131C Pershing	Eastern redcedar, Washington hawthorn, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Austrian pine, Osageorange, green ash.	Eastern white pine, pin oak.	---
1132C. Weller				
1715*: Nodaway	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
Klum	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
Lawson	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
5030*. Pits				
5040*. Orthents				

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

TABLE 9.--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
13B*: Olmitz	Slight	Slight	Moderate: slope.	Slight	Slight.
Zook	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
23C, 23C2 Arispe	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight	Slight.
24D, 24D2 Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
24E2, 24F2 Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
43 Bremer	Severe: wetness, flooding.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
51 Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
51B Vesser	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
54, 54+ Zook	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
56B Cantril	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Slight.
56C Cantril	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Slight	Slight.
58E, 58E2 Douds	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65D Lindley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
65E, 65E2, 65F2 Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
65G---------- Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
88---------- Nevin	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
94E*, 94E2*:					
Caleb----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Mystic----------	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
131B---------- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight----------	Slight.
131C, 131C2---------- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight----------	Slight.
132C, 132C2---------- Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight----------	Slight.
172---------- Wabash	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.
179D2---------- Gara	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
179E, 179E2, 179F, 179F2---------- Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
192C, 192C2---------- Adair	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
192D2---------- Adair	Severe: wetness.	Moderate: wetness, slope, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
208---------- Klum	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
211---------- Edina	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
220---------- Nodaway	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
222C, 222C2---------- Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
222D2---------- Clarinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
223C2---------- Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
223D2---------- Rinda	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
232C, 232C2---------- Keswick	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
269---------- Humeston	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
273B---------- Olmitz	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
273C---------- Olmitz	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
312B---------- Seymour	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight----------	Slight.
312C, 312C2---------- Seymour	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight----------	Slight.
362---------- Haig	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
364B---------- Grundy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
423C2---------- Bucknell	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
423D2---------- Bucknell	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, slope.
425C---------- Keswick	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
425D, 425D2---------- Keswick	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
425D3---------- Keswick	Severe: wetness, too clayey.	Severe: too clayey.	Severe: slope, too clayey, wetness.	Severe: too clayey, erodes easily.	Severe: too clayey.
451C2---------- Caleb	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
451D2---------- Caleb	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: slope.
451E2---------- Caleb	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
452C, 452C2---------- Lineville	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
453---------- Tuskeego	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
484---------- Lawson	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
520---------- Coppock	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
520B---------- Coppock	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
531B---------- Kniffin	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight----------	Slight.
531C, 531C2---------- Kniffin	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight----------	Slight.
532C, 532C2---------- Rathbun	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight----------	Slight.
587---------- Chequest	Severe: wetness, flooding.	Moderate: flooding, wetness, percs slowly.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
592C, 592C2---------- Mystic	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
592D2---------- Mystic	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
594D, 594D2---------- Galland	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
678G*: Gasconade----------	Severe: slope, thin layer.	Severe: slope, thin layer.	Severe: large stones, slope, thin layer.	Severe: slope.	Severe: large stones, slope, thin layer.
Rock outcrop.					
715*: Nodaway----------	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
Lawson----------	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Klum----------	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
730C*: Cantril----------	Moderate: wetness.	Moderate: wetness.	Severe: slope.	Slight----------	Slight.
Coppock----------	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Nodaway----------	Severe: flooding.	Slight----------	Moderate: flooding.	Slight----------	Moderate: flooding.
792C, 792C2---------- Armstrong	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
792D, 792D2, 792D3---- Armstrong	Severe: wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.
822C2---------- Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
822D2---------- Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness, slope.
831C2---------- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight----------	Slight.
832C2---------- Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight----------	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
994E*, 994E2*: Douds	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Galland	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
1130 Belinda	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
1131B Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
1131C Pershing	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: slope.	Slight	Slight.
1132C Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
1715*: Nodaway	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Klum	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Lawson	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
5030*. Pits					
5040*. Orthents					

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

TABLE 10.--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
13B*:										
Olmitz	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
23C, 23C2---- Arispe	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.
24D, 24D2---- Shelby	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
24E2, 24F2---- Shelby	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
43---- Bremer	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
51, 51B---- Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
54, 54+---- Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
56B, 56C---- Cantril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
58E, 58E2---- Douds	Very poor.	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
65D---- Lindley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
65E, 65E2, 65F2---- Lindley	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
65G---- Lindley	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
88---- Nevin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
94E*, 94E2*:										
Caleb	Poor	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
Mystic	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
131B---- Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
131C, 131C2---- Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
132C, 132C2-------- Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
172---------- Wabash	Poor	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
179D2---------- Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
179E, 179E2, 179F, 179F2---------- Gara	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
192C, 192C2, 192D2- Adair	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
208---------- Klum	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
211---------- Edina	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
220---------- Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
222C, 222C2, 222D2- Clarinda	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
223C2, 223D2------- Rinda	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
232C, 232C2-------- Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
269---------- Humeston	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
273B---------- Olmitz	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
273C---------- Olmitz	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
312B---------- Seymour	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
312C, 312C2-------- Seymour	Fair	Good	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
362---------- Haig	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
364B---------- Grundy	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
423C2, 423D2------- Bucknell	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
425C, 425D, 425D2, 425D3---------- Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
451C2, 451D2------- Caleb	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
451E2---------- Caleb	Poor	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
452C, 452C2-------- Lineville	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
453---------- Tuskeego	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
484---------- Lawson	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
520, 520B---------- Coppock	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
531B---------- Kniffin	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
531C, 531C2-------- Kniffin	Fair	Good	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
532C, 532C2-------- Rathbun	Fair	Good	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
587---------- Chequest	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
592C, 592C2, 592D2- Mystic	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
594D, 594D2-------- Galland	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
678G*:										
Gasconade---------	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
715*:										
Nodaway----------	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
Lawson----------	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Klum----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
730C*:										
Cantril----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Coppock----------	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Nodaway----------	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
792C, 792C2, 792D, 792D2, 792D3---- Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
822C2, 822D2---- Lamoni	Fair	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
831C2---- Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
832C2---- Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
994E*, 994E2*: Douds----	Very poor.	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
Galland----	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
1130---- Belinda	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
1131B---- Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
1131C---- Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
1132C---- Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
1715*: Nodaway----	Poor	Fair	Fair	Poor	Poor	Good	Fair	Poor	Poor	Fair.
Klum----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Lawson----	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
5030*. Pits										
5040*. Orthents										

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

TABLE 11.--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
13B*: Olmitz	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
23C, 23C2: Arispe	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, frost action, shrink-swell.	Slight.
24D, 24D2: Shelby	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
24E2, 24F2: Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
43: Bremer	Severe: wetness.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: wetness, shrink-swell, flooding.	Severe: shrink-swell, low strength.	Moderate: wetness.
51: Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
51B: Vesser	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
54, 54+: Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
56B: Cantril	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness.	Severe: low strength, frost action.	Slight.
56C: Cantril	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--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
58E, 58E2--------- Douds	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65D---------- Lindley	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
65E, 65E2, 65F2, 65G---------- Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
88---------- Nevin	Severe: wetness.	Severe: flooding.	Severe: wetness, flooding.	Severe: flooding.	Severe: frost action, low strength.	Slight.
94E*, 94E2*: Caleb---------- 	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Mystic---------- 	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell, slope.	Severe: slope.
131B, 131C, 131C2- Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
132C, 132C2------- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
172---------- Wabash	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, flooding, too clayey.
179D2---------- Gara	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
179E, 179E2, 179F, 179F2---------- Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
192C, 192C2------- Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength.	Moderate: wetness.
192D2---------- Adair	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness.	Severe: shrink-swell, wetness, slope.	Severe: shrink-swell, low strength.	Moderate: slope, wetness.

See footnote at end of table.

TABLE 11.--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
208---------- Klum	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
211---------- Edina	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
220---------- Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
222C, 222C2------- Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
222D2---------- Clarinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: wetness, slope.
223C2---------- Rinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness.
223D2---------- Rinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: frost action, low strength, shrink-swell.	Moderate: wetness, slope.
232C, 232C2------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
269---------- Humeston	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, wetness, low strength.	Severe: wetness.
273B---------- Olmitz	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
273C---------- Olmitz	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
312B, 312C, 312C2- Seymour	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
362---------- Haig	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--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
364B---------- Grundy	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
423C2---------- Bucknell	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
423D2---------- Bucknell	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: wetness, slope.
425C---------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
425D, 425D2------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
425D3---------- Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Severe: too clayey.
451C2---------- Caleb	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
451D2---------- Caleb	Moderate: wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
451E2---------- Caleb	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
452C, 452C2------- Lineville	Severe: wetness.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
453---------- Tuskeego	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
484---------- Lawson	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
520---------- Coppock	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, low strength, frost action.	Moderate: wetness, flooding.

See footnote at end of table.

