SOIL SURVEY OF

LEE COUNTY, IOWA

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 Department of Soil Conservation, State of Iowa

HOW TO USE

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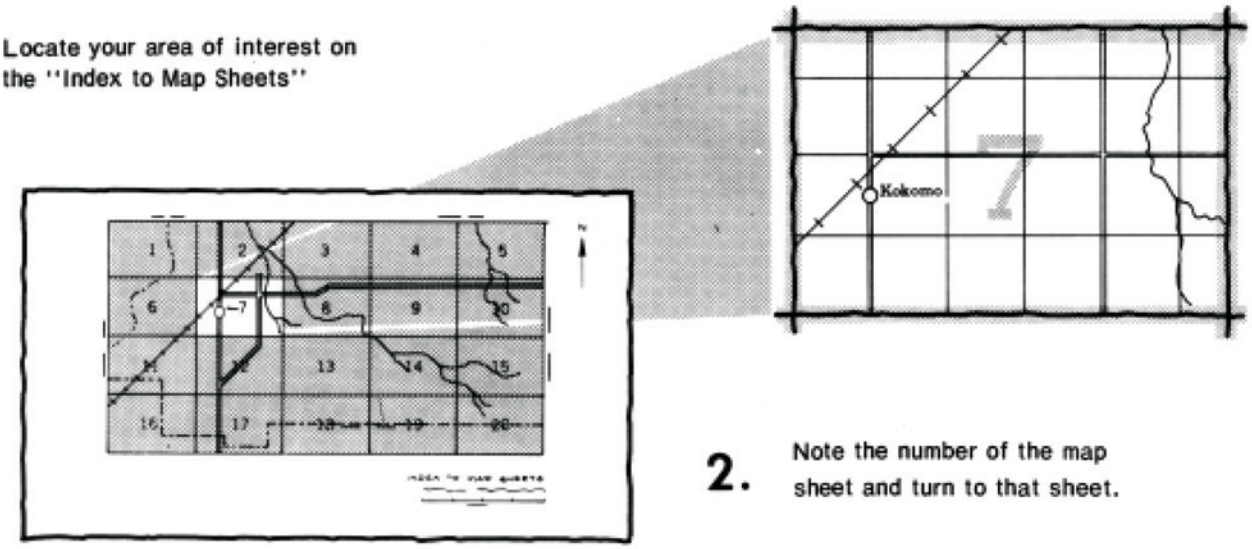

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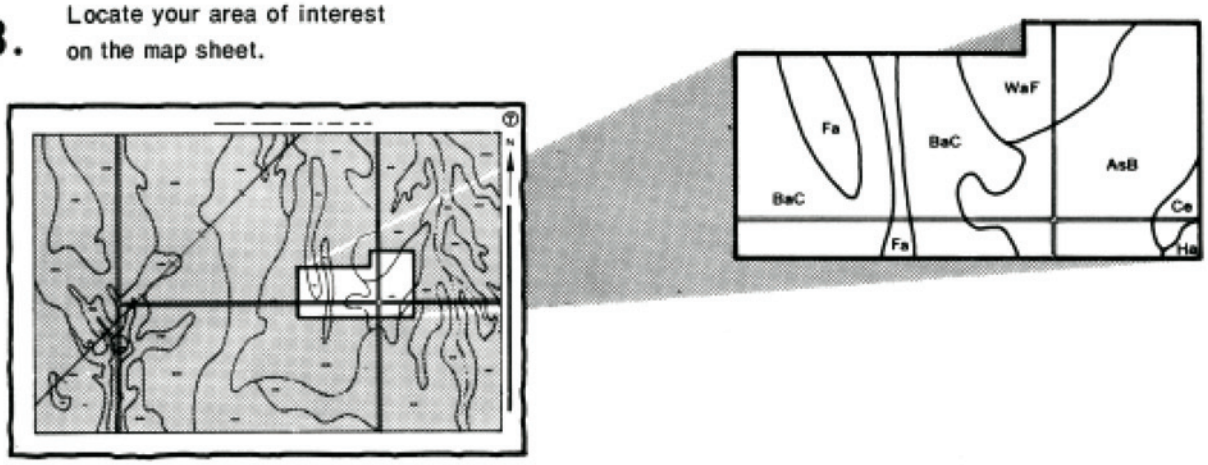

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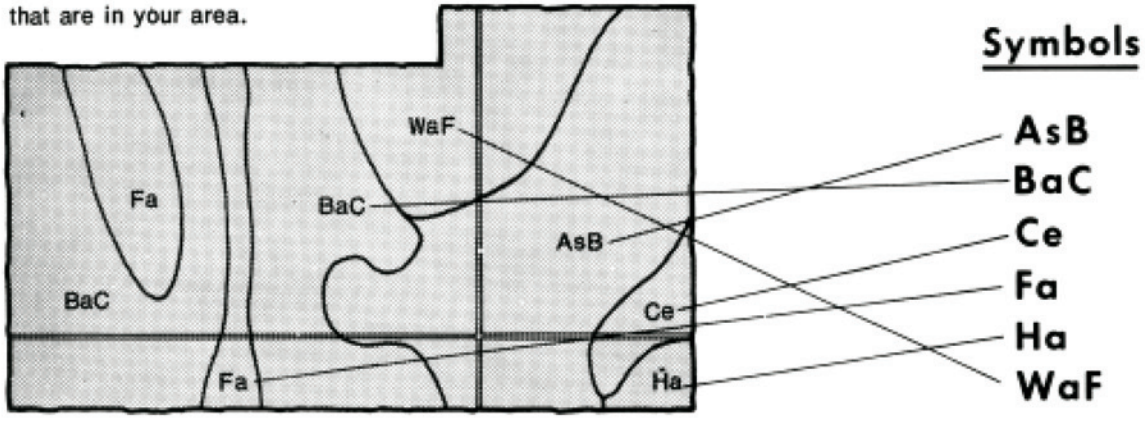

THIS SOIL SURVEY

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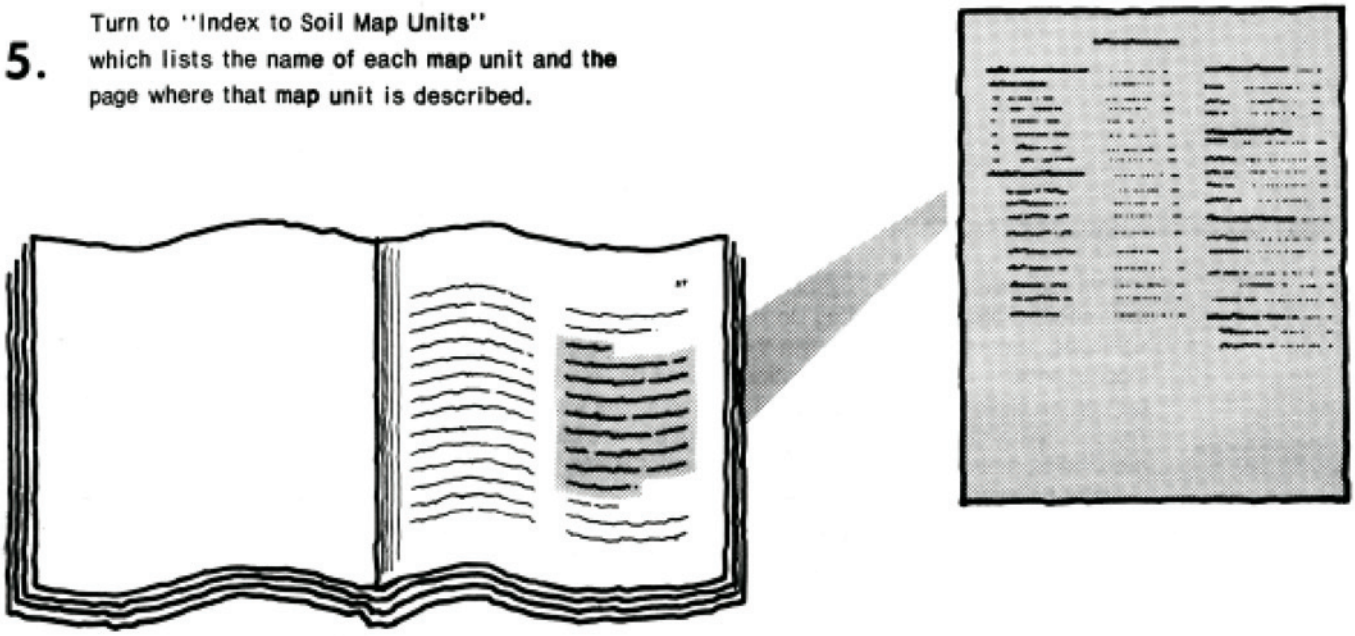
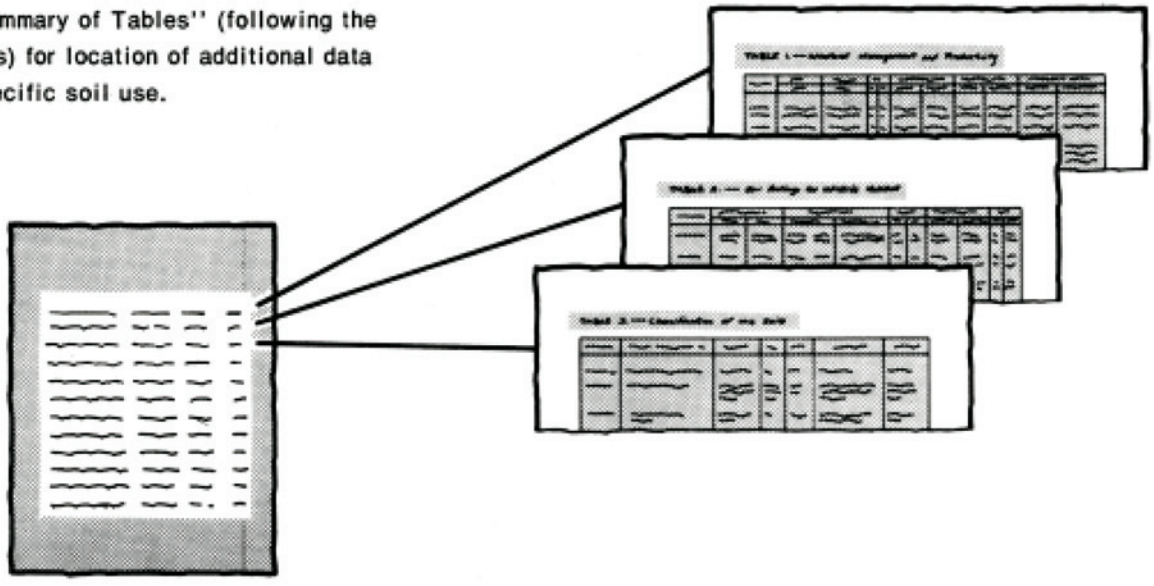


6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



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

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

Major fieldwork for this soil survey was completed in the period 1967-1972. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1973. This survey was made cooperatively by the Soil Conservation Service; the Iowa Agricultural and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Department of Soil Conservation, State of Iowa. It is part of the technical assistance furnished to the Lee County Soil and Water Conservation District. Funds appropriated by Lee County were used to defray part of the cost of this survey.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Mississippi River near Montrose.

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Preface

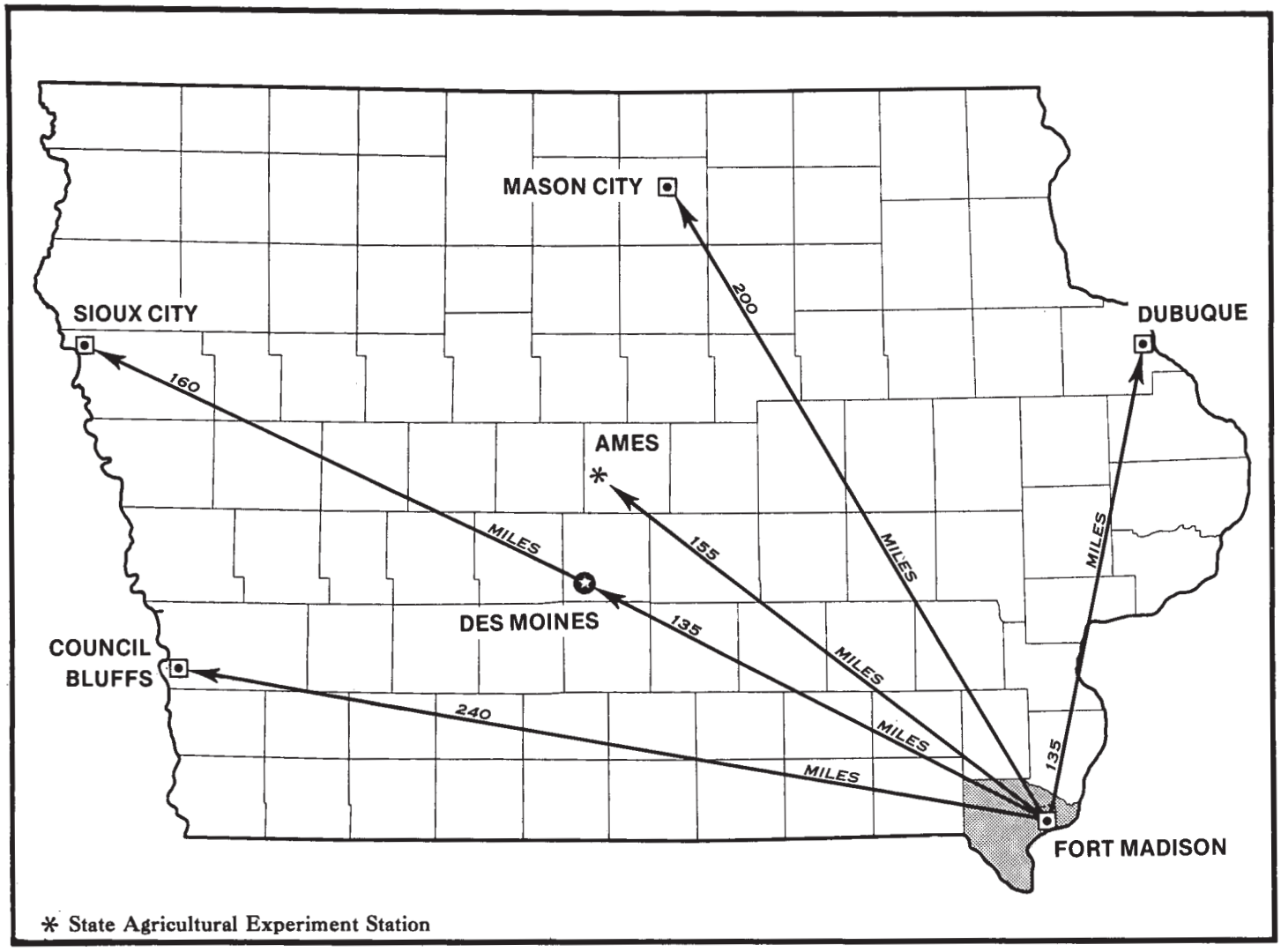
This soil survey contains much information useful in land-planning programs in Lee County. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.



Location of Lee County in Iowa.

SOIL SURVEY OF LEE COUNTY, IOWA

By L. Dale Lockridge, Soil Conservation Service

Fieldwork By L. Dale Lockridge, Charles E. Kiepe, and James E. Seaholm, 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 Department of Soil Conservation, State of Iowa

LEE COUNTY is in southeastern Iowa. It has a total area of 334,080 acres, or 522 square miles. Fort Madison, the county seat, has a population of 13,996. It is about 20 miles south of Burlington and about 20 miles north of Keokuk.

The county is mostly agricultural. The major acreage is in farms. About one-fourth is in timber, and most of the rest is used for corn, soybeans, hay, and pasture. Hogs and beef cattle are the principal livestock.

The Des Moines River flows southeasterly along the southern border, the Mississippi River flows southerly along the eastern border, and the Skunk River flows southeasterly along part of the northern border of the county. The land along the rivers is forested and steep.

Elevation ranges from 780 feet in the northern part of the county to 490 feet in the southeastern part, where the Des Moines and Mississippi Rivers join. Winters are cold, and summers are warm.

General nature of the county

The climate, relief and drainage, history and development, farming, transportation, and manufacturing and agricultural services of the county are described briefly in this section.

Climate

Prepared by Robert H. Shaw, climatologist, Iowa State University.

Tables 1 and 2 give temperature, precipitation, and freeze data for Lee County. Data are from Burlington and Keokuk.

On clear, calm nights, river valleys and other low areas may be several degrees cooler than upland or urban areas. Maximum temperatures in the tables are representative for the county. In an average year, about 31 days will have maximum temperatures of 90 degrees or higher. These temperatures are too high for optimum crop production because of excessive water demand.

The annual precipitation averages nearly 34 inches, making this one of the wettest counties in the state. During 1951 to 1960, Burlington received 0.5 inch or more of precipitation on an average of 22 days a year and 0.1 inch or more on an average of 61 days a year.

About 75 percent of the annual precipitation occurs during the warm season from April through September. The amount of rainfall during these showers is variable. June is usually the wettest month, and dry periods in summer are most likely in July.

Well-developed crops use more than an inch of water a week during summer. In June, the probability of receiving an inch or more of rainfall in a one-week period is about 4 years out of 10; in July and August the probability decreases to less than 3 out of 10.

The county is likely to have too much moisture in spring. On April 15, there is a 50 percent chance of the county having more than 9 inches of available water in the upper 5 feet of soil. A 5-inch reserve at that time would be a critically low level, and there is almost no chance of the county having less than that amount.

Relief and drainage

An interstream divide, starting north of Keokuk, widens from less than a mile to more than 10 miles near Houghton. The topography conforms to the flat to gently rolling underlying glacial till, but breaks quickly into narrow, loess-covered ridgetops surrounded by steep glacial till side slopes. The steepest slopes are along the bluffs bordering the rivers.

The northwest part of Cedar Township and the small watersheds bordering the Skunk River drain into the Skunk. The remaining area east of Highway 218, including Lost Creek and Big Devils Creek, drains into the Mississippi River. The watershed west of Highway 218, in which Sugar Creek is the major stream, drains into the Des Moines River. The levied area in Green Bay Township is a drainage district with a network of drainage ditches leading to a pumping station in the Mississippi.

History and development

The original vegetation of Lee County included oak-hickory forest in the southern half of the county and in large tracts near the rivers. The area that is now Green Bay Township was a marshy overflow of the Skunk and Mississippi Rivers that was inhabited by waterfowl. The northwestern part of the county supported tall prairie grasses.

Lee County was first visited by Marquette and Joliet in 1673 on their exploratory journey down the Mississippi River. A military outpost was established at Fort Madison in 1808 but was later overrun by Indians and abandoned. Settlers began arriving about 1820. Galland is the site of the first schoolhouse in Iowa.

With industrial development, Fort Madison and Keokuk have become population centers. The demands for conversion of rural land to urban uses have intensified, however, throughout the county. Because of the limitations of many soils for buildings and septic disposal, planned growth is tied closely to the soils. The trend in land use in Lee County is for preservation of the agricultural base from unplanned urbanization, agricultural uses related to soil potentials, and recognition of soil limitations in urban development.

Farming

Most of Lee County is farmed. The major crops are corn, soybeans, wheat, hay, pasture, and timber. Corn, soybeans, and wheat are the main cash crops for which excellent markets are available at the barge terminals on the Mississippi River. Some truck crops, especially melons, are raised in the sandy alluvial land near Montrose. The principle livestock enterprises are hogs, cattle feeding, beef cow herds, dairy, and sheep.

Row crops are grown on the broad loessial flats and ridgetops, and timber is harvested on the steeper slopes. Timber is a major resource. Excellent markets are available in Fort Madison and Illinois, and there is currently 75,000 acres of timber in Lee County.

In recent years, farm sizes have increased, but farm numbers have decreased. In 1971, the average size of a farm in Lee County was 227 acres.

Transportation

Lee County is crisscrossed by hard-surfaced roads and highways. Most areas have access to market roads. Rail service is available to Fort Madison and Keokuk. The Mississippi River is a major transportation artery, providing markets for agricultural goods and raw materials for industry. Goods can be moved cheaply to and from terminals on the river.

Manufacturing and agricultural services

Fort Madison has developed a large industrial base, of which a major portion is related to the Mississippi River. Several industries produce products for agricultural use, such as ammonia and pesticides. Others, such as a meat processer and a pulp mill, use raw agricultural products.

Keokuk is currently striving to expand its industrial base and has been successful in attracting several industries. The smaller towns center around agriculture services such as fertilizer sales, livestock feed processing, farm machinery businesses, and related services.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state

and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information is then organized and published so that it is readily available to different groups of users, among them farmers, managers of woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land-use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Grundy-Haig-Arispe association

Moderately well drained to poorly drained, nearly level to moderately sloping soils formed in loess on uplands

This association consists mainly of nearly level to moderately sloping soils on wide interstream divides (fig. 1, 2). These divides are at the highest elevation in the county. The larger areas of the association are in the northwest part of the county and on the main divide between Little Sugar Creek and Big Sugar Creek. Another area is on the divide between the tributaries of the Skunk and Mississippi Rivers.

This association covers about 16 percent of the county. It is about 34 percent Grundy soils, 29 percent Haig soils, 11 percent Arispe soils, and 26 percent soils of minor extent.

Grundy soils are somewhat poorly drained, gently sloping soils that border the nearly level Haig soils. These soils have a surface layer of black or very dark gray silt loam or silty clay loam 18 inches thick. The subsoil extends to a depth of 65 inches. It is very dark gray and dark gray silty clay loam and silty clay in the uppermost part, mottled grayish brown and olive silty clay or silty clay loam in the middle part, and mottled light olive gray and strong brown silty clay loam in the lowest part. A very slowly permeable gray clayey soil is at a depth of 7 to 8 feet.

The nearly level Haig soils are naturally poorly drained, and artificial drainage is needed to reduce seasonal wetness. These soils have a surface layer of black silt loam or silty clay loam about 16 inches thick. The subsoil extends to a depth of 60 inches. It is black silty clay in the uppermost part; mottled very dark gray, dark gray, and grayish brown silty clay and silty clay loam in the middle part; and olive gray silty clay loam in the lowest part. A very slowly permeable gray clayey soil is at a depth of 7 to 9 feet.

Arispe soils are moderately sloping, and they border areas of gently sloping Grundy soils. These soils are somewhat poorly drained and moderately well drained. They have a surface layer of very dark gray silty clay loam about 8 inches thick. The subsoil extends to a depth of 41 inches. It is very dark gray and dark grayish brown silty clay loam in the upper part and mottled grayish brown and gray, mottled silty clay loam in the lower part. The substratum is gray, mottled silty clay loam.

Of minor extent in this association are Edina, Clarinda, Colo, and Vesser soils. Edina soils are generally level to slightly depressional within areas of Haig soils. Clarinda soils are at the heads and along the sides of drainageways downslope from the Arispe soils. Colo and Vesser soils formed in alluvium in drainageways.

The soils of this association are among the most productive in Lee County. These soils have high available water capacity and relatively high natural fertility. Corn and soybeans are grown almost continuously on the nearly level and gently sloping soils. Crop rotations, crop residue management, and contour tillage or terracing are needed on the moderately sloping soils. Most corn is used as feed on farms in the county, but soybeans are used primarily as a cash crop.

2. Pershing-Weller association

Somewhat poorly drained and moderately well drained, gently sloping and moderately sloping soils formed in loess on uplands

This association is along the headwaters of the main streams within the northern part of the county. The landscape is gently sloping ridgetops and moderately sloping valleys (figs. 3, 4). Trees are scattered along drainageways and old fence rows. Along Little Cedar Creek

and Sugar Creek, thick timber growth is common. The soils in this association have a moderately dark or moderately light-colored surface layer.

This association covers about 4 percent of the county. It is about 35 percent Pershing soils, 35 percent Weller soils, and 30 percent soils of minor extent.

Pershing soils are on ridgetops and the upper parts of convex side slopes. These soils are somewhat poorly drained and moderately well drained. They have a surface layer of very dark gray silt loam about 8 inches thick. The subsurface layer is very dark gray or dark grayish brown silt loam and silty clay loam about 9 inches thick. The subsoil extends to a depth of 52 inches. It is dark grayish brown silty clay loam in the uppermost part; mottled, grayish brown silty clay in the middle part; and light olive gray and olive gray silty clay and silty clay loam in the lowest part. The substratum is mottled light olive gray and yellowish brown silty clay loam.

Weller soils are on ridgetops and the upper parts of convex side slopes. These soils are moderately well drained. They have a surface layer of very dark grayish brown silt loam about 3 inches thick. The subsurface layer is grayish brown silt loam about 13 inches thick. The subsoil extends to a depth of 50 inches. It is grayish brown and brown silty clay in the uppermost part, grayish brown silty clay in the middle part, and grayish brown silty clay loam in the lowest part. The substratum is mottled light olive gray and light olive brown silty clay loam.

Of minor extent in this association are fairly large acreages of Ashgrove, Galland, Gara, Keswick, Belinda, Nodaway, and Cantril soils. Ashgrove soils formed in highly weathered, gray, clayey glacial till, and Galland soils formed in old, loamy valley fill along the lower parts of slopes. Keswick and Gara soils formed in glacial till and are on the lower parts of convex slopes. Belinda soils formed in loess on upland divides. Vesser, Nodaway, and Cantril soils formed in alluvium on creek bottoms.

A large part of this association is cultivated, and the rest is in permanent pasture or forest. Most cultivated areas are subject to severe erosion. Many slopes are long and uniform and can be terraced or tilled on the contour.

3. Pershing-Belinda association

Moderately well drained to poorly drained, moderately sloping to nearly level soils formed in loess on uplands

This association consists mainly of moderately sloping, gently sloping, and nearly level soils (fig. 5) that formed under a native vegetation of prairie and forest. It is on relatively narrow interstream divides and in a band between the prairie soils and the timbered soils.

This association covers about 15 percent of the county. It is about 40 percent Pershing soils, 15 percent Belinda soils, and 45 percent soils of minor extent.

Pershing soils are somewhat poorly to moderately well drained. These soils are on ridgetops and upper parts of convex side slopes. They have a surface layer of very dark gray silt loam about 8 inches thick. The subsurface layer is very dark gray or dark grayish brown silt loam and silty clay loam about 9 inches thick. The subsoil extends to a depth of 52 inches. It is dark grayish brown silty clay loam in the uppermost part; mottled, grayish brown silty clay in the middle part; and light olive gray and olive gray silty clay and silty clay loam in the lowest part. The substratum is mottled, light olive gray and yellowish brown silty clay loam.

Belinda soils are poorly drained. These soils are nearly level and are on interstream divides. They have a surface layer of very dark gray silt loam about 7 inches thick. The subsurface layer is grayish brown and light brownish gray silt loam about 11 inches thick. The subsoil extends to a depth of 60 inches. It is mottled dark grayish brown and grayish brown silty clay in the uppermost part; mottled, grayish brown silty clay in the middle part; and light olive gray silty clay loam in the lowest part.

Of minor extent in this association are Armstrong, Edina, Rinda, Colo, and Vesser soils. Edina are prairie soils in small areas near the center of flat divides. Rinda are gray, highly weathered, clayey glacial till soils that are on side slopes along drainageways. Armstrong soils are similar to Rinda soils but have a much redder subsoil. Colo and Vesser soils formed in alluvium in drainageways.

The soils in this association have moderately high available water capacity and medium natural fertility. Farming is diversified. The gently sloping and nearly level soils are almost continuously cropped with corn and soybeans. The steeper soils can be cropped, but they generally are in permanent pasture. Most grain that is grown is fed to livestock.

4. Lindley-Weller association

Well drained and moderately well drained, moderately sloping to steep soils formed in glacial till and loess on uplands

This association consists of strongly dissected areas that border the Des Moines, Skunk, and Mississippi Rivers and areas that border the major streams in the county. The principal landscape features are narrow, rounded ridgetops; long, steep, convex side slopes; and narrow valleys (figs. 6, 7). Most of the area is covered with forest, but small, irregularly shaped fields are mainly in pasture. The soils of this association formed under forest vegetation, and they have a light-colored surface layer.

This association covers about 47 percent of the county. It is about 48 percent Lindley soils, 18 percent Weller soils, and 34 percent soils of minor extent.

Lindley soils are on lower, convex side slopes of dissected uplands. These soils are well drained. They have a surface layer of mixed very dark grayish brown and yellowish brown loam about 10 inches thick. The subsoil extends to a depth of 60 inches. It is yellowish brown loam in the upper part and yellowish brown clay loam in the lower part.

Weller soils are on rounded ridgetops and upper parts of convex side slopes. These soils are moderately well drained. They have a surface layer of very dark grayish brown silt loam about 3 inches thick. The subsurface layer is grayish brown silt loam about 13 inches thick. The subsoil extends to a depth of 50 inches. It is grayish brown and brown silty clay in the uppermost part, grayish brown silty clay in the middle part, and grayish brown silty clay loam in the lowest part. The substratum is mottled light olive gray and light olive brown silty clay loam.

Of minor extent in this association are Ashgrove, Beckwith, Clinton, Fayette, Keswick, Nordness, Nodaway, and Cantril soils. Beckwith soils are on the nearly level areas of the uplands, and they formed in loess. Ashgrove soils are gray, highly weathered, clayey glacial till soils. Keswick soils are similar to Ashgrove soils but have a much redder subsoil. Keswick soils are on convex side slopes. Clinton and Fayette soils are forested soils that are in positions similar to those of Weller soils, but they have less clay in the subsoil. Nordness soils are generally steep, and they formed in loamy material 10 to 18 inches thick over limestone bedrock. Nodaway and Cantril soils formed in alluvium in narrow drainageways.

The soils in this association are not well suited to row crops. Row crops are grown on ridgetops and upper side slopes, but a large part of the acreage is in permanent pasture and woodland. These soils are subject to severe erosion because runoff is rapid. Many drainageways that dissect this association are deep and uncrossable with farm machinery.

5. Douds-Clinton-Keomah association

Somewhat poorly drained and moderately well drained, nearly level to moderately steep soils formed in old alluvial sediment and loess on high benches

This association consists of loess-covered benches, the tops of which are nearly level to moderately sloping and the side slopes and escarpments of which are generally moderately steep. The material below the loess on side slopes is sand, silt, and clay, and it originated as alluvial sediment at a much earlier time. The benches are along the major stream valleys and are distinctly higher than the flood plain (figs. 8, 9). The most extensive area of nearly level bench soils is at the mouth of Sugar Creek, and another large area extends along most of Big Sugar Creek. Small areas of bench soils are scattered along the Des Moines River.

This association covers about 5 percent of the county. It is about 35 percent Douds soils, 20 percent Clinton soils, 12 percent Keomah soils, and 33 percent soils of minor extent.

Douds soils are moderately well drained. These soils are moderately steep and are downslope from the loess soils. They have a surface layer of very dark grayish brown loam about 5 inches thick. The subsurface layer is dark grayish brown loam about 9 inches thick. The subsoil extends to a depth of 60 inches. It is brown sandy clay loam or clay loam in the upper part and brown or strong brown sandy clay loam or sandy loam in the lower part.

Clinton soils are moderately well drained. These soils are upslope from Douds soils and are on the upper parts of the benches. They have a surface layer of very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and yellowish brown silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is yellowish brown and brown silty clay loam. The substratum is yellowish brown silty clay loam.

Keomah soils are somewhat poorly drained. These nearly level soils generally are nearer the center of the benches. They have a surface layer of brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is brown silty clay and silty clay loam in the upper part and mottled grayish brown, dark grayish brown, and yellowish brown silty clay and silty clay loam in the lower part.

Of minor extent in this association are Belinda, Galland, Pershing, Nodaway, and Weller soils. Galland soils are clay loam and are downslope from the loess soils. Weller soils are in positions similar to Clinton soils, but the content of clay in the subsoil is higher. Belinda and Pershing soils are in the loess part of the bench, but they have a darker surface layer than Weller or Clinton soils. Nodaway soils formed in alluvium on river bottoms.

The response of Clinton, Keomah, Douds, Galland, and Weller soils to fertilizers is good. Most of these soils are cultivated or have been cleared of trees and are in permanent pasture.

The steeper soils have low productivity and are subject to erosion. They are generally in timber or permanent pasture. Along some bench escarpments are sand pockets that are large enough to quarry. The bench escarpments along Big Sugar Creek near Franklin have outcroppings of limestone.

6. Sparta-Dickinson association

Excessively drained to well drained, nearly level to moderately sloping soils formed in coarse sediment on benches

This association consists of soils located mainly on sandy benches along the Mississippi and Des Moines Rivers. The edges of the benches are moderately steep in some places, but the landscape is typically nearly level to moderately sloping. Generally, this association is near the center of bottom lands and is surrounded by finer textured soils.

This association covers about 3 percent of the county. It is about 50 percent Sparta soils, 20 percent Dickinson soils, and 30 percent soils of minor extent.

Sparta soils are on sandy stream benches. These soils are excessively drained and have a sand and coarse sand subsoil. They have a surface layer of very dark grayish brown and dark brown loamy sand about 20 inches thick. The substratum is sand to a depth of 60 inches. It is dark yellowish brown in the upper part and yellowish brown in the lower part.

Dickinson soils developed in sandy sediment and are well drained and somewhat excessively drained. These soils generally are on sandy stream benches. They have a surface layer of very dark brown fine sandy loam and sandy loam about 18 inches thick. The subsoil extends to a depth of 44 inches. It is very dark grayish brown and brown sandy loam in the uppermost part, dark yellowish brown loamy sand in the middle part, and yellowish brown loamy sand in the lowest part. The substratum is yellowish brown loamy sand and sand.

Of minor extent in this association are excessively drained Chelsea and Hoopeston soils. Hoopeston soils are sandy loam and are in the lower and wetter parts of the association. Chelsea soils are in positions similar to Sparta soils; they formed under forest vegetation and the surface layer is thin and light colored.

The soils in this association have low available water capacity and are droughty. If rainfall is timely, however, good yields can be expected on Dickinson soils. Because these soils warm up early in spring, some areas are used for truck farming. Watermelons and cantaloupe are the predominant truck farming crops (fig. 10). The steep slopes and terrace escarpments are generally in grass.

In a few areas of this association, sand is quarried for commercial use. Just south of Fort Madison, a few industries have selected building sites on these soils.

7. Chequest-Nodaway-Landes association

Poorly drained, moderately well drained and well drained, nearly level soils formed in recent alluvium on bottom land

The soils of this association are nearly level and are on first and second bottoms (fig. 11). The largest areas are along the Mississippi River in the northeast part of the county and south of Fort Madison. These areas range from 2 to 7 miles in width. Smaller areas are along the Des Moines River and the major streams in the county. The soils formed in silty and loamy sediment deposited on the flood plains.

This association covers about 10 percent of the county. It is about 12 percent Chequest soils, 11 percent Nodaway soils, 10 percent Landes soils, and 67 percent soils of minor extent.

Chequest soils are poorly drained. These soils formed in silty alluvial sediment on the nearly level part of the flood plain that is some distance from the stream channels. They are subject to flooding unless protected by levees. Artificial drainage is needed for highest crop production. These soils have a surface layer of very dark gray silty clay loam about 9 inches thick. The subsoil extends to a depth of 60 inches. It is dark gray silty clay loam that has some brownish mottles. The substratum is generally at a depth below 60 inches.

Nodaway soils are a stratified mixture of silty material and a few sandy strata. These soils are near the main channel of the streams and are flooded unless protected. Remnants of former stream channels are in many places. The topography is gently undulating. In some areas these soils remain in forest vegetation. They have a surface layer of very dark grayish brown silt loam about 8 inches thick. The substratum is variable thin strata of dark grayish brown, grayish brown, and very dark grayish brown silt loam to a depth of 60 inches.

Landes soils are well drained. They formed in loamy alluvial sediments adjacent to the main channel of the stream. Some areas may need protection from flooding if used for row crop production. The soils have a surface layer of very dark grayish brown and dark grayish brown sandy loam about 12 inches thick. The substratum is stratified very dark grayish brown, dark grayish brown, and pale brown silt loam, loam, and sandy loam to a depth of 58 inches.

Of minor extent in this association are sizable acreages of Festina, Koszta, Lawler, Lawson, and Richwood soils. Festina soils are moderately dark, well drained soils that have a silty clay loam subsoil. Koszta soils are moderately dark, somewhat poorly drained soils that have a silty clay loam subsoil. These soils are on second bottoms and generally are not flooded. Lawler soils are dark, somewhat poorly drained, and they have a loam subsoil. Lawler soils formed in loamy alluvial sediment, but some areas may need tile drainage because of a seasonal high water table. Lawson soils are somewhat poorly drained silt loam soils that are near the main channel of the streams. Richwood soils have a dark surface and are well drained. They are some distance from the main stream and on higher stream benches.

Except for some areas of Landes soils, this association is used intensively for corn and soybeans. The available water capacity is high, and the productivity is higher than the county average. Some of the soils are flooded. For optimum yields, artificial drainage and flood protection may be needed.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Galland series, for example, was named for the town of Galland in Lee County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Galland loam, 5 to 9 percent slopes, moderately eroded, is one of several phases within the Galland series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the patterns and proportions are somewhat similar in all areas. Colo-Vesser complex, 2 to 5 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Galland soils, 9 to 14 percent slopes, severely eroded, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

13B—Colo-Vesser complex, 2 to 5 percent slopes. This complex consists of poorly drained and somewhat poorly drained, gently sloping soils on bottom lands. The soils are so intermingled that it is impractical to map each separately. The complex is about 60 percent Colo soils, 30 percent Vesser soils, and 10 percent included soils.

Colo soils are typically along waterways; Vesser soils are in uniform bands along the edges of the map unit at the base of slopes. Both soils are subject to flooding. In many places, they are cut by channels or gullies that cannot be crossed by farm machinery. This complex is in elongated areas that are as much as a mile or more long and generally about 150 to 400 feet wide.

Typically, the Colo soils have a surface layer of very dark gray and black silty clay loam about 37 inches thick. The subsoil extends to a depth of 60 inches. It is very dark gray silty clay loam. The substratum is gray silty clay loam.

Typically, the Vesser soils have a surface layer of very dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray or dark gray silt loam about 23 inches thick. The subsoil is silty clay loam that extends to a depth of 60 inches. It is gray and light gray in the uppermost part, very dark gray and black in the middle part, and very dark gray in the lowest part.

Included with this complex in mapping are small areas of soils in entrenched drainageways, which may carry water part of the year. Also included are small areas of Chequest soils.

Colo and Vesser soils have moderate or moderately slow permeability and high available water capacity. The subsoil is medium in available phosphorous and low to very low in potassium. The surface layer of these soils is acid unless limed within the past few years. Natural fertil-

ity is medium. The organic matter content is moderate to high.

The soils in this complex are well suited to pasture if they are protected from gullying. They are well suited to intensive row cropping if gullying is prevented and drainage is provided. Diversion terraces can be used to control runoff from the uplands, and most areas can be tile drained. Grass waterways are needed in gullied areas.

This complex is in capability subclass IIw.

23C—Arispe silty clay loam, 5 to 9 percent slopes. This is a moderately well drained and somewhat poorly drained soil on short, slightly convex side slopes. Most areas are longer than they are wide, but some are irregular in shape. They are commonly cut by small drainageways. Most are 20 acres to more than 40 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsoil is silty clay loam that extends to a depth of 41 inches. The upper part is very dark gray and dark grayish brown, and the lower part is grayish brown and gray and is mottled. The substratum is gray, mottled silty clay loam.

Included with this soil in mapping are small areas of Grundy and Mahaska soils. Also included are some areas of eroded soils that have a thinner surface layer. These included areas make up less than 10 percent of the map unit.

This Arispe soil is moderately slowly permeable and has a high available water capacity. The subsoil is very low to low in available phosphorus and low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

This soil is moderately well suited to corn and soybeans. Because runoff is medium, the erosion hazard is moderate. The surface layer is generally friable, has good tilth, and is moderately easy to till.