TABLE 11.--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
520 ---------- Co ck	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
531B, 531C, 531C2- Kniffin	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
532C, 532C2------- Rathbun	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
587---------- Chequest	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, low strength, shrink-swell.	Severe: flooding.
592C, 592C2------- Mystic	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
592D2---------- Mystic	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
594D, 594D2------- Galland	Moderate: too clayey, wetness, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope.
678G*: Gasconade--------	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.						
715*: Nodaway----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
Lawson----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
Klum----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
730C*: Cantril----------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength, frost action.	Slight.
Coppock----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--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
730C*: Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
792C, 792C2--- Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength.	Moderate: wetness.
792D, 792D2, 792D3--- Armstrong	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness, slope.	Severe: shrink-swell, low strength.	Moderate: slope, wetness.
822C2--- Lamoni	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, low strength.	Moderate: wetness.
822D2--- Lamoni	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
831C2--- Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
832C2--- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
994E*, 994E2*: Douds---	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Galland---	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
1130--- Belinda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
1131B, 1131C--- Pershing	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
1132C--- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "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	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
13B*: Olmitz	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Vesser	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
23C, 23C2 Arispe	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
24D, 24D2 Shelby	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
24E2, 24F2 Shelby	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
43 Bremer	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
51 Vesser	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
51B Vesser	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
54, 54+ Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
56B Cantril	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
56C Cantril	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
58E, 58E2 Douds	Severe: slope.	Severe: seepage, slope.	Severe: seepage, wetness, slope.	Severe: seepage, slope.	Poor: slope.

See footnote at end of table.

TABLE 11.--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
1715*: Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Severe: flooding.
Klum	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Lawson	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
5030*. Pits						
5040*. Orthents						

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

TABLE 12.--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
65D---------- Lindley	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
65E, 65E2, 65F2, 65G---------- Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
88---------- Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
94E*, 94E2*: Caleb----------	Severe: wetness, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
Mystic----------	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey, slope.	Severe: slope.	Poor: too clayey, hard to pack, slope.
131B---------- Pershing	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
131C, 131C2--------- Pershing	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
132C, 132C2--------- Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
172---------- Wabash	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
179D2---------- Gara	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, slope.	Moderate: slope.	Fair: too clayey, slope.
179E, 179E2, 179F, 179F2---------- Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
192C, 192C2, 192D2-- Adair	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
208---------- Klum	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.

See footnote at end of table.

TABLE 12.--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
211---------- Edina	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
220---------- Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
222C, 222C2, 222D2-- Clarinda	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
223C2, 223D2-------- Rinda	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness, hard to pack.
232C, 232C2--------- Keswick	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
269---------- Humeston	Severe: wetness, percs slowly, flooding.	Severe: flooding.	Severe: wetness, too clayey, flooding.	Severe: wetness, flooding.	Poor: wetness, too clayey, hard to pack.
273B---------- Olmitz	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
273C---------- Olmitz	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
312B---------- Seymour	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
312C, 312C2--------- Seymour	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
362---------- Haig	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
364B---------- Grundy	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
423C2, 423D2-------- Bucknell	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
425C, 425D, 425D2, 425D3---------- Keswick	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 12.--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
451C2---------- Caleb	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness, too clayey.	Slight----------	Fair: too clayey, wetness.
451D2---------- Caleb	Severe: wetness.	Severe: slope, wetness.	Moderate: wetness, slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, wetness.
451E2---------- Caleb	Severe: wetness, slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Poor: slope.
452C, 452C2--------- Lineville	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
453---------- Tuskeego	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
484---------- Lawson	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
520---------- Coppock	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
520B---------- Coppock	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
531B---------- Kniffin	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
531C, 531C2--------- Kniffin	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
532C, 532C2--------- Rathbun	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
587---------- Chequest	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: wetness, hard to pack, too clayey.
592C, 592C2--------- Mystic	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Slight----------	Poor: too clayey, hard to pack.
592D2---------- Mystic	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
594D, 594D2--------- Galland	Severe: wetness, percs slowly.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--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
678G*:					
Gasconade	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.					
715*:					
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Lawson	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Klum	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
730C*:					
Cantril	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Coppock	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
792C, 792C2, 792D, 792D2, 792D3--- Armstrong	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
822C2, 822D2--- Lamoni	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
831C2--- Pershing	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
832C2--- Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
994E*, 994E2*:					
Douds	Severe: slope.	Severe: seepage, slope.	Severe: seepage, wetness, slope.	Severe: seepage, slope.	Poor: slope.
Galland	Severe: wetness, percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, too clayey, slope.	Severe: slope.	Poor: too clayey, hard to pack, slope.

See footnote at end of table.

TABLE 12.--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
1130---------- Belinda	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
1131B---------- Pershing	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
1131C---------- Pershing	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
1132C---------- Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
1715*:					
Nodaway----------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
Klum----------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
Lawson----------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness..
5030*. Pits					
5040*. Orthents					

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

TABLE 13.--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
13B*:				
Olmitz	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Vesser	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
23C, 23C2 Arispe	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
24D Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
24D2 Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
24E2, 24F2 Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
43 Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
51, 51B Vesser	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
54, 54+ Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
56B, 56C Cantril	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
58E, 58E2 Douds	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
65D Lindley	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
65E, 65E2, 65F2 Lindley	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
65G Lindley	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
88 Nevin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
94E*, 94E2*: Caleb	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Mystic	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
131B, 131C Pershing	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
131C2 Pershing	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
132C, 132C2 Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
172 Wabash	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
179D2 Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope, small stones.
179E, 179E2, 179F, 179F2 Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
192C, 192C2, 192D2 Adair	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
208 Klum	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
211 Edina	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
220 Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
222C, 222C2, 222D2 Clarinda	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
223C2, 223D2 Rinda	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
232C, 232C2 Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
269---------- Humeston	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
273B, 273C---------- Olmitz	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
312B, 312C, 312C2----- Seymour	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
362---------- Haig	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
364B---------- Grundy	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
423C2, 423D2---------- Bucknell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
425C, 425D, 425D2, 425D3---------- Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
451C2---------- Caleb	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
451D2---------- Caleb	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
451E2---------- Caleb	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
452C, 452C2---------- Lineville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
453---------- Tuskeego	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
484---------- Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
520, 520B---------- Coppock	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
531B, 531C, 531C2----- Kniffin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
532C, 532C2---------- Rathbun	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
587---------- Chequest	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
592C, 592C2, 592D2---- Mystic	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
594D, 594D2---------- Galland	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
678G*: Gasconade----------	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.				
715*: Nodaway----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lawson----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Klum----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
730C*: Cantril----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Coppock----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Nodaway----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
792C, 792C2, 792D, 792D2, 792D3--------- Armstrong	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
822C2, 822D2---------- Lamoni	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
831C2---------- Pershing	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
832C2---------- Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
994E*, 994E2*: Douds----------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Galland----------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1130---------- Belinda	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
1131B, 1131C---------- Pershing	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
1132C---------- Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
1715*: Nodaway----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Klum----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
Lawson----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
5030*. Pits				
5040*. Orthents				

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

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
13B*: Olmitz	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Favorable	Favorable.
Zook	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
Vesser	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
23C, 23C2 Arispe	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Frost action, slope.	Erodes easily, wetness.	Erodes easily.
24D, 24D2, 24E2, 24F2 Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
43 Bremer	Slight	Severe: wetness, hard to pack.	Severe: slow refill.	Frost action	Wetness	Wetness.
51 Vesser	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
51B Vesser	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
54, 54+ Zook	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
56B, 56C Cantril	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Wetness	Rooting depth.
58E, 58E2 Douds	Severe: seepage, slope.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Slope, too sandy.	Slope.
65D, 65E, 65E2, 65F2, 65G Lindley	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope.
88 Nevin	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Erodes easily, wetness.	Erodes easily.
94E*, 94E2*: Caleb	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope	Slope, rooting depth.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
94E*, 94E2*: Mystic	Severe: slope, seepage.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
131B, 131C, 131C2- Pershing	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Wetness, erodes easily.	Erodes easily, percs slowly.
132C, 132C2- Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, erodes easily.	Percs slowly, erodes easily.
172- Wabash	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, percs slowly.	Wetness, droughty, percs slowly.
179D2, 179E, 179E2, 179F, 179F2- Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope.
192C, 192C2- Adair	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Wetness	Wetness, percs slowly.
192D2- Adair	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, slope, frost action.	Slope, wetness.	Wetness, slope, percs slowly.
208- Klum	Severe: seepage.	Severe: seepage, piping.	Moderate: deep to water.	Deep to water	Soil blowing	Favorable.
211- Edina	Slight	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
220- Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
222C, 222C2- Clarinda	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
222D2- Clarinda	Severe: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
223C2- Rinda	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Slope, percs slowly, frost action.	Erodes easily, wetness.	Erodes easily, wetness.
223D2- Rinda	Severe: slope.	Severe: hard to pack.	Severe: no water.	Slope, percs slowly, frost action.	Slope, wetness, erodes easily.	Wetness, slope, erodes easily.
232C, 232C2- Keswick	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
269---------- Humeston	Moderate: seepage.	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action, flooding.	Wetness, percs slowly.	Percs slowly, wetness.
273B, 273C-------- Olmitz	Moderate: seepage, slope.	Slight---------	Severe: no water.	Deep to water	Favorable------	Favorable.
312B, 312C, 312C2- Seymour	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
362---------- Haig	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
364B---------- Grundy	Moderate: slope.	Severe: hard to pack.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
423C2---------- Bucknell	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, percs slowly.	Wetness, percs slowly.
423D2---------- Bucknell	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Wetness, slope, percs slowly.
425C---------- Keswick	Moderate: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
425D, 425D2, 425D3---------- Keswick	Severe: slope.	Moderate: wetness.	Severe: no water.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
451C2---------- Caleb	Moderate: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Favorable------	Rooting depth.
451D2, 451E2------ Caleb	Severe: slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope----------	Slope, rooting depth.
452C, 452C2------- Lineville	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Wetness, erodes easily.
453---------- Tuskeego	Slight---------	Severe: wetness, hard to pack.	Severe: slow refill.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.
484---------- Lawson	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
520---------- Coppock	Moderate: seepage.	Severe: hard to pack, wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, erodes easily.	Wetness, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
520B---------- Coppock	Moderate: seepage, slope.	Severe: hard to pack, wetness.	Moderate: slow refill.	Frost action, slope.	Wetness, erodes easily.	Wetness, erodes easily.
531B, 531C, 531C2- Kniffin	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
532C, 532C2------- Rathbun	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
587---------- Chequest	Slight---------	Severe: wetness.	Severe: slow refill.	Flooding, frost action.	Wetness, erodes easily.	Wetness, erodes easily.
592C, 592C2------- Mystic	Severe: seepage.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Erodes easily, percs slowly.	Erodes easily, percs slowly.
592D2---------- Mystic	Severe: slope, seepage.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
594D, 594D2------- Galland	Severe: seepage, slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
678G*: Gasconade--------	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Severe: no water.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
715*: Nodaway----------	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
Lawson----------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
Klum----------	Severe: seepage.	Severe: seepage, piping.	Moderate: deep to water.	Deep to water	Soil blowing---	Favorable.
730C*: Cantril----------	Moderate: seepage, slope.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action, slope.	Wetness--------	Rooting depth.
Coppock----------	Moderate: seepage, slope.	Severe: hard to pack, wetness.	Moderate: slow refill.	Frost action, slope.	Wetness, erodes easily.	Wetness, erodes easily.
Nodaway----------	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
792C, 792C2---- Armstrong	Moderate: slope.	Moderate: wetness, hard to pack.	Severe: no water.	Slope, percs slowly, frost action.	Percs slowly, wetness.	Percs slowly, wetness.
792D, 792D2, 792D3---- Armstrong	Severe: slope.	Moderate: wetness, hard to pack.	Severe: no water.	Slope, percs slowly, frost action.	Slope, percs slowly, wetness.	Percs slowly, slope, wetness.
822C2---- Lamoni	Moderate: slope.	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly, slope.	Percs slowly, wetness.	Percs slowly, wetness.
822D2---- Lamoni	Severe: slope.	Moderate: wetness, hard to pack.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, wetness, percs slowly.
831C2---- Pershing	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Wetness, erodes easily.	Erodes easily, percs slowly.
832C2---- Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, erodes easily.	Percs slowly, erodes easily.
994E*, 994E2*: Douds----	Severe: seepage, slope.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Slope, too sandy.	Slope.
Galland----	Severe: seepage, slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
1130---- Belinda	Slight----	Severe: wetness.	Severe: slow refill.	Percs slowly---	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
1131B, 1131C---- Pershing	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: slow refill.	Percs slowly, frost action, slope.	Wetness, erodes easily.	Erodes easily, percs slowly.
1132C---- Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, erodes easily.	Percs slowly, erodes easily.
1715*: Nodaway----	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
Klum----	Severe: seepage.	Severe: seepage, piping.	Moderate: deep to water.	Deep to water	Soil blowing---	Favorable.
Lawson----	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.

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

TABLE 15.--ENGINEERING INDEX PROPERTIES

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

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
13B*:											
Olmitz	0-16	Loam	CL	A-6	0	100	90-100	85-95	60-80	30-40	11-20
	16-60	Clay loam	CL	A-6, A-7	0	100	90-100	85-95	60-80	35-45	15-25
Zook	0-7	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
	7-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
Vesser	0-7	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	7-26	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	26-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
23C, 23C2	0-13	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
Arispe	13-44	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-60	25-35
	44-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
24D	0-8	Loam	CL	A-6	0	95-100	85-95	75-90	55-70	30-40	10-20
Shelby	8-44	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	44-60	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24D2, 24E2, 24F2-	0-8	Clay loam	CL	A-6, A-7	0	90-95	85-95	75-90	55-70	35-45	15-25
Shelby	8-34	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	34-60	Clay loam	CL	A-6, A-7	0-5	90-95	85-95	75-90	55-70	30-45	15-25
43	0-20	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-40
Bremer	20-54	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-65	20-35
	54-60	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	40-60	25-40
51, 51B	0-10	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
Vesser	10-26	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	26-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
54	0-7	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-65	20-35
Zook	7-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
54+	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
Zook	8-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55
56B, 56C	0-17	Loam	CL	A-6	0	100	100	85-95	65-75	30-40	11-20
Cantril	17-60	Clay loam	CL	A-6, A-7	0	100	100	90-100	70-88	35-45	15-25
58E	0-15	Loam	CL	A-6	0	95-100	85-100	70-90	60-80	25-35	10-20
Douds	15-51	Clay loam, clay, sandy clay loam.	CL, SC	A-6, A-7	0	90-100	85-100	70-80	35-60	30-45	15-25
	51-60	Stratified loamy sand to clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2	0	90-100	85-100	65-85	20-60	15-35	5-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
58E2----------	0-6	Loam----------	CL	A-6	0	95-100	85-100	70-90	60-80	25-35	10-20
Douds	6-42	Clay loam, clay, sandy clay loam.	CL, SC	A-6, A-7	0	90-100	85-100	70-80	35-60	30-45	15-25
	42-60	Stratified loamy sand to clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2	0	90-100	85-100	65-85	20-60	15-35	5-15
65D, 65E---------	0-9	Loam----------	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
Lindley	9-39	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	39-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
65E2, 65F2-------	0-7	Clay loam---------	CL	A-6	0	95-100	90-100	85-95	55-75	30-40	15-20
Lindley	7-30	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	30-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
65G----------	0-6	Loam----------	CL	A-6	0	95-100	90-100	85-95	50-65	25-35	10-15
Lindley	6-30	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	12-20
	30-60	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	25-35	10-15
88----------	0-23	Silty clay loam	CL, OL	A-6, A-7	0	100	100	100	90-95	35-45	10-20
Nevin	23-38	Silty clay loam	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
	38-60	Silty clay loam, silt loam.	CL	A-7	0	100	100	95-100	90-95	40-50	20-30
94E*:											
Caleb----------	0-10	Loam----------	CL	A-6	0	95-100	85-100	70-90	60-80	30-40	10-20
	10-39	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-100	85-100	60-80	50-75	35-45	15-25
	39-60	Sandy clay loam, sandy loam, clay loam.	SC, CL, SM, ML	A-4, A-6, A-2	0	90-100	85-100	50-75	30-60	15-35	NP-15
Mystic----------	0-12	Silt loam---------	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
	12-44	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	44-60	Sandy clay loam, loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
94E2*:											
Caleb----------	0-6	Loam----------	CL	A-6	0	95-100	85-100	70-90	60-80	30-40	10-20
	6-35	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-100	85-100	60-80	50-75	35-45	15-25
	35-60	Sandy clay loam, sandy loam, clay loam.	SC, CL, SM, ML	A-4, A-6, A-2	0	90-100	85-100	50-75	30-60	15-35	NP-15
Mystic----------	0-8	Clay loam---------	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
	8-40	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	40-60	Sandy clay loam, loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
131B, 131C-------	0-7	Silt loam---------	CL	A-6	0	100	100	100	95-100	30-40	10-20
Pershing	7-10	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-30
	10-38	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-65	20-40
	38-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	35-55	20-35