This soil is in capability subclass IIIe.

23C2—Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained and somewhat poorly drained soil on short, slightly convex slopes. Areas generally are longer than they are wide, and they have irregular boundaries. Many small drainageways pass through this soil. Most areas are 20 acres or more than 50 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 6 inches thick. The subsoil is silty clay loam that extends to a depth of 34 inches. The upper part is very dark gray and grayish brown, and the lower part is grayish brown and gray and is mottled. The substratum to a depth of 60 inches is gray, mottled silty clay loam.

Included with this soil in mapping are small areas of Grundy and Mahaska soils. Also included are some areas of severely eroded soils that have a thinner surface layer. These included areas make up less than 15 percent of the map unit.

This Arispe soil is moderately slowly permeable and has a high available water capacity. The subsoil is very low to low in available phosphorous and low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

This soil is moderately suited to corn and soybeans. Because runoff is medium, the erosion hazard is moderate.

This soil is in capability subclass IIIe.

41—Sparta loamy sand, 0 to 2 percent slopes. This excessively drained soil is on stream benches, mainly along the Mississippi River. It is underlain by coarser sand and occasionally gravel at a depth below 4 feet in some places. Areas are 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown and dark brown loamy sand about 20 inches thick. The substratum is sand to a depth of 60 inches. It is dark yellowish brown in the upper part and yellowish brown in the lower part.

Included with this soil in mapping are small areas of Sparta soils that have a thick surface layer and some small areas of Dickinson and Saude soils. These included areas make up less than 10 percent of this map unit.

This Sparta soil is rapidly permeable and has a very low available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is low.

This soil is poorly suited to corn and soybeans unless irrigated. Some vegetables and melons are grown. The soil is moderately suited to pasture or hay and is also suited to wildlife habitat.

This soil is in capability subclass IVs.

41B—Sparta loamy sand, 2 to 7 percent slopes. This excessively drained soil is on convex ridge crests and side slopes and on slight rises, principally on benches along the Mississippi River valley. Areas are 5 to 10 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown and dark brown loamy sand about 20 inches thick. The substratum is sand to a depth of 60 inches. It is dark yellowish brown in the upper part and yellowish brown in the lower part.

Included with this soil in mapping are some areas of severely eroded soils.

This Sparta soil is rapidly permeable and has a very low available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low.

This soil is poorly suited to corn and soybeans unless it is irrigated. Some vegetables and melons are grown.

The soil is moderately suited to pasture or hay and is also suited to wildlife habitat. It is subject to wind and water erosion unless protected by vegetative cover.

This soil is in capability subclass IVs.

51—Vesser silt loam, 0 to 2 percent slopes. This is a somewhat poorly drained or poorly drained, nearly level soil along streams. The soil is subject to flooding. Areas generally are large.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray or dark gray silt loam about 23 inches thick. The subsoil is silty clay loam that extends to a depth of 60 inches. It is gray in the uppermost part, very dark gray and black in the middle part, and very dark gray in the lowest part.

Included with this soil in mapping are small areas of soils that have a thinner, gray subsurface layer and contain more clay in the subsoil than this Vesser soil.

This Vesser soil is moderately permeable and has a high available water capacity. The subsoil is medium in available phosphorus and low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

This soil, although flooded, is used mainly for pasture. The most frequently flooded areas are in trees. If artificially drained and protected from flooding, the soil is well suited to row crops. Tilth is generally good. Because natural drainage is poor, cultivation is often delayed unless the soil is artifically drained. Tile lines work well because the subsoil is moderately permeable. Crop response is favorable to lime and fertilizer.

This soil is in capability subclass IIw.

56—Cantril loam, 0 to 2 percent slopes. This is a somewhat poorly drained soil on bottom lands of the major streams and on lower parts of large alluvial fans. Areas range from 10 acres to as much as 40 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is dark grayish brown and grayish brown loam about 14 inches thick. The subsoil extends to a depth of 60 inches. It is mottled grayish brown and yellowish brown loam in the upper part and mottled yellowish brown loam and light brownish gray or gray silty clay loam in the lower part.

Included with this soil in mapping are some areas of soils that have a thicker, dark surface layer than this Cantril soil. Also included are a few small areas where light-colored loam is on the surface.

This Cantril soil is moderately permeable and has a high available water capacity. The subsoil is low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is low to moderate.

This soil is well suited to row crops. It is susceptible to erosion unless protected by diversions from runoff from the uplands. The soil has a seasonally high water table and is subject to siltation from soils on uplands.

This soil is in capability class I.

56B—Cantril loam, 2 to 5 percent slopes. This is a somewhat poorly drained, gently sloping soil on alluvial fans, foot slopes, and stream benches. Most areas are in major stream valleys. They range from 5 to 15 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is dark grayish brown and grayish brown loam about 14 inches thick. The subsoil extends to a depth of 60 inches. It is mottled grayish brown and yellowish brown loam in the upper part and mottled yellowish brown loam and light brownish gray or gray silty clay loam in the lower part.

Included with this soil in mapping are small areas of soils that have a slightly thicker surface layer and in which the lower part of the subsoil and the substratum contain more sand than this Cantril soil. Also included are areas that have recent deposition of light-colored loamy sediment.

This Cantril soil is moderately permeable and has a high available water capacity. The subsoil is low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content of this soil is low to moderately low.

This soil is moderately suited to row crops. Because most areas are narrow and small, it is best to farm them with adjacent soils. Surface runoff is medium. Unless runoff from soils on uplands is controlled, the soil is damaged by sheet and gully erosion.

This soil is in capability subclass IIe.

57—Rushville silt loam, 0 to 2 percent slopes. This is a poorly drained to very poorly drained soil on narrow ridgetops on uplands near the major streams. Areas range from 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is gray and light brownish gray silt loam about 7 inches thick. The subsoil extends to a depth of 52 inches. It is grayish brown silty clay loam in the uppermost part, grayish brown silty clay in the middle part, and grayish brown and yellowish brown silty clay loam in the lowest part. The substratum is mottled grayish brown and yellowish brown silt loam.

Included with this soil in mapping are small areas where runoff water collects in shallow depressions because there is no natural outlet to drain surface water. Also included are areas where plowing has mixed the grayish subsurface layer with the surface layer. These areas appear ashy.

This Rushville soil is slowly or very slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility and organic matter content are low.

This soil is best suited to row crops and meadow. Tile drainage is needed for optimum growth, but surface drainage is sufficient in some places.

This soil is in capability subclass IIIw.

58D2—Douds loam, 9 to 14 percent slopes, moderately eroded. This is a moderately well drained, strongly sloping soil on side slopes of high benches along the major rivers and their tributaries. Areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown loam about 5 inches thick. The subsurface layer is dark grayish brown loam about 9 inches thick. The subsoil extends to a depth of 60 inches. It is brown sandy clay loam or clay loam in the upper part and brown or strong brown sandy clay loam or sandy loam in the lower part.

Included with this soil in mapping are a few small areas of severely eroded soils and areas of soils that have short, steep slopes.

This Douds soil is moderately permeable and has a medium available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is very low. The organic matter content is low.

This soil is best suited to hay and pasture. It is moderately suited to corn and soybeans if erosion is controlled and fertility is improved. Surface runoff is medium or rapid. The soil receives varying amounts of seepage water. In some places artificial drainage is impractical.

This soil is in capability subclass IVe.

58E2—Douds loam, 14 to 18 percent slopes, moderately eroded. This is a moderately well drained, moderately steep soil on side slopes of high benches along the major rivers and their tributaries. Areas are irregular in shape and generally range from 15 acres to more than 40 acres in size.

Typically, the surface layer is very dark grayish brown loam about 5 inches thick. The subsurface layer is dark grayish brown loam about 9 inches thick. The subsoil extends to a depth of 60 inches. It is brown sandy clay loam or clay loam in the upper part and brown or strong brown sandy clay loam or sandy loam in the lower part. The clay loam subsoil is exposed near drainageways and short side slopes in some places.

This Douds soil is moderately permeable and has a medium available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is very low. The organic matter content is low.

This soil is used for pasture and woodland or as wildlife habitat. It is not suited to cultivation because it is susceptible to very severe erosion. Surface runoff is rapid. Establishing pasture seeding is difficult because of poor tilth and low fertility of the surface layer. The soil receives varying amounts of seepage water. In most places artificial drainage is not practical.

This soil is in capability subclass VIe.

63—Chelsea loamy fine sand, 0 to 2 percent slopes. This is an excessively drained, nearly level soil on benches along the Mississippi River. Areas are irregular in shape and range from 10 acres to more than 60 acres in size.

Typically, the surface layer is black loamy fine sand about 4 inches thick. The subsurface layer is brown fine sand about 42 inches thick. The substratum is brown fine sand. Bands of dark reddish brown, slightly cemented sand coated with clay and iron are at a depth below 40 inches. Coarse sand and some gravel are at a depth below about 3 feet in some areas.

Included with this soil in mapping are some small areas of Saude and Sparta soils.

This Chelsea soil is rapidly permeable and has a very low available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility and the organic matter content are very low.

This soil is suited to small grain or woodland. It is excessively drained and very droughty. If irrigated, it can be used for melons and vegetables. In dryfarmed areas satisfactory crop yields are dependent on timely and above-normal rainfall. The soil is subject to wind erosion unless vegetative cover is maintained. This wind activity can damage row crops. The soil is suitable as wildlife habitat.

This soil is in capability subclass IVs.

63B—Chelsea loamy fine sand, 2 to 7 percent slopes. This is an excessively drained, gently sloping soil on side slopes of benches along the Mississippi River. Areas are irregular in shape and generally are longer than they are wide. They are 5 to 30 acres in size.

Typically, the surface layer is black loamy fine sand about 4 inches thick. The subsurface layer is brown fine sand about 42 inches thick. The substratum is brown fine sand. Bands of dark reddish brown, slightly cemented sand coated with clay and iron are at a depth below 40 inches.

This Chelsea soil is rapidly permeable and has a very low available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years.

Natural fertility and the organic matter content are very low.

This soil is poorly suited to corn and soybeans. It is moderately suited to hay and woodland or as wildlife habitat. The soil is excessively drained and very droughty. It is subject to wind erosion unless a vegetative cover is maintained. This wind activity can damage young crops.

This soil is in capability subclass IVs.

65E2—Lindley loam, 14 to 18 percent slopes, moderately eroded. This is a well drained soil. It is most extensive on convex side slopes dissected by many, small, V-shaped drains. Areas range from 10 to 50 acres in size.

Typically, the surface layer is mixed very dark grayish brown and yellowish brown loam about 10 inches thick. The yellowish brown subsoil extends to a depth of 60 inches. It is loam in the upper part and clay loam in the lower part. Part of the original surface layer has been removed by erosion, and the rest has been mixed with the subsurface layer and part of the former subsoil by plowing.

Included with this soil in mapping are a few areas of uneroded soils in the woodlands.

This Lindley soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer generally is acid unless limed recently. Natural fertility is very low. The organic matter content is low.

This soil is best suited to permanent pasture and produces fair pasture if managed properly. Most areas are in pasture or woodland. If trees are removed, the pasture should be seeded as soon as possible because of the severe erosion hazard. Runoff is rapid.

This soil is in capability subclass VIe.

65E3—Lindley soils, 14 to 18 percent slopes, severely eroded. These are well drained soils. They are most extensive on irregular, convex side slopes that are dissected by many V-shaped drains. In places, numerous small gullies cross these soils. Areas generally are not large.

Typically, the surface layer is a plow layer about 8 inches thick. It is reddish brown and yellowish brown loam to clay loam. The yellowish brown subsoil extends to a depth of 48 inches. It is loam in the upper part and clay loam in the lower part. Erosion is so severe that in most places the present surface layer consists of subsoil mixed by tillage with a small amount of the remaining surface and subsurface layers. Many gullies have formed. In a few areas near waterways or at the base of slopes, the surface layer is a few inches of moderately dark loam.

These Lindley soils are moderately slowly permeable and have a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer generally is acid unless recently limed. Natural fertility and the organic matter content are very low.

These soils are not suited to row crops because of the moderately steep slopes and severe soil loss. Most areas are permanent pasture or idle areas within cultivated fields. The potential yield is low. The hazard of erosion is severe, and surface runoff is rapid. The soils are best suited to permanent pasture or trees. Establishing a stand of either is often difficult because of the poor tilth and low fertility. Tree growth is generally slow.

These soils are in capability subclass VIIe.

65F2—Lindley loam, 18 to 25 percent slopes, moderately eroded. This is a well drained, steep soil on side slopes. Areas range from 10 to 40 acres in size.

Typically, the surface layer is very dark grayish brown and yellowish brown loam or clay loam about 10 inches thick. The yellowish brown subsoil extends to a depth of 40 inches. It is loam in the upper part and clay loam in the lower part. In a few places, the clay loam subsoil is exposed. The subsoil contains lime at a depth of 40 inches in some places.

This Lindley soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer generally is acid unless recently limed. Natural fertility and the organic matter content are very low.

This soil is mainly in oak, hickory, and some elm. Some areas are used for very limited grazing, but clearing and seeding pasture generally is not practical. Surface runoff is very rapid. The soil is best suited to woodland.

This soil is in capability subclass VIIe.

65G—Lindley loam, 25 to 40 percent slopes. This is a well drained soil. It is most extensive on convex side slopes dissected by many small, V-shaped drains. Areas range from 10 to 30 acres in size.

Typically, the surface layer is very dark grayish brown loam about 2 inches thick. The subsurface layer is yellowish brown and brown loam about 7 inches thick. The yellowish brown subsoil extends to a depth of 40 inches. It is loam in the upper part and clay loam in the lower part.

Included with this soil in mapping are areas of eroded Lindley soils and a few small areas of Douds soils. Also included are a few small areas where shale or limestone crops out.

This Lindley soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is generally acid unless recently limed. Natural fertility is very low. The organic matter content is low.

Most areas of this soil are in trees, but a few areas are in permanent pasture. Runoff is very rapid. Because of the steep slopes, the soil is limited to pasture, woodland, or wildlife habitat (fig. 12).

This soil is in capability subclass VIIe.

75—Givin silt loam, 1 to 3 percent slopes. This is a somewhat poorly drained soil on uplands. Areas generally are irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil is silty clay loam that extends to a depth of 50 inches. It is dark grayish brown and grayish brown in the upper part and grayish brown and olive gray in the lower part. The substratum is light grayish brown and olive gray silty clay loam.

Included with this soil in mapping are small areas of a soil that has a thinner and lighter-colored surface layer than this Givin soil. Included areas make up less than 10 percent of the map unit.

This Givin soil is moderately slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is medium. The organic matter content is moderately low to low.

This soil is used intensively for and is well suited to row crops. Surface runoff is slow, and tile drainage is needed in some places for timely farming.

This soil is in capability class I.

80B—Clinton silt loam, 2 to 5 percent slopes. This is a moderately well drained soil on narrow upland divides and the upper parts of side slopes. Areas are generally long and narrow and have irregular boundaries. They are commonly more than a quarter-mile long and 10 to 30 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and yellowish brown silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is yellowish brown and brown silty clay loam. The substratum is yellowish brown silty clay loam.

Included with this soil in mapping are small areas of nearly level soils in which the thickness of the silt loam surface layer combined with that of the subsurface layer is 12 to 18 inches. Also included are small areas at the heads of drainageways where the soils have a mottled subsoil and are not so well drained as this Clinton soil. These included areas make up less than 15 percent of the map unit.

This Clinton soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderately low.

This soil is well suited to corn and hay. Some areas are used for woodland or pasture, but most of the acreage is in crops. The surface layer is friable and easy to till. Because runoff is medium, the erosion hazard is moderate.

This soil is in capability subclass IIe.

80C2—Clinton silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained soil on convex ridgetops, narrow divides, and side slopes. Areas are quite long and are irregular in shape. They generally are 5 to 40 acres in size.

Typically, the surface layer is a plow layer 8 inches thick. This plow layer is dark grayish brown or brown silt loam. The subsurface layer generally is mixed with the plow layer. The subsoil extends to a depth of 42 inches. It is yellowish brown and brown silty clay loam. The substratum also is yellowish brown silty clay loam. The surface layer is silty clay loam in some places.

Included with this soil in mapping are small areas where the subsoil and weathered clayey reddish paleosol are exposed. Also included are several 3- to 30-acre areas of uneroded Clinton soils.

This Clinton soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is low.

This soil is moderately suited to hay, corn, and soybeans if it is properly managed. It is well suited to pasture or woodland. Surface runoff is medium. The surface layer is friable, but tilth is poor. The surface soil is often cloddy and hard when dry and sticky when wet. The hazard of erosion is severe unless the soil is properly managed.

This soil is in capability subclass IIIe.

80D2—Clinton silt loam, 9 to 14 percent slopes, moderately eroded. This is a moderately well drained, strongly sloping soil. It generally is in bands around side slopes, but in some places it is on the crests of narrow ridges. Areas are long, narrow, and irregular in shape and generally range from 5 to 25 acres in size.

Typically, the surface layer is a plow layer 8 inches thick. This plow layer generally is dark grayish brown silt loam, but in some places it is silty clay loam. The subsurface layer is generally mixed with the plow layer. The subsoil extends to a depth of 42 inches. It is yellowish brown and brown silty clay loam. The substratum is yellowish brown silty clay loam.

Included with this soil in mapping are areas of moderately steep Clinton soils, small areas where the subsoil is exposed, and areas of reddish weathered paleosol. Also included are a few areas of Weller soils.

This Clinton soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is low.

The soil is moderately suited to corn, soybeans, and hay. It is well suited to pasture or woodland. Many areas are small and are managed with less sloping Clinton soils as cropland. The soil is often used with less suitable soils as pasture. Surface runoff is medium or rapid during hard rain. The erosion hazard is severe.

This soil is in capability subclass IIIe.

81B—Clinton silt loam, bedrock substratum, 2 to 6 percent slopes. This is a moderately well drained, gently sloping soil on loess-covered benches that extend into the bottom lands. These benches are underlain by limestone bedrock at a depth of 6 to 10 feet. This bedrock has crevices that allow the surface material to run into them with the percolating ground water. As a result, shallow depressions and, in some cases, deep depressions that are not crossable with farm machinery are on the surface. Areas range from 5 to 15 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and yellowish brown silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is yellowish brown and brown silty clay loam. The substratum also is yellowish brown silty clay loam.

This Clinton soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. Organic matter content is low.

Much of the acreage of this soil is used in crop rotation, but in some places the soil is in woodland. If cultivated, it erodes easily. Runoff is slow.

This soil is in capability subclass IIe.

81C2—Clinton silt loam, bedrock substratum, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained, moderately sloping soil on loess-covered benches that extend into the bottom lands. These benches are underlain by limestone bedrock at a depth of 6 to 10 feet. This bedrock has crevices that allow the surface material to run into them with the percolating ground water. As a result, shallow depressions and, in some cases, deep depressions that are not crossable with farm machinery are on the surface. Areas range from 10 to 20 acres in size.

Typically, the surface layer is a plow layer about 8 inches thick. This plow layer generally is dark grayish brown and grayish brown silt loam, but in some places it is silty clay loam. The subsurface layer has generally been mixed with the surface layer during plowing. The subsoil extends to a depth of 42 inches. It is yellowish brown and brown silty clay loam. The substratum also is yellowish brown silty clay loam.

Included with this soil in mapping are small areas of steeper and, in places, eroded Clinton soils.

This Clinton soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is medium. Organic matter content is low.

Much of the acreage of this soil is used for crop rotation. In some places, the soil is in woodland. If cultivated, it erodes easily. Surface runoff is medium.

This soil is in capability subclass IIIe.

115D—Chelsea soils, 9 to 18 percent slopes. These moderately steep, excessively drained soils are along the edges of benches in the major river valleys. They formed under a native vegetation of trees in sandy material exposed by geologic erosion of stream benches. Some gullies are on hillsides. Areas range from 10 to 30 acres in size.

Typically, the surface layer is brown fine sand about 6 inches thick. The substratum also is brown fine sand. Bands of dark reddish brown, slightly cemented sand coated with clay and iron are at a depth below 40 inches.

Included with this soil in mapping are small areas of Sparta, Dickinson, and unclassified loamy sand.

These Chelsea soils are rapidly permeable and have a very low available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is very low.

These soils are suited to permanent pasture and trees or as wildlife habitat; many areas are better suited to woodland or wildlife habitat than to pasture. Grazing needs to be controlled in pasture so that the cover of plants will not be lost. Diversion terraces placed at the base of some areas will protect soils downslope from runoff and silting. Runoff is medium.

These soils are in capability subclass VIs.

130—Belinda silt loam, 0 to 2 percent slopes. This is a poorly drained soil on narrow, flat ridgetops on the uplands near the major streams. Areas range from 10 to 60 acres in size.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is grayish brown and light brownish gray silt loam about 11 inches thick. The subsoil extends to a depth of 60 inches. It is mottled dark grayish brown and grayish brown silty clay in the uppermost part; grayish brown, mottled silty clay in the middle part; and light olive gray silty clay loam in the lowest part. In some places, the grayish subsurface layer

has been mixed with the surface layer during plowing. These areas appear ashy.

This Belinda soil is very slowly permeable and has a moderately high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer generally is acid unless limed. Natural fertility is medium. The organic matter content is moderate.

Because the subsoil contains large amounts of clay, tile lines are not suitable for drainage. Shallow ditches, however, remove excess water and improve drainage. Where surface drainage has been installed, this soil is suited to row crops. In periods of more-than-normal rainfall, crops may turn yellow and be stunted. This soil is often cultivated with Pershing and Clarinda soils.

This soil is in capability subclass IIIw.

131B—Pershing silt loam, 2 to 5 percent slopes. This is a moderately well drained to somewhat poorly drained, gently sloping soil. It is on moderately wide ridgetops and on slightly convex side slopes that are adjacent to the valleys of major drainageways. Areas are 5 to 25 acres.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is very dark gray or dark grayish brown silt loam and silty clay loam about 9 inches thick. The subsoil extends to a depth of 52 inches. It is dark grayish brown silty clay loam in the uppermost part, grayish brown silty clay in the middle part, and light olive gray and olive gray silty clay and silty clay loam in the lowest part. The substratum is mottled light olive gray and yellowish brown silty clay loam.

Included with this soil in mapping are some areas of moderately eroded soils that have a thinner surface layer than this Pershing soil.

This Pershing soil is slowly permeable and has a high available water capacity. The subsoil is high in available phosphorus and very low in available potassium. The surface layer is acid unless limed. Natural fertility is low to medium. The organic matter content is moderate to moderately low.

If management is good, this soil is moderately suited to row crops. Much of this soil is in crops, and the rest is in woodland or pasture (fig. 13). Runoff is medium, and erosion is likely in cultivated areas that are not tilled on the contour.

This soil is in capability subclass IIIe.

131C2—Pershing silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained to somewhat poorly drained, moderately sloping soil on rounded ridgetops and short, convex side slopes.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer has been mixed with the surface layer by tillage in most places. The subsoil extends to a depth of 48 inches. It is dark grayish brown silty clay loam in the uppermost part; grayish brown, mottled silty clay in the middle part; and light olive gray and olive gray silty clay and silty clay loam in the lowest part. The substratum is mottled light olive gray and yellowish brown silty clay loam. In a few places, the subsoil is exposed on the convex shoulders of side slopes.

Pershing soil is slowly permeable and has a high available water capacity. The subsoil is high in available phosphorus and very low in available potassium. The surface layer of this soil is acid unless limed. Natural fertility is low to medium. The organic matter content is moderately low to low.

This soil is moderately suited to row crops. Runoff is medium. After rain, the surface layer tends to seal and crust. The response is good to applications of lime and fertilizer.

This soil is in capability subclass IIIe.

132B—Weller silt loam, 2 to 5 percent slopes. This is a moderately well drained, gently sloping soil on moderately wide ridgetops and slightly convex side slopes. Areas are 5 to 30 acres.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is grayish brown silt loam about 13 inches thick. The subsoil extends to a depth of 50 inches. It is grayish brown and brown silty clay in the uppermost part, grayish brown silty clay in the middle part, and grayish brown silty clay loam in the lowest part. The substratum is mottled light olive gray and light olive brown silty clay loam. This soil is underlain with a reddish or gray clayey buried soil at depths of 48 to 90 inches. This buried soil is similar to Ashgrove and Keswick soils that formed in Kansan glacial till.

Included with this soil in mapping are small areas of Beckwith and Clinton soils.

This Weller soil is slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed. Natural fertility is low. The organic matter content is moderately low to low.

This soil is moderately suited to row crops. Much of the acreage is still wooded but trees have been removed in places and the soil is cultivated or in pasture. If cultivated, the soil erodes readily. Surface runoff is medium. The surface soil tends to seal during rain, and it becomes hard and crusty while drying.

This soil is in capability subclass IIIe.

132C2—Weller silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained, moderately sloping soil. It is on rounded ridgetops and short convex side slopes along the major stream valleys. Areas are as much as 80 acres in size.

Typically, the surface layer is a plow layer about 8 inches thick. It is dark grayish brown and grayish brown silt loam. The subsurface layer is generally mixed with

the surface layer in tillage. The subsoil extends to a depth of 48 inches. It is grayish brown and brown silty clay in the uppermost part, grayish brown silty clay in the middle part, and grayish brown silty clay loam in the lowest part. The substratum is mottled light olive gray and light olive brown silty clay loam. This soil is underlain by a reddish or gray clayey buried soil at a depth of 48 to 72 inches. This buried soil is similar to Ashgrove and Keswick soils that formed in Kansan glacial till.

Included with this soil in mapping are small areas of Clinton soils, areas of Weller soils that are only slightly eroded, and small areas of severely eroded Weller soils. Also included are a few small spots where the subsoil has been mixed with the surface layer by plowing.

This Weller soil is slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed. Natural fertility and the organic matter content are low.

This soil is moderately suited to row crops. Runoff is medium. After rain, the surface layer tends to seal and crust. The remaining surface layer is susceptible to high soil loss if barren of vegetation. This soil is best suited to hay or pasture.

The capability subclass is IIIe.

132D2—Weller silt loam, 9 to 14 percent slopes, moderately eroded. This is a moderately well drained, strongly sloping soil. It is at the crest of narrow ridges and on side slopes. The soil is upslope from the soils on foot slopes. Areas are small.

Typically, the surface layer is a plow layer about 8 inches thick. It is grayish brown silt loam. The subsoil extends to a depth of 42 inches. It is grayish brown and brown silty clay in the uppermost part, grayish brown silty clay in the middle part, and grayish brown silty clay loam in the lowest part. The substratum is mottled light olive gray and light olive brown silty clay loam. This soil is underlain by a reddish or gray clayey buried soil at a depth of 48 to 60 inches. This buried soil is similar to Ashgrove and Keswick soils that formed in Kansan glacial till.

Included with this soil in mapping are small areas of Pershing and Clinton soils that were too small to map separately. A few small areas are on high benches and, in these places, the loess parent material may have been derived from adjacent stream valleys.

This Weller soil is slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed. Natural fertility and the organic matter content are low.

Much of the acreage of this soil is in pasture, but some areas are cultivated. Because of strong slopes and medium runoff, soil loss is high unless a vegetative cover is maintained. Pasture or hay is the best use. The response is favorable to additions of lime and fertilizers.

This soil is in capability subclass IVe.

133—Colo silty clay loam, 0 to 2 percent slopes. This is a poorly drained soil that is subject to flooding. It is commonly on the bottom lands of smaller stream valleys, and it occupies the entire width of the valleys. It is also on wider, more stable bottom lands. Areas are as much as 60 acres in size.

Typically, the surface layer is very dark gray and black silty clay loam about 37 inches thick. The subsoil extends to a depth of 60 inches. It is very dark gray silty clay loam. The substratum is gray silty clay loam.

Included with this soil in mapping are a few small areas of Vesser and Chequest soils.

This Colo soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. Organic matter content is high.

Much of the acreage is cultivated, although this soil is flooded occasionally. The soil is well suited to cultivated crops if it is artificially drained and protected from flooding. Cultivation is often delayed unless the soil is artificially drained. Tile drains work satisfactorily although the subsoil is moderately slowly permeable. In smaller drainageways, the soil is generally dissected by a stream that cannot be crossed by farm machinery.

This soil is in capability subclass IIw.

140—Sparta loamy sand, thick surface, 0 to 2 percent slopes. This excessively drained soil is on high stream benches along the major rivers. It is in irregularly shaped areas that generally range from 20 acres to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, very dark brown, and dark brown loamy sand and sand about 33 inches thick. The subsoil extends to a depth of 43 inches. It is dark yellowish brown sand and coarse sand. The substratum also is dark yellowish brown sand and coarse sand. In some places, it is underlain by coarser sand and occasionally gravel at a depth below 4 feet.

Included with this soil in mapping are a few areas where the dark surface layer is thinner than that of this Sparta soil and areas where the surface layer is coarser than loamy sand.

This Sparta soil is very rapidly permeable and has a very low available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is low, but it is higher than typical for Sparta soils.

This soil is poorly suited to corn and soybeans unless irrigated. Some vegetables and melons are grown. The soil is moderately suited to pasture or hay. It is also

suited to wildlife habitat. It is subject to wind erosion unless protected by vegetative cover.

This soil is in capability unit IVs.

152—Marshan clay loam, deep, 0 to 2 percent slopes. This is a poorly drained, nearly level soil on stream benches and second bottoms along most streams. Areas are 10 to 30 acres.

Typically, the surface layer is black and very dark gray clay loam about 19 inches thick. The subsoil extends to a depth of 42 inches. It is mottled dark grayish brown and very dark gray or dark gray clay loam in the uppermost part, mottled grayish brown and strong brown clay loam in the middle part, and mottled grayish brown and yellowish red sandy loam in the lowest part. The substratum is grayish brown and light brownish gray sand. Sand or gravel is generally between depths of 40 and 48 inches. In a few places, the sand is within a depth of 3 feet.

Included with this soil in mapping are small areas that have 6 to 15 inches of lighter-colored recent overwash. Also included are some small spots of Marsh, which are slightly depressed and will pond unless drained.

This Marshan soil is moderately permeable and has a low to moderate available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is neutral in most places and does not require lime. Natural fertility is low to medium. The organic matter content is high.

This soil is well suited to row crops if properly drained. It generally has good tilth but puddles if worked when wet. Surface runoff is very slow, and in some areas the soil is subject to flooding. Artificial drainage is needed to produce good crops. Outlets are sometimes difficult to locate for tile drains.

This soil is in capability subclass IIw.

154G—Douds soils, 18 to 40 percent slopes. These moderately well drained, steep and very steep soils are on side slopes along the borders of high benches in the major river valleys.

In a typical area, the surface layer is very dark grayish brown loam, sandy loam, or both. It is about 5 inches thick. The subsurface layer is dark grayish brown loam about 9 inches thick. The subsoil extends to a depth of about 40 inches. It is brown sandy clay loam or clay loam in the upper part and brown or strong brown sandy clay loam or sandy loam in the lower part.

Included with this soil in mapping are some loamy escarpments that have been exposed by further geologic erosion.

These Douds soils are moderately permeable and have medium available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is very low. The organic matter content is low.

These soils are used mainly for permanent pasture, but many areas are better suited to woodland or wildlife habitat. Grazing needs to be controlled in pasture so the cover of plants is not lost.

The hazard of erosion is extreme when the surface is bare or it is protected by only a sparse cover of plants. Gullies are common on side slopes. Diversion terraces placed at the base of some areas protect soils downslope from very rapid runoff and silting. Trees should be planted in the gullied areas. In most places, farm machinery cannot be operated safely.

These soils are in capability subclass VIIe.

162B—Downs silt loam, 1 to 4 percent slopes. This well drained soil is on convex ridgetops adjacent to the valleys of the major rivers. It is in irregularly shaped areas that range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is mixed dark grayish brown and brown silt loam about 4 inches thick. The brown subsoil extends to a depth of 46 inches. It is silty clay loam in the upper part and silty clay loam or silt loam in the lower part. The substratum is pale brown silt loam.

Included with this soil in mapping are areas of a similar soil that has a thicker surface layer. These areas have no subsurface layers and few gray silt coatings if any, in the subsoil.

This Downs soil is moderately permeable and has a high available water capacity.

The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium to high. The organic matter content is moderate.

This soil is well suited to corn, soybeans, and hay if erosion is controlled. Surface runoff is medium. This soil has a wind erosion hazard in winter and early in spring unless it is protected. It is also subject to water erosion. The surface layer is friable, has good tilth, and is easy to till.

This soil is in capability class IIe.

163B—Fayette silt loam, 2 to 5 percent slopes. This well drained soil is on convex ridges and side slopes on uplands adjacent to the river valleys. Areas generally are long and narrow and have irregular boundaries. They generally range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown and brown silt loam about 8 inches thick. The yellowish brown subsoil extends to a depth of 38 inches. It is silt loam in the uppermost part, silty clay loam in the middle part, and silt loam in the lowest part. The substratum is yellowish brown silt loam.

Included with this soil in mapping are small areas of Clinton and Downs soils.

This Fayette soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is low.

This soil is well suited to corn, soybeans, and hay. Surface runoff is medium. The hazard of erosion is moderate. The surface layer is friable, has good tilth, and is easy to till.

This soil is in capability subclass IIe.

163C2—Fayette silt loam, 5 to 9 percent slopes, moderately eroded. This well drained soil is on narrow convex ridges and side slopes on uplands adjacent to the river valleys. Areas generally are long and narrow and have some irregular boundaries. They generally range from 15 to 25 acres in size.

Typically, the surface layer is a plow layer about 8 inches thick. It is mixed dark grayish brown and brown silt loam. Plowing has mixed the subsurface layer into the surface layer in most places. The yellowish brown subsoil extends to a depth of about 36 inches. It is silt loam in the uppermost part, silty clay loam in the middle part, and silt loam in the lowest part. The substratum is yellowish brown silt loam.

Included with this soil in mapping are small areas that have less clay in the subsoil.

This Fayette soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is medium. The organic matter content is low.

This soil is well suited to corn, soybeans, and hay. Surface runoff is medium. The hazard of erosion is moderate. The soil is friable and has good tilth.

This soil is in capability subclass IIIe.

172—Wabash silty clay, 0 to 2 percent slopes. This is a very poorly drained soil that is subject to flooding. It formed in low areas where floodwater stands long enough to allow the clay in it to settle. Most areas of this nearly level soil are on bottom lands adjoining the foot slopes. Some areas are in old bayous that have received deposits but are now a considerable distance from the stream channel. Areas range from 5 to 50 acres in size.

Typically, the surface layer is black silty clay about 20 inches thick. The subsoil extends to a depth of 60 inches. It is very dark gray silty clay.

Included with this soil in mapping are small areas of soils that have less clayey overwash than this Wabash soil.

This Wabash soil is very slowly permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is neutral and generally does not require lime. Natural fertility is medium. The organic matter content is high.

If this soil is drained and properly managed, it is moderately suited to frequent row crops. When the soil is dry, it is extremely hard and many cracks extend from the surface layer into the subsoil. The soil then absorbs rainfall at a moderate rate for a short time until it is saturated and the cracks seal. After the cracks seal, the surface layer is slowly permeable and the subsoil is very slowly permeable. Because the soil is ponded after heavy rains, excess water generally delays field operations in spring and fall and seedbeds are very difficult to prepare. Crops are sometimes lost when the rainfall is more than average. Tile drains generally do not function well. Surface ditches can be used to prevent ponding after rains. Undrained areas are used for pasture. Tilth is improved by plowing in fall and growing soybeans in place of corn.

This soil is in capability subclass IIw.

173—Hoopeston sandy loam, 0 to 2 percent slopes. This is a somewhat poorly drained soil on slightly elevated second bottoms of major rivers. Areas are irregular in shape and range from 10 acres to more than 100 acres in size.

Typically, the surface layer is black and very dark brown sandy loam about 15 inches thick. The subsoil is fine sandy loam that extends to a depth of 36 inches. It is dark grayish brown and very dark grayish brown in the upper part and dark grayish brown and mottled in the lower part. The substratum is mottled grayish brown and yellowish brown loamy fine sand and yellowish brown sand.

Included with this soil in mapping are small areas where coarser sand and gravel are at a depth below 40 inches. Also included are small areas of Saude and Dickinson soils.

This Hoopeston soil is moderately rapidly permeable and has a moderate available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium to low. The organic matter content is moderate.

This soil is moderately suited to corn and soybeans if rainfall is normal and timely. It is droughty in some years when rainfall is below normal. The soil is subject to wind erosion if cultivated.

This soil is in capability subclass IIs.

175—Dickinson fine sandy loam, 0 to 2 percent slopes. This is a well drained to somewhat excessively drained, nearly level soil on stream benches along major river bottoms. Areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is very dark brown fine sandy loam and sandy loam about 18 inches thick. The subsoil extends to a depth of 44 inches. It is very dark

grayish brown and brown sandy loam in the uppermost part, dark yellowish brown loamy sand in the middle part, and yellowish brown loamy sand in the lowest part. The substratum is yellowish brown loamy sand and sand.

Included with this soil in mapping are small areas of Saude and Sparta soils.

This Dickinson soil is moderately rapidly permeable and has a moderate available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium to low. The organic matter content is moderate.

This soil is moderately suited to corn and soybeans when rainfall is normal and timely. It is droughty in some years. The soil is subject to wind erosion if cultivated.

This soil is in capability subclass IIIs.

175B—Dickinson fine sandy loam, 2 to 5 percent slopes. This is a well drained to somewhat excessively drained soil on low ridge crests and side slopes of stream benches, mainly along major river bottoms. Areas are irregular in shape but are commonly longer than they are wide. Areas range from 5 acres to more than 20 acres in size.

Typically, the surface layer is very dark brown fine sandy loam and sandy loam about 18 inches thick. The subsoil extends to a depth of 44 inches. It is very dark grayish brown and brown sandy loam in the uppermost part, dark yellowish brown loamy sand in the middle part, and yellowish brown loamy sand in the lowest part. The substratum is yellowish brown loamy sand and sand.

Included with this soil in mapping are areas of moderately eroded soils that are lower in content of organic matter than this Dickinson soil. Also included are a few small areas of Sparta soils.

This Dickinson soil is moderately rapidly permeable and has a moderate available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium to low. The organic matter content is moderately low to moderate.

This soil is moderately suited to row crops if rainfall is normal and timely. It is droughty. The soil is subject to wind erosion if cultivated.

This soil is in capability subclass IIIe.

177—Saude loam, 0 to 2 percent slopes. This is a well drained, nearly level soil on stream benches along the Mississippi River bottoms. Areas are long and narrow and range from 10 to 25 acres in size.

Typically, the surface layer is very dark brown loam about 14 inches thick. The subsoil extends to a depth of 40 inches. It is dark brown loam in the uppermost part, brown and dark yellowish brown loam and sandy loam in the middle part, and yellowish brown loamy sand in the lowest part. The substratum is brown sand that has a few bands of reddish brown and brown.

Included with this soil in mapping are small areas of Sparta and Dickinson soils.

This Saude soil is moderately to very rapidly permeable and has a moderate available water capacity. The subsoil is low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is moderate.

This soil is moderately suited to row crops. It is droughty if rainfall is average or below average, but good yields can be obtained if rainfall is above normal and timely.

This soil is in capability subclass IIs.

179C—Gara loam, 5 to 10 percent slopes. This is a well drained to moderately well drained soil on slightly concave foot slopes and alluvial fans along bottoms of the Des Moines and Mississippi Rivers. Areas are rather long and narrow and range from 10 to 20 acres in size.

Typically, the surface layer is very dark gray loam about 7 inches thick. The subsurface layer is mixed very dark gray and dark grayish brown and dark yellowish brown clay loam about 5 inches thick. The subsoil is clay loam that extends to a depth of 46 inches. It is mixed brown and yellowish brown in the uppermost part, yellowish brown or brown in the middle part, and yellowish brown and dark yellowish brown in the lowest part. The substratum is yellowish brown and brown clay loam.