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
131C2----------	0-7	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-30
Pershing	7-32	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-65	20-40
	32-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	35-55	20-35
132C----------	0-12	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
Weller	12-43	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	43-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30
132C2----------	0-7	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
Weller	7-38	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	38-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30
172----------	0-21	Silty clay--------	CH	A-7	0	100	100	100	95-100	50-75	30-50
Wabash	21-60	Silty clay, clay	CH	A-7	0	100	100	100	95-100	52-78	30-55
179D2----------	0-7	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
Gara	7-39	Clay loam, loam, clay.	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	39-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179E----------	0-14	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
Gara	14-31	Clay loam, loam, clay.	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179E2----------	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
Gara	6-31	Clay loam, loam, clay.	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179F----------	0-6	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	85-95	75-85	55-70	20-30	5-15
Gara	6-31	Clay loam, loam, clay.	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
179F2----------	0-6	Clay loam--------	CL	A-6, A-7	0	90-95	85-95	70-85	55-75	35-45	15-25
Gara	6-31	Clay loam, loam, clay.	CL	A-6	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	31-60	Loam, clay loam	CL	A-6, A-7	0-5	90-95	85-95	70-85	55-75	35-45	15-25
192C, 192C2, 192D2----------	0-19	Clay loam--------	CL	A-6	0	95-100	80-95	75-90	60-80	30-40	10-20
Adair	19-36	Silty clay, clay, clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	40-55	20-30
	36-60	Clay loam--------	CL	A-6, A-7	0	95-100	80-95	70-90	55-80	35-50	15-25
208----------	0-10	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	95-100	70-90	40-55	20-35	3-10
Klum	10-60	Stratified silt loam to loamy fine sand.	SM, ML, SC, CL	A-4, A-2	0	100	95-100	70-95	10-70	<30	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
211---------- Edina	0-18	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	18-50	Silty clay-------	CH	A-7	0	100	100	95-100	90-100	55-75	30-45
	50-60	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-60	15-35
220---------- Nodaway	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
222C, 222C2, 222D2---------- Clarinda	0-14	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	14-37	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
	37-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
223C2, 223D2----- Rinda	0-9	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	9-16	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	85-100	45-55	20-30
	16-60	Clay, silty clay	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
232C, 232C2------ Keswick	0-9	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	9-32	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-70	20-35
	32-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
269---------- Humeston	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	7-14	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-15
	14-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35
273B, 273C------- Olmitz	0-16	Loam-------------	CL	A-6	0	100	90-100	85-95	60-80	30-40	11-20
	16-60	Clay loam--------	CL	A-6, A-7	0	100	90-100	85-95	60-80	35-45	15-25
312B, 312C, 312C2---------- Seymour	0-12	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
	12-35	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	55-70	30-40
	35-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	40-55	20-30
362---------- Haig	0-13	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	100	95-100	40-55	15-25
	13-24	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	40-55	20-30
	24-51	Silty clay-------	CH	A-7	0	100	100	100	95-100	50-65	30-40
	51-60	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-55	20-30
364B---------- Grundy	0-11	Silty clay loam	CH, CL	A-7	0	100	100	95-100	90-100	40-55	20-35
	11-19	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	90-100	45-55	25-35
	19-40	Silty clay-------	CH	A-7	0	100	100	95-100	90-100	50-70	30-45
	40-60	Silty clay loam	CH, CL	A-7	0	100	100	90-100	90-100	40-55	25-35
423C2, 423D2----- Bucknell	0-12	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
	12-24	Clay, clay loam	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	24-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
425C, 425D------- Keswick	0-12	Loam-------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	12-31	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-70	20-35
	31-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
425D2---------- Keswick	0-5	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-100	75-90	60-80	35-50	15-25
	5-24	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-70	20-35
	24-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
425D3----------	0-3	Clay----------	CL	A-7	0-5	90-100	80-100	75-90	60-80	40-50	15-25
Keswick	3-23	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-70	20-35
	23-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
451C2, 451D2, 451E2----------	0-7	Loam----------	CL	A-6	0	95-100	85-100	70-90	60-80	30-40	10-20
Caleb	7-39	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-100	85-100	60-80	50-75	35-45	15-25
	39-60	Sandy clay loam, sandy loam, clay loam.	SC, CL, SM, ML	A-4, A-6, A-2	0	90-100	85-100	50-75	30-60	15-35	NP-15
452C, 452C2------	0-7	Silt loam--------	CL, ML	A-6, A-7	0	100	100	95-100	95-100	35-45	10-20
Lineville	7-20	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	45-55	25-35
	20-38	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	75-95	65-90	35-50	20-35
	38-60	Clay loam, clay	CH, CL	A-7	0-5	95-100	80-100	70-90	55-80	45-60	25-35
453----------	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-35	5-15
Tuskeego	13-35	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	95-100	50-60	25-35
	35-60	Silty clay loam	CH, CL	A-7	0	100	100	95-100	95-100	45-55	25-35
484----------	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-40	5-20
Lawson	10-27	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	85-100	20-30	5-10
	27-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	60-100	20-45	10-25
520, 520B--------	0-7	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
Coppock	7-24	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	24-41	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	95-100	35-55	15-25
	41-60	Silty clay loam	CL, CH	A-7	0	100	100	98-100	95-100	40-60	15-30
531B, 531C-------	0-10	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	100	100	98-100	95-100	35-45	10-20
Kniffin	10-40	Silty clay-------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	40-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
531C2----------	0-7	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	20-30
Kniffin	7-37	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	55-70	30-40
	37-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
532C----------	0-7	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
Rathbun	7-25	Silty clay-------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	25-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
532C2----------	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
Rathbun	6-24	Silty clay-------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	24-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
587----------	0-12	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
Chequest	12-60	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	98-100	90-100	45-60	20-30

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
592C----------	0-12	Silt loam--------	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
Mystic	12-44	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	44-60	Sandy clay loam, loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
592C2, 592D2-----	0-8	Clay loam--------	CL	A-6, A-7	0	100	100	80-100	65-90	30-45	10-25
Mystic	8-40	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	90-100	80-100	65-80	40-55	25-35
	40-60	Sandy clay loam, clay loam.	SC, CL, SM-SC, CL-ML	A-6, A-4	0-5	90-100	80-100	70-95	40-65	25-40	5-20
594D----------	0-10	Loam----------	CL	A-6	0	90-100	80-100	75-100	65-90	30-40	10-20
Galland	10-57	Clay loam, clay, sandy clay loam.	CL, CH	A-7	0-5	90-100	80-100	75-100	65-80	40-55	25-35
	57-60	Stratified sandy loam to clay.	SM-SC, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
594D2----------	0-6	Clay loam--------	CL	A-6, A-7	0	90-100	80-100	75-100	65-90	30-45	10-20
Galland	6-53	Clay loam, clay, sandy clay loam.	CL, CH	A-7	0-5	90-100	80-100	75-100	65-80	40-55	25-35
	53-60	Stratified sandy loam to clay.	SM-SC, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
678G*:											
Gasconade-------	0-4	Flaggy silty clay	CL	A-6	20-50	75-90	70-85	60-75	55-65	30-40	15-25
	4-12	Flaggy silty clay, very flaggy clay, very flaggy silty clay.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
Rock outcrop.											
715*:											
Nodaway---------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Lawson----------	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-40	5-20
	10-27	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	85-100	20-30	5-10
	27-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	60-100	20-45	10-25
Klum------------	0-10	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	95-100	70-90	40-55	20-35	3-10
	10-60	Stratified silt loam to sandy loam.	SM, ML, SC, CL	A-4, A-2	0	100	95-100	70-95	10-70	<30	NP-10
730C*:											
Cantril---------	0-17	Loam----------	CL	A-6	0	100	100	85-95	65-75	30-40	11-20
	17-60	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	70-88	35-45	15-25
Coppock---------	0-7	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	7-29	Silt loam--------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	29-60	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	98-100	95-100	35-55	15-25
Nodaway---------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
792C----------	0-13	Loam----------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
Armstrong	13-30	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	30-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792C2----------	0-6	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
Armstrong	6-26	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	26-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792D----------	0-12	Loam----------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-90	55-80	20-30	5-15
Armstrong	12-29	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	29-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792D2----------	0-6	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
Armstrong	6-26	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	26-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
792D3----------	0-3	Clay loam--------	CL	A-6, A-7	0-5	90-100	80-95	75-90	55-80	35-45	15-25
Armstrong	3-20	Clay loam, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	80-95	70-90	55-80	45-70	20-35
	20-60	Clay loam--------	CL	A-6	0-5	90-100	80-95	70-90	55-80	30-40	15-20
822C2, 822D2-----	0-8	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	80-95	70-95	35-45	15-25
Lamoni	8-25	Clay loam, clay	CH	A-7	0	95-100	95-100	90-100	85-100	50-60	25-35
	25-60	Clay loam--------	CL	A-6, A-7	0	95-100	95-100	70-90	55-85	35-50	15-30
31C2----------	0-7	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-30
Pershing	7-32	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-65	20-40
	32-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	35-55	20-35
32C2----------	0-7	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
Weller	7-38	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	38-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30
94E*:											
Douds----------	0-15	Loam----------	CL	A-6	0	95-100	85-100	70-90	60-80	25-35	10-20
	15-51	Clay loam, loam, sandy clay loam.	CL, SL	A-6, A-7	0	90-100	85-100	70-80	35-60	30-45	15-25
	51-60	Stratified loamy sand to clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2	0	90-100	85-100	65-85	20-60	15-35	5-15
Galland----------	0-10	Loam----------	CL	A-6	0	90-100	80-100	75-100	65-90	30-40	10-20
	10-38	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	90-100	80-100	75-100	65-80	40-55	25-35
	38-60	Stratified sandy loam to clay.	SM-SC, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
994E2*:											
Douds----------	0-6	Loam----------	CL	A-6	0	95-100	85-100	70-90	60-80	25-35	10-20
	6-41	Clay loam, loam, sandy clay.	CL, SC	A-6, A-7	0	90-100	85-100	70-80	35-60	30-45	15-25
	41-60	Stratified loamy sand to clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2	0	90-100	85-100	65-85	20-60	15-35	5-15
Galland---------	0-6	Clay loam--------	CL	A-6, A-7	0	90-100	80-100	75-100	65-90	30-45	10-20
	6-34	Clay loam, clay, silty clay.	CL, CH	A-7	0-5	90-100	80-100	75-100	65-80	40-55	25-35
	34-60	Stratified sandy loam to clay.	SM-SC, SC, CL-ML, CL	A-4, A-2, A-6	0-5	90-100	80-100	65-95	30-60	20-35	5-15
1130----------	0-5	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
Belinda	5-12	Silt loam--------	CL-ML, CL, ML	A-4	0	100	100	100	95-100	25-35	5-10
	12-40	Silty clay-------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	40-60	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-65	25-35
1131B, 1131C-----	0-8	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
Pershing	8-13	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	40-55	15-30
	13-38	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-65	20-40
	38-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	35-55	20-35
1132C----------	0-12	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
Weller	12-43	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	43-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30
1715*:											
Nodaway---------	0-60	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Klum----------	0-10	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	95-100	70-90	40-55	20-35	3-10
	10-60	Stratified silt loam to sandy loam.	SM, ML, SC, CL	A-4, A-2	0	100	95-100	70-95	10-70	<30	NP-10
Lawson----------	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-40	5-20
	10-27	Silt loam--------	CL, CL-ML	A-4	0	100	100	90-100	85-100	20-30	5-10
	27-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	60-100	20-45	10-25
5030*. Pits											
5040*. Orthents											

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

TABLE 16.--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" 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
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
13B*:										
Olmitz----------	0-16	23-27	1.40-1.45	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6
	16-60	27-34	1.45-1.55	0.6-2.0	0.15-0.17	5.1-7.3	Moderate-----	0.28		
Zook----------	0-7	32-38	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High---------	0.28	5	7
	7-60	36-50	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High---------	0.28		
Vesser----------	0-7	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.32	5	6
	7-26	18-24	1.35-1.40	0.6-2.0	0.18-0.22	5.1-6.0	Moderate-----	0.43		
	26-60	30-38	1.40-1.45	0.6-2.0	0.17-0.21	5.6-6.5	Moderate-----	0.43		
23C, 23C2--------	0-13	28-39	1.35-1.40	0.6-2.0	0.21-0.23	5.6-7.3	High---------	0.32	3	7
Arispe	13-44	35-42	1.35-1.45	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.43		
	44-60	24-35	1.40-1.50	0.6-2.0	0.18-0.20	6.6-7.3	High---------	0.43		
24D----------	0-8	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.28	5	6
Shelby	8-44	28-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	44-60	28-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
24D2, 24E2, 24F2-	0-8	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28	5	6
Shelby	8-34	28-35	1.55-1.65	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28		
	34-60	28-35	1.55-1.65	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
43----------	0-20	27-33	1.25-1.30	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7
Bremer	20-54	33-42	1.30-1.40	0.2-0.6	0.15-0.17	5.6-6.5	High---------	0.28		
	54-60	32-38	1.40-1.45	0.2-0.6	0.18-0.20	5.6-6.5	High---------	0.28		
51, 51B----------	0-10	20-26	1.30-1.35	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.32	5	6
Vesser	10-26	18-24	1.35-1.40	0.6-2.0	0.18-0.22	5.1-7.3	Moderate-----	0.43		
	26-60	30-38	1.40-1.45	0.6-2.0	0.17-0.21	5.1-6.5	Moderate-----	0.43		
54----------	0-7	32-38	1.30-1.35	0.2-0.6	0.21-0.23	5.6-7.3	High---------	0.28	5	7
Zook	7-60	36-50	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High---------	0.28		
54+----------	0-8	20-26	1.30-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.28	5	6
Zook	8-60	36-50	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	High---------	0.28		
56B, 56C---------	0-17	14-27	1.40-1.45	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.32	5	6
Cantril	17-60	19-36	1.45-1.75	0.6-2.0	0.14-0.16	5.1-6.5	Moderate-----	0.32		
58E----------	0-15	10-27	1.45-1.50	0.6-2.0	0.15-0.17	4.5-7.3	Low----------	0.32	5	6
Douds	15-51	26-35	1.45-1.65	0.6-2.0	0.15-0.17	4.5-6.0	Moderate-----	0.32		
	51-60	5-30	1.55-1.75	0.6-6.0	0.11-0.13	4.5-6.0	Low----------	0.32		
58E2----------	0-6	10-27	1.45-1.50	0.6-2.0	0.15-0.17	5.1-7.3	Low----------	0.32	5	6
Douds	6-42	26-35	1.45-1.65	0.6-2.0	0.15-0.17	4.5-6.0	Moderate-----	0.32		
	42-60	5-30	1.55-1.75	0.6-6.0	0.11-0.13	5.1-6.0	Low----------	0.32		
65D, 65E---------	0-9	16-27	1.20-1.40	0.6-2.0	0.16-0.18	4.5-7.3	Low----------	0.32	5	6
Lindley	9-39	25-39	1.40-1.60	0.2-0.6	0.14-0.18	4.5-6.5	Moderate-----	0.32		
	39-60	18-32	1.45-1.65	0.2-0.6	0.12-0.16	6.1-7.8	Moderate-----	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
65E2, 65F2------- Lindley	0-7 7-30 30-60	27-35 25-39 18-32	1.30-1.40 1.40-1.60 1.45-1.65	0.2-0.6 0.2-0.6 0.2-0.6	0.14-0.18 0.14-0.18 0.12-0.16	4.5-7.3 4.5-6.5 6.1-7.8	Moderate----- Moderate----- Moderate-----	0.32 0.32 0.32	4	6
65G-------------- Lindley	0-6 6-30 30-60	18-27 25-39 18-32	1.20-1.40 1.40-1.60 1.45-1.65	0.6-2.0 0.2-0.6 0.2-0.6	0.16-0.18 0.14-0.18 0.12-0.16	4.5-7.3 4.5-6.5 6.1-7.8	Low---------- Moderate----- Moderate-----	0.32 0.32 0.32	5	6
88--------------- Nevin	0-23 23-38 38-60	27-29 30-35 25-36	1.30-1.35 1.30-1.40 1.40-1.45	0.6-2.0 0.6-2.0 0.6-2.0	0.21-0.23 0.18-0.20 0.18-0.20	5.6-7.3 5.6-6.5 6.1-7.3	Moderate----- Moderate----- Moderate-----	0.32 0.43 0.43	5	7
94E*: Caleb----------- Mystic---------- 	0-10 10-39 39-60 0-12 12-44 44-60	22-27 20-35 5-30 22-27 30-48 20-35	1.45-1.50 1.45-1.65 1.55-1.75 1.40-1.45 1.45-1.65 1.65-1.75	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0 0.06-0.2 0.6-2.0	0.14-0.18 0.14-0.18 0.12-0.16 0.22-0.24 0.15-0.19 0.16-0.18	4.5-7.3 4.5-6.0 5.1-6.5 4.5-6.5 4.5-6.5 6.1-6.5	Low---------- Moderate----- Low---------- Moderate----- High---------- Moderate-----	0.28 0.28 0.28 0.37 0.37 0.37	5 3 	6 6
94E2*: Caleb----------- Mystic---------- 	0-6 6-35 35-60 0-8 8-40 40-60	22-27 20-35 5-30 27-32 30-48 20-35	1.45-1.50 1.45-1.65 1.55-1.75 1.40-1.45 1.45-1.65 1.65-1.75	0.6-2.0 0.6-2.0 0.6-2.0 0.6-2.0 0.06-0.2 0.6-2.0	0.14-0.18 0.14-0.18 0.12-0.16 0.22-0.24 0.15-0.19 0.16-0.18	4.5-7.3 4.5-6.0 6.1-6.5 4.5-6.5 4.5-6.5 6.1-6.5	Low---------- Moderate----- Low---------- Moderate----- High---------- Moderate-----	0.28 0.28 0.28 0.37 0.37 0.37	5 3 	6 6
131B, 131C------- Pershing	0-7 7-10 10-38 38-60	20-27 27-35 35-48 24-40	1.30-1.40 1.30-1.40 1.35-1.45 1.35-1.50	0.6-2.0 0.2-0.6 0.06-0.2 0.2-0.6	0.22-0.24 0.20-0.22 0.18-0.20 0.18-0.20	4.5-7.3 5.1-6.0 4.5-6.0 5.1-6.5	Low---------- Moderate----- High---------- High----------	0.37 0.37 0.37 0.37	3	6
131C2------------ Pershing	0-7 7-32 32-60	27-38 35-48 24-40	1.30-1.40 1.35-1.45 1.35-1.50	0.2-0.6 0.06-0.2 0.2-0.6	0.22-0.24 0.18-0.20 0.18-0.20	4.5-7.3 4.5-6.0 5.1-6.5	Moderate----- High---------- High----------	0.37 0.37 0.37	3	7
132C------------- Weller	0-12 12-43 43-60	16-27 28-48 25-40	1.35-1.45 1.35-1.50 1.40-1.55	0.6-2.0 0.06-0.2 0.2-0.6	0.22-0.24 0.12-0.18 0.18-0.20	4.5-7.3 4.5-6.0 5.1-6.0	Low---------- High---------- High----------	0.43 0.43 0.43	3	6
132C2------------ Weller	0-7 7-38 38-60	27-36 28-48 25-40	1.35-1.45 1.35-1.50 1.40-1.55	0.2-0.6 0.06-0.2 0.2-0.6	0.22-0.24 0.12-0.18 0.18-0.20	4.5-7.3 4.5-6.0 5.1-6.0	High---------- High---------- High----------	0.43 0.43 0.43	2	7
172-------------- Wabash	0-21 21-60	40-46 40-60	1.25-1.45 1.20-1.45	<0.06 <0.06	0.12-0.14 0.08-0.12	5.6-7.3 5.6-7.8	Very high---- Very high----	0.28 0.28	5	4
179D2------------ Gara	0-7 7-39 39-60	27-35 25-42 24-38	1.50-1.55 1.55-1.75 1.65-1.75	0.2-0.6 0.2-0.6 0.2-0.6	0.16-0.18 0.16-0.18 0.16-0.18	5.6-7.3 4.5-6.5 6.6-8.4	Moderate----- Moderate----- Moderate-----	0.28 0.28 0.37	4	6
179E------------- Gara	0-14 14-31 31-60	24-27 25-42 24-38	1.50-1.55 1.55-1.75 1.65-1.75	0.6-2.0 0.2-0.6 0.2-0.6	0.20-0.22 0.16-0.18 0.16-0.18	5.6-7.3 4.5-6.5 6.6-8.4	Moderate----- Moderate----- Moderate-----	0.28 0.28 0.37	5	6
179E2------------ Gara	0-6 6-31 31-60	27-35 25-42 24-38	1.50-1.55 1.55-1.75 1.65-1.75	0.2-0.6 0.2-0.6 0.2-0.6	0.16-0.18 0.16-0.18 0.16-0.18	5.6-7.3 4.5-6.5 6.6-8.4	Moderate----- Moderate----- Moderate-----	0.28 0.28 0.37	4	6