Included with this soil in mapping are small areas of Cantril soils and soils that have a thicker surface layer than is typical for Gara soils. This soil generally is higher in content of organic matter and is leached deeper than is typical for Gara soils.

This Gara soil is moderately slowly permeable and has a high available water capacity. The subsoil is very low to low in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is low. The organic matter content is moderate.

This soil is moderately suited to corn and soybeans if protected from runoff upslope. The soil is susceptible to erosion and gullying if it is not protected by diversion terraces. Runoff is medium. The surface layer is friable and easy to work.

This soil is in capability subclass IIIe.

180—Keomah silt loam, 0 to 2 percent slopes. This is a somewhat poorly drained soil on uplands. Areas are small.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is brown silty clay and silty clay loam in the upper part and mottled grayish brown, dark grayish brown, and yellowish brown silty clay and silty clay loam in the lower part.

Included with this soil in mapping are small areas of Rushville soils.

This Keomah soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is low to medium. The organic matter content is low to moderately low.

This soil is well suited to corn, soybeans, and hay. Although crops grow moderately well, the soil requires drainage improvement in many places. Tile lines may function satisfactorily, but in places the flow tends to be slow.

This soil is in capability subclass IIw.

180B—Keomah silt loam, 2 to 5 percent slopes. This is a somewhat poorly drained soil on narrow, convex, sloping upland divides and on the upper parts of side slopes. Areas generally are long and narrow and have irregular boundaries. They are commonly more than a quarter of a mile long and 10 to 30 acres in size.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is brown silty clay and silty clay loam in the upper part and mottled grayish brown, dark grayish brown, and yellowish brown silty clay and silty clay loam in the lower part.

Included with this soil in mapping are small areas of nearly level soils in which the thickness of the silt loam surface layer combined with that of the subsurface layer is 6 to 8 inches. These included areas make up about 15 percent of the map unit.

This Keomah soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low to medium. The organic matter content is low.

This soil is moderately well suited to corn, soybeans, and hay. The surface layer is friable and easy to till. Because surface runoff is medium, the erosion hazard is moderate. Some areas are used as pasture or woodland, but most of the acreage is used for crops.

This soil is in capability subclass IIe.

208—Landes sandy loam, 0 to 2 percent slopes. This is a well drained, nearly level soil on first bottoms adjacent to stream channels (fig. 14). It is more undulating than other soils on bottom lands and is subject to flooding. Areas range from 10 to 80 acres in size.

Typically, the surface layer is very dark grayish brown and dark grayish brown sandy loam about 12 inches thick. The substratum is stratified very dark grayish brown, dark grayish brown, and pale brown silt loam, loam, and sandy loam to a depth of 58 inches.

Included with this soil in mapping are areas of soils that have a dark silty clay loam buried soil at a depth of 35 to 40 inches. Also included are small areas of Nodaway soils and areas of soils in which the underlying layer often has brown mottles The color of these mottles varies with the frequency of overflow.

This Landes soil is moderately rapidly permeable and has a low available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is neutral and generally does not require lime. Natural fertility is low. The organic matter content is moderately low.

If protected from overflow, this soil is suited to frequent row crops. Most areas are cultivated. Tilth generally is not a concern. The soil warms up quickly and can be worked earlier in spring than soils that have more development in the profile. Except after damaging floods, crops grow well.

This soil is in capability subclass IIw.

211—Edina silt loam, 0 to 1 percent slopes. This is a poorly drained soil on broad upland divides. Areas are irregular in shape and 20 to 80 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is mixed very dark gray and dark gray silt loam about 6 inches thick. The subsoil extends to a depth of 47 inches. It is black, dark grayish brown, and very dark gray silty clay in the uppermost part, grayish brown silty clay in the middle part, and olive gray and light olive brown silty clay loam in the lowest part. The substratum is light olive gray and light olive brown silty clay loam. This soil is underlain by a very slowly permeable, gray clayey soil at a depth of 6 to 8 feet. In some places, plowed areas have ashy spots on the surface because the grayish subsurface layer has been mixed with the surface layer. In some places, surface water collects and ponds in shallow depressions.

This Edina soil is very slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

Where surface drains have been dug, this soil is moderately suited to row crops. It puddles if worked when wet. The subsoil contains a large amount of clay, and tile drains often do not work well. Crops planted in undrained areas are sometimes drowned. When rainfall is more than normal, crops may turn yellow and be stunted. Improved drainage is the principal management need. Water erosion is not a concern.

This soil is in capability subclass IIIw.

220—Nodaway silt loam, 0 to 2 percent slopes. This is a moderately well drained, nearly level soil on first bottoms of major streams. It is more undulating than other soils on bottom lands. The undulating slopes are

often remnants of old meandering streams. In some places a large, permanent stream dissects areas of this soil, or it runs parallel to the boundary. The soil is subject to flooding. Areas range from 15 to 60 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The substratum is variable thin strata of dark grayish brown, grayish brown, and very dark grayish brown silt loam that extends to a depth of 60 inches. Thin strata of fine sand are in some places.

Included with this soil in mapping are a few areas of soils that have a dark buried soil at a depth below 40 inches. The subsoil of these soils is not mottled in most places. The amount and color of mottles varies with the frequency of overflow. Also included are slightly lower areas of soils that have a darker surface layer than this Nodaway soil.

This Nodaway soil is moderately permeable and has a high available water capacity. The subsoil is medium in available phosphorus and available potassium. The surface layer is neutral and generally does not require lime. Natural fertility is medium. The organic matter content is moderate.

This soil is well suited to row crops. Most areas are cultivated. Pasture and woodland are generally next to the main stream channel and are flooded more than cultivated fields. Protection from overflow is required. Tilth generally is not a concern. The soil warms up quickly and can be worked early in spring.

This soil is in capability subclass IIw.

222C—Clarinda silty clay loam, 5 to 9 percent slopes. This poorly drained soil is commonly called gumbotil. It is most extensive in coves of shallow drainageways that extend far back into the upland flats. Areas range from 5 to 20 acres in size.

Typically, the surface layer is black, very dark grayish brown, and very dark gray silty clay loam about 13 inches thick. The subsoil extends to a depth of 60 inches or more. It is mottled grayish brown, dark grayish brown, or gray silty clay and clay.

Included with this soil in mapping are areas of soils along drainageways which have a surface layer that has been thickened by local alluvium. These areas make up about 30 percent of the map unit. Seepy spots are at the uphill side of many of these areas where they border soils formed in loess. Also included are areas of Colo soils in drainageways.

This Clarinda soil is very slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and low to medium in available potassium. The surface layer is acid unless limed within the past few years. The soil has a high shrink-swell potential and cracks deeply upon drying. Natural fertility is low. The organic matter content is moderate.

Most areas of this soil are used for permanent pasture or row crops. Because of the fine textured subsoil and the moderate slopes, susceptibility to erosion is high in cultivated areas. Surface runoff is medium. When terracing is used to control erosion, the clayey subsoil, which has poor tilth, will be exposed in borrow areas. In many places, the soil stays wet for periods in spring and after heavy rainfall in any season. Placing interceptor tile drains in the adjacent, loess-derived soils upslope may be practical. The tiles help to prevent seepage and reduce surface wetness.

This soil is in capability subclass IVw.

222C2—Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded. This poorly drained soil is commonly called gumbotil. It is normally in bands about 200 feet wide. The soil is not extensive, but areas are fairly large.

Typically, the surface layer is a very dark gray silty clay loam plow layer about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is mottled grayish brown, dark grayish brown, or gray silty clay and clay.

Included with this soil in mapping are small areas on the upper parts of slopes or in the center of rounded slopes between drains where the grayish subsoil has been exposed by erosion. Also included are a few small areas of Colo soils near waterways.

This Clarinda soil is very slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and low to medium in available potassium. The surface layer is acid unless limed within the past few years. The soil has a high shrink-swell potential and cracks deeply upon drying. Natural fertility is low. The organic matter content is moderately low to moderate.

This soil is moderately suited to row crops, and many areas are used for pasture. If terracing is used to control erosion, the clayey subsoil, which has poor tilth, will be exposed in borrow areas. If erosion is not controlled, the tilth and fertility of the surface layer will continue to deteriorate as increasing amounts of the subsoil are mixed into the plow layer. Surface runoff is medium. Tile drains should not be used, but placing interceptor tile drains in the adjacent, loess-derived soils upslope reduces seepage and surface wetness. The soil dries slowly, and the growth of row crops is generally poor because of wetness.

This soil is in capability subclass IVw.

223C—Rinda silt loam, 5 to 9 percent slopes. This is a poorly drained, moderately sloping soil on short side slopes, in waterway coves, and on low, narrow ridgetops. Areas are long, narrow, and irregular in shape and are generally 20 acres or more in size.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches. It is dark grayish brown silty clay loam in the uppermost part; dark grayish brown

clay in the middle part; and mixed gray, dark gray, and yellowish brown clay in the lowest part.

Included with this soil in mapping are a few areas of severely eroded soils in which almost all of the original surface layer has been removed. Also included are a few small areas along waterways where the surface layer is much thicker and darker than is typical for this Rinda soil.

This Rinda soil is very slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and potassium. The surface layer is acid unless limed. Natural fertility is low. The organic matter content is moderate to moderately low.

This soil is best suited to a rotation of row crops and hay. Surface runoff is medium. The soil is susceptible to severe erosion if cultivated.

This soil is in capability subclass IVw.

223D2—Rinda silt loam, 9 to 14 percent slopes, moderately eroded. This is a poorly drained, strongly sloping soil on side slopes of uplands. Areas generally are 10 to 15 acres in size and are somewhat irregular in shape.

Typically, the surface layer is very dark and dark gray silt loam. The subsurface layer is generally mixed with the surface layer in tillage. The subsoil extends to a depth of 50 inches. It is brown silty clay loam in the uppermost part; dark grayish brown clay in the middle part; and mixed gray, dark gray, and yellowish brown clay in the lowest part.

Included with this soil in mapping are small areas of severely eroded soils and areas along waterways where the surface layer is thicker and darker than is typical for this Rinda soil. These areas are included because they are too small to map separately.

This Rinda soil is very slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and potassium. The surface layer is acid unless limed. Natural fertility is low. The organic matter content is moderately low.

This soil is best suited to permanent pasture. It is susceptible to severe sheet and gully erosion. Surface runoff is medium or rapid.

This soil is in capability subclass IVe.

226—Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes. This is a somewhat poorly drained, nearly level soil on stream benches and second bottoms along major streams. Areas range from 10 acres to as much as 50 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown loam about 17 inches thick. The subsoil extends to a depth of 38 inches. It is very dark grayish brown and dark grayish brown loam in the upper part and mottled dark grayish brown and grayish brown loam and sandy loam in the lower part. The upper part of the substratum is mottled dark grayish brown and grayish brown loamy sand, and the lower part is dark brown and strong brown fine sandy loam.

Included with this soil in mapping are a few small areas of soils that have sand or gravel at depths of 24 to 32 inches and a few areas that have silty material at a depth of 48 to 60 inches.

This Lawler soil is moderately permeable and has a low to moderate available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate to high.

This soil is well suited to row crops and can be used intensively for corn or soybeans. It benefits from tile drainage during wet seasons. Tile placement is difficult in places because of the loose, water-bearing sand at a depth of about 3 feet.

This soil is in capability class I.

260—Beckwith silt loam, 0 to 2 percent slopes. This is a poorly drained soil on narrow, flat ridgetops on uplands near the major streams. Areas range from 10 to 50 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is light brownish gray silt loam about 11 inches thick. The subsoil extends to a depth of 60 inches. It is dark grayish brown and grayish brown silty clay in the uppermost part, grayish brown silty clay that has common yellowish brown mottles in the middle part, and grayish brown and light olive gray silty clay loam in the lowest part.

This Beckwith soil is very slowly permeable and has a moderately high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is very low. The content of organic matter is very low.

This soil is only moderately suited to row crops because the subsoil is very slowly permeable and the soil is poorly drained. In some places, runoff collects and ponds in shallow depressions because there is no natural outlet drain. Because the subsoil contains large amounts of clay, tile lines are not suitable. Shallow ditches, however, will remove excess water and improve drainage. The soil puddles if worked when wet. In periods of more than normal rainfall, crops turn yellow and are stunted. The soil generally is strongly acid and requires additions of lime.

This soil is in capability subclass IIIw.

263—Okaw silt loam, 0 to 3 percent slopes. This is a poorly drained soil on second bottoms in the major stream valleys. Slope dominantly is less than 2 percent. In most places, the soil is adjacent to soils on first bottoms, and it is on elevated areas within the first bottoms. It is also adjacent to the soils on uplands. The soil

is subject to occasional flooding. Areas generally are from 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The subsurface layer is light brownish gray silt loam about 5 inches thick. The subsoil extends to a depth of 40 inches. It is grayish brown and dark grayish brown silty clay in the uppermost part, light brownish gray silty clay in the middle part, and light brownish gray silty clay loam in the lowest part. The substratum is light brownish gray silty clay loam. Commonly, layers of clay loam are in the lower part of the substratum.

Included with this soil in mapping are small areas of a soil that contains more sand in the subsoil than is typical for the Okaw series.

This Okaw soil is very slowly permeable and has a high to moderate available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is low.

This soil is moderately suited to row crops. Because the subsoil is very slowly permeable and the soil is poorly drained, drainage improvement is required in many places. Tile lines may function satisfactorily, but in many places drainage through them tends to be slow. Shallow ditches, however, remove excess water and improve drainage. The soil is cloddy if it is worked when wet.

This soil is in capability subclass IIIw.

291—Atterberry silt loam, 0 to 2 percent slopes. This is a somewhat poorly drained, nearly level soil on uplands. Areas generally are irregular in shape and 10 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 9 inches thick. The subsurface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches. It is dark grayish brown silty clay loam in the uppermost part, grayish brown silty clay loam in the middle part, and grayish brown silt loam in the lowest part. The substratum is light brownish gray silt loam.

Included with this soil in mapping are small areas of a soil that has a thinner and lighter-colored surface layer than this Atterberry soil. These included areas make up less than 10 percent of the map unit.

This Atterberry soil is moderately slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is high. The organic matter content is moderate.

This soil is well suited to corn, soybeans, and hay. In many places, the soil requires drainage improvement. Tile drains function satisfactorily in most places.

This soil is in capability class I.

315—Alluvial land, loamy. This miscellaneous area consists of recently deposited, highly stratified sediment that has not been in place long enough for soil to form. Until the recent levees were built, the land was frequently flooded and each flood added new sediment. The sediment varies in texture but is mainly loam, sandy loam, or silt loam.

Much of this miscellaneous area is channeled, and it contains low natural levees, small ponds, sloughs, and small oxbows. The natural drainage ranges from poor in the channels to good in the natural levees. Because of the oxbows and sloughs, this area is not very well suited to crops, and some of it remains in permanent pasture. In places, however, drainage ditches have been dredged and the area reshaped to make it suitable for cropland.

This miscellaneous area is in capability subclass Vw.

354—Marsh. This miscellaneous area consists of depressional areas covered by 1 foot to 3 feet of water part of the year. Most areas are oxbows or old depressed stream channels of the major rivers or their tributaries. During summer or periods of low rainfall, areas of water decrease in size or disappear. A dense swamp vegetation grows around the perimeter. Cattails and swampgrasses are dominant where water is shallow. These areas are periodically flooded.

The basin of the depressions contains dark, silty to clayey alluvial sediment. Around the rim of the depressions, the surface layer is 6 to 18 inches of muck or partly decayed plant residue.

This miscellaneous area is not artificially drained. In places, open ditches outlet into the area. Marsh is well suited to wildlife habitat.

This miscellaneous area is in capability subclass VIIw.

362—Haig silt loam, 0 to 2 percent slopes. This is a poorly drained soil on broad divides on uplands. Areas are irregular in shape and range from 10 to many acres in size.

Typically, the surface layer is black silt loam or silty clay loam about 16 inches thick. The subsoil extends to a depth of 60 inches. It is black silty clay in the uppermost part; mottled very dark gray, dark gray, and grayish brown silty clay and silty clay loam in the middle part; and olive gray silty clay loam in the lowest part. The soil is underlain with a very slowly permeable, gray, clayey soil at a depth of 7 to 9 feet.

Included with this soil in mapping are a few areas of Edina soils which are too small to map separately.

This Haig soil is slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is high.

This soil is well suited to row crops. It commonly is farmed with surrounding Grundy soils. The soil dries more slowly after rain and warms more slowly in spring

than Grundy soils. It is suitable for intensive row cropping if drained. Because surface drainage is poor and permeability is slow in the subsoil, shallow ditches are needed in places to remove surface water during wet periods. Tile drains should be placed at very close intervals to give adequate results.

This soil is in capability subclass IIw.

363—Haig silty clay loam, 0 to 2 percent slopes. This is a poorly drained soil on broad upland divides. Areas have irregularly shaped boundaries. They are rather large and often range from 60 acres to more than 100 acres in size.

Typically, the surface layer is black silty clay loam about 17 inches thick. The subsoil extends to a depth of 60 inches. It is black silty clay in the uppermost part; mottled very dark gray, dark gray, and grayish brown silty clay in the middle part; and olive gray silty clay loam in the lowest part. The soil is underlain by a very slowly permeable, gray, clayey soil at a depth of 7 to 9 feet.

Included with this soil in mapping are some small areas of Edina soils. Also included are a few depressions that pond water.

This Haig soil is slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is high.

This soil is moderately well suited to corn and soybeans. Surface runoff is very slow, and during wet seasons water remains on the surface in places. Drainage is needed for crops. The surface layer is friable if not worked when too wet. In many areas tile drains, installed at moderately close intervals, provide drainage. The tile lines function satisfactorily in many places, but drainage through them tends to be slow. If the soil is worked when wet, it becomes firm and compaction is a concern. Tillage is generally very difficult and is performed in fall to provide a good seedbed.

This soil is in capability subclass IIw.

364—Grundy silt loam, 0 to 2 percent slopes. This is a somewhat poorly drained soil on elevated areas of broad, upland divides, about 10 to 15 feet above surrounding soils. It is on the highest part of the landscape in the county. Areas generally are irregular in shape and 10 to 30 acres in size.

Typically, the surface layer is black or very dark gray silt loam or silty clay loam about 18 inches thick. The subsoil extends to a depth of 65 inches. It is very dark gray and dark gray silty clay loam and silty clay in the uppermost part, mottled grayish brown and olive silty clay or silty clay loam in the middle part, and mottled light olive gray and strong brown silty clay loam in the lowest part. The soil is underlain by a very slowly permeable, gray clayey soil at a depth of 7 to 8 feet.

Included with this soil in mapping are some small areas of soils that have a silty clay loam surface layer. Also included are small areas of a soil that has a grayer subsurface layer and a thinner surface layer than this Grundy soil. These included areas make up less than 10 percent of the map unit.

This Grundy soil is slowly permeable and has a high available water capacity. The subsoil is very low to low in available phosphorus and low to medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

This soil is well suited to corn and soybeans. Surface runoff is slow, and tile drainage is used in some places for timely farming operations. Tile lines may function satisfactorily, but in places drainage through them tends to be slow. Tilth is generally good.

This soil is in capability subclass IIw.

364B—Grundy silt loam, 2 to 5 percent slopes. This is a somewhat poorly drained soil on short, slightly convex side slopes and ridgetops near broad, upland flats. Areas are generally long and narrow in shape and range from 10 to 50 acres in size.

Typically, the surface layer is black or very dark gray silt loam or silty clay loam about 18 inches thick. The subsoil extends to a depth of 65 inches. It is very dark gray and dark gray silty clay loam and silty clay in the uppermost part, mottled grayish brown and olive silty clay or silty clay loam in the middle part, and mottled light olive gray and strong brown silty clay loam in the lowest part. The soil is underlain with a very slowly permeable, gray, clayey soil at a depth of 7 to 8 feet.

Included with this soil in mapping are small areas that have a thinner surface layer than this Grundy soil and areas where slope is about 6 percent.

This Grundy soil is slowly permeable and has a high available water capacity. The subsoil is very low to low in available phosphorus and low to medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

This soil is well suited to row crops. Most of the acreage is used for cultivated crops (fig. 15) and is generally in good tilth. Surface runoff is medium.

This soil is in capability subclass IIe.

380—Mahaska silt loam, 1 to 3 percent slopes. This is a somewhat poorly drained soil on elevated areas of broad upland divides. It has smooth, convex slopes and irregular boundaries. Areas are from 15 to 40 acres in size.

Typically, the surface layer is black and very dark gray silt loam or silty clay loam about 21 inches thick. The subsoil extends to a depth of 58 inches. It is very dark gray silty clay loam in the uppermost part, dark grayish brown silty clay or silty clay loam in the middle part, and

dark grayish brown, olive brown and grayish brown silty clay loam in the lowest part. The substratum is grayish brown silt loam.

Included with this soil in mapping are small areas of Grundy and Givin soils and small areas of a soil that has a gray subsurface layer. These included areas make up less than 15 percent of the map unit.

This Mahaska soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium to high. The organic matter content is moderate.

This soil is well suited to corn and soybeans. Surface runoff is medium or slow. Drainage is needed in some places for timely farming operations and is generally provided by tile. The surface layer generally has good tilth and is friable and moderately easy to till.

This soil is in capability class I.

424D2—Lindley-Keswick complex, 9 to 14 percent slopes, moderately eroded. This complex consists of well drained and moderately well drained soils on low ridgetops and long, convex side slopes that are dissected by shallow, crossable drainageways. The complex is about 60 percent Lindley soils, 30 percent Keswick soils, and 10 percent included soils. Areas are large in size and long and irregular in shape.

Typically, the Lindley soils have a surface layer that is a plow layer about 8 inches thick. It is dark grayish brown and brown loam. The subsurface layer is generally mixed with the plow layer in cultivation. The subsoil extends to a depth of 50 inches. It is yellowish brown loam in the upper part and yellowish brown clay loam in the lower part.

Typically, the Keswick soils have a surface layer that is a plow layer about 8 inches thick. It is dark grayish brown and brown loam. The subsurface layer is generally mixed with the plow layer in cultivation. The subsoil extends to a depth of 50 inches. It is a reddish brown clay loam or clay in the upper part, mottled strong brown and grayish brown clay or clay loam in the middle part, and yellowish brown and light brownish gray clay loam in the lower part.

Included with this complex in mapping are small areas of severely eroded Lindley soil and small areas of Galland and Ashgrove soils.

Lindley and Keswick soils have moderately slow to slow permeability and high available water capacity. The subsoil is medium to very low in available phosphorus and very low in available potassium. The surface layer generally is acid unless limed recently. Natural fertility is very low. The organic matter content is low.

The soils in this complex are well suited to woodland and moderately well suited to pasture. Surface runoff is medium or rapid. The soils are susceptible to severe erosion.

This complex is in capability subclass IVe.

424D3—Lindley-Keswick complex, 9 to 14 percent slopes, severely eroded. This complex consists of well drained and moderately well drained soils on convex, sloping side slopes. This complex is about 60 percent Lindley soils, 30 percent Keswick soils, and 10 percent included soils. The Keswick soils generally are in the upper part of the complex, and the Lindley soils are downslope from them. In places, numerous small gullies cross these soils. Areas generally are 5 to 20 acres in size.

Typically, the Lindley soils have a surface layer that is a plow layer about 8 inches thick. It is dark gray and yellowish brown loam or clay loam. The subsoil extends to a depth of 42 inches. It is yellowish brown loam in the upper part and yellowish brown clay loam in the lower part. Erosion has been so severe that in many places the surface layer is composed mostly of subsoil mixed with small amounts of the remaining surface and subsurface layers by tillage. Many gullies have formed.

Typically, the Keswick soils have a surface layer that is a plow layer about 8 inches thick. It is brown and reddish brown loam or clay loam. The subsoil extends to a depth of 42 inches. It is a reddish brown clay loam or clay in the upper part, mottled strong brown and grayish brown clay or clay loam in the middle part, and yellowish brown and light brownish gray clay loam in the lower part. Erosion has been so severe that in many places the surface layer consists of subsoil mixed with small amounts of the remaining surface and subsurface layers by tillage. In a few areas near waterways or at the base of slopes, the surface layer consists of a few inches of moderately dark loam.

Lindley and Keswick soils have moderately slow to slow permeability and high available water capacity. The subsoil is medium to very low in available phosphorous and very low in available potassium. The surface layer generally is acid unless limed recently. Natural fertility is very low. The organic matter content is low.

The soils in this complex are moderately suited to woodland or pasture. They are susceptible to severe erosion. Surface runoff is rapid.

This complex is in capability subclass VIe.

425C2—Keswick loam, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained soil. It is most extensive on narrow, sloping ridgetops in the most strongly dissected areas along major streams. Areas are small and irregular in shape.

Typically, the surface layer is a plow layer about 8 inches thick. It is dark grayish brown and brown loam. The subsurface layer is generally mixed with the surface layer by cultivation. The subsoil extends to a depth of 60 inches. It is reddish brown clay loam or clay in the upper part, mottled strong brown and grayish brown clay or

clay loam in the middle part, and yellowish brown and light brownish gray clay loam in the lower part.

Included with this soil in mapping are a few small areas of severely eroded Keswick soils and a few small areas of moderately eroded Ashgrove soils.

This Keswick soil is slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is very low. The organic matter content is low.

This soil is moderately suited to row crops, but it is mainly used for pasture or hay. Surface runoff is medium. If terraces are built to control erosion, the clayey subsoil, which has poor tilth and low fertility, is exposed in borrow areas. Stockpiling the surface soil during construction and replacing it afterward help to overcome this concern. The surface layer is often somewhat difficult to till. It becomes hard and cloddy when dry if tilled when too wet. If erosion is not controlled, tilth of the surface layer will continue to deteriorate as increasing amounts of the subsoil are mixed into the plow layer.

This soil is in capability subclass IIIe.

425D2—Keswick loam, 9 to 14 percent slopes, moderately eroded. This is a moderately well drained, strongly sloping soil. It is most extensive on ridgetops in the most strongly dissected areas along major streams. In places, it occupies entire short side slopes. Areas range from 5 to 30 acres in size.

Typically, the surface layer is a plow layer about 8 inches thick. It is dark grayish brown and brown loam. The subsurface layer is generally mixed with the plow layer by cultivation. The subsoil extends to a depth of 50 inches. It is reddish brown clay loam or clay in the upper part, mottled strong brown and grayish brown clay or clay loam in the middle part, and yellowish brown and light brownish gray clay loam in the lower part.

Included with this soil in mapping are large areas of uneroded Keswick soils that have the profile described as representative of this series. Also included are areas where the surface layer contains more clay, and small areas of Lindley loam.

This Keswick soil is slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is very low. The organic matter content is low.

This soil is best suited to hay, pasture, or woodland. In many places, a stand of low quality timber is growing on the soil. It must be cleared if a productive pasture is desired. Surface runoff is medium or rapid.

This soil is in capability subclass IVe.

425D3—Keswick soils, 9 to 14 percent slopes, severely eroded. These are moderately well drained soils. They are most extensive on narrow, sloping ridgetops in the most strongly dissected areas along major streams. They are commonly dissected by gullies and waterways. Areas are small and irregular in shape.

Typically, the surface layer is a plow layer about 8 inches thick. It is brown loam, clay, or clay loam. The subsurface layer and part of the subsoil are generally mixed with the surface layer by cultivation. The subsoil extends to a depth of 60 inches. It is reddish brown clay loam or clay in the upper part, mottled strong brown and grayish brown clay or clay loam in the middle part, and yellowish brown and light brownish gray clay loam in the lower part. In some places, the reddish clay subsoil is exposed.

Included with this soil in mapping are some areas of Keswick soils where erosion has been less severe, and 3 to 6 inches of the original surface and subsurface layers remains.

These Keswick soils are slowly permeable and have a high available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility and the organic matter content are very low.

These soils are not suited to cultivation. They are best suited to hay and pasture. Erosion is a serious hazard. Establishing a seeding is difficult because of the strong slopes and the poor tilth of the surface soil. The surface soil becomes hard and cloddy when almost dry. It tends to seal over during rain, reducing infiltration and increasing runoff.

These soils are in capability subclass VIe.

452C2—Lineville silt loam, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained to somewhat poorly drained, moderately sloping soil. It is mainly on rounded ridgetops. The total acreage of the soil in the county is small, and areas generally are small.

Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches. It is brown silty clay loam in the uppermost part, grayish brown clay loam or clay in the middle part, and gray and yellowish brown clay in the lowest part. The surface layer is silty clay loam in a few more eroded areas on short slopes near drainageways.

This Lineville soil is moderately slowly permeable in the upper part and very slowly permeable in the lower part. It has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is low to moderate.

This soil is moderately suited to row crops, but in many places it is used for pasture. The tilth of the surface layer is often poor. The soil generally has a perched water table near the surface in wet seasons. After heavy rain the surface tends to crust. Surface runoff is medium.

This soil is in capability subclass IIIe.

453—Tuskeego silt loam, 0 to 2 percent slopes. This is a poorly drained soil on low benches that are nearly level to slightly depressional. Areas range from 5 to 40 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown silt loam about 9 inches thick. The subsurface layer is grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 49 inches. It is dark grayish brown silty clay loam in the uppermost part, grayish brown silty clay in the middle part, and light olive gray silty clay loam or clay loam in the lowest part. The substratum is light brownish gray sandy clay loam.

Included with this soil in mapping are a few areas of soils that have a thicker dark surface layer than this Tuskeego soil.

This Tuskeego soil is very slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is moderate.

This soil is moderately suited to row crops. Water often ponds for short periods after rain, and the soil generally is wet. Tile drainage generally is effective but requires close spacing. Surface drains are needed in some areas to remove excess water. Even in artificially drained areas, the soil is difficult to work and puddles easily. It dries slowly in spring or after rain, and cultivation is often delayed. Good management is required to maintain tilth and production.

This soil is in capability subclass IIIw.

478G—Nordness-Rock outcrop complex, 25 to 40 percent slopes. This complex consists of a shallow, well drained soil and Rock outcrop. It is most extensive on steep, lower side slopes and escarpments along deeply entrenched drainageways. The soil and Rock outcrop are so intermingled that it is impractical to map each separately. The complex generally is 60 percent Nordness soil, 35 percent Rock outcrop, and 5 percent included soils. Most areas are small. About 10 percent of the area has slopes of less than 25 percent.

Typically, the Nordness soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil extends to a depth of 14 inches. It is mottled brown and dark yellowish brown silty clay loam. The substratum is fractured, hard, level, bedded limestone. The Rock outcrop is generally level, bedded, fractured limestone.

Included with this complex in mapping are areas of severely eroded soils and a few areas of moderately eroded soils.

The Nordness soil is moderately permeable and has a very low water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid, but lime generally is not required. The organic matter content is very low.

This shallow, stony complex is not suitable for cultivation. It is best suited to pasture or wildlife habitat. Surface runoff is very rapid. The very low available water capacity, frequent limestone outcrops, steep slopes, and severe hazard of erosion are the chief limitations in management. To control erosion, a permanent cover of grass is needed as well as protection from overgrazing. Fair pastures can be maintained in periods of normal or high rain, but woodland is a better use. Replanting of trees must be done by hand.

This complex is in capability subclass VIIs.

484—Lawson silt loam, 0 to 2 percent slopes. This is a somewhat poorly drained, nearly level soil on flood plains of major streams and rivers. The soil is subject to occasional flooding. Areas generally are 15 acres to as much as 80 acres in size.

Typically, the surface layer is black, very dark gray, and very dark grayish brown silt loam about 36 inches thick. The substratum is very dark grayish brown silt loam.

Included with this soil in mapping are small areas of lighter-colored recent overwash 6 to 15 inches thick. Also included are small areas of soils that have a silty clay loam subsoil.

This Lawson soil is moderately permeable and has a very high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer generally is neutral and does not require lime. Natural fertility is high. The organic matter content is high.

This soil is well suited to row crops. In some years, tile drainage contributes to timely field operations. Unless this soil is protected by dikes (fig. 16), it is subject to overflow, especially along the larger streams.

This soil is in capability subclass IIw.

485—Spillville loam, 0 to 2 percent slopes. This is a moderately well drained to somewhat poorly drained, nearly level soil on the larger stream and river bottoms. Areas are generally irregular in shape and 10 to 30 acres in size.

Typically, the surface layer is black or very dark grayish brown loam about 24 inches thick. The subsoil is loam that extends to a depth of 45 inches. It is very dark brown in the upper part and very dark grayish brown in the lower part. The substratum is mottled very dark grayish brown and dark grayish brown loam.

Included with this soil in mapping are small areas of Landes soils.

This Spillville soil is moderately permeable and has a moderate to high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer commonly is neutral and

does not require lime. Natural fertility is medium. The organic matter content is high.

This soil is well suited to corn and soybeans. The surface runoff is slow, and protection from overflow water is required in some places. The surface layer is very friable and has good tilth. If moisture conditions are proper, the soil is easy to till.

This soil is in capability class I.

499D2—Nordness silt loam, 9 to 18 percent slopes, moderately eroded. This is a well drained, strongly sloping and moderately steep soil. It is most extensive on convex, lower side slopes and escarpments along steeply entrenched drainageways. Most areas are small. The slope is less than 14 percent in about 60 percent of the areas.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil extends to a depth of 16 inches. It is mottled brown and dark yellowish brown silty clay loam. The substratum is fractured, hard and level, bedded limestone.

Included with this soil in mapping are some areas of severely eroded soils, a few small rills or gullies, and exposed limestone and shale outcrops.

This Nordness soil is moderately permeable and has a very low available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is acid, but lime generally is not required. Natural fertility is low. The organic matter content is very low.

This shallow, stony soil is not suitable for cultivation. It is best used as pasture or wildlife habitat. The very low available water capacity; common, low outcroppings of limestone; strong slope; and severe hazard of erosion are the chief limitations to management. Surface runoff is medium. To control erosion, a permanent cover of grass is required as well as protection from overgrazing. Good pasture can be maintained in periods of normal or high rainfall.

This soil is in capability subclass VIIe.

499F—Nordness silt loam, 18 to 30 percent slopes. This is a shallow, well drained soil on convex slopes on uplands that border major streams. It is commonly dissected by many drainageways. Areas are long, narrow, and irregular in shape. They commonly are less than 300 feet wide and less than 40 acres.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil extends to a depth of 16 inches. It is mottled brown and dark yellowish brown silty clay loam. The substratum is fractured, hard and level, bedded limestone.

Included with this soil in mapping are a few small areas of Clinton, Fayette, and Weller soils; a few places where the surface layer is loam or silty clay loam; and common outcrops and ledges of limestone.

This Nordness soil is moderately permeable and has a very low available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid, but lime generally is not required. Natural fertility is low. The organic matter content is very low.

This soil is suitable for limited use as pasture, woodland, or wildlife habitat. Surface runoff is very rapid. The hazard of erosion is severe unless the soil is properly managed.

This soil is in capability subclass VIIe.

520—Coppock silt loam, 0 to 2 percent slopes. This is a somewhat poorly drained or poorly drained, nearly level soil on streams or old meandering stream-belt areas. The soil is subject to flooding. Areas commonly are large.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is dark gray, dark grayish brown, grayish brown, or light brownish gray silt loam about 17 inches thick. The subsoil is silty clay loam that extends to a depth of 50 inches. It is light gray in the upper part and light brownish gray in the lower part. The substratum is light brownish gray silty clay loam high in content of sand.

This Coppock soil is moderately permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low to medium. The organic matter content is moderately low to moderate.

This soil is flooded at times, but most of it is cultivated. More frequently flooded or inaccessible areas are in pasture or woodland. If protected from overflow and artificially drained, the soil is well suited to row crops. Because natural drainage is poor to somewhat poor, cultivation is sometimes delayed unless the soil is artificially drained. Tile lines work well because the subsoil is moderately permeable.

This soil is in capability subclass IIw.

587—Chequest silty clay loam, 0 to 2 percent slopes. This is a poorly drained soil on the wider bottom lands. It is subject to flooding. It formed in low areas where floodwater often stands or where the water table is generally high. Bayous or low areas that receive deposits during floods are common. Areas commonly are large.

Typically, the surface layer is very dark gray silty clay loam about 9 inches thick. The subsoil extends to a depth of 60 inches. It is dark gray silty clay loam that has some brownish mottles. The substratum is generally at a depth below 60 inches.

Included with this soil in mapping are small areas that have an overwash of loamy sediment and some areas

where the surface layer is slightly thinner than that described for the Chequest series.

This Chequest soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

This soil is generally farmed with soils that are better suited to cultivated crops. Artificially drained areas can be planted to row crops often, but row crops are only moderately suited. The soil generally has poor tilth and puddles if worked when wet. It is limited because of poor drainage and flooding. Cultivated areas should be drained by open ditches or tile drains if outlets can be established. Undrained areas are better suited to pasture than to row crops.

This soil is in capability subclass IIw.

594C2—Galland loam, 5 to 9 percent slopes, moderately eroded. This is a somewhat poorly drained soil. It is often near the ends of ridgetops which extend down onto the high stream benches. The ridges generally are lower than surrounding ridges. The soil is not extensive, and each area generally is less than 10 acres.

Typically, the surface layer is very dark grayish brown loam about 5 inches thick. The subsurface layer is brown loam about 4 inches thick. The subsoil extends to a depth of 48 inches. It is brown, dark reddish brown, and reddish brown clay loam or clay in the uppermost part; brown, strong brown, and light brownish gray clay loam in the middle part; and strong brown and light brownish gray clay loam in the lowest part. The substratum is strong brown and brown sandy loam. In some places, plowing has mixed the clayey subsoil with the surface and subsurface layers.

Included with this soil in mapping are some areas of soils that have a thicker surface layer than this Galland soil.

This Galland soil is slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low to very low. The organic matter content is low.

This soil is better suited to hay and pasture than to row crops. Row crops are only moderately suited. If erosion is not controlled, tilth and fertility of the surface layer will continue to deteriorate as increasing amounts of the subsoil are mixed into the plow layer. Although varying amounts of seepage are received, artificial drainage is not practical in most places. If the soil is used for row crops, it generally is farmed with soils upslope. Surface runoff is medium. Suitable sites for dams are difficult to locate because of the high seepage potential of the stratified underlying layer.

This soil is in capability subclass IIIe.

594D2—Galland loam, 9 to 14 percent slopes, moderately eroded. This is a somewhat poorly drained, strongly sloping soil on side slopes of high bench terraces along the larger streams. Areas range from 5 to 35 acres in size.

Typically, the surface layer is very dark grayish brown loam about 5 inches thick. Plowing has mixed the subsurface layer with the surface layer in most areas. The subsoil extends to a depth of 48 inches. It is brown, dark reddish brown, and reddish brown clay loam or clay in the uppermost part; brown, strong brown, and light brownish gray clay loam in the middle part; and strong brown and light brownish gray clay loam in the lowest part. The substratum is strong brown and brown sandy loam.

Included with this soil in mapping are some areas where the subsoil is exposed.

This Galland soil is slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low to very low. The organic matter content is low.

Much of the acreage of this soil is used for permanent pasture or hay because of severe erosion susceptibility and medium or rapid surface runoff. The soil would erode excessively if used for row crops on a regular basis. Tilth and fertility of the surface layer become more unfavorable if erosion is not controlled. If tilled when too wet, the surface layer becomes hard and cloddy when dry. The soil receives varying amounts of seepage water, but in most places artificial drainage is not practical. Suitable sites for dams are difficult to locate because of the high seepage potential of the stratified underlying material.

This soil is in capability subclass IVe.

594D3—Galland soils, 9 to 14 percent slopes, severely eroded. This is a somewhat poorly drained, strongly sloping soil on side slopes of high bench terraces along the larger streams. Areas range from 5 to 15 acres in size.

Typically, the surface layer is a plow layer about 8 inches thick. It is mainly brown and dark reddish brown silt loam or clay loam, and in some places it is clay. The subsoil extends to a depth of 40 inches. It is brown, dark reddish brown, and reddish brown clay loam or clay in the uppermost part; brown, strong brown, and light brownish gray clay loam in the middle part; and strong brown and light brownish gray clay loam in the lowest part. The substratum is strong brown and brown sandy loam. The subsurface layer has been mixed with the plow layer in most places, and part of the former subsoil has been mixed with the surface layer by plowing. Small rills and gullies are common along drainageways.

This Galland soil is slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is

acid unless limed within the past few years. Natural fertility and the organic matter content are very low to low.

This soil is suited to permanent pasture or hay. The carrying capacity of pasture is low, however, and grazing needs to be controlled. A good seeding is difficult to establish because of poor tilth and very poor fertility of the surface layer. The surface layer becomes hard and cloddy when dry and tends to seal over during rains, reducing infiltration and increasing runoff. Runoff is rapid. Gullies form readily if the soil is not protected by dense vegetation. Suitable sites for dams are difficult to locate because of the high seepage potential of the stratified underlying material.

This soil is in capability subclass VIe.

594E2—Galland loam, 14 to 18 percent slopes, moderately eroded. This is a somewhat poorly drained, moderately steep soil on side slopes of high bench terraces along the larger streams. Areas range from 10 to 40 acres in size.

Typically, the surface layer is a plow layer about 8 inches thick. It is very dark grayish brown and brown loam. The subsurface layer is generally mixed with the surface layer in cultivation. The subsoil extends to a depth of 42 inches. It is brown, dark reddish brown, and reddish brown clay loam or clay in the uppermost part; brown, strong brown, and light brownish gray clay loam in the middle part; and strong brown and light brownish gray clay loam in the lowest part. The substratum is strong brown and brown sandy loam.

Included with this soil in mapping are areas of severely eroded soils, areas of steeply sloping soils, and a few small areas of Douds soils.

This Galland soil is slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low to very low. The organic matter content is low.

This soil is used for pasture, woodland, or grazing or as wildlife habitat. It is not suited to cultivation because of very severe susceptibility to erosion. Surface runoff is rapid. A pasture seeding is difficult to establish because of poor tilth and low fertility of the surface layer. The soil receives varying amounts of seepage water, but, in most places, artificial drainage is not practical. Suitable sites for dams are difficult to locate because of the high seepage potential of the stratified underlying material.

This soil is in capability subclass VIe.

687—Watkins silt loam, 1 to 3 percent slopes. This is a well drained or moderately well drained soil on low benches or high second bottoms in valleys of the larger streams and rivers. Areas generally are 5 to 20 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown silt loam about 7 inches thick. The subsurface layer is dark grayish brown silt loam about 4 inches thick. The subsoil extends to a depth of 48 inches. It is brown silty clay loam in the uppermost part, brown and yellowish brown silty clay loam in the middle part, and yellowish brown silty clay in the lowest part. The substratum is yellowish brown silty clay loam.

This Watkins soil is moderately permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate.

This soil is well suited to corn and soybeans and can be cultivated intensively.

This soil is in capability class I.

688—Koszta silt loam, 0 to 2 percent slopes. This is a somewhat poorly drained soil on low benches or second bottoms along the major streams and rivers. Areas generally are long but irregularly shaped. They are somewhat parallel to the stream channels. The soil is subject to occasional flooding. Areas generally are 10 to 20 acres in size.

Typically, the surface layer is very dark gray silt loam about 10 inches thick. The subsurface layer is dark gray and dark grayish brown silty clay loam about 8 inches thick. The subsoil is silty clay loam that extends to a depth of 47 inches. It is dark grayish brown and grayish brown and has mottles in the upper part and mottled grayish brown and light brownish gray in the lower part. The substratum is mottled dark gray and grayish brown silty clay loam.

Included with this soil in mapping are small areas of Colo and Chequest soils, which make up as much as 10 percent of the map unit.

This Koszta soil is moderately permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderately low to moderate.

This soil is well suited to row crops. It can be used intensively for corn and soybeans. Tile drainage generally is not needed, but it may be beneficial along waterways.

This soil is in capability class I.

720—Racoon silt loam, 0 to 2 percent slopes. This is a poorly drained soil on first bottoms and low second bottoms of the major streams. The soil is subject to flooding. Areas are 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is light brownish gray and grayish brown silt loam about 18 inches thick. The subsoil extends to a depth of 60 inches. It is light brownish gray silty clay loam in the upper part and light brownish gray and yellowish brown silt loam in the lower part.

Included with this soil in mapping are small areas of Coppock, Nodaway, and Okaw soils, which make up less than 10 percent of this map unit.

This Racoon soil is slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is very low.

This soil is moderately suited to row crops. It puddles if worked when wet. In periods of more than normal rainfall, crops may turn yellow and be stunted. The soil is strongly acid and needs additions of lime.

This soil is in capability subclass IIw.

730B—Nodaway-Cantril complex, 2 to 5 percent slopes. This complex consists of moderately well drained and somewhat poorly drained soils on narrow stream bottoms on uplands. The soils are so intermingled that it is impractical to map each separately. The complex is about 60 percent Nodaway soils, 30 percent Cantril soils, and 10 percent included soils. The Nodaway soils are typically along waterways, and the Cantril soils are in fairly uniform bands along the edges of the map unit at the base of the slopes. Both soils are subject to flooding. In many places, they are cut by channels or gullies that cannot be crossed by farm machinery. This complex is in elongated areas that are as much as a mile or more long but only a few hundred feet wide. Areas range from 5 to 60 acres in size.

Typically, the Nodaway soils have a surface layer of very dark grayish brown silt loam about 8 inches thick. The substratum is variable thin strata of dark grayish brown, grayish brown, and very dark grayish brown silt loam to a depth of 60 inches. Thin strata of fine sand are in some places.

Typically, the Cantril soils have a surface layer of very dark grayish brown loam about 9 inches thick. The subsurface layer is dark grayish brown and grayish brown loam about 14 inches thick. The subsoil is loam that extends to a depth of 60 inches. It is mottled grayish brown and yellowish brown in the upper part and mottled yellowish brown, gray, and light brownish gray in the lower part.

Included with this complex in mapping are small areas of Landes soils that are generally adjacent to waterways.

Nodaway and Cantril soils have moderate permeability and high available water capacity. The subsoil is low to medium in available phosphorus and potassium. The surface layer of these soils is acid to neutral. Natural fertility is low to medium. The organic matter content is low to moderate.

This complex is seasonally wet because of the hazard of overflow. Small areas are farmed with surrounding soils because they are generally too small or narrow to be cropped separately. Much of this complex is in pasture or woodland.

This complex is in capability subclass IIw.

763D2—Fayette-Exette silt loams, 9 to 15 percent slopes, moderately eroded. These are well drained soils on narrow convex ridges and convex side slopes on uplands adjacent to river valleys. The Fayette soil is mainly on ridgetops, and the Exette soil is on the side slopes. Areas generally are long and narrow and have irregular boundaries in places. They generally are 20 to 40 acres in size. This map unit is about 40 percent Fayette soil, 30 percent Exette soil, and 30 percent included soils.

Typically, the surface layer of the Fayette soils is a plow layer about 6 inches thick. It is mixed dark grayish brown and brown silt loam. Plowing has mixed the subsurface layer with the surface layer in most places. The yellowish brown subsoil extends to a depth of about 36 inches. It is silt loam in the uppermost part, silty clay loam in the middle part, and silt loam in the lowest part. The substratum in yellowish brown silt loam.

This Fayette soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is low. The organic matter content is very low.

Typically, the surface layer of the Exette soil is dark grayish brown silt loam about 6 inches thick. The subsoil is silt loam that extends to a depth of 34 inches. It is yellowish brown and has grayish mottles in the upper part and is light olive gray and yellowish brown in the lower part. The substratum is olive gray silt loam. The soil is mildly effervescent at a depth of 34 inches.

This Exette soil is moderately permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is low.

Included with this map unit in mapping are areas of Downs, Clinton, Lindley, and Keswick soils.

This map unit is moderately suited to corn, soybeans, and hay. It is well suited to pasture or woodland. Surface runoff is medium or rapid. The plow layer is low in fertility and very low in content of organic matter. It becomes cloddy if worked when wet, and it may puddle during intense rain, resulting in more runoff and retarded plant growth.

This map unit is in capability unit IIIe.

792C2—Armstrong loam, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained or somewhat poorly drained, moderately sloping soil. It is most extensive on sloping ridgetops and upper parts of side slopes in the more strongly dissected areas near the larger streams. Areas range from 5 to 30 acres in size.

Typically, the surface layer is a plow layer 8 inches thick. It is very dark grayish brown and brown loam. In cultivated areas, plowing has mixed part of the former

subsoil and some pebbles with the surface and subsurface layers. The subsoil extends to a depth of 36 inches. It is yellowish brown, brown, or strong brown clay loam and clay in the upper part and yellowish brown clay loam in the lower part. The substratum is reddish brown and yellowish brown clay loam.

Included with this soil in mapping are some areas of Lineville soils which are too small to be mapped separately. These areas generally are less than 2 acres in size and are in the center of sloping ridges. Also included are some areas of uneroded Armstrong soils.

This Armstrong soil is slowly permeable and has a moderately high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is medium acid unless limed within the past few years. Natural fertility is low to very low. The organic matter content is moderately low.

Much of the acreage of this soil is used for permanent pasture or hay. The soil is moderately suited to row crops. It is generally associated with moderately steep soils that are not suited to row crops. The major hazard is high susceptibility to erosion. Surface runoff is medium. If terraces are built to control erosion, the clayey subsoil, which has poor tilth and fertility, is exposed in borrow areas. This concern can be overcome by stockpiling the surface layer during construction and replacing it afterward. If used for row crops, the soil generally is managed with the loess soils upslope.

This soil is in capability subclass IIIe.

792D2—Armstrong loam, 9 to 14 percent slopes, moderately eroded. This is a moderately well drained or somewhat poorly drained, strongly sloping soil on side slopes and ridgetops in more strongly dissected areas along the larger streams. Areas range from 5 to 25 acres in size.

Typically, the surface layer is a plow layer 8 inches thick. It is very dark grayish brown and brown loam. In cultivated areas, plowing has mixed part of the former subsoil and some pebbles with the surface layer and subsurface layer. The subsoil extends to a depth of 32 inches. It is yellowish brown, brown, or strong brown clay loam and clay in the upper part and yellowish brown clay loam in the lower part. The substratum is reddish brown and yellowish brown clay loam.

Included with this soil in mapping are some areas where only slight erosion has occurred and the surface layer and subsurface layer remain similar to those in the profile described for the uneroded Armstrong soils. Also included are a few small areas of severely eroded soils.

This Armstrong soil is slowly permeable and has a moderately high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is medium acid unless limed within the past few years. Natural fertility is low to very low. The organic matter content is moderately low.

This soil is best suited to hay and pasture. It is moderately suited to row crops. The soil would erode excessively if used for row crops on a regular basis, and production from row crops is low on this soil. Surface runoff is medium or rapid. Tilth and fertility of the surface layer become even more unfavorable if erosion is not controlled. If tilled when too wet, the surface layer becomes hard and cloddy when almost dry.

This soil is in capability subclass IVe.

793—Bertrand silt loam, 0 to 2 percent slopes. This is a well drained, nearly level soil on benches near the major streams. Areas are irregular in shape and range from 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is silty clay loam that extends to a depth of 40 inches. It is brown in the upper part and dark yellowish brown in the lower part. The substratum is mainly yellowish brown loam but is pinkish gray light clay loam in places.

Included with this soil in mapping are small areas where clay is in the subsoil and a few areas where pinkish clay material is at a depth below 40 inches.

This Bertrand soil is moderately permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is low.

This soil is well suited to corn and soybeans. The surface layer tends to seal and crust in places.

This soil is in capability class I.

793B—Bertrand silt loam, 2 to 5 percent slopes. This is a well drained soil on benches near major streams. Areas are irregular in shape and from 10 to 25 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is silty clay loam that extends to a depth of 40 inches. It is brown in the upper part and dark yellowish brown in the lower part. The substratum is mainly yellowish brown loam but is pinkish gray clay loam in places.

Included with this soil in mapping are small areas where the subsoil contains more clay than the subsoil described for the series. Also included are some areas where pinkish clay material is at a depth below 40 inches.

This Bertrand soil is moderately permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is low.

This soil is well suited to corn and soybeans, but it is subject to erosion if cultivated. Surface runoff is medium. In some places, terraces are difficult to construct because slopes are short and irregular in shape.

This soil is in capability subclass IIe.

793C2—Bertrand silt loam, 5 to 9 percent slopes, moderately eroded. This is a well drained, moderately sloping soil on benches along the major streams. Areas generally are long and narrow and are 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 36 inches. It commonly is brown silty clay loam, but in places it has layers of dark yellowish brown loam and pinkish gray clay loam.

Included with this soil in mapping are some areas of Bertrand soils that have reddish clay material at a depth of about 30 inches. This soil makes up less than 20 percent of the map unit. Also included are some small areas of severely eroded soils.

This Bertrand soil is moderately permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is low.

This soil is moderately suited to row crops. It is susceptible to moderate erosion during hard rain. Surface runoff is medium. The surface layer has moderate tilth. It is friable and easy to till.

This soil is in capability subclass IIIe.

795C2—Ashgrove silt loam, 5 to 9 percent slopes, moderately eroded. This is a poorly drained and somewhat poorly drained soil that is commonly called gumbotil. The soil commonly is in small areas in coves. It generally is on the edges of strongly dissected areas of timber.

Typically, the surface layer is a very dark grayish brown silt loam plow layer about 9 inches thick. The subsoil extends to a depth of 62 inches. It is brown silty clay loam in the upper 5 inches and dark grayish brown and dark gray clay, silty clay, and clay loam at a depth below 14 inches.

Included with this soil in mapping are small areas where the surface soil has been removed by erosion and the gray clay subsoil is exposed on the surface.

This Ashgrove soil is very slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is very acid unless limed within the past few years. Natural fertility is very low. The shrink-swell potential is high, and the soil cracks deeply upon drying. The organic matter content is low.

Although this soil is moderately suited to row crops, most of the acreage is used for pasture or woodland. Surface runoff is medium. If erosion is not controlled, the tilth of the surface layer deteriorates as increasing amounts of the subsoil are mixed into the plow layer. The soil dries slowly.

This soil is in capability subclass IVe.

795C3—Ashgrove soils, 5 to 9 percent slopes, severely eroded. These are poorly drained and somewhat poorly drained soils that are commonly called gumbotil. They are on side slopes and in coves. Areas generally are 10 to 15 acres in size, and they are generally dissected by noncrossable drainageways.

Typically, the surface layer is a dark grayish brown silty clay loam or clay plow layer about 8 inches thick. The subsoil extends to a depth of 52 inches. It is brown silty clay loam in the upper 5 inches and dark grayish brown and dark gray clay, silty clay, and clay loam at a depth below 14 inches. In some places, the clay subsoil is exposed.

Included with these soils in mapping are some small areas of moderately eroded soils and a few small areas of Rinda soils.

These Ashgrove soils are very slowly permeable and have a high available water capacity. The subsoil is very low in available phosphorus and available potassium. The surface layer is very acid unless limed within the past few years. Natural fertility is very low. The shrink-swell potential is high, and the soil cracks deeply upon drying. Organic matter content is very low.

These soils generally are used for hay and pasture or are left idle. They are not suited to cultivated crops. Erosion and wetness are the main concerns. Surface runoff is medium. The surface layer hardens and cracks severely when it dries. It puddles readily and absorbs moisture very slowly. The deep, active gullies that have formed in places should be shaped and planted to grass to prevent further erosion. A short, temporary diversion terrace placed upslope from the gullies helps to prevent erosion until a seeding is established.

These soils are in capability subclass IVe.

795D2—Ashgrove silt loam, 9 to 14 percent slopes, moderately eroded. This is a poorly drained and somewhat poorly drained soil that is commonly called gumbotil. It is in coves and on side slopes at the edges of strongly dissected areas of timber. Areas range from 5 to 20 acres in size.

Typically, the surface layer is a very dark grayish brown silt loam plow layer about 9 inches thick. The subsoil extends to a depth of 57 inches. It is brown silty clay loam in the upper 5 inches and dark grayish brown and dark gray clay, silty clay, and clay loam at a depth below 14 inches.

Included with this soil in mapping are numerous areas that have never been plowed and have a thicker surface

layer. Also included are areas where most of the surface layer has been removed by erosion and the gray, clayey subsoil is exposed.

This Ashgrove soil is very slowly permeable and has a high available water capacity. The subsoil is very low in available phosphorous and available potassium. The surface layer is very acid unless limed within the past few years. Natural fertility is very low. The shrink-swell potential is high, and the soil cracks deeply upon drying. Organic matter content is low.

This soil is moderately suited to row crops. It is best suited to pasture or woodland. If erosion is not controlled, tilth of the surface layer deteriorates as increasing amounts of the clayey subsoil are mixed into the plow layer. Surface runoff is medium or rapid.

This soil is in capability subclass IVe.

795D3—Ashgrove soils, 9 to 14 percent slopes, severely eroded. These are poorly drained and somewhat poorly drained soils that are commonly called gumbotil. They are on convex slopes on uplands. They are just below the loess-till contact line and run on the contour along hillsides and into coves at the heads of drainageways. Areas generally are rather long and narrow and have irregular boundaries. They are 5 to 20 acres in size.

Typically, the surface layer is a dark grayish brown silty clay loam or clay plow layer about 8 inches thick. The subsoil extends to a depth of 42 inches. It is brown silty clay loam in the upper 5 inches and dark grayish brown and dark gray clay, silty clay, and clay loam at a depth below 14 inches. In some places the clay subsoil is exposed.

Included with these soils in mapping are some small areas of moderately eroded soils and a few areas of Keswick soils.

These Ashgrove soils are very slowly permeable and have a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is very acid unless limed within the past few years. Natural fertility is very low. The shrink-swell potential is high, and the soil cracks deeply upon drying. Organic matter content is very low.

These soils generally are used for hay and pasture or are left idle. They are not suited to cultivated crops. Erosion and wetness are the main concerns of management. Surface runoff is rapid. The deep, active gullies that have formed in places should be shaped and planted to grass to prevent further erosion.

These soils are in capability subclass IVe.

820—Dockery silt loam, 0 to 2 percent slopes. This is a poorly drained soil on first bottoms of the Mississippi River. The soil is subject to flooding. Areas are from 10 acres to as much as 80 acres in size.

Typically, the surface layer is very dark gray and very dark grayish brown silt loam about 9 inches thick. The upper part of the substratum is dark gray silt loam or silty clay loam that has reddish mottles, and the lower part is mottled dark gray and grayish brown silt loam and silty clay loam.

Included with this soil in mapping are small areas of Colo and Landes soils.

This Dockery soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is commonly neutral and does not require lime. Natural fertility is medium. The organic matter content is high.

This soil is well suited to row crops if it is protected from flooding by dikes. Wetness during spring is a concern, and the timeliness of operations can be greatly improved by tile drainage where outlets are available. The surface layer is friable and easy to till under proper moisture conditions.

This soil is in capability subclass IIw.

832B—Weller silt loam, benches, 2 to 5 percent slopes. This is a moderately well drained, gently sloping soil on loess-covered benches that extend into the bottom lands of smaller streams. Areas are small.

Typically, the surface layer is very dark grayish brown silt loam about 3 inches thick. The subsurface layer is grayish brown silt loam about 13 inches thick. The subsoil extends to a depth of 50 inches. It is grayish brown and brown silty clay loam and silty clay in the uppermost part, grayish brown silty clay in the middle part, and grayish brown silty clay loam in the lowest part. The substratum is mottled light olive gray and light olive brown silty clay loam. This soil is underlain by alluvial sediment of loamy sand and sand at a depth below 6 feet. The underlying material has high seepage potential and low stability where deep cuts are made.

Included with this soil in mapping are small areas of eroded Weller soils.

This Weller soil is slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed. Natural fertility is low. The organic matter content is low.

This soil is moderately suited to row crops. Much of the acreage is used in crop rotation. In places, the soil is in woodland. If cultivated, it erodes readily. Runoff is medium. The soil has favorable moisture-holding properties and is friable and easily worked.

This soil is in capability subclass IIIe.

832C2—Weller silt loam, benches, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained soil on benches along many of the smaller stream valleys. Areas are small.

Typically, the surface layer is a plow layer about 8 inches thick. It is grayish brown and dark grayish brown silt loam. The subsurface layer is generally mixed with

the surface layer in tillage. The subsoil extends to a depth of 42 inches. It is grayish brown and brown silty clay loam and silty clay in the uppermost part, grayish brown silty clay in the middle part, and grayish brown silty clay loam in the lowest part. The substratum is mottled light olive gray and light olive brown silty clay loam. This soil is underlain by loamy sand or sandy material at a depth of 6 to 10 feet. The underlying material has high seepage potential and low stability where deep cuts are made.

This Weller soil is slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed. Natural fertility is low. The organic matter content is low.

This soil is moderately suited to row crops. It is susceptible to erosion because runoff is medium. Some areas are in woodland, and the soil is well suited to woodland. Seepage and variable textures may be expected where deep cuts or fills are made.

This soil is in capability subclass IIIe.

880B—Clinton silt loam, benches, 2 to 5 percent slopes. This is a moderately well drained, gently sloping soil on loess-covered benches that extend into bottom lands along the smaller streams. Areas range from 5 to 15 acres in size.

Typically, the surface layer is very dark gray silt loam about 3 inches thick. The subsurface layer is dark grayish brown and yellowish brown silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is yellowish brown and brown silty clay loam. The substratum also is yellowish brown silty clay loam. Sandy alluvium is at a depth of 6 to 10 feet. In some cultivated areas, the surface layer is mixed with the subsurface layer. The underlying substratum has seepage potential and low stability where deep cuts are made.

Included with this soil in mapping are small areas of eroded Clinton soils.

This Clinton soil is moderately slowly permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is medium. The organic matter content is low.

This soil is well suited to row crops. Much of the acreage is used in crop rotations, but in some places it is still wooded. The soil erodes readily if cultivated. Surface runoff is medium.

This soil is in capability subclass IIe.

880C2—Clinton silt loam, benches, 5 to 9 percent slopes, moderately eroded. This is a moderately well drained, moderately sloping soil on benches along many of the smaller stream valleys. The soil is on side slopes and short ridges. Areas are small.

Typically, the surface layer is a plow layer of dark grayish brown and grayish brown silt loam about 8 inches thick. In some places, this layer is silty clay loam. The subsurface layer is generally mixed with the surface layer in plowing. The subsoil extends to a depth of 48 inches. It is yellowish brown and brown silty clay loam. The substratum is yellowish brown silty clay loam. Sandy alluvium is at a depth of 6 to 10 feet. This underlying material has high seepage potential and low stability where deep cuts are made.

Included with this soil in mapping are small, uneroded areas and a few spots where the subsoil is exposed.

This Clinton soil is moderately permeable and has a high available water capacity. The subsoil is high in available phosphorus and medium in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is medium. The organic matter content is low.

Much of the acreage is used in crop rotation, but this soil is best suited to hay or pasture. It is very erosive. Surface runoff is medium. The surface layer is generally poor in tilth. After rain, it tends to crust. Use of meadow generally improves tilth.

This soil is in capability subclass IIIe.

950—Niota silty clay loam, 0 to 2 percent slopes. This is a poorly drained, nearly level soil on high benches along the major rivers and their lower tributaries. Areas range from 5 acres to more than 20 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsurface layer is dark gray silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches. It is dark grayish brown and grayish brown clay in the upper part and grayish brown silty clay in the lower part.

Included with this soil in mapping are some areas of soils that have a silt loam surface layer. Also included are some areas of soils that have a sandy substratum at a depth of 4 to 6 feet.

This Niota soil is very slowly permeable and has a moderate to high available water capacity. The subsoil is very low in available phosphorus and medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is moderately low.

This soil is only moderately suited to row crops because the subsoil is very slowly permeable and poorly drained. Because the subsoil contains large amounts of clay, tile lines are not suitable for drainage. The soil puddles if worked when wet. In periods of more than normal rainfall, crops turn yellow and are stunted.

This soil is in capability subclass IIIw.

950B—Niota silty clay loam, 2 to 5 percent slopes. This is a poorly drained, gently sloping soil on side slopes of high benches along the major rivers and their

lower tributaries. Areas are long and narrow and range from 5 to 20 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsurface layer is dark gray silt loam about 7 inches thick. The subsoil extends to a depth of 55 inches. It is dark grayish brown and grayish brown clay in the upper part and grayish brown silty clay in the lower part.

Included with this soil in mapping are some areas where the substratum has layers of sandy material at a depth below 48 inches.

This Niota soil is very slowly permeable and has a moderate to high available water capacity. The subsoil is very low in available phosphorus and medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is low.

This soil is moderately suited to row crops. It erodes readily because the silty surface layer contains a low amount of organic matter and is generally not well granulated. Loss of the surface layer increases the hazard of exposing the firm, clayey subsoil. Surface runoff is medium.

This soil is in capability subclass IIIe.

950D2—Niota silty clay loam, 7 to 14 percent slopes, moderately eroded. This is a poorly drained, strongly sloping soil on side slopes of high benches along the major rivers and their lower tributaries. In most places, it occupies entire short side slopes. Areas generally are more than 5 to 10 acres in size.

Typically, the surface layer is a plow layer about 8 inches thick. It is very dark gray silty clay loam. The subsurface layer generally is mixed with the surface layer in tillage. The subsoil extends to a depth of 50 inches. It is dark grayish brown and grayish brown clay in the upper part and grayish brown silty clay in the lower part.

Included with this soil in mapping are small areas on the part of the slope where the grayish and sometimes pinkish subsoil has been exposed by erosion.

This Niota soil is very slowly permeable and has a moderate to high available water capacity. The subsoil is very low in available phosphorus and is medium in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low. The organic matter content is low.

This soil is best suited to hay or pasture because it is strongly sloping and has a clayey subsoil. It is extremely erodible and difficult to manage. If erosion is not reduced, the tilth and fertility of the surface layer will continue to deteriorate as increasing amounts of the former subsoil are mixed into the plow layer. When the surrounding soils are ready for cultivation, this soil may still be too wet to work. Surface runoff is rapid. The surface layer is very hard and cloddy when dry.

This soil is in capability subclass IVe.

952—Denrock Variant silt loam, 0 to 2 percent slopes. This is a poorly drained, nearly level soil on low second bottoms of the Mississippi River. The soil is subject to flooding. Areas are from 10 to 30 acres in size.

Typically, the surface layer is very dark gray silt loam about 15 inches thick. The subsoil extends to a depth of 65 inches. The uppermost part is brown silty clay loam that has reddish mottles, the middle part is strong brown silty clay that has reddish mottles, and the lowest part is reddish brown silty clay and clay.

Included with this soil in mapping are some areas where the substratum has a high amount of sand or fine gravel at a depth below 40 inches.

This Denrock soil is very slowly permeable and has a moderate to high available water capacity. The subsoil is very low in available phosphorus and medium in available potassium. The surface layer commonly is neutral and does not require lime. Natural fertility is low. The organic matter content is moderate.

This soil is not suited to row crops. It is best suited to hay or pasture. Most areas are wet because of the high water table created by the navigation dam on the Mississippi River at Keokuk. In some places, runoff collects and ponds in shallow depressions because no natural outlets are available. Because the subsoil contains large amounts of clay, tile lines are not suitable for drainage. Also, suitable outlets for tile drains generally are not available.

This soil is in capability subclass IIIw.

977—Richwood silt loam, 0 to 2 percent slopes. This is a well drained soil at the mouth of upland drainageways that fan out onto stream benches, mainly along the Mississippi River. Areas are from 10 acres to as much as 50 acres in size.

Typically, the surface layer is very dark brown and very dark grayish brown silt loam about 19 inches thick. The subsoil extends to a depth of 60 inches. It is very dark grayish brown and brown silt loam in the upper part and yellowish brown silty clay loam or loam in the lower part.

Included with this soil in mapping are some areas of soils that have more sand in the surface layer and some areas of soils that are lighter-colored than this Richwood soil.

This Richwood soil is moderately permeable and has a high available water capacity. The subsoil is very low in available phosphorus and potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is high.

This soil is well suited to row crops. It is easily tilled, and control of erosion is not a concern. In some places, properly placed diversion terraces protect the soil from siltation from higher soils.

This soil is in capability class I.

978—Festina silt loam, 1 to 3 percent slopes. This is a well drained soil on second bottoms and benches

along the major rivers. The soil is subject to rare flooding. Areas are from 10 to 30 acres in size.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is dark grayish brown or brown silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches. It is brown, yellowish brown, and dark yellowish brown silt loam or silty clay loam in the upper part and brown, yellowish brown, and grayish brown silt loam in the lower part.

Included with this soil in mapping are small areas of Watkins and Bertrand soils. Also included are small areas of soils that have more sand in the surface layer than this Festina soil.

This soil is moderately permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is medium. The organic matter content is moderate to moderately low.

This soil is well suited to row crops and can be used intensively for corn and soybeans. Surface runoff is slow in most places. The surface layer has good tilth, is friable, and is easy to till.

This soil is in capability class I.

993D2—Armstrong-Gara loams, 9 to 14 percent slopes, moderately eroded. These are well drained to somewhat poorly drained soils on uplands. The soils are on cove slopes and irregular side slopes that are dissected by shallow, crossable drainageways. They are so intermingled that it is not practical to map each separately. This map unit is about 60 percent Armstrong soil, 30 percent Gara soil, and 10 percent included soils.

Typically, the surface layer of the Armstrong soil is a plow layer 8 inches thick. It is very dark grayish brown and brown loam. In cultivated areas, plowing has mixed part of the former subsoil and some pebbles with the surface and subsurface layers. The subsoil extends to a depth of 32 inches. It is yellowish brown, brown, or strong brown clay loam and clay in the upper part and yellowish brown clay loam in the lower part. The substratum is reddish brown and yellowish brown clay loam.

Typically, the surface layer of the Gara soil is a plow layer about 8 inches thick. It is a very dark gray loam. If present, the subsurface layer is mixed very dark gray, dark grayish brown, and dark yellowish brown clay loam about 5 inches thick. The subsoil is clay loam that extends to a depth of 46 inches. It is mottled brown and yellowish brown in the upper part and mottled yellowish brown in the lower part. The substratum is mottled yellowish brown and brown clay loam.

Included with this map unit in mapping are small areas of severely eroded soils that have a clay loam surface layer.

Permeability is moderately slow to slow, and available water capacity is moderately high to high. The subsoil is very low or low in available phosphorous and very low in available potassium. Unless limed, the surface layer generally is acid. Natural fertility is low to very low. The organic matter content is moderate to moderately low.

These soils are primarily used for cultivated crops, hay, and pasture. They are poorly suited to corn, soybeans, and oats but are well suited to alfalfa. Most areas have been cleared and are used as pasture. Fertility is more limiting in this map unit than for uneroded Gara and Armstrong soils. The soils have a strong tendency to be cloddy when tilled, making seedbed preparation more difficult and requiring greater production input than for uneroded soils. A high level of overall management is required in cultivated areas. Surface runoff is medium or rapid, and the main hazard is erosion from runoff water. This map unit is more erodible than uneroded soils because the surface layer has poorer physical condition. These moderately eroded soils crust after heavy rain, and seedling emergence is a problem. Good residue management, returning crop residue and adding manure are necessary to maintain tilth and crop production. Management of pasture requires greater input of fertilizer and erosion control practices than on uneroded soils. Removal of the topsoil causes severe management concerns because of the unfavorable subsoil properties.

This map unit is in capability subclass IVe.

1057—Rushville silt loam, benches, 0 to 2 percent slopes. This is a poorly drained or very poorly drained soil on the flatter part of benches along the larger streams. Slope is dominantly less than 1 percent. Areas range from 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsurface layer is gray and light brownish gray silt loam and silty clay loam about 7 inches thick. The subsoil is grayish brown and extends to a depth of 52 inches. It is silty clay loam in the upper part and silty clay and silty clay loam in the lower part. The substratum is mottled grayish brown and yellowish brown silt loam. The underlying material is stratified sand and loamy sand from alluvial sediment at a depth of 8 to 10 feet.

Included with this soil in mapping are a few small areas of Keomah soils.

This Rushville soil is slowly to very slowly permeable and has a high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility and the organic matter content are low.

Individual areas are small, and most are cropped the same as surrounding soils. This soil is moderately suited to crops if properly drained. Shallow surface ditches remove excess water and improve drainage, but in many places tile drainage is more effective. Seepage and variable textures of the underlying material may be expected where deep cuts are made on this soil.

This soil is in capability subclass IIIw.

1130—Belinda silt loam, benches, 0 to 2 percent slopes. This is a poorly drained soil on the flatter parts of benches along the larger streams. Slope is dominantly less than 1 percent. Areas range from 10 to 40 acres in size.

Typically, the surface layer is very dark gray silt loam about 7 inches thick. The subsurface layer is grayish brown and light brownish gray silt loam about 11 inches thick. The subsoil extends to a depth of 60 inches. It is mottled dark grayish brown and grayish brown silty clay in the uppermost part, grayish brown silty clay in the middle part, and light olive gray silty clay loam in the lowest part. The soil is underlain by sandy alluvium at a depth of 5 to 10 feet.

Included with this soil in mapping are a few small areas of Beckwith soils.

This Belinda soil is very slowly permeable and has a moderately high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer generally is acid unless limed. Natural fertility is medium. The organic matter content is moderate.

Individual areas of this soil are small, and most are cropped the same as surrounding soils. Row crops are moderately suited if the soil is drained. Shallow surface ditches remove excess water and improve drainage. The high clay content of the subsoil limits effective use of tile lines. Seepage and variable textures of the underlying material may be expected where deep cuts are made on this soil.

This soil is in capability subclass IIIw.

1131B—Pershing silt loam, benches, 2 to 5 percent slopes. This is a moderately well drained and somewhat poorly drained, gently sloping soil on high benches that extend out into the bottom lands along the smaller stream valleys. Areas are small.

Typically, the surface layer is very dark gray silt loam about 8 inches thick. The subsurface layer is very dark gray or dark grayish brown silt loam and silty clay loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is dark grayish brown silty clay loam in the uppermost part; grayish brown, mottled silty clay in the middle part; and light olive gray silty clay loam in the lowest part. The substratum is mottled light olive gray and yellowish brown silty clay loam. The underlying material, at a depth of 6 to 8 feet, often consists of stratified loamy sand or sand alluvial sediment.

Included with this soil in mapping are a few small areas of moderately eroded soils.

This Pershing soil is slowly permeable and has a high available water capacity. The subsoil is high in available phosphorus and very low in available potassium. The surface layer is acid unless limed. Natural fertility is low to medium. The organic matter content is moderate to moderately low.

This soil is moderately suited to row crops. Most areas are cultivated but are susceptible to erosion. Surface runoff is medium. If tilth becomes poor, the soil should be kept in meadow for an additional year. Seepage and variable textures may be expected in deep cuts and fills.

This soil is in capability subclass IIIe.

1180—Keomah silt loam, benches, 0 to 2 percent slopes. This is a somewhat poorly drained, nearly level soil on loess-covered benches that extend out into the bottom lands along the major streams. Areas are from 10 to 40 acres in size.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is brown silty clay loam and silty clay in the upper part and mottled grayish brown, dark grayish brown, and yellowish brown silty clay and silty clay loam in the lower part. The maximum clay content is commonly at a depth of 20 to 24 inches. If cultivated, the surface layer is mixed with the subsurface layer in places. The underlying material, at a depth below 8 to 10 feet, is often alluvial sediment of loamy sand and sand. This material has a seepage potential and low stability where deep cuts are made.

This Keomah soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low to medium. The organic matter content is low to moderately low.

This soil is well suited to corn, soybeans, or hay. Much of the acreage is used in crop rotation, but in some places it is still wooded or is used for pasture. If cultivated, the soil requires drainage improvement in places. Tile lines may function satisfactorily, but in places drainage through them tends to be slow. Tilth is generally good.

This soil is in capability subclass IIw.

1180B—Keomah silt loam, benches, 2 to 5 percent slopes. This is a somewhat poorly drained, gently sloping soil on loess-covered benches that extend out into the bottom lands along the major streams. Areas range from 10 to 30 acres in size.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is brown silty clay loam and silty clay in the upper part and mottled grayish brown, dark grayish brown, and yellowish brown silty clay and silty clay loam in the lower part. The maximum clay content is commonly at a depth of 16 to 20 inches. If cultivated, the surface layer is mixed with the subsurface layer in places. The underlying material, at a depth below 6 feet, is often alluvial sediment of loamy sand and sand. This material

has a high seepage potential and low stability where deep cuts are made.

Included with this soil in mapping are small areas of eroded Keomah soils.

This Keomah soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed within the past few years. Natural fertility is low to medium. The organic matter content is low.

This soil is moderately well suited to corn, soybeans, or meadow. It is susceptible to erosion if cultivated. Runoff is medium. Moisture is favorable. The soil is friable and easy to work.

This soil is in capability subclass IIe.

1181—Keomah silt loam, bedrock substratum, 1 to 3 percent slopes. This is a somewhat poorly drained soil on loess-covered benches that extend out into the bottom lands. Areas range from 10 to 20 acres in size. The benches are underlain by limestone bedrock at a depth of 6 to 10 feet. This bedrock has crevices that allow the surface material to run into them with the percolating ground water. As a result, shallow depressions occur on the surface, and, in some cases, deep depressions form that are not crossable with farm machinery.

Typically, the surface layer is brown silt loam about 4 inches thick. The subsurface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is yellowish brown silty clay in the upper part and mottled grayish brown, dark grayish brown, and yellowish brown silty clay loam in the lower part.

This soil is moderately slowly permeable and has a high available water capacity. The subsoil is medium in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility is low to medium. The organic matter content is low to moderately low.

This soil is well suited to corn, soybeans, and hay. Although crops grow moderately well, the soil requires drainage improvement in many places. Tile lines may function satisfactorily, but in places drainage through them tends to be slow.

This soil is in capability subclass IIw.

1220—Nodaway silt loam, channeled, 0 to 2 percent slopes. This is a moderately well drained soil that is adjacent to meandering channels of the major streams. The soil is subject to flooding. Slopes are more undulating than those of other soils on bottom lands. Areas are dissected by many old channels and bayous, and some are filled with water at least part of the year. They generally are large.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The substratum extends to a depth of 60 inches. It is variable, thin strata of dark grayish brown, grayish brown, and very dark grayish brown silt loam. Dense strata of fine sand occur in places.

Included with this soil in mapping are areas of soils that have loamy, dark, recently deposited alluvial sediment of meandering stream channels and bayous. This material ranges from loamy sand to silty clay within short distances in these areas. Nodaway soils make up about 75 percent of the map unit.

This Nodaway soil is moderately permeable and has a high available water capacity. The subsoil is medium in available phosphorus and potassium. The surface layer is neutral and generally does not require lime. Natural fertility is medium. The organic matter content is moderate.

In many places, this soil has a thick stand of trees. A few areas are cropped, but most of the acreage is used for permanent pasture or woodland. Generally, the soil is not used for crops because trees must be removed, channels straightened or filled, and dikes built or drainage ditches dug. Yields of row crops vary greatly unless overflow is controlled. If trees and shrubs are removed, the carrying capacity of pasture is high.

This soil is in capability subclass Vw.

1260—Beckwith silt loam, benches, 0 to 2 percent slopes. This is a poorly drained, nearly level soil on loess-covered benches that extend out into the bottom lands along the major streams. Areas are 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is light brownish gray silt loam about 11 inches thick. The subsoil extends to a depth of 60 inches. The uppermost part is dark grayish brown and grayish brown silty clay, the middle part is grayish brown silty clay that has common yellowish brown mottles, and the lowest part is grayish brown and light olive gray silty clay loam. The benches are underlain by sandy alluvium at a depth of 8 to 12 feet. In some cultivated areas the surface layer is mixed with the subsurface layer. As a result, it has an ashy appearance in these areas.