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
179F----------	0-6	24-27	1.50-1.55	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.28	5	6
Gara	6-31	25-42	1.55-1.75	0.2-0.6	0.16-0.18	4.5-7.3	Moderate-----	0.28		
	31-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
179F2----------	0-6	27-35	1.50-1.55	0.2-0.6	0.16-0.18	5.1-7.3	Moderate-----	0.28	4	6
Gara	6-31	25-42	1.55-1.75	0.2-0.6	0.16-0.18	4.5-6.5	Moderate-----	0.28		
	31-60	24-38	1.65-1.75	0.2-0.6	0.16-0.18	6.6-8.4	Moderate-----	0.37		
192C, 192C2,										
192D2----------	0-19	27-35	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.32	2	6
Adair	19-36	38-60	1.50-1.60	0.06-0.2	0.13-0.16	5.1-7.3	High----------	0.32		
	36-60	30-38	1.60-1.70	0.2-0.6	0.14-0.16	5.6-7.8	Moderate-----	0.32		
208----------	0-10	5-18	1.50-1.60	2.0-6.0	0.15-0.18	5.6-7.3	Low----------	0.20	5	3
Klum	10-60	5-18	1.50-1.60	2.0-6.0	0.13-0.18	6.1-7.3	Low----------	0.20		
211----------	0-18	15-35	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.37	4	6
Edina	18-50	45-60	1.30-1.45	<0.06	0.11-0.13	5.6-7.3	Very high-----	0.37		
	50-60	27-40	1.35-1.50	0.06-0.2	0.18-0.20	6.6-7.3	High----------	0.37		
220----------	0-60	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6
Nodaway										
222C, 222C2,										
222D2----------	0-14	30-38	1.45-1.50	0.2-0.6	0.17-0.19	5.1-7.3	Moderate-----	0.37	3	7
Clarinda	14-37	40-60	1.45-1.60	<0.06	0.14-0.16	5.1-6.5	High----------	0.37		
	37-60	40-60	1.50-1.60	<0.06	0.14-0.16	5.1-7.3	High----------	0.37		
223C2, 223D2-----	0-9	27-35	1.45-1.50	0.2-0.6	0.20-0.22	5.6-7.3	Moderate-----	0.43	2	7
Rinda	9-16	30-40	1.45-1.50	0.2-0.6	0.18-0.20	5.1-6.5	High----------	0.43		
	16-60	40-60	1.45-1.60	<0.06	0.14-0.16	5.1-7.3	High----------	0.32		
232C, 232C2------	0-9	22-27	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.37	3	6
Keswick	9-32	35-60	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High----------	0.37		
	32-60	30-40	1.60-1.75	0.2-0.6	0.12-0.16	4.5-7.3	Moderate-----	0.37		
269----------	0-7	24-27	1.35-1.40	0.2-2.0	0.21-0.23	5.1-7.3	Moderate-----	0.32	4	6
Humeston	7-14	20-26	1.30-1.35	0.2-2.0	0.20-0.22	4.5-6.0	Moderate-----	0.32		
	14-60	30-48	1.35-1.50	<0.06	0.13-0.15	4.5-7.3	High----------	0.32		
273B, 273C-------	0-16	24-27	1.40-1.45	0.6-2.0	0.19-0.21	5.6-7.3	Moderate-----	0.28	5	6
Olmitz	16-60	28-34	1.45-1.55	0.6-2.0	0.15-0.17	5.1-7.3	Moderate-----	0.28		
312B, 312C,										
312C2----------	0-12	28-32	1.40-1.45	0.2-0.6	0.18-0.20	5.6-7.3	Moderate-----	0.37	3	6
Seymour	12-35	36-55	1.40-1.45	<0.06	0.12-0.18	5.1-7.3	High----------	0.37		
	35-60	35-40	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	High----------	0.37		
362----------	0-13	32-40	1.35-1.40	0.6-2.0	0.21-0.23	5.6-7.3	High----------	0.37	5	7
Haig	13-24	28-48	1.30-1.35	0.6-2.0	0.21-0.23	5.1-6.8	High----------	0.37		
	24-51	40-50	1.30-1.45	0.06-0.2	0.12-0.14	5.1-6.5	High----------	0.37		
	51-60	28-40	1.40-1.50	0.2-0.6	0.18-0.20	6.1-7.3	High----------	0.37		
364B----------	0-11	28-35	1.35-1.45	0.2-0.6	0.18-0.20	5.6-7.3	High----------	0.37	3	7
Grundy	11-19	32-45	1.35-1.45	0.2-0.6	0.18-0.20	5.1-6.5	High----------	0.37		
	19-40	40-50	1.30-1.40	0.06-0.2	0.11-0.13	5.1-7.3	High----------	0.37		
	40-60	28-35	1.35-1.40	0.06-0.2	0.18-0.20	5.6-7.3	High----------	0.37		
423C2, 423D2-----	0-12	27-38	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.32	2	6
Bucknell	12-24	38-50	1.55-1.65	0.06-0.2	0.13-0.17	4.5-6.0	High----------	0.32		
	24-60	30-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.3	High----------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
425C, 425D-------	0-12	22-27	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.37	3	6
Keswick	12-31	35-60	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37		
	31-60	30-40	1.60-1.75	0.2-0.6	0.12-0.16	4.5-7.8	Moderate-----	0.37		
425D2------------	0-5	27-40	1.45-1.50	0.2-0.6	0.17-0.19	4.5-7.3	Moderate-----	0.37	3	6
Keswick	5-24	35-60	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37		
	24-60	30-40	1.60-1.75	0.2-0.6	0.12-0.16	4.5-7.8	Moderate-----	0.37		
425D3------------	0-3	40-42	1.45-1.50	0.2-0.6	0.17-0.19	4.5-7.3	Moderate-----	0.37	2	4
Keswick	3-23	35-60	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.0	High---------	0.37		
	23-60	30-40	1.60-1.75	0.2-0.6	0.12-0.16	4.5-7.3	Moderate-----	0.37		
451C2, 451D2, 451E2----------	0-7	22-27	1.45-1.50	0.6-2.0	0.14-0.18	4.5-7.3	Low----------	0.28	5	6
Caleb	7-39	20-35	1.45-1.65	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.28		
	39-60	5-30	1.55-1.75	0.6-2.0	0.12-0.16	6.1-6.5	Low----------	0.28		
452C, 452C2------	0-7	22-27	1.45-1.50	0.6-2.0	0.16-0.20	5.1-7.3	Moderate-----	0.37	3	6
Lineville	7-20	28-35	1.50-1.55	0.2-0.6	0.17-0.21	5.1-6.5	Moderate-----	0.37		
	20-38	20-35	1.65-1.75	0.06-0.2	0.17-0.21	5.6-6.5	Moderate-----	0.37		
	38-60	28-45	1.65-1.75	0.06-0.2	0.13-0.21	5.6-7.3	High---------	0.37		
453--------------	0-13	16-22	1.35-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Moderate-----	0.32	3	5
Tuskeego	13-35	32-48	1.30-1.45	<0.06	0.13-0.17	5.1-7.3	High---------	0.32		
	35-60	28-40	1.40-1.50	0.06-0.2	0.16-0.19	5.6-6.5	Moderate-----	0.32		
484--------------	0-10	10-27	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.28	5	5
Lawson	10-27	10-20	1.20-1.55	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.28		
	27-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43		
520, 520B--------	0-7	16-26	1.30-1.35	0.6-2.0	0.20-0.24	6.1-7.3	Moderate-----	0.32	5	6
Coppock	7-24	16-27	1.30-1.40	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.43		
	24-41	24-35	1.30-1.40	0.6-2.0	0.17-0.21	4.5-6.0	Moderate-----	0.43		
	41-60	24-40	1.40-1.45	0.6-2.0	0.15-0.19	4.5-6.0	Moderate-----	0.43		
531B, 531C-------	0-10	22-34	1.35-1.40	0.6-2.0	0.22-0.24	4.5-7.8	Low----------	0.37	3	6
Kniffin	10-40	48-56	1.40-1.45	<0.06	0.12-0.14	4.5-6.5	High---------	0.37		
	40-60	32-40	1.45-1.50	0.2-0.6	0.18-0.20	5.1-7.3	High---------	0.37		
531C2------------	0-7	28-34	1.40-1.45	0.2-0.6	0.18-0.20	4.5-7.3	Moderate-----	0.37	3	7
Kniffin	7-37	48-56	1.40-1.45	<0.06	0.12-0.14	4.5-6.5	High---------	0.37		
	37-60	32-40	1.45-1.50	0.2-0.6	0.18-0.20	5.1-7.3	High---------	0.37		
532C------------	0-7	16-34	1.35-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	6
Rathbun	7-25	48-56	1.40-1.45	<0.06	0.12-0.14	4.5-5.5	High---------	0.32		
	25-60	32-40	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.32		