This Beckwith soil is very slowly permeable and has a moderately high available water capacity. The subsoil is low in available phosphorus and very low in available potassium. The surface layer is acid unless limed in the past few years. Natural fertility and the organic matter content are very low.

This soil is only moderately suited to row crops because it is poorly drained and the subsoil is very slowly permeable. Because the subsoil contains large amounts of clay, tile lines are not suitable for drainage. Shallow ditches, however, remove excess water and improve drainage. The soil is cloddy if worked when wet. In periods of more than normal rainfall, crops turn yellow and are stunted.

This soil is in capability subclass IIIw.

1316—Alluvial land, frequently flooded. This miscellaneous area is on the river side of areas protected by levees and is also in areas unprotected by levees. It consists of recently deposited, highly stratified sediment that has not been in place long enough for soil to form. It is frequently flooded, and each flood adds new sediment. The sediment is mainly sandy loam, loamy sand, and sand, but it varies in texture.

Much of this unit is channeled, and it contains low natural levees, small ponds, sloughs, and small oxbows. Natural drainage is poor. Because of the flood hazard, oxbows, and sloughs, this unit is not well suited to cropping, and much of it remains in willows and, in some cases, in permanent pasture.

Alluvial land, frequently flooded, is in capability subclass VIIw.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, 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 presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 250,000 acres in the county was used for crops and pasture in 1973, according to the 1973 Iowa Agriculture Statistics (*18*). Of this total, 91,000 acres was used for permanent pasture; 134,000 acres for row crops, mainly corn and soybeans; 6,000 acres for close-grown crops, mainly oats; and 19,000 acres for rotation hay and pasture.

The potential of the soils in Lee County for increased production of food is good. About 15,000 acres of potentially good cropland is currently woodland, and about 20,000 acres is in pasture. In addition to the reserve productive capacity represented by this land, production could be increased considerably by extending better technology to all cropland in the county.

Acreage in crops and pasture has been gradually decreasing as more and more land is used for urban development. In 1973 there was an estimated 9,000 acres of urban and built-up land in the county; this figure has been growing at the rate of about 200 acres per year.

Soil erosion is the major soil problem on about two-thirds of the cropland and pasture in Lee County. Where the slope is more than 2 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. This is especially damaging on

soils that have a clayey subsoil. Erosion also reduces productivity on soils that tend to be droughty. Second, soil erosion on farmland results in sediment entering streams. Reducing erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for wildlife.

In many sloping fields, preparing a good seedbed and tilling are difficult on clayey spots because the original friable surface layer has been eroded away. Such spots are common in areas of moderately eroded soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms (fig. 17), which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion and also provide nitrogen and improve tilth for the following crop.

In some areas, slopes are so short and irregular that contour tillage or terracing is not practical. Cropping systems that provide substantial vegetative cover are required in these areas to control erosion unless minimum tillage is practiced. Minimizing tillage and leaving crop residues on the surface increase infiltration and reduce runoff and erosion. These practices can be adapted to most soils in the survey area but are more difficult to apply successfully on the eroded soils and the soils that have a clayey surface layer. No tillage for corn, which is increasingly common, is effective in reducing erosion on sloping land and can be adapted to many soils in the survey area. It is more difficult to practice successfully, however, on soils that have a clayey surface layer.

Terraces and diversions shorten the slope and reduce runoff and erosion. They are most practical on deep, well drained soils that have regular slopes. Other soils are less suitable for terraces and diversions because of irregular slopes, excessive wetness in the terrace channels, or a clayey subsoil that would be exposed in terrace channels.

Contouring and contour stripcropping are erosion control practices in the survey area. They are best adapted to soils that have smooth, uniform slopes.

Soil blowing is a hazard on sandy soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining vegetative cover, surface mulch, or rough surfaces through proper tillage minimizes soil blowing on these soils.

Information on the design of erosion control practices for each kind of soil can be found in the Technical Guide, available at local offices of the Soil Conservation Service.

Soil drainage is the major management need on about one-third of the cropland and pasture in the survey area. Some soils are so naturally wet that production of crops common to the area is generally not possible. These are some of the poorly drained and very poorly drained soils, which make up about 10,000 acres in the survey area. Unless artificially drained, the poorly drained and part of the somewhat poorly drained soils are so wet that crops are damaged during most years.

Some soils have good natural drainage most of the year but tend to dry slowly after rains. Small areas of wetter soils along drainageways and in swales are commonly included in areas of the moderately well drained and somewhat poorly drained soils, especially those that have slopes of 2 to 5 percent. Artificial drainage is needed in most of these wetter areas.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed for intensive row cropping in most areas of the poorly drained and very poorly drained soils. Drains have to be more closely spaced in slowly permeable soils than in the more permeable soils. Tile drainage is very slow in soils that have a high content of clay in the subsoil. Finding adequate outlets for tile drainage systems is difficult in many bottom land areas. Information on drainage design for each kind of soil can be found in the Technical Guide, available at local offices of the Soil Conservation Service.

Soil fertility is naturally low in many soils of the uplands in the survey area. Most soils are naturally acid. If they have never been limed, they require applications of ground limestone to raise the pH level sufficiently for alfalfa and other crops that grow well only on nearly neutral soils. Available phosphorus and potash levels are naturally low in many of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to apply.

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

Most of the soils used for crops in the survey area have a dark silt loam or silty clay loam surface layer that is moderate in content of organic matter. The moderately or severely eroded soil phase has a surface layer that is lower in organic matter content and higher in clay content than the uneroded phase. Generally, the structure of eroded soils is weak, and intense rainfall causes the formation of crust on the surface. When it is dry, the crust is hard and nearly impervious to water. This reduces infiltration and increases runoff. Regular additions of crop residues, manure, and other organic material can improve soil structure and reduce crust formation.

Fall plowing is generally a good practice on the county's dark soils that have a heavy silty clay loam or a silty clay surface layer because the structure is improved by freezing and thawing. If they are wet when plowed, they tend to be very cloddy when dry, making good seedbeds

difficult to prepare. About two-thirds of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in the fall.

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 4. 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. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class; they are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too 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, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Woodland management and productivity

Table 5 contains information useful to woodland owners or forest managers planning use of the soils for wood crops. Only those soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 5 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

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

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

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

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

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

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

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species 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 depending on erodibility of the soil. They protect cropland and crops from wind, hold snow on the fields, reduce 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. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 6 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 6, based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or

extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and, if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, and *poor*, which mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is

spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction material. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel or stones.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

Camp areas require such site preparation as shaping and leveling for 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 for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but re-

mains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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 that are planted for wildlife food and cover. Major soil properties 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, that provide food and cover for wildlife. Major soil properties 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 the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of hardwood plants are oak, poplar, cherry, apple, hawthorn, dogwood, hickory, and elderberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capac-

ity, 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, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 13 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two

classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems. It is expressed as inches of water per inch of soil.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but 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, but 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, but crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and 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, and crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, and with runoff from adjacent slopes. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*16*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Arispe series

The Arispe series consists of somewhat poorly drained to moderately well drained soils on side slopes and low ridgetops. These soils formed in leached deoxidized loess. The native vegetation was prairie grasses. Slope ranges from 5 to 9 percent.

Typical pedon of Arispe silty clay loam, 5 to 9 percent slopes, 150 feet east and 175 feet south of the NW corner of sec. 28, T. 69 N., R. 5 W.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) light silty clay loam; moderate medium subangular blocky structure; firm; neutral; abrupt smooth boundary.

B1—8 to 13 inches; very dark gray (10YR 3/1) light silty clay loam; moderate very fine granular and subangular blocky structure; friable; slightly acid; clear smooth boundary.

B21—13 to 17 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate very fine subangular blocky structure; friable; few thin discontinuous clay films; common very dark grayish brown (10YR 3/2) coatings on faces of peds; medium acid; clear smooth boundary.

B22tg—17 to 23 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; friable; few thin discontinuous clay films; few very dark grayish brown (10YR 3/2) coatings on faces of peds; few hard concretions and pipestems; medium acid; gradual smooth boundary.

B23tg—23 to 27 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles, dominantly on ped interiors; moderate fine subangular blocky structure; firm; thin discontinuous clay films; common hard concretions and pipestems; medium acid; gradual smooth boundary.

B31tg—27 to 34 inches; grayish brown (2.5Y 5/2) light silty clay loam; many fine distinct yellowish brown (10YR 5/4 and 5/6) mottles and few fine distinct brown (7.5YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; thick discontinuous clay films; common hard concretions; slightly acid; gradual smooth boundary.

B32tg—34 to 41 inches; gray (5Y 5/1 and 6/1) light silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles and common strong brown

(7.5YR 5/6) mottles; weak medium prismatic structure; firm; thick discontinuous clay films; common hard concretions; neutral; gradual smooth boundary.

Cg—41 to 60 inches; gray (5Y 5/1 and 6/1) light silty clay loam; few medium distinct strong brown (7.5YR 5/6) mottles; massive; firm; deoxidized; common hard concretions; neutral.

The A horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1). It ranges from heavy silt loam to light silty clay loam and is 8 to 13 inches thick.

The B2tg horizon ranges from dark gray (10YR 4/1) to grayish brown (2.5Y 5/2). It ranges from medium to heavy silty clay loam. Content of clay ranges from 35 to 42 in the zone of maximum accumulation.

The depth to clayey glacial till ranges from 4 to 7 feet and depends on topographic position.

Map unit 23C2 lacks the required thickness for a mollic epipedon. This difference does not alter the usefulness and behavior of the map unit.

Armstrong series

The Armstrong series consists of somewhat poorly drained and moderately well drained soils on upland ridgetops and convex, upper side slopes. These soils formed in previously weathered glacial till. The native vegetation was grasses and trees. Slope ranges from 5 to 14 percent.

Typical pedon of uneroded Armstrong loam in an area of Armstrong loam, 9 to 14 percent slopes, moderately eroded, 390 feet south and 40 feet west of the NE corner of SE1/4SE1/4 sec. 14, T. 67 N., R. 7 W.:

A1—0 to 7 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 12 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; few fine faint very dark grayish brown (10YR 3/2) mottles; weak medium platy structure parting to moderate very fine subangular blocky; friable; few discontinuous silt coatings on faces of peds; slightly acid; clear smooth boundary.

B1—12 to 16 inches; yellowish brown (10YR 5/4) clay loam; common fine faint dark brown (10YR 3/2) mottles on ped interiors; strong fine and very fine subangular blocky structure; friable; nearly continuous light brownish gray (10YR 6/2) silt coatings on faces of peds; strongly acid; clear smooth boundary.

IIB21t—16 to 20 inches; brown (7.5YR 4/2) light clay; common fine prominent red (2.5YR 4/6) mottles and few fine prominent dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; firm; few small pebbles; nearly continuous clay films; strongly acid; clear smooth boundary.

IIB22t—20 to 24 inches; strong brown (7.5YR 5/6) light clay; common fine distinct red (2.5YR 4/6) mottles and few fine faint gray (10YR 5/1) mottles; moderate fine and medium subangular blocky structure; firm; common dark discontinuous clay films; some small pebbles; strongly acid; gradual smooth boundary.

IIB23t—24 to 33 inches; yellowish brown (10YR 5/6) heavy clay loam; few fine distinct reddish brown (5YR 4/4) mottles, common fine faint brown (7.5YR 4/4) mottles, and few fine distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few thin dark discontinuous clay films; few fine dark soft oxides; some small pebbles; strongly acid; gradual smooth boundary.

IIB3t—33 to 41 inches; yellowish brown (10YR 5/6) clay loam; common fine faint brown (7.5YR 4/4) mottles and few fine faint light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; common discontinuous dark clay films and organic deposits; few dark soft oxides; some small pebbles; slightly acid; clear smooth boundary.

IIC1—41 to 49 inches; mottled reddish brown (5YR 4/4) and yellowish brown (10YR 5/4) clay loam; few fine distinct light brownish gray (10YR 6/2) mottles and few fine faint yellowish red (5YR 4/6) mottles; massive; firm; few dark soft oxides; some coarse sand lenses and some small pebbles; neutral; clear smooth boundary.

IIC2—49 to 60 inches; yellowish brown (10YR 5/6) clay loam; common fine faint strong brown (7.5YR 5/6 and 5/8) mottles and common fine distinct light olive gray (5Y 6/2) mottles; massive; firm; few fine soft dark oxides; common small pebbles; carbonates at a depth of 58 inches; neutral.

The A1 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It ranges from 2 to 6 inches in thickness. The IIB2t horizon ranges from yellowish brown (10YR 5/6) and brown (7.5YR 4/2) to yellowish red (5YR 5/4). Maximum clay content in the upper part of the B horizon ranges from 40 to 48 percent. In some pedons, a stone line is not in the upper part of the B horizon.

Ashgrove series

Ashgrove series consists of somewhat poorly drained and poorly drained soils on uplands. These soils formed under forest vegetation in previously weathered glacial till. The till is gray clay or silty clay that is commonly called gumbotil. A deposit of loess originally covered the gumbotil, but geologic erosion has removed the loess in many places and has exposed the gumbotil. Slope ranges from 5 to 14 percent.

Typical pedon of Ashgrove silt loam in an area of Ashgrove silt loam, 9 to 14 percent slopes, moderately eroded, 480 feet east and 170 feet south of NW corner of NW1/4 sec. 5, T. 66 N., R. 5 W.:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry, kneaded color same as matrix; moderate fine subangular structure parting to moderate fine granular; friable; strongly acid; abrupt smooth boundary.

A2—5 to 9 inches; yellowish brown (10YR 5/4) light silty clay loam, kneaded color same as matrix; moderate fine subangular blocky structure; friable; strongly acid; clear smooth boundary.

B1—9 to 14 inches; brown (10YR 4/3) silty clay loam; fine and very fine subangular blocky structure; firm; nearly continuous silt coatings on faces of peds; few hard concretions; very strongly acid; abrupt smooth boundary.

IIB21tg—14 to 20 inches; dark grayish brown (10YR 4/2) clay; common fine distinct yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; firm; thick discontinuous clay films; strongly acid; gradual smooth boundary.

IIB22tg—20 to 31 inches; mottled dark grayish brown (10YR 4/2) and dark brown (7.5YR 4/4) clay; few fine distinct yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; firm; thick discontinuous clay films; medium acid; gradual smooth boundary.

IIB23tg—31 to 40 inches; dark gray (10YR 4/1) silty clay; few medium distinct dark brown (10YR 4/3) mottles; weak medium subangular blocky structure; firm; thick discontinuous clay films; medium acid; gradual smooth boundary.

IIB24tg—40 to 43 inches; dark gray (10YR 4/1) and yellowish red (5YR 4/6) silty clay; weak medium subangular blocky structure; firm; medium acid; gradual smooth boundary.

IIB3tg—43 to 60 inches; dark gray (10YR 4/1) and light olive gray (5Y 6/2) heavy silty clay loam; massive; firm; slightly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to grayish brown (10YR 4/2). It is mainly silt loam but ranges to silty clay loam. The A2 horizon is grayish brown (10YR 5/2) or yellowish brown (10YR 5/4). Combined thickness of the A1 and A2 horizons ranges to as much as 11 inches. The B1 horizon is brown (10YR 4/3) to grayish brown (10YR 5/2). The IIB2tg horizon is dominantly dark grayish brown (10YR 4/2) but is dark gray (10YR 4/1) and dark brown (7.5YR 4/4) in some areas and has mottles that are high in chroma. Maximum clay content in the B2t horizon ranges from 45 to 60 percent. Depth to the yellowish brown clay loam underlying material ranges from 3 1/2 to 7 feet.

Atterberry series

The Atterberry series consists of somewhat poorly drained soils on narrow upland divides near the major river valleys. These soils formed in leached loess about 12 to 15 feet thick. The native vegetation was grass and trees. Slope ranges from 0 to 2 percent.

Typical pedon of Atterberry silt loam, 0 to 2 percent slopes, 105 feet north and 440 feet east of the SW corner of sec. 24, T. 66 N., R. 5 W.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2—9 to 17 inches; dark grayish brown (10YR 4/2) silt loam; few fine faint mottles of grayish brown (10YR 5/2) in lower part; weak fine platy structure parting to weak fine subangular blocky; friable; medium acid; clear smooth boundary.

B21t—17 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint and distinct mottles of grayish brown (10YR 5/2) and yellowish brown (10YR 5/6); common discontinuous coatings of very dark grayish brown (10YR 3/2) on peds; moderate fine and medium prismatic structure parting to moderate fine subangular blocky; friable; few discontinuous thin clay films; few discontinuous silt coatings on peds; few fine segregations and concretions of yellowish brown (10YR 5/6) and black (10YR 2/1) iron and manganese oxides; medium acid; clear smooth boundary.

B22t—22 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine and medium faint and distinct mottles of yellowish brown (10YR 5/8) and grayish brown (10YR 5/2); moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; firm; thin continuous clay films; few fine segregations and concretions of yellowish brown (10YR 5/6), reddish brown (5YR 4/4), and black (10YR 2/1) iron and manganese oxides; medium acid; clear smooth boundary.

B23t—34 to 43 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/8); weak to moderate medium subangular blocky structure; firm; many thin continuous clay films; common fine and medium segregations and concretions of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; slightly acid; clear smooth boundary.

B31t—43 to 50 inches; mixed grayish brown (2.5Y 5/2) and dark grayish brown (10YR 4/2) light silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); weak medium subangular blocky structure; firm; common fine and medium segregations and concretions of yellowish brown (10YR 5/6), strong brown

(7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; slightly acid; clear smooth boundary.

B32t—50 to 60 inches; grayish brown (2.5Y 5/2) heavy silt loam; common fine distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/8); weak medium subangular blocky structure; friable; common fine and medium segregations and concretions of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; neutral; gradual smooth boundary.

C—60 to 66 inches; light brownish gray (2.5Y 6/2) heavy silt loam; common fine and medium mottles and streaks of yellowish brown (10YR 5/8); massive; friable; common fine and medium segregations and concretions of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; neutral.

The Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from 6 to 12 inches in thickness. The B2t horizon ranges from 30 to 35 percent clay. It ranges from strongly acid to slightly acid.

Beckwith series

The Beckwith series consists of poorly drained soils on narrow, flat ridgetops near streams. These soils formed in leached loess 6 to 8 feet thick. The native vegetation was trees. Slope ranges from 0 to 2 percent.

Typical pedon of Beckwith silt loam, 0 to 2 percent slopes, 320 feet south and 75 feet west of the NE corner of sec. 32, T. 68 N., R. 7 W.:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; strongly acid; clear smooth boundary.

A21—6 to 12 inches; light brownish gray (10YR 6/2) silt loam, white (10YR 8/2) dry; few fine faint light olive brown (2.5Y 5/4) mottles; moderate fine platy structure; friable; few soft dark oxides; very strongly acid; clear smooth boundary.

A22—12 to 17 inches; light brownish gray (10YR 6/2) heavy silt loam, white (10YR 8/2) dry; few fine faint light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; friable; common nearly continuous white (10YR 8/1) silt coatings on faces of peds; common dark soft oxides and hard concretions; very strongly acid; abrupt smooth boundary.

B21—17 to 23 inches; mottled dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silty clay; common fine faint yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; few discontinuous silt coatings on faces of peds in upper part; few fine soft oxides and hard concretions; very strongly acid; gradual smooth boundary.

B22t—23 to 29 inches; grayish brown (2.5Y 5/2) silty clay; common fine faint yellowish brown (10YR 5/4 and 5/6) and few fine faint gray (10YR 5/1) mottles; moderate medium subangular blocky structure; firm; few discontinuous clay films; discontinuous silt coatings on faces of peds in upper part; few fine soft dark oxides and hard concretions; strongly acid; gradual smooth boundary.

B23t—29 to 36 inches; grayish brown (10YR 5/2) light silty clay; common fine faint yellowish brown (10YR 5/4, 5/6, and 5/8) and common fine faint gray (10YR 5/1) mottles; weak medium subangular blocky structure; firm; few discontinuous clay films; discontinuous silt coatings on faces of peds in upper part; few fine soft oxides and concretions; strongly acid; gradual smooth boundary.

B31—36 to 42 inches; mottled grayish brown (2.5Y 5/2) and light olive gray (5Y 6/2) silty clay loam; few fine faint yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; many soft dark oxides and hard concretions; few reddish oxides; medium acid; gradual smooth boundary.

B32—42 to 60 inches; light olive gray (5Y 6/2) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; common soft oxides and concretions; medium acid.

The A1 horizon ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2). It is 6 to 9 inches thick and is strongly acid or slightly acid. The A2 horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2). It is 6 to 11 inches thick and is strongly acid or very strongly acid. The B2t horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2). Depth to clayey glacial till is about 6 to 8 feet.

Belinda series

Belinda series consists of poorly drained, nearly level soils on upland divides and level soils on loess-covered benches. These soils formed in loess. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 0 to 2 percent.

Typical pedon of Belinda silt loam, 0 to 2 percent slopes, 200 feet south and 400 feet west of NE corner of NE1/4SE1/4 sec. 29, T. 68 N., R. 7 W.:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry, kneaded color same as matrix; weak fine granular structure; friable; common roots and pores; neutral; abrupt smooth boundary.

A21—7 to 12 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry, kneaded color same as matrix; moderate fine to medium platy structure; friable; slightly darker on underside of peds; few iron-manganese concretions; strongly acid; clear smooth boundary.

A22—12 to 18 inches; mottled grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) silt loam, light gray (10YR 7/2) dry; few dark grayish brown (2.5Y 4/2) mottles; moderate fine platy structure parting to strong fine subangular blocky; friable; almost continuous light gray (10YR 7/1) silt coatings on faces of peds; common iron-manganese concretions; very strongly acid; abrupt smooth boundary.

B21tg—18 to 24 inches; mottled dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silty clay; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate fine to medium subangular blocky structure; very firm; common discontinuous clay films; common soft reddish oxides; common iron-manganese concretions; very strongly acid; gradual smooth boundary.

B22tg—24 to 31 inches; grayish brown (2.5Y 5/2) silty clay; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; very firm; common discontinuous clay films; few soft reddish oxides; common hard concretions; strongly acid; gradual smooth boundary.

B23tg—31 to 37 inches; grayish brown (2.5Y 5/2) light silty clay; common fine distinct yellowish brown (10YR 5/6 and 5/8) and few strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common discontinuous clay films; common large soft dark oxides; slightly acid; gradual smooth boundary.

B31tg—37 to 45 inches; light olive gray (5Y 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6 and 5/8) and few strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few thin discontinuous clay films; common dark large soft oxides; slightly acid; gradual smooth boundary.

B32g—45 to 60 inches; light olive gray (5Y 6/2) clay loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; massive; firm; few large soft dark oxides; slightly acid.

The Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). It ranges from 8 to 12 inches in thickness. This soil is underlain by a clayey glacial till at a depth of about 7 to 8 feet.

Bertrand series

The Bertrand series consists of well drained soils on benches along the major rivers. These soils formed in silty alluvium. The native vegetation was forest. Slope ranges from 0 to 9 percent.

Typical pedon of Bertrand silt loam, 0 to 2 percent slopes, 290 feet east and 35 feet north of SW corner of sec. 9, T. 67 N., R. 5 W.:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; moderate thin platy structure; friable; some very fine sand; neutral; clear smooth boundary.

A2—8 to 15 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; moderate thin platy structure; friable; slightly acid; clear smooth boundary.

B1—15 to 20 inches; brown (10YR 4/3) light silty clay loam, brown (10YR 5/3) dry; weak fine and very fine subangular blocky structure; friable; nearly continuous silt coatings on faces of peds; slightly acid; gradual smooth boundary.

B21t—20 to 26 inches; brown (10YR 4/3) light silty clay loam; moderate fine subangular and angular blocky structure; friable; thin discontinuous silt coatings and thin discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—26 to 36 inches; brown (10YR 4/3) silty clay loam, dark yellowish brown (10YR 4/4) kneaded; moderate fine and medium subangular blocky structure; friable; few thin discontinuous silt coatings on faces of peds; nearly continuous clay films; few dark oxides; slightly acid; gradual smooth boundary.

B23t—36 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; few thin discontinuous silt coatings on faces of peds; thin discontinuous clay films; medium acid; gradual smooth boundary.

IIC1—40 to 52 inches; yellowish brown (10YR 5/4 and 5/6) loam; few fine faint pale brown (10YR 6/3) mottles; massive; friable; increase in very fine sand; slightly acid; gradual smooth boundary.

IIC2—52 to 60 inches; yellowish brown (10YR 5/4) and pinkish gray (7.5YR 6/2) light clay loam, yellowish brown (10YR 5/6) kneaded; massive; sand is coarser; thin pinkish clay bands; some dark oxides; slightly acid.

The solum ranges from 40 to 60 inches or more in thickness, and depth to stratified textures range from about 40 to 50 inches. The Ap horizon is very dark grayish brown (10YR 3/2) to brown (10YR 4/3). The A2 horizon ranges from dark grayish brown to brown (10YR 4/2 to 5/3). It is 3 to 8 inches thick or may be wholly incorporated in the plow layer. The B2t horizon ranges from heavy silt loam to light silty clay loam, and the clay

content ranges from about 22 to 30 percent. The C horizon is quite variable in color and texture because of stratification. It ranges from brown (10YR 4/3) to pinkish gray (7.5YR 6/2) and from sandy loam to clay. The narrow bands of clay are generally pinkish.

Cantril series

The Cantril series consists of somewhat poorly drained soils on stream terraces, foot slopes, and alluvial fans of nearly all stream and river valleys. These soils formed in local alluvium. The native vegetation was trees and grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Cantril loam, 0 to 2 percent slopes, 150 feet east and 250 feet north of SW corner of NE1/4SW1/4 sec. 21, T. 66 N., R. 6 W.:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; friable; neutral; clear smooth boundary.

A21—9 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) on a few faces of peds; common fine faint dark brown (7.5YR 3/2) mottles; weak medium platy structure; friable; slightly acid; clear smooth boundary.

A22—14 to 23 inches; mottled dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) kneaded; common fine distinct brown (7.5YR 4/4) and few fine faint dark reddish brown (5YR 3/2) mottles; weak fine subangular blocky structure; friable; silt coatings on faces of peds; strongly acid; clear smooth boundary.

B21t—23 to 29 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) loam; weak to moderate fine subangular blocky structure; friable; thick silt coatings on faces of peds; common dark reddish brown (5YR 3/2) oxides; medium acid; clear smooth boundary.

B22t—29 to 44 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) heavy loam, light gray (5Y 6/1) on faces of peds; moderate medium prismatic structure; friable; thick discontinuous clay films on faces of peds; many dark brown (7.5YR 3/2) oxides; medium acid; gradual smooth boundary.

IIB3t—44 to 60 inches; mottled yellowish brown (10YR 5/4) and gray (10YR 5/1) silty clay loam; moderate medium prismatic structure; firm; thick discontinuous clay films on faces of peds; many dark brown (7.5YR 3/2) oxides; medium acid.

The Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It is dominantly loam but ranges to silt loam. The A2 horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2).

Chelsea series

The Chelsea series consists of excessively drained soils on benches along the major rivers. These soils formed in dominantly wind-deposited sand. The native vegetation was forest. Slope ranges from 0 to 18 percent.

Typical pedon of Chelsea loamy fine sand, 0 to 2 percent slopes, 180 feet east and 350 feet south of NW corner of NE1/4SE1/4 sec. 32, T. 67 N., R. 5 W.:

A1—0 to 4 inches; black (10YR 2/1) loamy fine sand, very dark gray (10YR 3/1) dry; weak fine granular structure; loose; numerous roots; neutral; abrupt smooth boundary.

A21—4 to 10 inches; brown (10YR 4/3) fine sand, dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky structure parting to single grained; loose; neutral; gradual smooth boundary.

A22—10 to 46 inches; brown (7.5YR 4/4) fine sand; single grained; loose; slightly acid; gradual smooth boundary.

A&B—46 to 60 inches; brown (7.5YR 4/4) fine sand (A), 1/4- to 1/2-inch bands of dark reddish brown (5YR 3/4) sand that are slightly higher in clay content and are 4 to 6 inches apart (B); single grained; loose; slightly acid.

The solum ranges from 4 to many feet in thickness. In undisturbed areas the A1 horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2).

Chequest series

The Chequest series consists of poorly drained soils on first bottoms in and along old abandoned stream channels and bayous. These soils formed in moderately fine textured alluvium. The native vegetation was grasses and scattered trees. Slope ranges from 0 to 2 percent.

Typical pedon of Chequest silty clay loam, 0 to 2 percent slopes, 80 feet south and 310 feet west of the NE corner of the SE1/4NW1/4 sec. 14, T. 68 N., R. 3 W.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) light silty clay loam; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

B1—9 to 17 inches; mottled very dark gray (10YR 3/1) and dark gray (10YR 4/1) light silty clay loam, very dark gray (10YR 3/1) kneaded; moderate fine granular and subangular blocky structure; friable; common reddish soft oxides and hard concretions; few silt coatings on faces of peds; strongly acid; clear smooth boundary.

B21tg—17 to 22 inches; dark gray (10YR 4/1) silty clay loam; common fine faint dark grayish brown (10YR 4/2) and dark yellowish brown (10YR 4/4) mottles;

moderate fine subangular blocky structure; firm; many soft reddish oxides and hard concretions; few silt coatings on faces of peds; few discontinuous clay films; strongly acid; gradual smooth boundary.

B22tg—22 to 28 inches; dark gray (10YR 4/1) heavy silty clay loam; common fine and medium distinct brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; firm; many reddish soft oxides and hard concretions; few light gray (10YR 7/1) silt coatings on faces of peds; few dark discontinuous clay films; strongly acid; gradual smooth boundary.

B23tg—28 to 42 inches; dark gray (10YR 4/1) heavy silty clay loam; common fine and medium distinct brown (7.5YR 4/4) and yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; firm; many reddish soft oxides and hard concretions; few light gray (10YR 7/1) silt coatings on faces of peds; few dark discontinuous clay films; strongly acid; gradual smooth boundary.

B31tg—42 to 50 inches; dark gray (10YR 4/1) silty clay loam; common fine and medium distinct brown (7.5YR 4/4) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; many reddish soft oxides and hard concretions; few light gray (10YR 7/1) silt coatings on faces of peds; few dark discontinuous clay films; medium acid; gradual smooth boundary.

B32tg—50 to 60 inches; dark gray (10YR 4/1) silty clay loam; many fine and medium distinct brown (7.5YR 4/4) mottles; weak medium subangular blocky structure; firm; many reddish soft oxides and hard concretions; few light gray (10YR 7/1) silt coatings on faces of peds; few dark discontinuous clay films; slightly acid.

Typically, the B2tg horizon is heavy silty clay loam, but subhorizons range from 30 to 45 percent clay.

Clarinda series

The Clarinda series consists of poorly drained soils. These soils formed in previously weathered glacial till. The till is gray clay or silty clay that is commonly called gumbotil. A deposit of loess originally covered the gumbotil, but geologic erosion has removed the loess in many places and has exposed the gumbotil. The native vegetation was prairie grasses. Slope ranges from 5 to 9 percent.

Typical pedon of Clarinda silty clay loam, 5 to 9 percent slopes, 290 feet west and 160 feet south of NE corner of NW1/4NW1/4 sec. 16, T. 68 N., R. 7 W.:

A1—0 to 9 inches; black (10YR 2/1) light silty clay loam, gray (10YR 5/1) dry, same color as matrix kneaded; moderate fine granular structure; friable; neutral; clear smooth boundary.

A3—9 to 13 inches; mottled very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) light silty clay loam, gray (10YR 5/1) dry, very dark grayish brown (10YR 3/2) kneaded; moderate very fine subangular blocky and moderate fine granular structure; friable; slightly acid; clear smooth boundary.

B1t—13 to 16 inches; dark grayish brown (10YR 4/2) heavy silty clay loam; common fine faint very dark gray (10YR 3/1) and common fine prominent red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; thin discontinuous clay films; slightly acid; clear smooth boundary.

IIB21tg—16 to 24 inches; dark grayish brown (10YR 4/2) clay; few fine prominent red (2.5YR 4/6) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; thick nearly continuous clay films; slightly acid; gradual smooth boundary.

IIB22tg—24 to 33 inches; mottled strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) clay; weak subangular blocky structure; firm; thick discontinuous clay films; medium acid; gradual smooth boundary.

IIB23tg—33 to 39 inches; grayish brown (2.5Y 5/2) clay; few common distinct strong brown (7.5YR 5/6) mottles; moderate to weak medium subangular blocky structure; very firm; thick clay films almost continuous on faces of peds and in root channels; neutral; gradual smooth boundary.

IIB24tg—39 to 50 inches; grayish brown (2.5YR 5/2) heavy silty clay; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very firm; nearly continuous thick clay films; neutral; gradual smooth boundary.

IIB25tg—50 to 68 inches; gray (5Y 5/1) heavy silty clay; weak medium subangular blocky structure; very firm; nearly continuous thick clay films; neutral.

The A horizon ranges from very dark gray (10YR 3/1) to black (10YR 2/1). It ranges from silty clay loam to silt loam. The horizon is 10 to 18 inches thick and ranges from medium acid to neutral. It formed in loess or silty sediment high in content of sand. In many places, the loess in the upper part of the Clarinda soils ranges from 6 to 16 inches in thickness. The B2tg horizon ranges from dark gray (10YR 4/1) to light olive gray (5Y 5/2). It ranges from silty clay to clay. The horizon is 48 to 60 inches thick. Mottles in the B2tg horizon are generally yellowish brown (10YR 5/6) to strong brown (7.5YR 5/6).

Clinton series

The Clinton series consists of moderately well drained soils on upland ridgetops, convex upper side slopes, and high benches along the major streams and rivers. These soils formed in leached loess 6 to 10 feet thick. The

native vegetation was trees. Slope ranges from 2 to 14 percent.

Typical pedon of Clinton silt loam, 2 to 5 percent slopes, 50 feet south and 400 feet west of the NE corner of the NW1/4 sec. 20, T. 67 N., R. 5 W.:

A1—0 to 3 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate very fine granular structure; very friable; neutral; clear smooth boundary.

A21—3 to 7 inches; mottled dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/4) silt loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure parting to weak fine platy; very friable; neutral; clear smooth boundary.

A22—7 to 12 inches; yellowish brown (10YR 5/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate fine and medium subangular blocky structure; very friable; few dark coatings on abandoned root channels; slightly acid; clear smooth boundary.

B1—12 to 19 inches; yellowish brown (10YR 5/4) light silty clay loam; strong fine angular and subangular blocky structure; friable; few fine dark soft oxides; common light-colored silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B21—19 to 25 inches; yellowish brown (10YR 5/4) heavy silty clay loam; strong fine and medium angular and subangular blocky structure; firm; few fine dark soft oxides; common light-colored silt coatings on faces of peds; thin discontinuous clay films; strongly acid; gradual smooth boundary.

B22t—25 to 33 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint strong brown (7.5YR 5/6) and brown (10YR 5/3) mottles; moderate medium subangular blocky structure; firm; few fine dark soft oxides; few light-colored silt coatings on faces of peds; thin discontinuous clay films; strongly acid; gradual smooth boundary.

B3t—33 to 48 inches; mottled yellowish brown (10YR 5/4) and brown (10YR 5/3) light silty clay loam; few fine faint strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine dark soft oxides; few light-colored silt coatings on faces of peds; thin discontinuous clay films; medium acid; gradual smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) light silty clay loam; few fine faint strong brown (7.5YR 5/6) mottles; massive; friable; few dark soft oxides; few light-colored silt coatings; medium acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). It ranges from 2 to 5 inches in thickness. The A2 horizon ranges from 5 to 10 inches in thickness. The B2t horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4). The maximum clay content ranges from 36 to 42 percent in the B2t horizon. The depth to clayey glacial till ranges from 6 to 10 feet.

Colo series

The Colo series consists of poorly drained soils on first bottoms of the major streams and rivers. These soils formed in moderately fine textured, silty alluvium under a native vegetation of prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Colo silty clay loam, 0 to 2 percent slopes, 310 feet north and 120 feet west of SE corner of SW1/4 sec. 1, T. 69 N., R. 7 W.:

A11—0 to 11 inches; very dark gray (10YR 3/1) light silty clay loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; slightly acid; gradual smooth boundary.

A12—11 to 20 inches; black (N 2/0) silty clay loam; moderate fine and very fine subangular blocky structure; firm; few medium and coarse hard concretions; neutral; gradual smooth boundary.

A13—20 to 27 inches; black (10YR 2/1) silty clay loam; moderate fine subangular blocky structure; firm; few medium and coarse hard concretions; neutral; gradual smooth boundary.

AB—27 to 37 inches; black (10YR 2/1) silty clay loam; weak fine prismatic structure parting to moderate fine subangular blocky; firm; neutral; gradual smooth boundary.

B2—37 to 54 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium prismatic structure parting to moderate medium subangular; firm; neutral; gradual smooth boundary.

B3—54 to 60 inches; very dark gray (10YR 3/1) silty clay loam; few fine distinct gray (5Y 5/1) mottles; weak medium prismatic structure; firm; neutral; gradual smooth boundary.

C—60 to 67 inches; gray (5Y 5/1) silty clay loam; few fine faint strong brown (7.5YR 5/6) mottles; firm; few medium deposits of dark organic material; neutral.

In most places, the A horizon is 26 inches or more thick. The B2 horizon ranges from very dark gray (10YR 3/1) to black (10YR 2/1). The clay content of Colo soils ranges from 28 to 38 percent. It averages less than 35 percent in the upper 40 inches. The B horizon ranges from neutral to medium acid.

Coppock series

The Coppock series consists of somewhat poorly drained and poorly drained soils on first bottoms of the major streams and rivers. These soils formed in alluvium. The native vegetation was trees and grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Coppock silt loam, 0 to 2 percent slopes, 50 feet north and 75 feet west of the SE corner of sec. 7, T. 68 N., R. 3 W.:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.

A21—9 to 14 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak fine granular; friable; neutral; clear smooth boundary.

A22—14 to 20 inches; mottled dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) silt loam; common fine faint very dark grayish brown (10YR 3/2) mottles; weak medium platy structure parting to weak fine subangular blocky; friable; few soft oxides; neutral; clear smooth boundary.

A23—20 to 26 inches; grayish brown (10YR 5/2) silt loam; common fine distinct dark brown (7.5YR 4/2) and brown (7.5YR 4/4) mottles; weak medium platy structure parting to weak fine subangular blocky; friable; few soft oxides; medium acid; clear smooth boundary.

A&B—26 to 33 inches; light brownish gray (10YR 6/2) light silty clay loam; common fine distinct dark brown (7.5YR 4/2) and brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; friable; common soft oxides; medium acid; gradual smooth boundary.

B2tg—33 to 42 inches; light gray (10YR 6/1) silty clay loam; common fine distinct brown (7.5YR 4/4) and few fine distinct yellowish red (5YR 4/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few thin discontinuous clay films; numerous hard concretions and soft oxides; few sand grains; medium acid; gradual smooth boundary.

B3g—42 to 50 inches; mottled light brownish gray (10YR 6/2), reddish brown (5YR 4/4), and yellowish red (5YR 4/6) silty clay loam; weak medium prismatic structure; friable; common sand grains; medium acid; gradual smooth boundary.

C—50 to 60 inches; light brownish gray (10YR 6/2) silty clay loam; common fine distinct reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles; massive; friable; common sand grains; medium acid.

The Ap horizon is 7 to 10 inches thick and ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). The A2 horizon ranges from 14 to 24 inches in thickness. The B2t horizon ranges from 27 to 35 percent clay.

Denrock Variant

The Denrock Variant consists of poorly drained, nearly level soils on benches along the Mississippi River. These soils formed in fine-textured alluvium. The native vegetation was grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Denrock Variant silt loam, 0 to 2 percent slopes, 50 feet south and 550 feet east of the NW corner of SW1/4SE1/4 sec. 27, T. 67 N., R. 5 W.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A3—9 to 15 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; few fine faint dark grayish brown (10YR 4/2) mottles; moderate fine granular and moderate fine subangular blocky structure; friable; few silt coatings on faces of peds when dry; neutral; clear smooth boundary.

B1—15 to 21 inches; brown (7.5YR 4/2) silty clay loam; few fine distinct reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; few light brownish gray (10YR 6/2) silt coatings on faces of peds; neutral; clear smooth boundary.

IIB21t—21 to 28 inches; strong brown (7.5YR 5/6) light silty clay; common fine and medium distinct reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; firm; brown (7.5YR 4/4) silt coatings on faces of peds; brown (7.5YR 4/2) clay films on faces of peds; few soft oxides in abandoned root channels; neutral; clear smooth boundary.

IIB22t—28 to 39 inches; strong brown (7.5YR 5/6) light silty clay; common fine and medium distinct reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm; brown (7.5YR 4/4) silt coatings on faces of peds; brown (7.5YR 4/2) clay films on peds; few soft oxides; neutral; clear smooth boundary.

IIB23t—39 to 50 inches; reddish brown (5YR 4/4) heavy silty clay; weak medium prismatic structure; firm; few discontinuous clay films; common dark soft oxides; neutral; gradual smooth boundary.

IIB24t—50 to 65 inches; reddish brown (2.5YR 4/4) clay; weak medium prismatic structure; firm; few discontinuous clay films; neutral.

The solum ranges from 50 to more than 65 inches in thickness. The A horizon ranges from 10 to 16 inches in thickness. It ranges from silt loam to light silty clay loam. The B2 horizon ranges from 30 to 60 inches in thickness.

Dickinson series

The Dickinson series consists of well drained and somewhat excessively drained soils on benches along the major rivers. These soils formed in 24 to 36 inches of sandy loam over loamy sand and sand. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Dickinson fine sandy loam, 0 to 2 percent slopes, 150 feet south and 800 feet west of the NE corner of NW1/4 sec. 4, T. 65 N., R. 6 W.:

Ap—0 to 10 inches; very dark brown (10YR 2/2) fine sandy loam; weak to moderate fine granular structure; friable; slightly acid; clear smooth boundary.

A3—10 to 18 inches; very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2) sandy loam; medium granular structure parting to weak fine subangular blocky; friable; neutral; gradual smooth boundary.

B1—18 to 24 inches; mottled very dark grayish brown (10YR 3/2) and brown (10YR 4/3) sandy loam; weak fine and medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

B21—24 to 31 inches; brown (10YR 4/3) sandy loam; weak fine and very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

B22—31 to 36 inches; dark yellowish brown (10YR 4/4) loamy sand; few coarse faint yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; very friable; medium acid; gradual smooth boundary.

B31—36 to 44 inches; yellowish brown (10YR 5/4) loamy sand; few coarse faint dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

C1—44 to 50 inches; yellowish brown (10YR 5/4) loamy sand; few coarse faint dark yellowish brown (10YR 4/4) mottles; single grain; very friable; slightly acid; gradual smooth boundary.

C2—50 to 60 inches; yellowish brown (10YR 5/4) sand; common coarse faint dark yellowish brown (10YR 4/4) mottles; single grain; very friable; slightly acid.

The solum ranges from 24 to 48 inches in thickness. Depth to loamy sand and sand is commonly 24 to 36 inches, and sand particles are dominantly fine and medium in size. The A horizon ranges from black (10YR 2/1) or very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). It is commonly 10 to 20 inches thick. The upper part of the B horizon ranges from dark brown (10YR 3/3) to brown (10YR 4/3), and the lower part ranges from dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/4). The C horizon ranges from loamy sand to fine sand.

Dockery series

The Dockery series consists of poorly drained, nearly level soils on first bottoms of the major rivers. These soils formed in silty alluvium. The native vegetation was grasses, sedges, and water-tolerant plants. Slope ranges from 0 to 2 percent. These soils are outside the defined range of the Dockery series because they are poorly drained. This difference, however, does not alter their usefulness and behavior.

Typical pedon of Dockery silt loam, 0 to 2 percent slopes, 500 feet west and 60 feet north of the SE corner of sec. 27, T. 68 N., R. 3 W.:

Ap—0 to 9 inches; mottled very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; neutral; abrupt smooth boundary.

C1—9 to 18 inches; dark gray (10YR 4/1) light silty clay loam; few fine faint gray (10YR 5/1) mottles and common fine and medium prominent reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles; moderate fine and very fine subangular blocky structure; friable; neutral; clear smooth boundary.

C2—18 to 22 inches; dark gray (10YR 4/1) light silty clay loam; fine prominent strong brown (7.5YR 5/6) mottles, common fine and medium prominent reddish brown (5YR 4/4) mottles, and many fine prominent red (2.5YR 5/6) mottles; thin strata of grayish brown (10YR 5/2); moderate fine subangular blocky structure; friable; common black ped coatings and fillings in old root channels; neutral; clear smooth boundary.

C3—22 to 29 inches; dark gray (10YR 4/1) heavy silt loam and light silty clay loam; common fine prominent yellowish red (5YR 4/6) mottles and few fine prominent red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; friable; few very dark gray (10YR 3/1) ped coatings; neutral; gradual smooth boundary.

C4—29 to 42 inches; dark gray (5Y 4/1) heavy silt loam; many medium prominent reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles and many fine faint dark reddish brown (5YR 3/2) mottles; weak medium subangular blocky structure; friable; few fine dark oxides; neutral; gradual smooth boundary.

C5—42 to 50 inches; mottled dark gray (5Y 4/1) and grayish brown (10YR 5/2) silt loam; few fine faint dark reddish brown (5YR 3/2) mottles and common fine distinct reddish brown (5YR 4/4) and yellowish red (5YR 4/6) mottles; massive; friable; neutral; gradual smooth boundary.

C6—50 to 60 inches; mottled dark gray (5Y 4/1) and grayish brown (10YR 5/2) light silty clay loam; few fine faint dark brown (7.5YR 3/2) mottles; massive; friable; slightly acid.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The C horizon ranges from dark gray (10YR 4/1) to gray (5Y 5/1). It is highly mottled with reddish colors because of decaying organic matter.

Douds series

The Douds series consists of moderately well drained soils on high stream benches along most of the major streams and rivers. These soils formed in water-sorted glacial sediment deposited as alluvium during an earlier geologic period. The native vegetation was trees. Slope ranges from 9 to 40 percent.

Typical pedon of Douds loam, 14 to 18 percent slopes, moderately eroded, 540 feet north and 950 feet west of the SE corner of SW1/4 sec. 18, T. 67 N., R. 7 W.:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) light loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

A2—5 to 14 inches; dark grayish brown (10YR 4/2) loam; few fine faint yellowish brown (10YR 5/4) mottles; weak fine granular structure; friable; slightly acid; clear smooth boundary.

B21t—14 to 24 inches; brown (7.5YR 4/4) light sandy clay loam; few fine faint dark grayish brown (10YR 4/2) mottles; moderate medium subangular blocky structure; friable; few thin discontinuous clay films; few discontinuous fine sand coatings on faces of peds; few medium manganese-iron soft oxides; medium acid; gradual smooth boundary.

B22t—24 to 38 inches; brown (7.5YR 4/4) light clay loam; common fine faint strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few thin discontinuous clay films; common discontinuous dark grayish brown (10YR 4/2) fine sand coatings on faces of peds; common medium magnanese-iron soft oxides; strongly acid; gradual smooth boundary.

B31t—38 to 48 inches; strong brown (7.5YR 5/6) light sandy clay loam; few fine faint brown (7.5YR 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few thin discontinuous clay films; few discontinuous dark grayish brown (10YR 4/2) fine sand coatings on faces of peds; few medium manganese-iron soft oxides; strongly acid; gradual smooth boundary.

B32t—48 to 60 inches; brown (7.5YR 4/4) sandy loam; common fine faint strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few thin discontinuous clay films; few discontinuous dark grayish brown (10YR 4/2) fine sand coatings on faces of peds; few fine and medium manganese-iron soft oxides; strongly acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 3 to 5 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2) and from loam to sandy loam. The B2t horizon ranges from brown (10YR 4/3) to strong brown (7.5YR 5/6). It ranges from clay loam to sandy clay loam, and strata of sandy loam and loamy sand or coarser material are in some places. The underlying material ranges from fine sandy loam to sandy clay loam and has strata of coarser material in places.

Downs series

The Downs series consists of well drained soils on upland ridgetops and convex upper side slopes near the major river valleys. These soils formed in leached loess 9 to 15 feet thick. The native vegetation was grass and trees. Slope ranges from 1 to 4 percent.

Typical pedon of Downs silt loam, 2 to 5 percent slopes, 150 feet south and 600 feet east of the NW corner of NW1/4SE1/4 sec. 15, T. 66 N., R. 5 W.:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A2—9 to 13 inches; mixed dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam; weak thin platy structure parting to weak fine subangular blocky; friable; common discontinuous coatings of very dark grayish brown (10YR 3/2) on faces of peds, dark grayish brown (10YR 4/2) kneaded; thin discontinuous silt coatings of grayish brown (10YR 5/2) on faces of peds; medium acid; clear smooth boundary.

B1t—13 to 19 inches; brown (10YR 4/3) light silty clay loam; weak very fine and fine subangular blocky structure; common discontinuous coatings of very dark grayish brown (10YR 3/2) on faces of peds; thin discontinuous grayish brown (10YR 5/2) silt coatings; medium acid; clear smooth boundary.

B21t—19 to 24 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few thin discontinuous clay films of dark grayish brown (10YR 4/2); few thin discontinuous silt coatings of grayish brown (10YR 5/2) on faces of peds; medium acid; clear smooth boundary.

B22t—24 to 30 inches; brown (10YR 4/3) silty clay loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few thin discontinuous clay films of dark grayish brown (10YR 4/2); few thin discontinuous silt coatings of grayish brown (10YR 5/2) on faces of peds; few fine segregations and concretions of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; medium acid; clear smooth boundary.

B23t—30 to 40 inches; brown (10YR 5/3) light silty clay loam; common fine faint mottles of yellowish brown (10YR 5/4 and 10YR 5/6) and dark yellowish brown (10YR 4/4); weak fine prismatic structure parting to weak medium subangular blocky; friable; few thin discontinuous clay films of dark grayish brown (10YR 4/2); few thin discontinuous silt coatings of grayish brown (10YR 5/2) on faces of peds; few fine segregations and concretions of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; slightly acid; gradual smooth boundary.

B3t—40 to 46 inches; brown (10YR 5/3) heavy silt loam; common fine and medium faint and distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2); very weak medium subangular blocky structure; friable; few thin discontinuous silt coatings of light brownish gray (10YR 6/2) on faces of peds; common fine and medium segregations and concretions of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; slightly acid; gradual smooth boundary.

C—46 to 68 inches; pale brown (10YR 6/3) silt loam; common fine and medium faint and distinct mottles of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2); massive; friable; fine thin patches of light brownish gray (10YR 6/2) silts; common fine and medium segregations and concretions of yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and black (10YR 2/1) iron and manganese oxides; neutral.

The Ap horizon ranges from very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It ranges from 4 to 8 inches in thickness. The B2t horizon ranges from brown (10YR 4/3) to yellowish brown (10YR 5/4) The maximum clay content in the B2t horizon ranges from 27 to 35 percent. The depth to glacial till ranges from 9 to 15 feet.

Edina series

The Edina series consists of poorly drained soils on level and slightly depressional areas of the upland divides and on flat, narrow ridgetops. These soils formed in leached loess about 6 to 8 feet thick. The native vegetation was tall prairie grasses. Slope is 0 to 1 percent.

Typical pedon of Edina silt loam, 0 to 1 percent slopes, 520 feet east and 725 feet north of the SW corner of SE1/4NW1/4 sec. 23, T. 68 N., R. 7 W.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry, same color as matrix kneaded; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—8 to 14 inches; mottled very dark gray (10YR 3/1) and dark gray (10YR 4/1) silt loam, gray (10YR 5/1) and light gray (10YR 7/1) dry, dark gray (10YR 4/1) kneaded; moderate very fine granular structure; friable; nearly continuous silt coatings on faces of peds; slightly acid; abrupt smooth boundary.

B1—14 to 17 inches; very dark gray (10YR 3/1) light silty clay, gray (10YR 5/1) and light gray (10YR 7/1) dry, very dark grayish brown (10YR 3/2) kneaded; few fine faint dark brown (7.5YR 3/2) mottles; moderate fine subangular blocky structure; friable; few concretions and common silt coatings on faces of peds; medium acid; abrupt smooth boundary.

B21t—17 to 23 inches; mottled black (10YR 2/1) and dark grayish brown (2.5Y 4/2) light silty clay; common fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate very fine subangular blocky structure; firm; common hard concretions; nearly continuous clay films; medium acid; clear smooth boundary.

B22t—23 to 31 inches; grayish brown (2.5Y 5/2) silty clay; few fine distinct strong brown (7.5YR 5/8) and many fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate medium subangular blocky structure; firm; common black (10YR 2/1) abandoned root channels; hard concretions; thick discontinuous clay films; slightly acid; gradual smooth boundary.

B31t—31 to 38 inches; olive gray (5Y 5/2) heavy silty clay loam; common fine faint light olive brown (2.5Y 5/4) and few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few black (10YR 2/1) worm channels; common hard concretions; thick discontinuous clay films; slightly acid; gradual smooth boundary.

B32t—38 to 47 inches; mottled olive gray (5Y 5/2) and light olive brown (2.5Y 5/4) light silty clay loam; common fine distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; firm; common hard concretions; common black (N 2/0) clay fills in abandoned root channels; slightly acid; gradual smooth boundary.

C1—47 to 60 inches; mottled light olive brown (2.5Y 5/4) and light olive gray (5Y 6/2) light silty clay loam; common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; weak medium subangular blocky structure; firm; neutral; gradual smooth boundary.

C2—60 to 65 inches; mottled light olive gray (5Y 6/2) and light olive brown (2.5Y 5/4) light silty clay loam; common medium distinct strong brown (7.5YR 5/6 and 5/8) mottles; massive; firm; neutral.

The Ap horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1). It ranges from 8 to 12 inches in thickness. The A2 horizon ranges from very dark gray

(10YR 3/1) to gray (10YR 5/1). It ranges from 6 to 10 inches in thickness. Depth to the B2t horizon ranges from 16 to 24 inches.

Exette series

The Exette series consists of well drained soils on upland convex side slopes near the major river valleys. These soils formed in mildly alkaline, deoxidized loess 7 to 10 feet thick. The native vegetation was trees. Slope ranges from 9 to 15 percent.

Typical pedon of Exette silt loam from an area of Fayette-Exette silt loams, 9 to 15 percent slopes, moderately eroded, 650 feet north and 410 feet east of the corner of NE1/4NW1/4 sec. 14, T. 66 N., R. 5 W.:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak medium platy structure parting to moderate fine subangular blocky; friable; neutral; abrupt smooth boundary.

B21t—6 to 12 inches; yellowish brown (10YR 5/4) light silt loam, light yellowish brown (10YR 6/4) dry; few fine faint light brownish gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; friable; few thin clay films; few brown (10YR 4/3) coatings on faces of peds; slightly acid; clear smooth boundary.

B22t—12 to 20 inches; yellowish brown (10YR 5/4) heavy silt loam; many coarse faint grayish brown (2.5Y 5/2) mottles; weak medium subangular blocky structure; friable; few thin clay films; few yellowish red (5YR 4/6 and 5/6) iron deposits and pipestems; neutral; gradual smooth boundary.

B3—20 to 34 inches; mottled light olive gray (5Y 6/2) and yellowish brown (10YR 5/6) silt loam; few fine faint strong brown (7.5YR 5/8) mottles; weak medium prismatic structure; friable; few very dark grayish brown (10YR 3/2) deposits in former root channels; few pipestems and iron deposits; few dark soft oxides; neutral; clear smooth boundary.

C—34 to 60 inches; mottled light olive gray (5Y 6/2) and grayish brown (2.5Y 5/2) silt loam; common coarse distinct yellowish brown (10YR 5/4 and 5/6) mottles; weak medium prismatic structure; friable; few medium dark oxides; common iron deposits; mild effervescence; mildly alkaline.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2). It ranges from 2 to 8 inches in thickness. The B2t horizon ranges from brown (10YR 5/3) to yellowish brown (10YR 5/4). It ranges from 12 to 24 inches in thickness. The maximum clay content in the B2t horizon ranges from 20 to 26 percent. Depth to maximum clay content ranges from 5 to 15 inches.

Fayette series

The Fayette series consists of well drained soils on upland ridgetops and convex side slopes near the major river valleys. These soils formed in leached loess 9 to 15 feet thick. The native vegetation was trees. Slope ranges from 2 to 15 percent.

Typical pedon of Fayette silt loam, 2 to 5 percent slopes, 550 feet east and 380 feet south of the NW corner of NE1/4NW1/4 sec. 14, T. 66 N., R. 5 W.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) light silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky and granular structure; friable; neutral; abrupt smooth boundary.

A21—7 to 10 inches; mottled dark grayish brown (10YR 4/2) and brown (10YR 4/3) light silt loam, light brownish gray (10YR 6/2) dry; moderate thin platy structure; friable; common silt coatings on faces of peds; slightly acid; clear smooth boundary.

A22—10 to 15 inches; brown (10YR 4/3) light silt loam; weak medium platy structure parting to moderate very fine subangular blocky; friable; common silt coatings on faces of peds; slightly acid; clear smooth boundary.

B1—15 to 26 inches; yellowish brown (10YR 5/4) silt loam; moderate very fine subangular blocky structure; friable; common silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B2t—26 to 30 inches; yellowish brown (10YR 5/4) light silty clay loam; moderate fine angular and subangular blocky structure; friable; nearly continuous light gray (10YR 7/2) silt coatings on faces of peds; few thin clay films; strongly acid; gradual smooth boundary.

B3t—30 to 38 inches; yellowish brown (10YR 5/4) silt loam; few fine faint brown (7.5YR 4/2) mottles; weak medium subangular blocky structure; friable; nearly continuous light gray (10YR 7/2) silt coatings on faces of peds; few thin clay films; few dark soft oxides; strongly acid; gradual smooth boundary.

C1—38 to 60 inches; yellowish brown (10YR 5/4) light silt loam; common fine faint grayish brown (2.5Y 5/2) mottles; massive; friable; few silt coatings on faces of peds; few dark soft oxides; medium acid.

The Ap horizon ranges from very dark gray (10YR 3/1) in uneroded areas to dark grayish brown (10YR 4/2) in plowed areas. It ranges from 3 to 7 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It ranges from 6 to 10 inches in thickness. The B2t horizon ranges from brown (10YR 5/3) to yellowish brown (10YR 5/4). It ranges from 12 to 28 inches in thickness.

Festina series

The Festina series consists of well drained, nearly level soils on benches along the major rivers. These soils formed in silty alluvium. The native vegetation was mixed grass and trees. Slope ranges from 1 to 3 percent.

Typical pedon of Festina silt loam, 1 to 3 percent slopes, 800 feet east and 920 feet north of the SW corner of NW1/4 sec. 10, T. 66 N., R. 5 W.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A2—8 to 14 inches; dark grayish brown (10YR 4/2) and brown (10YR 4/3) silt loam; weak fine platy structure; friable; few silt coatings on faces of peds; neutral; clear smooth boundary.

B1—14 to 20 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; few discontinuous silt coatings on peds; slightly acid; gradual smooth boundary.

B21t—20 to 28 inches; dark yellowish brown (10YR 4/4) light silty clay loam; moderate fine subangular blocky structure; friable; few discontinuous silt coatings on peds; few very thin clay films; few dark oxides; slightly acid; gradual smooth boundary.

B22t—28 to 37 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) light silty clay loam; few fine faint strong brown (7.5YR 5/4) mottles; moderate fine and medium subangular blocky structure; friable to firm; common silt coatings on peds; few thin clay films; few dark oxides; slightly acid; gradual smooth boundary.

B31t—37 to 47 inches; brown (10YR 4/3), yellowish brown (10YR 5/4), and grayish brown (2.5Y 5/2) silt loam; few fine faint strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; friable to firm; common silt coatings on peds; few thin clay films; few dark oxides; slightly acid; gradual smooth boundary.

B32t—47 to 60 inches; mottled brown (10YR 4/3), yellowish brown (10YR 5/4), and light brownish gray (2.5Y 6/2) silt loam; few fine faint strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; friable to firm; common silt coatings on peds; few thin clay films; few dark oxides; neutral.

The solum ranges from 48 inches to more than 60 inches in thickness. The A1 and A2 horizons are typically silt loam, but they range to loam in places. The B2 horizon ranges from silt loam to light silty clay loam high in content of sand, and the clay content ranges from about 20 to 30 percent.

The C horizon, when present, ranges from silt loam to stratified layers of silt loam and sandy loam, and loamy sand is at a depth below 48 inches in some places.

Galland series

The Galland series consists of somewhat poorly drained soils on high stream benches along all the streams and rivers. These soils formed in water-sorted, moderately fine textured to fine-textured glacial sediment. This material was deposited as alluvium during an earlier geologic period. The native vegetation was trees. Slope ranges from 5 to 18 percent.

Typical pedon of Galland loam, 9 to 14 percent slopes, moderately eroded, 40 feet north and 350 feet west of the SE corner of sec. 26, T. 68 N., R. 7 W.:

Ap—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate very fine and fine granular structure; friable; neutral; clear smooth boundary.

A2—5 to 9 inches; brown (7.5YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak thick platy structure parting to moderate fine subangular blocky; friable; nearly continuous silt coatings of light gray (10YR 7/2) dry on peds; medium acid; clear smooth boundary.

B1t—9 to 12 inches; mixed dark reddish brown (5YR 3/4) and reddish brown (5YR 4/4) clay loam; common fine distinct mottles of dark reddish brown (2.5YR 3/4) and dark red (2.5YR 3/6); strong fine subangular blocky structure; friable; few discontinuous dark brown (7.5YR 3/2) clay films; nearly continuous silt coatings of light brownish gray (10YR 6/2) dry on peds; strongly acid; clear smooth boundary.

B21t—12 to 19 inches; brown (7.5YR 5/4) light clay; common fine prominent and faint mottles of red (10R 4/8), dark red (2.5YR 3/6), and grayish brown (10YR 5/2); moderate fine subangular blocky structure; firm; nearly continuous thick dark brown (7.5YR 3/2) clay films; strongly acid; clear smooth boundary.

B22t—19 to 27 inches; brown (7.5YR 5/4) heavy clay loam; common fine distinct and prominent mottles of yellowish red (5YR 4/6 and 5YR 5/8), grayish brown (2.5Y 5/2), and red (10R 4/8); moderate fine and medium subangular blocky structure; firm; common discontinuous clay films and organic deposits of dark gray (10YR 4/1) and dark brown (7.5YR 3/2); few fine dark segregations of iron and manganese oxides; strongly acid; gradual smooth boundary.

B31t—27 to 38 inches; mixed strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) clay loam; few fine faint mottles of reddish brown (5YR 4/4); moderate medium subangular blocky structure; firm; common discontinuous dark gray (10YR 4/1) clay films; few fine dark segregations of iron and manga-

nese oxides; medium acid; gradual smooth boundary.

B32t—38 to 48 inches; mixed strong brown (7.5YR 5/6) and light brownish gray (2.5Y 6/2) light clay loam and heavy sandy loam; few fine faint mottles of yellowish red (5YR 4/6); weak medium subangular blocky structure; firm; common discontinuous dark grayish brown (10YR 4/2) clay films; few fine dark segregations of iron and manganese oxides; common 2- to 5-millimeter pebbles; medium acid; gradual smooth boundary.

C—48 to 60 inches; mixed strong brown (7.5YR 5/6) and brown (7.5YR 4/4) heavy sandy loam; common fine distinct mottles of light brownish gray (2.5Y 6/2); massive; firm; few old fine root channels filled with dark brown (7.5YR 3/2) clay loam; few fine dark segregations of iron and manganese oxides; slightly acid.

The Ap horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). It ranges from 3 to 8 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to dark brown or brown (7.5YR 4/3). It ranges from 3 to 6 inches in thickness. The B2t horizon ranges from dark reddish brown (5YR 3/3) to brown (7.5YR 5/4). It ranges from heavy clay loam to clay. The clay content is extremely variable in the B3 and C horizons; they range from sandy loam to clay loam within short distances. Carbonates are leached to a depth of 6 to 8 feet or more.

Gara series

The Gara series consists of moderately well drained to well drained soils on lower parts of slopes adjacent to bottom lands. These soils formed in glacial till. The native vegetation was prairie grasses and deciduous trees. Slope ranges from 5 to 10 percent.

Typical pedon of uneroded Gara loam from an area of Armstrong-Gara complex, 9 to 14 percent slopes, moderately eroded, 880 feet north and 150 feet west of the SE corner of SE1/4 sec. 3, T. 68 N., R. 7 W.:

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam; weak very fine subangular blocky structure parting to weak very fine granular; friable; slightly acid; clear smooth boundary.

A2—7 to 12 inches; mottled very dark gray (10YR 3/1), dark grayish brown (10YR 4/2), and dark yellowish brown (10YR 4/4) light clay loam, brown (10YR 4/3) kneaded; weak thin platy structure parting to weak very fine subangular blocky; friable; distinct grayish brown silt coatings on faces of peds; medium acid; gradual smooth boundary.

B21—12 to 18 inches; mottled brown (10YR 4/3) and yellowish brown (10YR 5/6) clay loam, dark yellowish brown (10YR 4/4) kneaded, about 10 percent of the peds are very dark gray (10YR 3/1); weak fine and very fine subangular blocky structure; friable; few thin discontinuous clay films; thin silt coatings on faces of peds; few pebbles, 1/4 inch in diameter; strongly acid; gradual smooth boundary.

B22t—18 to 25 inches; mottled yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) clay loam, yellowish brown (10YR 5/6) kneaded; moderate fine and very fine subangular blocky structure; friable; thin discontinuous clay films; thin silt coatings on faces of peds; few dark oxides; common pebbles, 1/4 inch in diameter or less; strongly acid; gradual smooth boundary.

B23t—25 to 34 inches; mottled yellowish brown (10YR 5/6) and brown (10YR 4/3) clay loam, yellowish brown (10YR 5/6) kneaded; weak fine prismatic structure parting to moderate medium subangular blocky and moderate fine subangular blocky; firm; continuous clay films; few black soft oxides; common pebbles, 1/4 inch in diameter; strongly acid; gradual smooth boundary.

B3t—34 to 46 inches; mottled yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) clay loam, yellowish brown (10YR 5/6) kneaded; common medium distinct light brownish gray (10YR 6/2) mottles; weak fine prismatic structure parting to weak medium subangular blocky; firm; thin discontinuous clay films; few black soft oxides; common pebbles, 1/4 inch in diameter; medium acid; gradual smooth boundary.

C—46 to 60 inches; mottled yellowish brown (10YR 5/6) and brown (10YR 4/3) clay loam, yellowish brown to dark yellowish brown (10YR 4/4 to 5/6) kneaded; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; few dark oxides; common small pebbles; slightly acid; gradual smooth boundary.

The Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon is commonly 4 to 8 inches thick. It ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). The matrix of the substratum can be calcareous at a depth ranging from 2 1/2 to 12 feet or more. Depth to calcareous material depends on the position of the Gara soils on the landscape.

Givin series

The Givin series consists of somewhat poorly drained soils on upland flat ridgetops and on high, loess-covered benches of the major streams and rivers. These soils formed in leached loess that is 7 to 9 feet thick. The native vegetation was trees and grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Givin silt loam, 1 to 3 percent slopes, 1,180 feet north and 250 feet east of the SW corner of sec. 16, T. 69 N., R. 5 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; weak fine and medium granular structure; friable; neutral; abrupt smooth boundary.

A2—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam; weak medium and thick platy structure; friable; neutral; clear smooth boundary.

B1—12 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam; many discontinuous very dark grayish brown (10YR 3/2) coatings on faces of peds; weak very fine subangular blocky structure; friable; very few very fine strong brown (7.5YR 5/6) segregations of iron oxides; slightly acid; clear smooth boundary.

B21t—15 to 18 inches; dark grayish brown (10YR 4/2) heavy silty clay loam; common discontinuous very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) coatings on faces of peds; common fine distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) and common fine faint mottles of dark brown (10YR 4/3); moderate very fine and fine subangular blocky structure; firm; thin continuous dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay films; common very fine and fine strong brown (7.5YR 5/6) and very dark gray (10YR 3/1) segregations and concretions of iron and manganese oxides; medium acid; gradual smooth boundary.

B22t—18 to 22 inches; dark grayish brown (10YR 4/2) light silty clay; common fine distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) and common fine faint mottles of dark brown (10YR 4/3); moderate very fine and fine subangular blocky structure; firm; thin continuous dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay films; common very fine and fine strong brown (7.5YR 5/6) and very dark gray (10YR 3/1) segregations and concretions of iron and manganese oxides; medium acid; gradual smooth boundary.

B23tg—22 to 28 inches; grayish brown (2.5Y 5/2) heavy silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) and common fine faint mottles of dark brown (10YR 4/3); moderate fine and medium subangular blocky structure; firm; nearly continuous thin dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay films; common very fine and fine strong brown (7.5YR 5/6) and very dark gray (10YR 3/1) segregations and concretions of iron and manganese oxides; medium acid; gradual smooth boundary.

B3tg—28 to 37 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) and common fine faint mottles of dark brown (10YR 4/3); moderate medium subangular blocky structure; firm; common discontinuous thin dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay films; common very fine and fine strong brown (7.5YR 5/6) and very dark gray (10YR 3/1) segregations and concretions of iron and manganese oxides; slightly acid; gradual smooth boundary.

B32tg—37 to 42 inches; mottled olive gray (5Y 5/2) and grayish brown (2.5Y 5/2) silty clay loam; common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); weak medium subangular blocky structure; friable; few discontinuous dark gray (10YR 4/1) clay films; common fine strong brown (7.5YR 5/6) and very dark gray (10YR 3/1) segregations and concretions of iron and manganese oxides; slightly acid; gradual smooth boundary.

B33—42 to 50 inches; mottled olive gray (5Y 5/2) and grayish brown (2.5Y 5/2) silty clay loam; common fine distinct mottles of light olive brown (2.5Y 5/4), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6); weak medium subangular blocky structure; friable; common fine dark soft segregations and concretions of iron and manganese oxides; neutral; gradual smooth boundary.

C—50 to 60 inches; mottled olive gray (5Y 5/2) and grayish brown (2.5Y 5/2) light silty clay loam; common fine distinct mottles of yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6); massive; friable; common fine dark soft segregations and concretions of iron and manganese oxides; neutral.

The Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 9 inches in thickness. The A2 horizon ranges from dark gray (10YR 4/1) to dark grayish brown (10YR 4/2). The B horizon is at a depth ranging from 10 to 18 inches. The B2t horizon ranges from heavy silty clay loam to light silty clay. The C horizon is at a depth ranging from 45 to 72 inches. Clayey glacial till is at a depth of about 7 to 9 feet.

Grundy series

The Grundy series consists of somewhat poorly drained soils on convex side slopes and ridgetops on uplands. These soils formed in leached loess that generally is 7 to 8 feet thick. The native vegetation was prairie grasses. Grundy soils on benches are underlain by alluvium. Slope ranges from 0 to 5 percent.

Typical pedon of Grundy silt loam, 0 to 2 percent slopes, 20 feet north and 50 feet west of the SW corner of the NE1/4 sec. 26, T. 69 N., R. 7 W.:

Ap—0 to 10 inches; black (10YR 2/1) silt loam, gray (10YR 5/1) dry; cloddy; firm; neutral; clear smooth boundary.

A3—10 to 18 inches; very dark gray (10YR 3/1) light silty clay loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; few silt coatings on faces of peds; medium acid; clear smooth boundary.

B1—18 to 23 inches; dark gray (10YR 4/1) silty clay loam; few fine faint grayish brown (10YR 5/2) mottles; moderate very fine subangular blocky structure; friable; common silt coatings on faces of peds; medium acid; clear smooth boundary.

B21t—23 to 28 inches; very dark gray (10YR 3/1) light silty clay; many fine distinct yellowish brown (10YR 5/4 and 5/6) mottles; moderate fine subangular blocky structure; firm; few thin discontinuous clay films; few hard concretions; medium acid; clear smooth boundary.

B22tg—28 to 36 inches; grayish brown (2.5Y 5/2) light silty clay; many fine distinct yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium subangular blocky structure; firm; few thin discontinuous clay films; few hard concretions; medium acid; gradual smooth boundary.

B23tg—36 to 47 inches; mottled grayish brown (2.5Y 5/2) and olive (5Y 5/3) heavy silty clay loam; many fine distinct yellowish brown (10YR 5/6) and few fine distinct brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm; few thin discontinuous dark clay films; few hard concretions; slightly acid; gradual smooth boundary.

B31tg—47 to 55 inches; mottled light olive gray (5Y 6/2) and strong brown (7.5YR 5/6) silty clay loam; weak medium subangular blocky structure; firm; common black clay deposits; common hard concretions; slightly acid; gradual smooth boundary.

B32g—55 to 65 inches; light olive gray (5Y 6/2) light silty clay loam; few fine prominent yellowish red (5YR 4/6) mottles; massive; firm; neutral.

The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It ranges from silt loam to light silty clay loam and is 10 to 19 inches thick. The B21t horizon ranges from very dark gray (10YR 3/1) to grayish brown (2.5Y 5/2). It ranges from silty clay loam to light silty clay. The B21t horizon is 5 to 10 inches thick and ranges from medium acid to slightly acid. Content of clay ranges from about 42 to 48 percent in the zone of maximum accumulation. The depth to clayey glacial till ranges from 7 to 8 feet and depends on topographic position.

Haig series

The Haig series consists of poorly drained soils on broad, upland flats. These soils formed in leached loess. The native vegetation was prairie grasses. Haig soils on benches are underlain by alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Haig silt loam, 0 to 2 percent slopes, 410 feet east and 75 feet north of the SW corner of SE 1/4 sec. 4, T. 68 N., R. 7 W.:

Ap—0 to 9 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A3—9 to 16 inches; black (10YR 2/1) light silty clay loam, dark gray (10YR 4/1) dry; moderate very fine granular structure; friable; few silt coatings on faces of peds; slightly acid; clear smooth boundary.

B1t—16 to 22 inches; black (10YR 2/1) light silty clay; moderate fine subangular blocky structure; firm; thick discontinuous clay films; few hard concretions; slightly acid; clear smooth boundary.

B21t—22 to 27 inches; mottled black (10YR 2/1) and very dark gray (10YR 3/1) light silty clay; many fine distinct grayish brown (2.5Y 5/2) and few fine distinct light olive brown (2.5Y 5/4) mottles; moderate fine subangular blocky structure; very firm; thick discontinuous clay films; common hard concretions; neutral; clear smooth boundary.

B22tg—27 to 36 inches; mottled dark gray (5Y 4/1) and grayish brown (2.5Y 5/2) heavy silty clay loam; common fine distinct light olive brown (2.5Y 5/4) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; black clay deposits in old root channels; thick discontinuous clay films; common hard concretions; neutral; gradual smooth boundary.

B31tg—36 to 45 inches; olive gray (5Y 5/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; black clay deposits in old root channels; thick discontinuous clay films; common hard concretions; neutral; gradual smooth boundary.

B32tg—45 to 56 inches; olive gray (5Y 5/2) light silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; black clay deposits in old root channels; neutral; clear smooth boundary.

B33g—56 to 60 inches; mottled olive gray (5Y 5/2) and strong brown (7.5YR 5/6) light silty clay loam; massive; firm; neutral.

The A horizon ranges from black (10YR 2/1) to very dark gray (10YR 3/1). It ranges from silt loam to silty clay loam and is 10 to 18 inches thick. The B2t horizon ranges from very dark gray to grayish brown in hues of 10YR to 5Y. It ranges from light to medium silty clay. The B2t horizon is 10 to 18 inches thick and ranges from medium acid to neutral. Content of clay ranges from 42 to 48 percent in the zone of maximum accumulation. Depth to glacial till is about 7 to 9 feet.

Hoopeston series

The Hoopeston series consists of somewhat poorly drained, nearly level soils on low benches along the major rivers. These soils formed in 24 to 36 inches of sandy loam over loamy sand and sand. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Hoopeston sandy loam, 0 to 2 percent slopes, 345 feet south and 100 feet east of the NW corner of SW1/4 sec. 15, T. 68 N., R. 3 W.:

Ap—0 to 10 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A12—10 to 15 inches; very dark brown (10YR 2/2) sandy loam; many fine faint dark brown (7.5YR 3/2) mottles; weak fine to medium subangular blocky structure; firm and friable; neutral; clear smooth boundary.

B1—15 to 24 inches; mottled dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) fine sandy loam; many fine faint dark brown (7.5YR 3/2) mottles; medium subangular blocky structure; very friable; fine soft black oxides; neutral; gradual smooth boundary.

B2—24 to 36 inches; dark grayish brown (10YR 4/2) fine sandy loam; many fine distinct dark brown (7.5YR 3/2) mottles and common fine faint grayish brown (10YR 5/2) and dark yellowish brown (10YR 4/4) mottles; weak fine to medium subangular blocky structure; very friable; fine soft black oxides; slightly acid; gradual smooth boundary.

C1—36 to 50 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) loamy fine sand; common fine faint dark brown (7.5YR 4/4) mottles; massive; very friable; slightly acid; gradual smooth boundary.

C2—50 to 60 inches; yellowish brown (10YR 5/6) sand; few fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; slightly acid.

The solum ranges from 24 to 40 inches in thickness. Depth to loamy sand and sand is commonly 24 to 36 inches, and sand particles are dominantly fine and medium in size. The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 10 to 20 inches thick. The C horizon ranges from loamy sand to sand.

Keomah series

The Keomah series consists of somewhat poorly drained soils on upland flat ridgetops and on high, loess-covered benches of the major streams and rivers. These soils formed in leached loess that is 7 to 9 feet thick. The native vegetation was trees. Slope ranges from 0 to 5 percent.

Typical pedon of Keomah silt loam, 0 to 2 percent slopes, 500 feet east and 150 feet south of the NW corner of SW1/4 sec. 25, T. 68 N., R. 5 W.:

Ap—0 to 4 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

A2—4 to 9 inches; brown (10YR 5/3) silt loam; weak medium platy structure; friable; neutral; clear smooth boundary.

B1—9 to 13 inches; brown (10YR 5/3) silty clay loam; moderate fine angular blocky structure; firm; light brownish gray (10YR 6/2) silt coatings on peds; strongly acid; clear smooth boundary.

B21t—13 to 24 inches; brown (10YR 5/3) light silty clay; moderate fine subangular blocky structure; common fine faint grayish brown (10YR 5/2), yellowish red (5YR 4/6), and yellowish brown (10YR 5/6) mottles; few clay films; light brownish gray (10YR 6/2) silt coatings on peds; strongly acid; gradual smooth boundary.

B22t—24 to 30 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) light silty clay; light brownish gray (10YR 6/2) ped coatings; moderate medium to coarse subangular blocky structure; few darker coatings on faces of peds; few discontinuous clay films; strongly acid; gradual smooth boundary.

B31—30 to 48 inches; mottled grayish brown (2.5Y 5/2 and 10YR 5/2), dark grayish brown (2.5Y 4/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) silty clay loam; clay content decreases slightly with increasing depth; moderate coarse subangular blocky structure; firm; strongly acid; gradual smooth boundary.