532C2------------	0-6	28-34	1.40-1.45	0.2-0.6	0.18-0.20	4.5-7.3	Moderate-----	0.43	3	7
Rathbun	6-24	48-56	1.40-1.45	<0.06	0.12-0.14	4.5-5.5	High---------	0.32		
	24-60	32-40	1.45-1.50	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.32		
587--------------	0-12	30-35	1.30-1.35	0.2-0.6	0.18-0.20	5.6-7.3	High---------	0.28	5	7
Chequest	12-60	35-42	1.35-1.45	0.2-0.6	0.14-0.18	5.1-6.0	High---------	0.43		
592C------------	0-12	22-27	1.40-1.45	0.6-2.0	0.22-0.24	4.5-6.5	Moderate-----	0.37	3	6
Mystic	12-44	30-48	1.45-1.65	0.06-0.2	0.15-0.19	4.5-6.5	High---------	0.37		
	44-60	20-35	1.65-1.75	0.6-2.0	0.16-0.18	6.1-6.5	Moderate-----	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
592C2, 592D2-----	0-8	27-32	1.40-1.45	0.6-2.0	0.22-0.24	4.5-6.5	Moderate-----	0.37	3	6
Mystic	8-40	30-48	1.45-1.65	0.06-0.2	0.15-0.19	4.5-6.5	High---------	0.37		
	40-60	20-35	1.65-1.75	0.6-2.0	0.16-0.18	5.6-6.5	Moderate-----	0.37		
594D----------	0-10	22-27	1.45-1.50	0.6-2.0	0.19-0.21	5.1-7.3	Moderate-----	0.37	3	6
Galland	10-57	35-48	1.45-1.65	0.06-0.2	0.14-0.19	4.5-6.0	High---------	0.37		
	57-60	10-45	1.55-1.75	0.6-6.0	0.11-0.13	5.6-6.5	Low----------	0.24		
594D2----------	0-6	27-35	1.45-1.50	0.6-2.0	0.19-0.21	5.1-7.3	Moderate-----	0.37	3	6
Galland	6-53	35-48	1.45-1.65	0.06-0.2	0.14-0.19	4.5-6.0	High---------	0.37		
	53-60	10-45	1.55-1.75	0.6-6.0	0.11-0.13	5.6-6.5	Low----------	0.24		
678G*:										
Gasconade-------	0-4	40-50	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate-----	0.20	2	8
	4-12	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20		
Rock outcrop.										
715*:										
Nodaway---------	0-60	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6
Lawson----------	0-10	10-27	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low----------	0.28	5	5
	10-27	10-20	1.20-1.55	0.6-2.0	0.20-0.22	6.1-7.8	Low----------	0.28		
	27-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate-----	0.43		
Klum----------	0-10	5-18	1.50-1.60	2.0-6.0	0.15-0.18	6.1-7.3	Low----------	0.20	5	3
	10-60	5-18	1.50-1.60	2.0-6.0	0.13-0.18	6.1-7.3	Low----------	0.20		
730C*:										
Cantril---------	0-17	14-27	1.40-1.45	0.6-2.0	0.17-0.19	5.1-7.3	Low----------	0.32	5	6
	17-60	27-35	1.45-1.75	0.6-2.0	0.14-0.16	5.1-6.5	Moderate-----	0.32		
Coppock---------	0-7	16-26	1.30-1.35	0.6-2.0	0.20-0.24	6.1-7.3	Moderate-----	0.32	5	6
	7-29	16-27	1.30-1.40	0.6-2.0	0.18-0.22	5.6-7.3	Moderate-----	0.43		
	29-60	24-35	1.30-1.40	0.6-2.0	0.17-0.21	4.5-6.0	Moderate-----	0.43		
Nodaway---------	0-60	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate-----	0.37	5	6
792C----------	0-13	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.32	3	6
Armstrong	13-30	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	30-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
792C2----------	0-6	27-38	1.45-1.50	0.2-0.6	0.18-0.20	5.1-7.3	Moderate-----	0.32	3	6
Armstrong	6-26	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	26-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
792D----------	0-12	22-27	1.45-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.32	3	6
Armstrong	12-29	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	29-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
792D2----------	0-6	27-38	1.45-1.50	0.2-0.6	0.18-0.20	5.1-7.3	Moderate-----	0.32	3	6
Armstrong	6-26	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	26-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
792D3----------	0-3	27-38	1.45-1.50	0.2-0.6	0.18-0.20	5.1-7.3	Moderate-----	0.32	2	6
Armstrong	3-20	36-60	1.45-1.55	0.06-0.2	0.11-0.16	4.5-6.5	High---------	0.32		
	20-60	30-36	1.55-1.70	0.2-0.6	0.14-0.16	5.1-7.8	Moderate-----	0.32		
822C2, 822D2-----	0-8	27-40	1.45-1.50	0.2-0.6	0.17-0.21	5.1-7.3	Moderate-----	0.32	3	6
Lamoni	8-25	38-50	1.55-1.65	0.06-0.2	0.13-0.17	5.1-6.5	High---------	0.32		
	25-60	32-40	1.60-1.70	0.06-0.2	0.14-0.18	5.6-7.8	High---------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				
831C2	0-7	27-38	1.30-1.40	0.2-0.6	0.22-0.24	4.5-7.3	Moderate	0.37	3	7
Pershing	7-32	35-48	1.35-1.45	0.06-0.2	0.18-0.20	4.5-6.0	High	0.37		
	32-60	24-40	1.35-1.50	0.2-0.6	0.18-0.20	5.1-6.5	High	0.37		
832C2	0-7	27-36	1.35-1.45	0.2-0.6	0.22-0.24	4.5-7.3	High	0.43	3	7
Weller	7-38	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High	0.43		
	38-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.0	High	0.43		
994E*:										
Douds	0-15	20-27	1.45-1.50	0.6-2.0	0.15-0.17	4.5-7.3	Low	0.32	5	6
	15-51	26-35	1.45-1.65	0.6-2.0	0.15-0.17	4.5-6.0	Moderate	0.32		
	51-60	5-30	1.55-1.75	0.6-6.0	0.11-0.13	5.1-6.0	Low	0.32		
Galland	0-10	22-27	1.45-1.50	0.6-2.0	0.19-0.21	5.1-7.3	Moderate	0.37	3	6
	10-38	35-48	1.45-1.65	0.06-0.2	0.14-0.19	4.5-6.0	High	0.37		
	38-60	10-45	1.55-1.75	0.6-6.0	0.11-0.13	4.5-6.5	Low	0.24		
994E2*:										
Douds	0-6	20-27	1.45-1.50	0.6-2.0	0.15-0.17	4.5-7.3	Low	0.32	5	6
	6-41	26-35	1.45-1.65	0.6-2.0	0.15-0.17	4.5-6.0	Moderate	0.32		
	41-60	5-30	1.55-1.75	0.6-6.0	0.11-0.13	4.5-6.0	Low	0.32		
Galland	0-6	27-35	1.45-1.50	0.6-2.0	0.19-0.21	4.5-7.3	Moderate	0.37	3	6
	6-34	35-48	1.45-1.65	0.06-0.2	0.14-0.19	4.5-6.0	High	0.37		
	34-60	10-45	1.55-1.75	0.6-6.0	0.11-0.13	4.5-6.5	Low	0.24		
1130	0-5	16-22	1.35-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	4	6
Belinda	5-12	18-27	1.30-1.35	0.6-2.0	0.20-0.22	4.5-7.3	Low	0.37		
	12-40	42-52	1.30-1.45	<0.06	0.12-0.14	4.5-6.0	High	0.28		
	40-60	28-40	1.40-1.50	0.06-0.6	0.18-0.20	5.1-6.5	High	0.28		
1131B, 1131C	0-8	20-27	1.30-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.37	3	6
Pershing	8-13	27-35	1.30-1.40	0.2-0.6	0.20-0.22	4.5-6.0	Moderate	0.37		
	13-38	35-48	1.35-1.45	0.06-0.2	0.18-0.20	5.1-6.0	High	0.37		
	38-60	24-40	1.35-1.50	0.2-0.6	0.18-0.20	5.1-6.5	High	0.37		
1132C	0-12	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.43	3	6
Weller	12-43	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High	0.43		
	43-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.0	High	0.43		
1715*:										
Nodaway	0-60	18-27	1.25-1.35	0.6-2.0	0.20-0.23	6.1-7.3	Moderate	0.37	5	6
Klum	0-10	5-18	1.50-1.60	2.0-6.0	0.15-0.18	6.1-7.3	Low	0.20	5	3
	10-60	5-18	1.50-1.60	2.0-6.0	0.13-0.18	6.1-7.3	Low	0.20		
Lawson	0-10	10-27	1.20-1.55	0.6-2.0	0.22-0.24	6.1-7.8	Low	0.28	5	5
	10-27	10-20	1.20-1.55	0.6-2.0	0.20-0.22	6.1-7.8	Low	0.28		
	27-60	18-30	1.55-1.65	0.6-2.0	0.18-0.20	6.1-7.8	Moderate	0.43		
5030*. Pits										
5040*. Orthents										