B32—48 to 60 inches; mottled grayish brown (2.5Y 5/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) light silty clay loam; massive; friable; common reddish oxides; medium acid.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to brown (10YR 4/3). It ranges from 3 to 8 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) and brown (10YR 5/3). It ranges from 5 to 10 inches in thickness. The B2t horizon ranges from grayish brown (10YR 5/2) to yellowish brown (10YR 5/4). It ranges from heavy silty clay loam to light silty clay. Clayey glacial till is at a depth of about 7 to 9 feet.

Keswick series

The Keswick series consists of moderately well drained soils on narrow ridgetops and convex, short side slopes. These soils formed in previously weathered gla-

cial till. The native vegetation was trees. Slope ranges from 5 to 14 percent. These soils are typically in the most strongly dissected areas along the major streams.

Typical pedon of uneroded Keswick loam from an area of Keswick loam, 9 to 14 percent slopes, moderately eroded, 660 feet east and 390 feet north of the SW corner of SE1/4 sec. 8, T. 69 N., R. 7 W.:

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to moderate very fine granular; friable; slightly acid; clear smooth boundary.

A2—7 to 12 inches; brown (10YR 5/3) loam, pale brown (10YR 6/3) dry; few fine faint dark brown (10YR 3/3 and 7.5YR 4/4) mottles; moderate fine subangular blocky structure; friable; nearly continuous silt coatings on faces of peds; medium acid; clear smooth boundary.

B21t—12 to 17 inches; reddish brown (5YR 4/4) heavy clay loam; few fine faint grayish brown (10YR 5/2) and red (2.5YR 4/6) mottles; strong fine subangular blocky structure; firm; few thin discontinuous clay films; stone line at a depth of 16 inches; strongly acid; clear smooth boundary.

B22t—17 to 24 inches; reddish brown (5YR 4/4) light clay; common fine faint red (2.5YR 4/6) and grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; few discontinuous clay films; strongly acid; gradual smooth boundary.

B23t—24 to 29 inches; mottled strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) light clay; common fine distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; firm; few clay films; strongly acid; gradual smooth boundary.

B24t—29 to 36 inches; mottled strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) clay loam; common fine distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; firm; few clay films; strongly acid; gradual smooth boundary.

B31—36 to 46 inches; strong brown (7.5YR 5/6) light clay loam; common fine and medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few clay films; common soft dark oxides; medium acid; gradual smooth boundary.

B32—46 to 60 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) light clay loam; common fine faint strong brown (7.5YR 5/8) mottles; weak medium prismatic structure; few clay films; common soft dark oxides; neutral.

The Ap horizon, when present, ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). It ranges from 3 to 5 inches in thickness where it is darker but ranges to 7 inches where it is lighter. The A2 horizon ranges from brown (10YR 5/3) to pale brown (10YR 6/3). It ranges from 4 to 8 inches in thickness. The B horizon is at a depth ranging from 8 to 15 inches. The B2t horizon ranges from heavy clay loam to clay and is 38 to 48 percent clay. A stone line generally is in the upper part of the B horizon.

Koszta series

The Koszta series consists of somewhat poorly drained, nearly level soils on low benches along the major rivers and streams. These soils formed in silty alluvium. The native vegetation was mixed grass and trees. Slope ranges from 0 to 2 percent.

Typical pedon of Koszta silt loam, 0 to 2 percent slopes, 150 feet west and 150 feet north of the SE corner of sec. 12, T. 68 N., R. 3 W.:

A1—0 to 10 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A21—10 to 13 inches; mottled dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) light silty clay loam, light brownish gray (10YR 6/2) dry; few fine faint brown (7.5YR 4/4) and very dark gray (10YR 3/1) mottles; moderate very fine granular structure; friable; few fine dark reddish brown (5YR 3/3) oxides; neutral; clear smooth boundary.

A22—13 to 18 inches; dark grayish brown (10YR 4/2) light silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles and few fine faint very dark grayish brown (10YR 3/2) mottles; moderate very fine granular and moderate very fine subangular blocky structure; friable; common fine dark reddish brown (5YR 3/2) oxides; few discontinuous silt coatings on faces of peds; slightly acid; gradual smooth boundary.

B21t—18 to 23 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles and few medium faint brown (7.5YR 4/4) mottles; moderate very fine subangular blocky structure; firm; common fine dark reddish brown (5YR 3/2) oxides and few dark soft oxides; common discontinuous silt coatings on faces of peds; few thin clay films; medium acid; gradual smooth boundary.

B22t—23 to 29 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4 and 5/6) mottles and few medium faint brown (7.5YR 4/4) mottles; moderate fine and medium subangular blocky structure; firm; thick discontinuous light brownish gray (10YR 6/2) silt coatings on faces of peds; few dark soft oxides; common discontinuous clay films; medium acid; gradual smooth boundary.

B23t—29 to 37 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky;

firm; nearly continuous light brownish gray (10YR 6/2) silt coatings on faces of peds; few dark soft oxides; few discontinuous clay films; medium acid; gradual smooth boundary.

B3t—37 to 47 inches; mottled grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) light silty clay loam; common fine distinct yellowish brown (10YR 5/4) mottles; weak fine prismatic structure parting to weak fine subangular blocky; friable; nearly continuous light gray (10YR 7/2) silt coatings on faces of peds; few thin dark clay films; few reddish soft oxides; medium acid; gradual smooth boundary.

C1—47 to 60 inches; mottled dark gray (10YR 4/1) and grayish brown (2.5Y 5/2) light silty clay loam; massive; friable; common light gray (10YR 7/2) silt coatings on vertical cleavages; few reddish soft oxides; medium acid.

The solum ranges from 45 inches to more than 60 inches in thickness. The A1 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It is 6 to 10 inches thick. The A2 horizon is 6 to 12 inches thick. The B2t horizon is typically light silty clay loam but ranges to medium silty clay loam. The clay content of the B2 horizon ranges from about 30 to 35 percent. Koszta soils show evidence of stratification in a few places at a depth below 40 inches because lenses of different colors or textures are in the profile.

Landes series

The Landes series consists of well drained soils on first bottoms near the stream channels. These soils formed in recent stratified sandy alluvium, and vegetation has not influenced formation. Slope ranges from 0 to 2 percent. The Landes soils are likely to be flooded in periods of high rainfall and receive deposits of coarse-textured material. These soils are outside the defined range of the Landes series because they have no mollic epipedon. The difference, however, does not alter their use and behavior.

Typical pedon of Landes sandy loam, 0 to 2 percent slopes, 640 feet south and 390 feet east of the NW corner of sec. 7, T. 68 N., R. 3 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; numerous roots; neutral; abrupt smooth boundary.

A12—8 to 12 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) sandy loam, grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; few roots; neutral; clear smooth boundary.

C1—12 to 22 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) sandy loam; massive; very friable; neutral; clear smooth boundary.

C2—22 to 27 inches; pale brown (10YR 6/3) loamy fine sand; single grain; very friable; neutral; abrupt smooth boundary.

C3—27 to 30 inches; very dark grayish brown (10YR 3/2) silt loam; few fine faint brown (7.5YR 4/4) mottles; weak fine subangular blocky structure; friable; neutral; abrupt smooth boundary.

C4—30 to 58 inches; stratified very dark grayish brown (10YR 3/2) and light brownish gray (10YR 6/2) silt loam and fine sandy loam; few lenses of brown (7.5YR 4/4); massive with horizontal cleavages; friable; most strata are 1/8 to 1/4 of an inch thick; neutral; abrupt smooth boundary.

C5—58 to 70 inches; very dark grayish brown (10YR 3/2) loam; massive; friable; neutral.

The Landes soils are highly stratified in the upper 3 to 5 feet, and they range from very dark gray (10YR 3/1) to pale brown (10YR 6/3). The A horizon and upper part of the C horizon to a depth of 22 inches typically are sandy loam, but they range from sandy loam to fine sandy loam. Some strata of silt loam are in the C horizon, generally at a depth of 27 to 58 inches. Thin strata of coarser or finer material are at this depth in some places.

Lawler series

The Lawler series consists of somewhat poorly drained, nearly level soils on low benches along the major rivers. They formed in 32 to 40 inches of loamy material over loamy sand or sand. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, 2,590 feet north and 160 feet west of the SE corner of sec. 20, T. 68 N., R. 3 W.:

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A12—8 to 13 inches; very dark gray (10YR 3/1) loam; moderate fine granular structure; friable; slightly acid; gradual clear boundary.

A13—13 to 17 inches; very dark gray (10YR 3/1) loam mixed with very dark grayish brown (10YR 3/2) loam in lower part; weak very fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

B1—17 to 21 inches; mottled very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) loam; few fine faint mottles of dark brown (7.5YR 3/2); very dark grayish brown (10YR 3/2) kneaded;

weak very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21—21 to 27 inches; dark grayish brown (10YR 4/2) loam; common fine faint mottles of grayish brown (10YR 5/2) and dark brown (7.5YR 3/2); moderate very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

B22—27 to 33 inches; mottled dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) loam; common fine faint mottles of grayish brown (2.5Y 5/2) and few fine distinct mottles of strong brown (7.5YR 5/6); weak very fine subangular blocky structure; friable; medium acid; gradual smooth boundary.

IIB3—33 to 38 inches; mottled dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) sandy loam; common fine faint mottles of grayish brown (2.5Y 5/2) and dark brown (7.5YR 3/2); weak very fine subangular blocky structure; very friable; medium acid; clear smooth boundary.

IIC1—38 to 46 inches; mottled dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) loamy sand; common fine faint mottles of very dark grayish brown (10YR 3/2); single grain; loose; slightly acid; clear smooth boundary.

IIC2—46 to 60 inches; mottled dark brown (7.5YR 4/2) and strong brown (7.5YR 5/6) fine sandy loam; common fine faint mottles of gray (10YR 5/1); massive; very friable; few fine segregations of black (10YR 2/1) manganese oxides; slightly acid; gradual smooth boundary.

Depth to coarse textures ranges from 24 to 42 inches. The A horizon ranges from 12 to 18 inches in thickness, although in some areas a color value of 3 extends to a depth of 24 inches. The B horizon ranges from loam to sandy loam. It is typically dark grayish brown (10YR to 2.5YR 4/2) and has mottles that are high in chroma.

Lawson series

The Lawson series consists of somewhat poorly drained, nearly level soils on first bottoms. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Lawson silt loam, 0 to 2 percent slopes, 440 feet south and 260 feet west of the NE corner of NW1/4NW1/4 sec. 3, T. 65 N., R. 6 W.:

Ap—0 to 10 inches; very dark gray (10YR 3/1) heavy silt loam, grayish brown (10YR 5/2) dry, very dark grayish brown (10YR 3/2) kneaded; moderate fine subangular blocky structure parting to moderate fine granular; friable; neutral; clear smooth boundary.

A12—10 to 19 inches; black (10YR 2/1) heavy silt loam; moderate fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A13—19 to 29 inches; very dark gray (10YR 3/1) heavy silt loam; moderate fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A14—29 to 36 inches; very dark grayish brown (10YR 3/2) heavy silt loam; moderate fine subangular blocky structure; friable; neutral; gradual smooth boundary.

C1—36 to 46 inches; very dark grayish brown (10YR 3/2) heavy silt loam; moderate fine prismatic structure parting to moderate fine and very fine subangular blocky; few fine sand coatings on faces of peds; neutral; gradual smooth boundary.

C2—46 to 60 inches; very dark grayish brown (10YR 3/2) heavy silt loam; weak medium prismatic and subangular blocky structure; friable; few fine sand coatings on faces of peds; neutral.

The solum ranges from about 36 to 60 inches in thickness. The A horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2), and there is no evidence of stratification. The A horizon is typically silt loam low in content of sand, but it ranges to light silty clay loam. The B horizon ranges from very dark gray to dark grayish brown. It is typically silt loam but ranges to light silty clay loam.

Lindley series

The Lindley series consists of well drained soils on the rounded ends of narrow ridgetops and irregular, complex side slopes on uplands. These soils formed in slightly weathered glacial till. The native vegetation was forest. Slope ranges from 9 to 40 percent.

Typical pedon of uneroded Lindley loam from an area of Lindley loam, 18 to 25 percent slopes, moderately eroded, 150 feet east and 150 feet north of the SW corner of SE1/4SE1/4 sec. 5, T. 67 N., R. 7 W.:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A21—2 to 6 inches; (10YR 5/3) loam, very pale brown (10YR 7/3) dry; moderate thin platy structure; friable; medium acid; clear smooth boundary.

A22—6 to 11 inches; yellowish brown (10YR 5/4) loam; moderate fine and very fine subangular blocky structure; friable; few thin discontinuous silt coatings on faces of peds; medium acid; clear smooth boundary.

B1—11 to 16 inches; yellowish brown (10YR 5/4) heavy loam; moderate fine subangular blocky structure; friable; nearly continuous very pale brown (10YR 7/3) silt coatings on faces of peds; few small pieces of gravel; strongly acid; clear smooth boundary.

B21t—16 to 24 inches; yellowish brown (10YR 5/6) heavy clay loam; moderate fine and medium subangular blocky structure; firm; thick discontinuous pale brown (10YR 6/3) silt and sand coatings on faces of

peds; thin discontinuous brown (10YR 4/3) clay films; common pebbles; strongly acid; gradual smooth boundary.

B22t—24 to 37 inches; yellowish brown (10YR 5/6) clay loam; moderate fine and medium subangular blocky structure; firm; thick discontinuous pale brown (10YR 6/3) silt and sand coatings on faces of peds; thick discontinuous brown (7.5YR 4/4) clay films; common pebbles; strongly acid; gradual smooth boundary.

B31t—37 to 48 inches; yellowish brown (10YR 5/4) clay loam; few fine faint light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; firm; thick discontinuous pale brown (10YR 6/3) silt and sand coatings on peds; thick discontinuous brown (7.5YR 4/4) clay films; common pebbles; few dark soft oxides; strongly acid; gradual smooth boundary.

B32t—48 to 62 inches; yellowish brown (10YR 5/4) clay loam; few fine faint light brownish gray (2.5Y 6/2) mottles; weak medium subangular blocky structure; firm; thick discontinuous pale brown (10YR 6/3) silt and sand coatings on peds; thick discontinuous brown (7.5YR 4/4) clay films; common pebbles; few dark soft oxides; strongly acid.

The A1 horizon is very dark grayish brown (10YR 3/2) or dark grayish brown (10YR 4/2) loam or light clay loam. It is 2 to 7 inches thick and is neutral to strongly acid. The A2 horizon ranges from loam to light clay loam. It is 4 to 9 inches thick and ranges from medium acid to strongly acid. The B2t horizon ranges from yellowish brown (10YR 5/6) to brown (10YR 3/4). It is medium to heavy clay loam. It is 20 to 24 inches thick and is medium acid to strongly acid.

Lineville series

The Lineville series consists of moderately well drained to somewhat poorly drained soils on narrow ridgetops. These soils formed in leached loess 10 to 20 inches thick over water-sorted sediment and weathered glacial till. The native vegetation was grasses and trees. Slope ranges from 5 to 9 percent. These soils are outside the defined range of the Lineville series because they do not have hues of 7.5YR and 5YR and are more clayey. These differences, however, do not alter their use and behavior.

Typical pedon of Lineville silt loam, 5 to 9 percent slopes, moderately eroded, 810 feet south and 350 feet west of the NE corner of SE1/4NE1/4 sec. 4, T. 67 N., R. 6 W.:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; neutral; abrupt smooth boundary.

A2—6 to 14 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate very fine subangular blocky structure; friable; medium acid; clear smooth boundary.

B1—14 to 18 inches; brown (10YR 5/3) light silty clay loam; few fine faint yellowish brown (10YR 5/4) mottles; moderate and strong fine and very fine subangular blocky structure; friable; few sand grains; nearly continuous light gray (10YR 7/2) silt coatings on faces of peds; medium acid; clear smooth boundary.

IIB21—18 to 27 inches; brown (10YR 5/3) silty clay loam; few fine faint yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; friable; numerous sand grains; few discontinuous light gray (10YR 7/2) silt coatings on faces of peds; few dark soft oxides; medium acid; gradual smooth boundary.

IIB22—27 to 34 inches; brown (10YR 5/3) heavy silty clay loam; few fine faint yellowish brown (10YR 5/6) mottles; moderate fine and medium subangular blocky structure; friable; many sand grains; few soft dark oxides; slightly acid; gradual smooth boundary.

IIB23tg—34 to 41 inches; grayish brown (10YR 5/2) clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; and few fine distinct yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few small stones at a depth of 40 inches; dark grayish brown (10YR 4/2) clay films in root channels; few soft dark oxides; neutral; gradual smooth boundary.

IIIB24tg—41 to 48 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) clay; few fine prominent red (2.5Y 4/6) mottles and common fine faint gray (10YR 5/1) mottles; moderate fine subangular blocky structure; firm; thick discontinuous clay films; few soft dark oxides; neutral; gradual smooth boundary.

IIIB25tg—48 to 60 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) clay; few fine prominent red (2.5Y 4/6) mottles; common fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; firm; thick discontinuous clay films; few soft dark oxides; neutral.

The Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). It ranges from 4 to 8 inches in thickness. The IIB2t has a maximum accumulation of clay of 28 to 35 percent and is high in content of sand. The pedisediment of the IIB horizon ranges from 18 to 28 inches in thickness. The IIIB horizon or paleosol is at a depth of 24 to 48 inches. The content of clay in the IIIB horizon ranges from 38 to 50 percent.

Mahaska series

The Mahaska series consists of somewhat poorly drained soils on uplands, commonly on slightly higher areas of the broad divides. These soils formed in leached loess. The native vegetation was prairie grasses. Slope ranges from 1 to 3 percent.

Typical pedon of Mahaska silt loam, 1 to 3 percent slopes, 35 feet east and 175 feet south of the NW corner of sec. 34, T. 69 N., R. 5 W.:

Ap—0 to 7 inches; black (10YR 2/1) silt loam; moderate very fine granular structure; friable; neutral; abrupt smooth boundary.

A12—7 to 16 inches; black (10YR 2/1) and very dark gray (10YR 3/1) silt loam; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A3—16 to 21 inches; very dark gray (10YR 3/1) light silty clay loam; moderate fine granular structure; slightly firm; strongly acid; clear smooth boundary.

B1—21 to 27 inches; very dark gray (10YR 3/1) heavy silty clay loam; many fine strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; slightly firm; strongly acid; gradual smooth boundary.

B21t—27 to 32 inches; dark grayish brown (2.5Y 4/2) light silty clay, faces of peds very dark gray (10YR 3/1); many fine strong brown (7.5YR 5/6) mottles; moderate medium prismatic and strong fine subangular blocky structure; firm; thick clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—32 to 38 inches; dark grayish brown (2.5Y 4/2) heavy silty clay loam; many fine strong brown (7.5YR 5/6) mottles; moderate medium prismatic and strong medium subangular blocky structure; very firm; very dark gray (10YR 3/1) clay films on some prism faces and in channels; thick continuous clay films.

B23t—38 to 45 inches; mixed dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/3) silty clay loam; moderate medium prismatic and moderate medium subangular blocky structure; firm; very dark gray (10YR 3/1) clay and organic coatings on faces of some prisms; continuous clay films on faces of peds, slightly thinner than in B22t horizon; medium acid; gradual smooth boundary.

B3—45 to 58 inches; grayish brown (2.5Y 5/2) light silty clay loam; common coarse strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; compound weak medium prismatic and weak coarse subangular blocky structure; firm; very dark gray (10YR 3/1) clay and organic coatings on 10 to 20 percent of faces of prisms; discontinuous clay films on peds and in channels; many manganese specks; medium acid; gradual smooth boundary.

C1—58 to 72 inches; grayish brown (2.5Y 5/2) silt loam; common coarse strong brown mottles; massive; slightly firm; few very dark gray (10YR 3/1) clay and organic coatings in vertical channels and on vertical faces of peds; neutral.

The solum ranges from 50 inches to 60 or more inches in thickness. The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It is 12 to 24 inches thick. The B2t horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (2.5Y 5/2). It ranges from heavy silty clay loam to light silty clay. The clay content ranges from 36 to 42 percent in the zone of maximum accumulation. The depth to clayey glacial till ranges from 7 to 10 feet.

Marshan series

The Marshan series consists of poorly drained, nearly level soils on low benches along the major rivers. These soils formed in moderately fine textured alluvium that is about 30 to 48 inches thick over coarse material. The native vegetation was prairie grasses, sedges, and other water-tolerant plants. Slope ranges from 0 to 2 percent. The Marshan soils are outside the defined range of the series because the transition to contrasting horizons is more than 5 inches and the B2t horizon is more clayey than typical. These differences, however, do not affect the use and behavior of these soils.

Typical pedon of Marshan clay loam, deep, 0 to 2 percent slopes, 650 feet west and 100 feet south of the NE corner of sec. 28, T. 68 N., R. 3 W.:

A1—0 to 10 inches; black (10YR 2/1) light clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; few coarse sand grains; neutral; clear smooth boundary.

A3—10 to 19 inches; very dark gray (10YR 3/1) light clay loam; common fine faint very dark grayish brown (2.5Y 3/2) mottles; moderate fine granular and subangular blocky structure; friable; common fine reddish soft oxides; common fine and medium dark hard concretions; common coarse sand grains; neutral; clear smooth boundary.

B1—19 to 23 inches; mottled dark grayish brown (2.5Y 4/2) and very dark gray (10YR 3/1) clay loam; moderate fine subangular blocky structure; friable; common fine reddish soft oxides; common fine dark hard concretions; common coarse sand grains; slightly acid; clear smooth boundary.

B21t—23 to 28 inches; mottled dark grayish brown (2.5Y 4/2) and dark gray (10YR 4/1) clay loam; common fine prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common fine reddish soft oxides; few fine and medium dark hard concretions; common coarse sand grains; few thin discontinuous clay films; slightly acid; gradual smooth boundary.

B22t—28 to 35 inches; mottled grayish brown (2.5Y 5/2) and strong brown (7.5YR 5/8) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; many fine reddish soft oxides; few fine and medium dark hard concretions; common coarse sand grains; nearly continuous dark gray (10YR 4/1) clay films on faces of prisms; slightly acid; gradual smooth boundary.

B3t—35 to 42 inches; mottled grayish brown (2.5Y 5/2) and yellowish red (5YR 5/8) heavy sandy loam; few fine faint dark reddish brown (5YR 3/4) mottles; weak medium subangular blocky structure; friable; few fine and medium dark hard concretions; many coarse sand grains and few pieces of gravel; thin discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

IIC1—42 to 50 inches; grayish brown (2.5Y 5/2) sand; common medium prominent dark reddish brown (5YR 3/4) mottles and few fine prominent yellowish red (5YR 5/8) mottles; massive; very friable; many coarse sand grains and common pieces of gravel; slightly acid; gradual smooth boundary.

IIC2—50 to 60 inches; light brownish gray (2.5Y 6/2) sand; few medium prominent dark reddish brown (5YR 3/2) mottles and few medium distinct brown (10YR 4/3) mottles; massive; loose; common coarse sand grains; slightly acid.

Thickness of solum and depth to material II are typically 36 to 42 inches but range from 30 to 48 inches. The A horizon ranges from black (N 2/0) to very dark gray (10YR 3/1) in color and from 15 to 24 inches in thickness. It is typically clay loam but ranges to loam or silty clay loam high in content of sand. The upper part of the IIC horizon is clay loam or sandy in some places, but loamy sand or sand is between depths of 30 and 48 inches.

Niota series

The Niota series consists of poorly drained soils on high benches along the major rivers and streams. These soils formed in fine-textured alluvium. The native vegetation was grasses and trees. Slope ranges from 0 to 14 percent. The soils are outside the defined range of the Niota series because the control section is very fine. This difference, however, does not alter the use and behavior of these soils.

Typical pedon of Niota silty clay loam, 0 to 2 percent slopes, 100 feet south and 25 feet west of the NE corner of NW1/4NW1/4 sec. 7, T. 68 N., R. 3 W.:

A1—0 to 8 inches; very dark gray (10YR 3/1) light silty clay loam, gray (10YR 6/1) dry; cloddy; firm; neutral; clear smooth boundary.

A2—8 to 15 inches; dark gray (10YR 4/1) heavy silt loam, grayish brown (10YR 5/2) dry, dark grayish brown (10YR 4/2) kneaded; moderate fine subangular blocky structure; friable; nearly continuous silt coatings on faces of peds; strongly acid; clear smooth boundary.

B21t—15 to 24 inches; dark grayish brown (10YR 4/2) heavy clay; weak fine subangular blocky structure; firm; thick discontinuous clay films; few hard concretions; very strongly acid; gradual smooth boundary.

B22t—24 to 31 inches; grayish brown (10YR 5/2) clay; weak medium subangular blocky structure; firm; few thick clay films; few hard concretions; strongly acid; gradual smooth boundary.

B23t—31 to 35 inches; grayish brown (10YR 5/2) heavy silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few thin discontinuous clay films; few hard concretions; strongly acid; gradual smooth boundary.

B31t—35 to 45 inches; grayish brown (2.5Y 5/2) heavy silty clay; common fine distinct yellowish brown (10YR 5/8) mottles; weak coarse subangular blocky structure; firm; few discontinuous clay films; few hard concretions; medium acid; gradual smooth boundary.

B32t—45 to 60 inches; grayish brown (2.5Y 5/2) silty clay; few fine distinct dark brown (7.5YR 3/2) and strong brown (7.5YR 5/6) mottles and common fine distinct yellowish brown (10YR 5/4, 5/6, and 5/8) mottles; weak medium prismatic structure; firm; few hard concretions and soft oxides; few streaks of reddish brown (5YR 4/3) clay; few thin clay films; medium acid.

The solum ranges from 48 inches to more than 60 inches in thickness. The A1 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from heavy silt loam to light silty clay loam. The horizon is 6 to 9 inches thick. The A2 horizon ranges from dark gray (10YR 4/1) to grayish brown (10YR 5/2). It ranges from silt loam to light silty clay loam. The horizon is 6 to 10 inches thick. The B2t horizon ranges from dark gray (10YR 4/1) to light brownish gray (10YR 6/2). It ranges from 15 to 30 inches in thickness.

Nodaway series

The Nodaway series consists of moderately well drained soils on first bottoms near the main channel of the streams and rivers. These soils formed in recent deposits of silty alluvium. Each flood deposits fresh sediment on the surface. Slope ranges from 0 to 2 percent.

Typical pedon of Nodaway silt loam, 0 to 2 percent slopes, 475 feet west of the SE corner of NW1/4NE1/4 sec. 31, T. 65 N., R. 5 W.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; moder-

ate fine granular structure; friable; neutral; clear smooth boundary.

C1—8 to 42 inches; stratified dark grayish brown (10YR 4/2), grayish brown (10YR 5/2), and very dark grayish brown (10YR 3/2) silt loam; massive with some horizontal cleavage; friable; thin strata of fine and very fine sand; neutral; clear smooth boundary.

C2—42 to 60 inches; very dark grayish brown (10YR 3/2) silt loam; few fine faint brown (10YR 5/3) mottles; moderate fine angular and subangular blocky structure; friable; neutral.

The A horizon ranges from very dark gray (10YR 3/2) to dark grayish brown (10YR 4/2). It is 6 to 10 inches thick. The C horizon ranges from very dark grayish brown (10YR 3/2) to pale brown (10YR 6/3). It ranges from silt loam to very fine sand that has thin strata of fine sand. Some platy structure is evident in most profiles. The platy structure is generally caused by stratification of relatively recent deposits of the material. If mottles occur, they are at a depth of 10 to 24 inches and are few, fine, and faint. The occurrence of mottles depends on the frequency and duration of overflow. The solum ranges from slightly acid to neutral.

Nordness series

The Nordness series consists of shallow, well drained soils on upland side slopes and escarpments of terraces of the major streams and rivers. These soils formed in 5 to 18 inches of silty material underlain by limestone bedrock. The native vegetation was trees. Slope ranges from 9 to 30 percent.

Typical pedon of Nordness silt loam, 9 to 18 percent slopes, 310 feet north and 690 feet west of the SE corner of NW1/4 sec. 20, T. 67 N., R. 7 W.:

A1—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 11 inches; 80 percent dark grayish brown (10YR 4/2) and 20 percent brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; moderate medium platy structure parting to moderate very fine subangular blocky; friable; few thin silt coatings on faces of peds; medium acid; clear smooth boundary.

B2t—11 to 16 inches; mottled brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silty clay loam; moderate fine angular and subangular blocky structure; firm; thin discontinuous clay films on ped faces; few dark soft oxides; medium acid; abrupt smooth boundary.

IIR—16 inches; hard level-bedded limestone.

The A1 horizon ranges from very dark grayish brown (10YR 3/4) to dark grayish brown (10YR 4/2). It is 4 to 8 inches thick and ranges from medium acid to neutral. The A2 horizon ranges from dark grayish brown (10YR 4/3) to yellowish brown (10YR 5/4). It is 4 to 8 inches thick. The B2t horizon ranges from dark grayish brown (10YR 4/2) to yellowish brown (10YR 5/4). It ranges from light to medium silty clay loam. The horizon is 4 to 8 inches thick.

Okaw series

The Okaw series consists of poorly drained soils on low second bottoms along the major streams. These soils formed in silty alluvium. The native vegetation was trees. Slope ranges from 0 to 3 percent.

Typical pedon of Okaw silt loam, 0 to 3 percent slopes, 850 feet east and 50 feet south of the NW corner of SE1/4 sec. 18, T. 67 N., R. 6 W.:

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; cloddy; friable; slightly acid; abrupt smooth boundary.

A2—5 to 10 inches; light brownish gray (2.5Y 6/2) silt loam; few fine faint yellowish brown (10YR 5/4) mottles; weak thin platy and moderate fine subangular blocky structure; friable; few fine dark oxides; discontinuous silt coatings on faces of peds; very strongly acid; abrupt smooth boundary.

B21tg—10 to 18 inches; mottled grayish brown (2.5Y 5/2) and dark grayish brown (10YR 4/2) silty clay; common fine faint brown to dark brown (7.5YR 4/4) mottles; moderate fine and very fine subangular blocky structure; firm; few fine dark oxides; discontinuous silt coatings on faces of peds in upper part; very strongly acid; gradual smooth boundary.

B22tg—18 to 25 inches; light brownish gray (2.5Y 6/2) light silty clay; many fine distinct brown to dark brown (7.5YR 4/4) mottles; weak to moderate medium subangular blocky structure; firm; few fine dark oxides; few discontinuous clay films; very strongly acid; gradual smooth boundary.

B23tg—25 to 32 inches; light brownish gray (2.5Y 6/2) heavy silty clay loam; common fine distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; firm; few fine dark oxides; few thin discontinuous clay films; strongly acid; gradual smooth boundary.

B31tg—32 to 40 inches; light brownish gray (2.5Y 6/2) silty clay loam; common fine distinct yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; few fine dark oxides; few thin discontinuous clay films; slightly acid; gradual smooth boundary.

C1—40 to 46 inches; light brownish gray (2.5Y 6/2) light silty clay loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; few fine dark oxides; slightly acid; gradual smooth boundary.

C2—46 to 54 inches; light brownish gray (2.5Y 6/2) light silty clay loam; many fine distinct dark yellowish brown (10YR 4/4) mottles; massive; firm; slightly acid; gradual smooth boundary.

IIC—54 to 60 inches; mottled light brownish gray (2.5Y 6/2) and brown to dark brown (7.5YR 4/2) light clay loam; massive; friable; few fine dark oxides; slightly acid.

The solum ranges from 40 inches to more than 55 inches in thickness. The Ap horizon is dark grayish brown (10YR 4/2) but ranges to very dark grayish brown. It is 3 to 7 inches thick. The A2 horizon ranges from grayish brown (10YR 5/2) to light gray (2.5Y 7/2). It is 4 to 8 inches thick. The B2tg horizon ranges from light to medium silty clay that is about 40 to 48 percent clay.

Pershing series

The Pershing series consists of somewhat poorly drained to moderately well drained soils on convex, short slopes and summits of upland ridges and stream benches. These soils formed in loess. The native vegetation was mixed prairie grasses and deciduous trees. Slope ranges from 2 to 9 percent.

Typical pedon of Pershing silt loam, 2 to 5 percent slopes, 920 feet south and 320 feet east of the NW corner of sec. 13, T. 68 N., R. 7 W.:

A1—0 to 8 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry, same color as matrix kneaded; moderate fine granular structure; friable; medium acid; clear smooth boundary.

A21—8 to 11 inches; mottled very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry, dark grayish brown (10YR 4/2) kneaded; few fine faint brown (10YR 4/3) mottles; moderate medium platy structure parting to moderate fine granular; friable; medium acid; clear smooth boundary.

A22—11 to 17 inches; dark grayish brown (10YR 4/2) light silty clay loam, grayish brown (10YR 5/2) dry, brown (10YR 4/3) kneaded; few fine faint brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; friable; common hard concretions; strongly acid; clear smooth boundary.

B1—17 to 19 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint yellowish brown (10YR 5/4) mottles; moderate fine subangular blocky structure; firm; common hard concretions; common discontinuous silt coatings on faces of peds; strongly acid; clear smooth boundary.

B21t—19 to 27 inches; grayish brown (2.5Y 5/2) light silty clay; common fine distinct yellowish brown (10YR 5/4 and 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium subangular blocky structure; very firm; common hard concretions; few discontinuous clay films; medium acid; gradual smooth boundary.

B22t—27 to 34 inches; olive gray (5Y 5/2) light silty clay; common fine distinct yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common hard concretions; few discontinuous clay films; few black (10YR 2/1) clay fills in root channels; slightly acid; gradual smooth boundary.

B31t—34 to 42 inches; light olive gray (5Y 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common hard concretions; few black (10YR 2/1) clay fills in root channels; slightly acid; gradual smooth boundary.

B32t—42 to 52 inches; light olive gray (5Y 6/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and common fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; firm; common hard concretions; few black (10YR 2/1) clay fills in root channels; slightly acid; gradual smooth boundary.

C—52 to 68 inches; mottled light olive gray (5Y 6/2) and yellowish brown (10YR 5/4) light silty clay loam; few fine prominent dark brown (7.5YR 4/4) mottles; massive; firm; few hard concretions; neutral.

The A1 horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). It ranges from 0 to 10 inches in thickness. The B2tg horizon ranges from dark grayish brown (10YR 4/2) to olive gray (5Y 5/2). It ranges from light to medium silty clay. The gray subsoil colors are relict and related to deoxidized and leached weathering zones. The depth to the clayey glacial till ranges from 4 to 7 feet.

Racoon series

The Racoon series consists of poorly drained soils on bottom lands along the major streams. These soils formed in silty alluvium. The native vegetation was trees. Slope ranges from 0 to 2 percent.

Typical pedon of Racoon silt loam, 0 to 2 percent slopes, 830 feet south and 280 feet east of the NW corner of NE1/4 sec. 14, T. 66 N., R. 6 W.:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A21—6 to 17 inches; light brownish gray (10YR 6/2) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine platy structure parting to moderate very fine subangular blocky; friable; few

discontinuous silt coatings on faces of peds; slightly acid; clear smooth boundary.

A22—17 to 24 inches; grayish brown (10YR 5/2) heavy silt loam; many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure parting to moderate fine subangular blocky; friable; common discontinuous silt coatings on faces of peds; strongly acid; clear smooth boundary.

B21—24 to 36 inches; light brownish gray (10YR 6/2) light silty clay loam; many fine distinct yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; friable; nearly continuous silt coatings on faces of peds; few soft oxides; strongly acid; gradual smooth boundary.

B22—36 to 42 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) light silty clay loam; moderate fine subangular blocky structure; friable; nearly continuous silt coatings on faces of peds; few soft oxides; strongly acid; gradual smooth boundary.

B23—42 to 50 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) heavy silt loam; weak fine and medium subangular blocky structure; friable; nearly continuous silt coatings on faces of peds; few soft oxides; strongly acid; gradual smooth boundary.

B3—50 to 60 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) heavy silt loam; massive; friable; few discontinuous silt coatings on faces of peds; common coarse oxides; medium acid.

The solum ranges from 48 to 60 inches or more in thickness. The Ap horizon is commonly dark grayish brown (10YR 4/2) but ranges to very dark grayish brown (10YR 3/2). It is 3 to 7 inches thick. The A2 horizon ranges from grayish brown (10YR 5/2) to light gray (2.5Y 7/2). It is 12 to 24 inches thick. The B2 horizon ranges from 20 to 27 percent in clay content.

Richwood series

The Richwood series consists of well drained soils on low benches along the major rivers. These soils formed in silty alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Richwood silt loam, 0 to 2 percent slopes, 45 feet south and 390 feet east of the NW corner of SW1/4 sec. 1, T. 67 N., R. 5 W.:

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; moderate very fine granular structure; friable; neutral; clear smooth boundary.

A12—8 to 13 inches; very dark brown (10YR 2/2) silt loam; moderate fine and very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

A3—13 to 19 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) silt loam; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.

B1—19 to 24 inches; very dark grayish brown (10YR 3/2) and brown (10YR 4/3) silt loam, very dark grayish brown (10YR 3/2) kneaded; moderate fine subangular blocky structure; friable; neutral; gradual smooth boundary.

B21t—24 to 31 inches; brown (10YR 4/3) and very dark grayish brown (10YR 3/2) heavy silt loam, brown (10YR 4/3) kneaded; moderate fine and medium subangular blocky structure; friable; thin discontinuous clay films; neutral; gradual smooth boundary.

B22t—31 to 42 inches; brown (10YR 4/3) and very dark grayish brown (10YR 3/2) heavy silt loam, yellowish brown (10YR 5/4) kneaded; moderate medium subangular blocky structure; friable; thin dark grayish brown (10YR 4/2) discontinuous clay films; neutral; gradual smooth boundary.

B31t—42 to 51 inches; yellowish brown (10YR 5/6) light silty clay loam high in content of sand; moderate fine subangular blocky structure; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films; neutral; gradual smooth boundary.

B32t—51 to 60 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; thin discontinuous dark grayish brown (10YR 4/2) clay films; neutral.

The solum ranges from 48 inches to more than 60 inches in thickness. The A horizon ranges from black (10YR 2/1) to very dark grayish brown (10YR 3/2). It ranges from light to medium silt loam that in some places is high in content of sand. The horizon is 15 to 20 inches thick. The B2t horizon ranges from medium silt loam to light silty clay loam; the clay content is about 20 to 30 percent, and in places, the sand content is at the upper limit for silt loam. The B3t horizon is typically silt loam or light silty clay loam but ranges to loam. Sandy loam is below a depth of 48 inches in some places.

Rinda series

The Rinda series consists of poorly drained soils on low ridgetops, on side slopes, and in waterway coves. These soils formed in an exhumed clayey paleosol. The native vegetation was prairie grass and deciduous trees. Slope ranges from 5 to 14 percent.

Typical pedon of Rinda silt loam, 5 to 9 percent slopes, 650 feet east and 300 feet north of the SW corner of NW1/4SW1/4 sec. 18, T. 68 N., R. 7 W.:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry, same color as matrix kneaded; moderate fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 13 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry, brown (10YR 4/3) kneaded; few fine faint very dark gray (10YR 3/1) mottles; moderate fine granular structure; friable; common silt coatings on faces of peds; slightly acid; clear smooth boundary.

B1—13 to 17 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint dark brown (10YR 4/3) mottles; strong fine subangular blocky structure; firm; nearly continuous silt coatings on faces of peds; medium acid; abrupt smooth boundary.

B21t—17 to 23 inches; dark grayish brown (10YR 4/2) clay; common fine distinct olive brown (2.5Y 4/6) mottles; moderate fine subangular blocky structure; very firm; common thick discontinuous clay films; medium acid; gradual smooth boundary.

B22t—23 to 30 inches; dark grayish brown (2.5Y 4/2) clay; few fine faint reddish brown (5YR 4/4) mottles; moderate medium subangular blocky structure; very firm; thick discontinuous clay films; slightly acid; gradual smooth boundary.