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

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
13B*: Olmitz	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Zook	C/D	Occasional	Brief to long.	Feb-Nov	0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
Vesser	C	Rare	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
23C, 23C2--- Arispe	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
24D, 24D2, 24E2, 24F2--- Shelby	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
43--- Bremer	C	Rare	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	Moderate	Moderate.
51--- Vesser	C	Occasional	Brief	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
51B--- Vesser	C	Rare	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
54, 54+--- Zook	C/D	Occasional	Brief to long.	Feb-Nov	0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
56B, 56C--- Cantril	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
58E, 58E2--- Douds	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate	Moderate.
65D, 65E, 65E2, 65F2, 65G--- Lindley	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
88--- Nevin	B	Rare	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Low.
94E*, 94E2*: Caleb	B	None	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	Moderate	Moderate	Moderate.
Mystic	C	None	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
131B, 131C, 131C2-- Pershing	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
132C, 132C2-- Weller	C	None	---	---	2.0-4.0	Perched	Nov-Jul	>60	---	High	High	High.
172-- Wabash	D	Frequent	Brief to long.	Nov-May	0-1.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.
179D2, 179E, 179E2, 179F, 179F2-- Gara	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
192C, 192C2, 192D2-- Adair	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
208-- Klum	B	Occasional	Brief	Mar-Nov	3.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Low	Low.
211-- Edina	D	None	---	---	0.5-2.0	Perched	Nov-Jul	>60	---	Moderate	High	Moderate.
220-- Nodaway	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
222C, 222C2, 222D2-- Clarinda	D	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
223C2, 223D2-- Rinda	D	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
232C, 232C2-- Keswick	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
269-- Humeston	C/D	Occasional	Very brief	Feb-Nov	0-1.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
273B, 273C-- Olmitz	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
312B, 312C, 312C2-- Seymour	D	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.
362-- Haig	C/D	None	---	---	1.0-2.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
364B---------- Grundy	C	None--------	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
423C2, 423D2------ Bucknell	D	None--------	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	Moderate	High-----	Moderate.
425C, 425D, 425D2, 425D3---------- Keswick	C	None--------	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
451C2, 451D2, 451E2---------- Caleb	B	None--------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	Moderate	Moderate	Moderate.
452C, 452C2------- Lineville	C	None--------	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
453---------- Tuskeego	C/D	Rare--------	---	---	0-1.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
484---------- Lawson	C	Occasional	Brief to long.	Mar-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	Moderate	Low.
520---------- Coppock	B	Occasional	Brief-----	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
520B---------- Coppock	B	Rare--------	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
531B, 531C, 531C2- Kniffin	C	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
532C, 532C2------- Rathbun	C	None--------	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	Moderate	High-----	Moderate.
587---------- Chequest	C	Frequent----	Long------	Feb-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
592C, 592C2, 592D2---------- Mystic	C	None--------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High-----	Moderate	Moderate.
594D, 594D2------- Galland	D	None--------	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High-----	High-----	Moderate.
678G*: Gasconade--------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	High-----	Low.
Rock outcrop.												

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
715*:												
Nodaway	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
Lawson	C	Occasional	Brief to long.	Mar-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
Klum	B	Occasional	Brief	Mar-Nov	3.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Low	Low.
730C*:												
Cantril	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
Coppock	B	Rare	---	---	1.0-3.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
Nodaway	B	Occasional	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
792C, 792C2, 792D, 792D2, 792D3--- Armstrong	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
822C2, 822D2--- Lamoni	C	None	---	---	1.0-3.0	Perched	Nov-Jul	>60	---	Moderate	High	Moderate.
831C2--- Pershing	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
832C2--- Weller	C	None	---	---	2.0-4.0	Perched	Nov-Jul	>60	---	High	High	High.
994E*, 994E2*:												
Douds	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Moderate	Moderate.
Galland	D	None	---	---	3.0-5.0	Perched	Nov-Jul	>60	---	High	High	Moderate.
1130--- Belinda	D	None	---	---	0.5-2.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.
1131B, 1131C--- Pershing	C	None	---	---	2.0-4.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
1132C--- Weller	C	None	---	---	2.0-4.0	Perched	Nov-Jul	>60	---	High	High	High.
1715*:												
Nodaway	B	Frequent	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
Klum	B	Frequent	Brief	Mar-Nov	3.0-6.0	Apparent	Nov-Jul	>60	---	Moderate	Low	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1715*: Lawson	C	Frequent	Brief to long.	Mar-Nov	1.0-3.0	Apparent	Nov-Jul	>60	---	High	Moderate	Low.
5030*. Pits												
5040*. Orthents												

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

TABLE 18.--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
Adair	Fine, montmorillonitic, mesic Aquic Argiudolls
Arispe	Fine, montmorillonitic, mesic Aquic Argiudolls
Armstrong	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Belinda	Fine, montmorillonitic, mesic Mollic Albaqualfs
Bremer	Fine, montmorillonitic, mesic Typic Argiaquolls
*Bucknell	Fine, montmorillonitic, mesic, sloping Udollic Ochraqualfs
Caleb	Fine-loamy, mixed, mesic Mollic Hapludalfs
Cantril	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Chequest	Fine, montmorillonitic, mesic Typic Haplaquolls
Clarinda	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Coppock	Fine-silty, mixed, mesic Mollic Ochraqualfs
Douds	Fine-loamy, mixed, mesic Typic Hapludalfs
Edina	Fine, montmorillonitic, mesic Typic Argialbolls
Galland	Fine, montmorillonitic, mesic Aquic Hapludalfs
*Gara	Fine-loamy, mixed, mesic Mollic Hapludalfs
*Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Grundy	Fine, montmorillonitic, mesic Aquic Argiudolls
Haig	Fine, montmorillonitic, mesic Typic Argiaquolls
Humeston	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Keswick	Fine, montmorillonitic, mesic Aquic Hapludalfs
Klum	Coarse-loamy, mixed, nonacid, mesic Mollic Udifluvents
*Kniffin	Fine, montmorillonitic, mesic Udollic Ochraqualfs
*Lamoni	Fine, montmorillonitic, mesic Aquic Argiudolls
Lawson	Fine-silty, mixed, mesic Cumulic Hapludolls
*Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
Lineville	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Mystic	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Nevin	Fine-silty, mixed, mesic Aquic Argiudolls
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Olmitz	Fine-loamy, mixed, mesic Cumulic Hapludolls
Orthents	Loamy, mixed, mesic Typic Udorthents
Pershing	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Rathbun	Fine, montmorillonitic, mesic Aeric Ochraqualfs
Rinda	Fine, montmorillonitic, mesic, sloping Mollic Ochraqualfs
Seymour	Fine, montmorillonitic, mesic Aquic Argiudolls
Shelby	Fine-loamy, mixed, mesic Typic Argiudolls
Tuskeego	Fine, montmorillonitic, mesic Mollic Ochraqualfs
Vesser	Fine-silty, mixed, mesic Argiaquic Argialbolls
Wabash	Fine, montmorillonitic, mesic Vertic Haplaquolls
Weller	Fine, montmorillonitic, mesic Aquic Hapludalfs
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

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