B23t—30 to 38 inches; dark grayish brown (2.5Y 4/2) clay; common fine faint gray (10YR 5/1) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very firm; thick discontinuous clay films; neutral; gradual smooth boundary.

B24t—38 to 48 inches; mottled gray (10YR 5/1) and yellowish brown (10YR 5/6) clay; few medium distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very firm; few thick clay films; neutral; gradual smooth boundary.

B25t—48 to 60 inches; mottled dark gray (5Y 4/1) and gray (5Y 5/1) clay; few fine distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; firm; few thick clay films; neutral.

The Ap horizon ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). It ranges from 6 to 10 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). It ranges from 4 to 8 inches in thickness. The A horizon formed in loess or silty sediment low in content of sand. The B2t horizon ranges from silty clay to clay. It ranges from 48 to 60 inches in thickness.

Rushville series

The Rushville series consists of poorly drained and very poorly drained soils on narrow, flat upland ridgetops and on high, loess-covered benches of the major streams and rivers. These soils formed in leached loess that is 7 to 9 feet thick. The native vegetation was trees. Slope ranges from 0 to 2 percent.

Typical pedon of Rushville silt loam, 0 to 2 percent slopes, 950 feet west and 600 feet south of the NE corner of sec. 35, T. 68 N., R. 5 W.:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/1) dry; weak fine granular structure parting to weak fine platy in lower part; friable; neutral; abrupt smooth boundary.

A21—9 to 13 inches; gray (10YR 6/1) silt loam; moderate medium platy structure; very friable; few dark hard concretions; strongly acid; clear smooth boundary.

A22—13 to 16 inches; light brownish gray (2.5Y 6/2) light silty clay loam; strong to medium fine subangular blocky structure; friable; continuous light gray (10YR 7/1) silt coatings on faces of peds; very strongly acid; abrupt smooth boundary.

B21g—16 to 19 inches; grayish brown (2.5Y 5/2) heavy silty clay loam; few fine mottles of yellowish brown (10YR 5/6); moderate fine subangular blocky structure; firm; few light gray (10YR 7/1) silt coatings on faces of some peds; very strongly acid; clear smooth boundary.

B22tg—19 to 30 inches; grayish brown (2.5Y 5/2) light silty clay; few fine distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few clay films; light gray (10YR 7/1) silt coatings on vertical faces of peds; very strongly acid; gradual smooth boundary.

B23tg—30 to 44 inches; grayish brown (2.5Y 5/2) silty clay; common fine to medium yellowish brown (10YR 5/6) mottles; moderate coarse subangular blocky structure; firm; few dark gray (10YR 4/1) clay films on faces of peds; soft dark manganese-iron oxides; very strongly acid; gradual smooth boundary.

B3g—44 to 52 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) light silty clay loam; few light gray (10YR 7/1) silt coatings on faces of peds; weak coarse subangular blocky structure; firm; medium acid; gradual smooth boundary.

C—52 to 60 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) heavy silt loam; massive; firm; segregated iron; medium acid.

The A1 horizon, where present, ranges from 3 to 5 inches in thickness. It ranges from very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2). The Ap horizon, when mixed to a depth of 7 to 9 inches, ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). The A2 horizon ranges from gray (10YR 5/1) to light gray (2.5Y 7/2). The B2t horizon ranges from very dark grayish brown (10YR 3/2) to grayish brown (2.5Y 5/2). This soil is underlain by clayey glacial till at a depth of about 7 to 9 feet.

Saude series

The Saude series consists of well drained soils on stream benches of the major rivers. These soils formed

in loamy material overlying sands. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Saude loam, 0 to 2 percent slopes, 50 feet north and 50 feet east of the SW corner of NE1/4SW1/4NW1/4 sec. 34, T. 67 N., R. 5 W.:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; strongly acid; clear smooth boundary.

A12—8 to 14 inches; very dark brown (10YR 2/2) loam, grayish brown (10YR 5/2) dry, very dark grayish brown (10YR 3/2) kneaded; weak fine subangular blocky structure parting to weak fine and very fine granular; friable; strongly acid; clear smooth boundary.

B1—14 to 19 inches; dark brown (10YR 3/3) loam; weak fine and medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

B2—19 to 28 inches; brown (10YR 4/3) loam and heavy sandy loam; weak medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

B31—28 to 33 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; few small pieces of gravel; medium acid; clear smooth boundary.

IIB32—33 to 40 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; slightly acid; gradual smooth boundary.

IIC—40 to 60 inches; brown (10YR 5/3) sand; few fine faint dark reddish brown (5YR 3/4) mottles; single grain; loose; 1- to 2-inch brown (7.5YR 4/4) and reddish brown (5YR 4/4) bands; slightly acid.

The A horizon is black (10YR 2/1) or very dark brown (10YR 2/2) and is 10 to 15 inches thick. The B horizon ranges from 12 to 20 percent in clay content.

Sparta series

The Sparta series consists of excessively drained soils on benches along the major rivers. These soils formed in sands deposited dominantly by water but, in some places, by wind. The native vegetation was prairie grasses. Slope ranges from 0 to 7 percent. These soils are outside the defined range of the Sparta series because they lack sufficient organic carbon to qualify as a Mollisol. This difference, however, does not affect the use and behavior of these soils.

Typical pedon of Sparta loamy sand, thick surface, 0 to 2 percent slopes, 1,030 feet south and 100 feet west of the NE corner of sec. 32, T. 66 N., R. 6 W.:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy sand; weak coarse blocky structure; very friable; slightly acid; clear smooth boundary.

A12—10 to 20 inches; very dark brown (10YR 2/2) loamy sand; single grain; very friable; strongly acid; gradual smooth boundary.

A3—20 to 33 inches; dark brown (7.5YR 3/2) sand and coarse sand; single grain; very friable; strongly acid; gradual smooth boundary.

B2—33 to 43 inches; dark yellowish brown (10YR 3/4) sand and coarse sand; weak coarse blocky structure parting to single grain; loose; medium acid; gradual smooth boundary.

C—43 to 60 inches; dark yellowish brown (10YR 3/4) sand and coarse sand; single grain; loose; medium acid.

The solum ranges from 30 to 48 inches in thickness. The A horizon ranges from very dark brown (10YR 2/2) to dark brown (7.5YR 3/2). The Ap horizon ranges from medium loamy sand to loamy fine sand. The dark colors extend to a depth of 20 to 40 inches. Sand content and size increase with increasing depth. Medium sized sand is dominant in the control section.

Spillville series

The Spillville series consists of moderately well drained and somewhat poorly drained soils on flood plains of the major streams and rivers. These soils formed in medium-textured alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Spillville loam, 0 to 2 percent slopes, 1,050 feet east and 990 feet south of the NW corner of sec. 4, T. 65 N., R. 6 W.:

A11—0 to 18 inches; black (10YR 2/1) to very dark grayish brown (10YR 3/2) loam, very dark grayish brown (10YR 3/2) kneaded; weak very fine granular structure; very friable; neutral; gradual smooth boundary.

A12—18 to 24 inches; black (10YR 2/1) to very dark grayish brown (10YR 3/2) loam; weak very fine granular and subangular blocky structure; friable; neutral; gradual smooth boundary.

B1—24 to 36 inches; very dark brown (10YR 2/2) loam; weak very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

B2—36 to 45 inches; very dark grayish brown (10YR 3/2) loam; few fine faint dark yellowish brown (10YR 4/4) mottles; weak very fine subangular blocky structure; friable; neutral; gradual smooth boundary.

C—45 to 60 inches; mottled very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) loam; few fine faint dark yellowish brown (10YR 4/4) mottles; massive; friable; neutral.

The solum ranges from 40 to 55 inches in thickness. The A horizon is typically black (10YR 2/1) to very dark

grayish brown (10YR 3/2) but ranges to very dark gray (10YR 3/1) and very dark brown (10YR 2/2). These colors extend to a depth of 40 inches or more. The B horizon is typically loam but ranges to sandy loam that is less than 60 percent sand. At a depth below 40 inches, the texture is also generally loam but ranges to sandy loam and strata of loamy sand.

Tuskeego series

The Tuskeego series consists of poorly drained soils on low foot slopes, low benches, and some first bottoms of the major rivers. These soils formed in silty alluvium. The native vegetation was trees and grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Tuskeego silt loam, 0 to 2 percent slopes, 35 feet north and 580 feet west of the SE corner of NE1/4SW1/4 sec. 30, T. 66 N., R. 5 W.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry, very dark grayish brown (10YR 3/2) kneaded; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A2—9 to 16 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; few fine faint yellowish brown (10YR 5/4) mottles; weak medium platy structure parting to moderate fine subangular blocky; friable; nearly continuous light gray (10YR 7/1) silt coatings on faces of peds when dry; few dark brown (7.5YR 3/2) soft oxides; medium acid; clear smooth boundary.

B1—16 to 19 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine faint yellowish brown (10YR 5/6) mottles; strong fine angular and subangular blocky structure; friable; common gray (10YR 5/1) coatings on faces of peds; thick discontinuous light gray (10YR 7/1) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

B21tg—19 to 27 inches; grayish brown (2.5Y 5/2) silty clay; many fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; thin gray (10YR 5/1) clay films in former root channels and on faces of some peds; very strongly acid; gradual smooth boundary.

B22tg—27 to 34 inches; grayish brown (2.5Y 5/2) light silty clay; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; thin clay films in former root channels and on faces of some peds; strongly acid; gradual smooth boundary.

B23tg—34 to 40 inches; light olive gray (5Y 6/2) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin clay films in former root channels and on faces of some peds; common very fine sand grains; strongly acid; gradual smooth boundary.

B3tg—40 to 49 inches; light olive gray (5YR 6/2) clay loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few clay films in former root channels; few very fine sand coatings on faces of peds; strongly acid; gradual smooth boundary.

IIC—49 to 60 inches; light brownish gray (2.5Y 6/2) sandy clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable; common very fine sand coatings on faces of peds; strongly acid.

The A2 horizon ranges from dark gray (10YR 4/1) to light brownish gray (10YR 6/2). It ranges from 6 to 12 inches in thickness. The B2tg horizon ranges from very dark gray (10YR 3/1) to light olive gray (5Y 6/2). The maximum clay content of the B2tg horizon ranges from 38 to 48 percent. The substratum is generally at a depth of 48 inches to 60 or more inches. It is generally quite sandy, but, in some places, it ranges to silty clay loam.

Vesser series

The Vesser series consists of somewhat poorly drained and poorly drained soils on first bottoms of the major streams and rivers. These soils formed in alluvium. The native vegetation was prairie grasses. Slope ranges from 0 to 5 percent.

Typical pedon of Vesser silt loam, 0 to 2 percent slopes, 510 feet west and 430 feet north of the SE corner of SW1/4SE1/4 sec. 24, T. 68 N., R. 7 W.:

A1—0 to 10 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine and very fine subangular blocky structure; friable; slightly acid; clear smooth boundary.

A21—10 to 22 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) and grayish brown (10YR 5/2) dry, very dark grayish brown (10YR 3/2) kneaded; few fine faint dark brown (7.5YR 3/2) and dark grayish brown (10YR 4/2) mottles; moderate thin platy structure; discontinuous light gray (10YR 7/1) silt coatings on plates; medium acid; clear smooth boundary.

A22—22 to 28 inches; dark gray (10YR 4/1) silt loam; few fine faint dark brown (7.5YR 3/2) and dark grayish brown (10YR 4/2) mottles; weak coarse platy structure parting to moderate fine subangular blocky; friable; nearly continuous light gray (10YR 7/1 and 7/2) silt coatings on faces of peds; strongly acid; clear smooth boundary.

A23—28 to 33 inches; mottled dark gray (10YR 4/1) and gray (10YR 5/1) silt loam; few fine and medium distinct dark brown (7.5YR 3/2) mottles; weak fine and medium subangular blocky structure; friable; continuous light gray (10YR 7/1) silt coatings on faces of peds; strongly acid; clear smooth boundary.

B21t—33 to 41 inches; mottled gray (10YR 5/1) and light gray (10YR 6/1) light silty clay loam; common fine distinct dark brown (7.5YR 3/2) mottles; moderate medium subangular blocky structure; friable; thick discontinuous light gray (10YR 7/1) silt coatings on faces of peds; few dark clay films on vertical cleavages; strongly acid; clear smooth boundary.

B22t—41 to 49 inches; mottled very dark gray (10YR 3/1) and black (10YR 2/1) silty clay loam; common fine faint dark brown (7.5YR 3/2) mottles; moderate medium subangular blocky structure; firm; few thin white (10YR 8/1) silt coatings on faces of peds; few dark clay films on vertical cleavages; medium acid; gradual smooth boundary.

B3t—49 to 60 inches; very dark gray (10YR 3/1) light silty clay loam; weak medium subangular blocky structure; friable; few thin discontinuous light gray (10YR 7/1) silt coatings on faces of peds; few dark clay films on vertical surfaces; medium acid.

The A1 horizon ranges from 10 to 18 inches in thickness. It ranges from very dark gray (10YR 3/1) to black (10YR 2/1). The A2 horizon ranges from 16 to 24 inches in thickness. It ranges from gray (10YR 6/1) to very dark gray (10YR 3/1). The B2t ranges from very dark gray (10YR 3/1) to grayish brown (10YR 5/2). It ranges from silt loam to silty clay loam. Layers of underlying material higher in content of clay are at a depth of 60 or more inches in some places.

Wabash series

The Wabash series consists of very poorly drained soils on flood plains in slack water areas generally away from the stream and river channels. These soils formed in fine-textured alluvium. The native vegetation was wetland grasses. Slope ranges from 0 to 2 percent.

Typical pedon of Wabash silty clay, 0 to 2 percent slopes, 600 feet west and 75 feet north of the SE corner of sec. 20, T. 68 N., R. 3 W.:

Ap—0 to 10 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; firm; neutral; clear smooth boundary.

A12—10 to 20 inches; black (10YR 2/1) silty clay; few fine faint dark brown (7.5YR 3/2) mottles; moderate fine and very fine subangular and angular blocky structure; firm; neutral; gradual smooth boundary.

B21—20 to 30 inches; very dark gray (10YR 3/1) silty clay; few fine faint very dark grayish brown (2.5Y 3/2) mottles; moderate fine and very fine subangular blocky structure; firm; neutral; gradual smooth boundary.

B22—30 to 40 inches; very dark gray (2.5Y 3/0) silty clay; few fine faint dark grayish brown (2.5Y 4/2) mottles; weak fine subangular blocky structure; firm; neutral; gradual smooth boundary.

B31—40 to 48 inches; very dark gray (2.5Y 3/0) silty clay; massive; firm; neutral; gradual smooth boundary.

B32—48 to 60 inches; very dark gray (2.5Y 3/0) and dark gray (2.5Y 4/0) silty clay; massive; firm; neutral.

The A horizon ranges from black (N 2/0, 10YR 2/1) to very dark gray (10YR 3/1). It ranges from 12 to 24 inches in thickness. The B horizon ranges from black (10YR 2/1) to very dark gray (2.5Y 3/0). It ranges from heavy silty clay to clay. The horizon ranges from slightly acid to neutral. This soil formed in fine-textured alluvium that is more than 3 1/2 feet thick. The content of sand is very low.

Watkins series

The Watkins series consists of well drained and moderately well drained soils on low benches along the major rivers. These soils formed in silty alluvium. The native vegetation was mixed grasses and trees. Slope ranges from 1 to 3 percent.

Typical pedon of Watkins silt loam, 0 to 2 percent slopes, 200 feet east of the SW corner of NW1/4SW1/4NW1/4 sec. 14, T. 67 N., R. 5 W.:

Ap—0 to 7 inches; very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silt loam; weak fine and very fine granular structure; friable; neutral; clear smooth boundary.

A2—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam; weak thin platy structure parting to weak very fine subangular blocky; friable; few thin continuous silt coatings on faces of peds; slightly acid; clear smooth boundary.

B1—11 to 17 inches; brown (10YR 4/3) light silty clay loam; moderate fine subangular blocky structure; friable; few thin discontinuous silt coatings on faces of peds; medium acid; gradual smooth boundary.

B21t—17 to 23 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few thin discontinuous silt coatings on faces of peds; thin nearly continuous clay films; some dark oxide stains; strongly acid; gradual smooth boundary.

B22t—23 to 33 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; nearly continuous clay films; strongly acid; gradual smooth boundary.

B31t—33 to 40 inches; brown (10YR 4/3) and yellowish brown (10YR 5/6) silty clay loam; weak fine subangular blocky structure; friable; thin discontinuous clay films; medium acid; gradual smooth boundary.

B32—40 to 48 inches; yellowish brown (10YR 5/4) silty clay loam, faces of peds dark grayish brown (10YR 4/2); yellowish brown (10YR 5/6) kneaded; weak fine subangular blocky structure; friable; slight increase in sand; slightly acid; gradual smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) light silty clay loam, yellowish brown (10YR 5/6) kneaded; common medium distinct grayish brown (2.5Y 5/2) mottles; massive; friable; slight increase in sand; mottles tend to be banded; medium acid.

The solum ranges from 45 inches to more than 60 inches in thickness. The Ap horizon ranges from very dark gray (10YR 3/2) to very dark grayish brown (10YR 3/2). It is 6 to 9 inches thick. The A2 horizon ranges from very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2). It is 4 to 8 inches thick. The B2t horizon is typically light silty clay loam but ranges to medium silty clay loam. At a depth above 40 inches, the content of fine sand and sand is less than 15 percent, although the soil may feel gritty. These soils show evidence of stratification in some places at a depth below 40 inches by having lenses of sandy material.

Weller series

The Weller series consists of moderately well drained soils on convex summits and side slopes of upland ridges. These soils formed in leached loess 4 to 8 feet thick. The native vegetation was deciduous trees. Slope ranges from 2 to 14 percent.

Typical pedon of Weller silt loam, 2 to 5 percent slopes, 260 feet east and 100 feet north of the SW corner of SW1/4SE1/4 sec. 33, T. 68 N., R. 7 W.:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam, light grayish brown (10YR 6/2) dry, same color as matrix kneaded; moderate thin platy structure parting to moderate fine subangular blocky; friable; common roots and pores; strongly acid; abrupt smooth boundary.

A21—3 to 10 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry, same color as matrix kneaded; moderate thin platy structure; friable; strongly acid; gradual smooth boundary.

A22—10 to 16 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry, same color as matrix kneaded; weak thin platy and moderately fine subangular blocky structure; friable; discontinuous dry silt coatings on faces of peds; very strongly acid; clear smooth boundary.

AB—16 to 18 inches; brown (10YR 5/3) light silty clay loam; moderate to strong fine subangular blocky structure; friable; almost continuous silt coatings on faces of peds when dry; very strongly acid; clear smooth boundary.

B21t—18 to 24 inches; grayish brown (10YR 5/2) and brown (10YR 5/3) silty clay; common fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm; thin discontinuous clay films; few dark hard concretions, very strongly acid; gradual smooth boundary.

B22t—24 to 31 inches; grayish brown (10YR 5/2) silty clay; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; firm; thin discontinuous clay films; strongly acid; gradual smooth boundary.

B31t—31 to 39 inches; grayish brown (2.5Y 5/2) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few fine discontinuous clay films; strongly acid; few dark hard concretions; gradual smooth boundary.

B32t—39 to 50 inches; grayish brown (2.5Y 5/2) light silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium to coarse subangular blocky structure; firm; few thin discontinuous clay films; few dark hard concretions; strongly acid; gradual smooth boundary.

C—50 to 60 inches; mottled light olive gray (5Y 6/2) and light olive brown (2.5Y 5/4) silty clay loam; few fine distinct strong brown (7.5YR 5/6) mottles; massive; firm; few dark deposits in old root channels; few dark soft oxides; medium acid.

The A1 horizon ranges from very dark gray (10YR 3/1) to dark grayish brown (10YR 4/2). It ranges from 2 to 5 inches in thickness. The A2 horizon ranges from dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2). The B2t horizon ranges from grayish brown (10YR 5/2) to yellowish brown (10YR 5/4). The grayish colors in the B horizon are relict and related to a deoxidized and leached weathering zone.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*17*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 16, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among

orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udoll (*Ud*, meaning humid, 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 expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Argiudolls (*Argi*, meaning Argillic horizons, plus *udoll*, the suborder of Mollisols that have an Udic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups 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 is thought to typify the great group. An example is Typic Argiudolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-silty, mixed, mesic, Typic Argiudolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

In this section the factors that affected the formation of the soils in Lee County are described.

Factors of soil formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil development have acted on the soil material (*4*).

Climate and vegetation are the active factors in the formation of soil. They act on parent material, which has accumulated through the weathering of rocks, and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. It may be much or little, but some time is always required for the development of distinct horizons.

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

Parent material and geology

Most of the soils in Lee County formed in glacial till, or ice-laid material; loess, or windblown material; and alluvium, or water-laid material. A few small areas of eolian sands are along the Des Moines and Mississippi Rivers, and in some places limestone and shale are parent materials. In this county, parent material has been less influential in developing the general character of the profile than have other factors of soil formation.

In Lee County the major Pleistocene deposits of pre-Wisconsin age are Nebraskan and Kansan drift (*15*). The Kansan drift is identifiable throughout the county, and on side slopes it forms an extensive part of the landscape. The Nebraskan drift, however, is not readily identifiable on the surface in Lee County.

In some of the deep road cuts and along some of the major stream valleys, a gumbotil is below the Kansan glacial till. This is called Aftonian gumbotil (*5,6*). It consists mainly of glacial till made up of coarse fragments in a clay loam matrix. The upper part of this till is a yellowish brown material that is oxidized and leached. Below this zone is a dark gray material that is calcareous, contains limestone and dolomite particles, and is neither oxidized nor leached.

Soils formed on the Kansan till plain during the Yarmouth and Sangamon interglacial ages, before the loess was deposited. On nearly level interstream divides, the

soils were strongly weathered and had a gray, plastic subsoil consisting of gumbotil. This gumbotil remains; it is several feet thick and is very slowly permeable. The Ashgrove, Rinda, and Clarinda soils formed in this gumbotil; Ashgrove and Rinda soils are extensive throughout Lee County. Geologic erosion has cut below the Yarmouth-Sangamon paleosol and into the Kansan till and older deposits. At the depth to which this erosion has cut, generally there is a stone line or subjacent till overlain by pedisediment (*9,14*). A paleosol formed in the pedisediment stone line and in the subjacent till. The Armstrong and Keswick soils formed in this material.

Geologic erosion removed the loess from many slopes and exposed strongly eroded, weathered paleosols. In some places, the paleosols have been beveled or truncated, and only the lower part of the strongly weathered material remains. In other places, erosion removed all of the paleosols and exposed till that is only slightly weathered. The period during which erosion cut through below the Yarmouth-Sangamon paleosol is called Late Sangamon (*9,10*). The material below the paleosols consists of loamy sediment over a stone line that, in turn, is over a highly weathered, clayey, reddish brown, acid till. Material that formed in the Late Sangamon period is exposed on the narrow, slightly lower interstream divides and on some side slopes.

Armstrong and Keswick soils formed in this Late Sangamon material. Lineville soils formed where the loamy pedisediment is 2 feet or more thick over the glacial till. Douds and Galland soils formed in pre-Sangamon sediments in valley fills. These sediments are of glacial origin, and vary in texture (*10*). Douds and Galland soils are on low, stepped interfluves above the present drainage system. They owe their landscape partly to valley fill, but their surface merges with the present erosional uplands. Douds and Galland soils are distinctly higher than the soils on the flood plain, but are lower than Lindley soils that formed on dissected slopes of Late Wisconsin age. These pre-Sangamon erosional sediments appear to have been angularly truncated in many places. As a result, they generally consist of an irregular mixture of materials that have contrasting textures.

Wisconsin-age loess covers most of Lee County and is an extensive parent material (*12,13*). It consists of accumulated particles of silt and clay that have been deposited by wind. Variations in soils are related to the distance of the soils from the source of loess. The dominant source of loess in Lee County is probably to the northwest in the central part of Iowa, but some probably comes from the Missouri River in western Iowa (*3*).

On the stable upland divides, the loess is about 8 feet thick. It is slightly thicker in the northwestern part of the county, where Grundy and Haig soils are dominant. Other soils derived from loess are the Arispe, Atterberry, Bélinda, Beckwith, Clinton, Downs, Edina, Exette, Fayette, Givin, Keomah, Mahaska, Pershing, Rushville, and Weller soils. Many of the high benches along the major streams and rivers are covered with loess. The loess on these benches contains slightly less clay and slightly more sand than does the loess covering the uplands. The soil material underlying the loess in these areas is a stratified alluvium that is generally high in sand and gravel content.

Sediments that have been removed and laid down by water are called alluvium. As they are carried, these sediments are sorted to some extent, but only in a few places are they as well sorted as loess. Also, alluvium does not have the wide range of particle sizes that occurs in glacial drift. The alluvium in Lee County is derived from loess and glacial drift, so it is largely a mixture of silt and clay, of silt and sand, or of sand and gravel. The coarse sand and gravel generally are only in the pre-Sangamon alluvial sediments on the stream benches. Sediments at the foot of the slope on which they originated are called colluvium, or local alluvium.

Alluvial sediments are the parent materials of the soils on flood plains, on terraces, and along drainageways. As a river overflows its channels and the water spreads over the flood plains, coarse materials such as sand and coarse silt are deposited first. As the flooding water continues to spread, it moves more slowly, and finer-textured sediments are deposited. After the flood recedes, the finest particles, or clay, settle from the water that is left standing on the lowest parts of the flood plain.

Lawson, Landes, Dockery, and Nodaway soils commonly are closest to the stream channel and are coarser than the other soils on bottom land. Coppock and Chequest soils are fairly extensive along rivers where they commonly are away from the meanders of the stream. Colo, Racoon, Vesser, and Tuskeego soils are mainly along the smaller streams in the county. Wabash and Chequest soils commonly are on the lower part of the bottom land and are the finest textured soils derived from alluvium on first bottoms. Nodaway and Cantril soils are widely distributed throughout the county. In some places they formed in colluvium. Cantril soils are the dominant soils that formed in colluvium, and they commonly contain more sand than the other soils that formed in alluvium.

In some areas streams are still cutting through lime rock and shale, and flood plains are narrower and steeper. The Nodaway-Cantril complex and the Landes soils are commonly on these flood plains.

The oldest parent material in the county is a series of beds deposited during the Mississippian and Pennsylvanian age. These beds vary in thickness and consist of limestone, shale of different colors and textures, and a few organic layers such as coal.

The limestone beds range from a few inches to several feet in thickness. Nordness soils formed in these. Some of the thicker limestone beds are very good sources of road aggregate and agricultural lime.

Several layers of limestone are commonly exposed on slopes along the major rivers and their tributaries. In

most places, this exposed rock is many feet thick, and rock fragments are on the side slope below the outcropping.

Climate

The soils in Lee County have been forming under a midcontinental, subhumid climate for the past 5,000 years (*9,13*). The morphology and properties of most of the soils indicate that this climate was similar to the present climate. From 16,000 to 6,500 years ago, however, the climate probably was cool and moist and was conducive mostly to forest vegetation (*9,13*). A pollen study (*7*) indicates that the cool, moist climate of the Sangamon period of the Pleistocene epoch was conducive mostly to conifers.

The influence of the general climate in a region is modified by local conditions in or near the developing soils. For example, soils on south-facing slopes formed under a microclimate that was warmer and drier than the climate of nearby areas. The low, poorly drained soils on bottom lands formed under a wetter and colder climate than that in most areas above them. These local differences influenced the soils and account for some of the differences between soils in the same general climatic region.

Vegetation

Many changes in climate and vegetation took place during the postglacial period in the area that is now Iowa (*7,9*). Spruce grew on the soils from 12,000 to 8,000 years ago and was followed by a coniferous-deciduous forest that lasted until about 6,500 years ago. Then grass began to dominate.

For the past 5,000 years, the soils of Lee County appear to have been influenced by two main kinds of vegetation, prairie grasses and trees. Big bluestem and little bluestem were the main prairie grasses. The main trees were deciduous, mainly oak, hickory, ash, elm, and maple.

Evidence shows that vegetation shifted in areas bordering the trees and grasses. The morphology of Armstrong, Belinda, Downs, Tuskeego, Gara, Givin, Lineville, Rinda, and Pershing soils reflects the influence of both trees and grasses. The Ashgrove, Keswick, Lindley, and Weller soils formed under the influence of trees (*8*). Grasses influenced the formation of Grundy, Haig, Arispe, Edina, Mahaska, Clarinda, Colo, Dickinson, Lawler, Lawson, Wabash, Sparta, and Vesser soils.

Soils that formed under trees are lighter colored, are more acid, and have a thinner surface layer than soils that formed under grasses. The soils in the county that formed under shifting vegetation or mixed grasses and trees have properties that are intermediate between the properties of soils that formed under grasses and those of soils that formed under trees.

Relief

Relief is an important cause of differences between soils. It indirectly influences soil formation through its effect on drainage. In Lee County, soils range from level to steep. In many bottom lands the nearly level soils are frequently flooded and have a permanently or periodically high water table. In depressions, water soaks into the nearly level soils that are subject to flooding. Much of the rainfall runs off the steep soils.

Level soils are on the broad upland flats and on the stream bottoms. The steepest soils in the county are generally on the southern and western sides of the major streams and their tributaries. The intricate pattern of upland drainageways indicates that in nearly all of the county the landscape has been modified by geological processes.

Generally, the soils in Lee County that formed where the water table is high have a subsoil that is dominantly grayish. Examples are Haig, Chequest, Edina, Wabash, and Vesser soils. Grundy, Arispe, Pershing, Givin, and similar soils formed where the water table fluctuated and was periodically high. Gara, Lindley, and other soils formed where the water table was below the subsoil, and their subsoil is yellowish brown. Colo, Haig, Wabash, and Vesser and soils that developed under prairie grasses and that have a high water table contain more organic matter in the surface layer than well drained soils that formed under prairie grasses. Clay accumulates in the subsoil of soils such as Edina, which are slightly depressional or nearly level, because a large amount of water enters the soils and carries clay particles downward. Edina soils are commonly called claypan soils because of their very slowly permeable subsoil where the greatest amount of clay accumulates.

A comparison of Grundy and Arispe soils illustrates an effect of relief on the soils. From the stable to the unstable slopes, there is an increase in content of clay in the A horizon and a decrease in thickness of the A1 horizon. In the unstable landscape, where the Arispe soils are, the zone of maximum clay accumulation is at a shallow depth. The Grundy soils on the most stable landscape have some grainy coats in the lower part of the A horizon and the upper part of the B horizon, and they have more dark clay films in the B2 horizon. This indicates that more soil development has taken place on the more stable parts of the landscape.

In Lindley, and similar soils that have many degrees and kinds of slopes, depth to carbonate is shallowest where slopes are steepest, are convex, or are most unstable.

Time

The length of time required for a soil to form affects the kind of soil that forms. An old or strongly developed soil shows well-defined genetic horizons. A less developed soil shows no horizons, or only weakly defined

ones. Most soils on the flood plains are weakly developed because they have not been in place long enough for distinct horizons to form. Radioactive carbon dates of a red elm log found beneath 10 feet of alluvium in southern Iowa indicate the alluvial soils in this area are less than 1,830 years old, plus or minus a hundred years (*11*).

On steeper soils, material is generally removed before there has been time to develop a thick profile that has strong horizons. Even though the material has been in place a long time, the soil may still be immature because much of the water runs off the slopes rather than through the soil material. Evidence indicates that Gara and Lindley soils formed on recently dissected slopes of the late Wisconsin age (*9,10*). This would mean that these soils are no more than 11,000 to 14,000 years old and probably are much younger.

According to Ruhe and Scholtes (*10,12*) Ashgrove, Armstrong, Keswick, Lineville, Clarinda, Rinda, and Galland are among the oldest soils in the county. Ashgrove, Clarinda, and Rinda soils formed in Kansan glacial till during the Yarmouth-Sangamon period. Armstrong, Keswick, Lineville, and Galland soils formed from materials deposited during the late Sangamon interglacial stage. These materials are much older than the loessial parent material of Arispe, Beckwith, Belinda, Edina, Givin, Clinton, Mahaska, Pershing, Rushville, and Weller soils. These soils are no more than 14,000 to 16,000 years old, and they may be considerably younger (*10*).

In Lee County, the loess is thickest in the nearly level soils on stable upland divides, where it is underlain by a Yarmouth-Sangamon paleosol that is on the Kansan till surface. The Kansan till surface is about 8 feet below the present land surface. In many places below the stable uplands, there is an organic layer at the base of the loess. Ruhe and others recently studied the loess and organic matter below the solum of the Edina and Haig soils in Wayne County, Iowa, and obtained radioactive carbon ages of 19,000 to 20,000 years.

Man's influence on the soil

Important changes take place in the soil when it is cultivated. Some of these changes have little effect on productivity; others have drastic effect.

Changes caused by water erosion generally are the most apparent. On many of the cultivated soils in the county, particularly the gently rolling to hilly ones, part or all of the original surface layer has been lost through sheet erosion. In some places shallow to deep gullies have formed.

In many continuously cultivated fields, the granular structure that was apparent when the grassland was undisturbed is no longer present. In these fields the surface tends to bake 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 undisturbed areas.

Man has done much to increase productivity of the soils and to reclaim areas not suitable for crops. He has made large areas of bottom land suitable for cultivation by digging drainage ditches and constructing diversions at the foot of slopes. Broad flats of Edina and Haig soils have been greatly improved for cultivation by installing drainage systems. The application of commercial fertilizers has counteracted deficiencies in plant nutrients and has made some soils more productive than they were in their natural state.

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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. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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 base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the 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 a 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 frequent flooding.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

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

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

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

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

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.

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 (or contour farming). 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 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects 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 for 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, as for example in "hillpeats" and "climatic moors."

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

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 running 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 a bare surface.

Erosion pavement. A layer of gravel or stones that remains on the ground surface after fine particles are removed by wind or water. Desert pavements result from wind erosion in arid areas.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Favorable. Favorable soil features for the specified use.

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 (heavy textured) soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. 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 an average of once or less in 2 years; and *frequent* that it occurs on an average of 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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Frost action. Freezing and thawing of soil moisture. Frost action can damage 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 assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

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

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

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

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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

Light textured soil. Sand and loamy sand.

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

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

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

Low strength. Inadequate strength for supporting loads.

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

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

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

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

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.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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

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

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

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

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

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

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

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

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

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

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground 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. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in a landscape where limestone has been locally dissolved.

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.

Slow intake. The slow movement of water into the soil.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Soil. A natural, three-dimensional body at the earth's surface that 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: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stone line. A concentration of coarse fragments in soils that generally marks an old weathering surface. In a cross section, the line may be one fragment or more thick. The line generally overlies material that weathered in place and marks the top of a paleosol. It is ordinarily overlain by recent sediment of variable thickness.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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 or management.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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, silt loam, 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. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

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

Unstable fill. Risk of caving or sloughing in banks of fill material.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading sediments onto the lowland as a series of adjacent alluvial fans.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.
Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.
Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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

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

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

ILLUSTRATIONS

Figure 1.—Haig silt loam on broad upland flats in the Grundy-Haig-Arispe association.

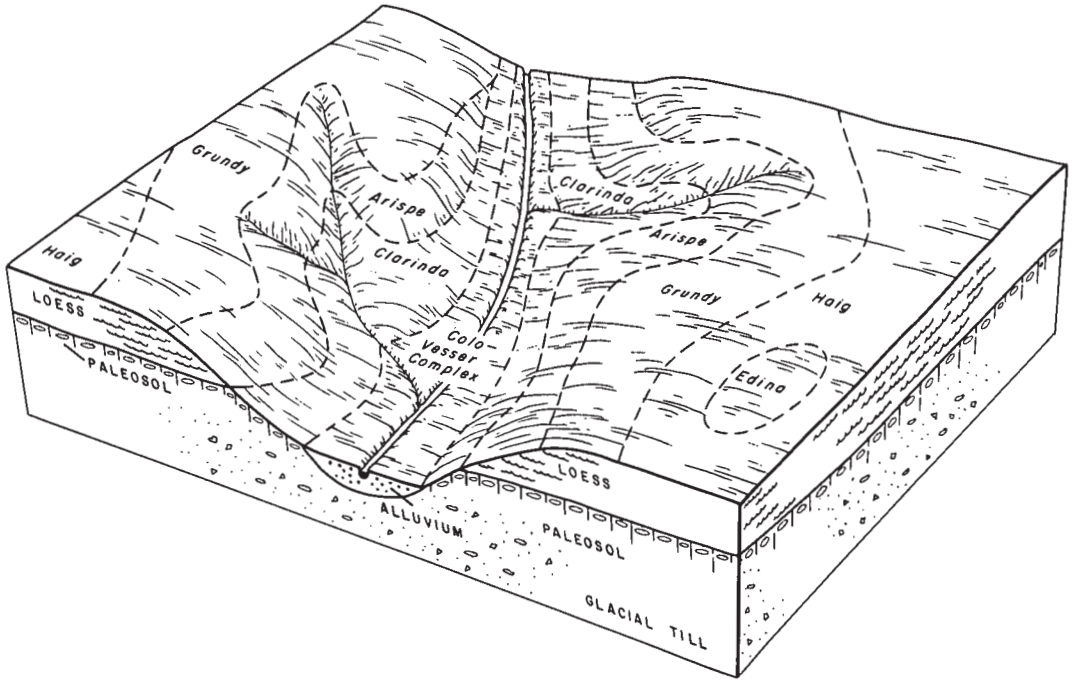

Figure 2.—Typical pattern of soils and parent materials in the Grundy-Haig-Arispe association.

Figure 3.—Landscape on the Pershing-Weller association.

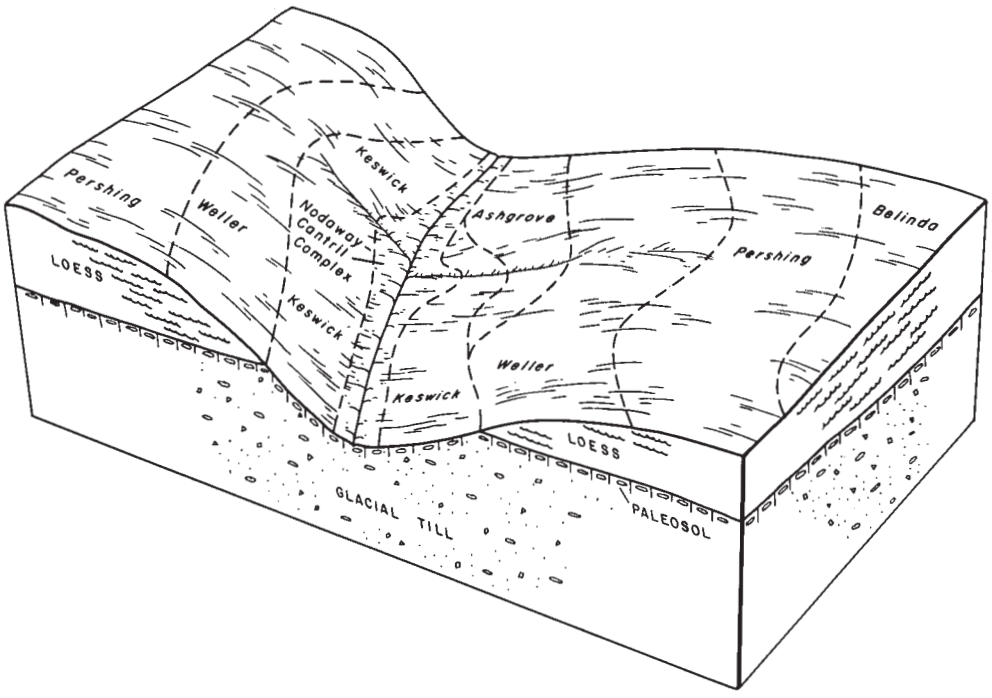

Figure 4.—Typical pattern of soils and parent materials in the Pershing-Weller association.

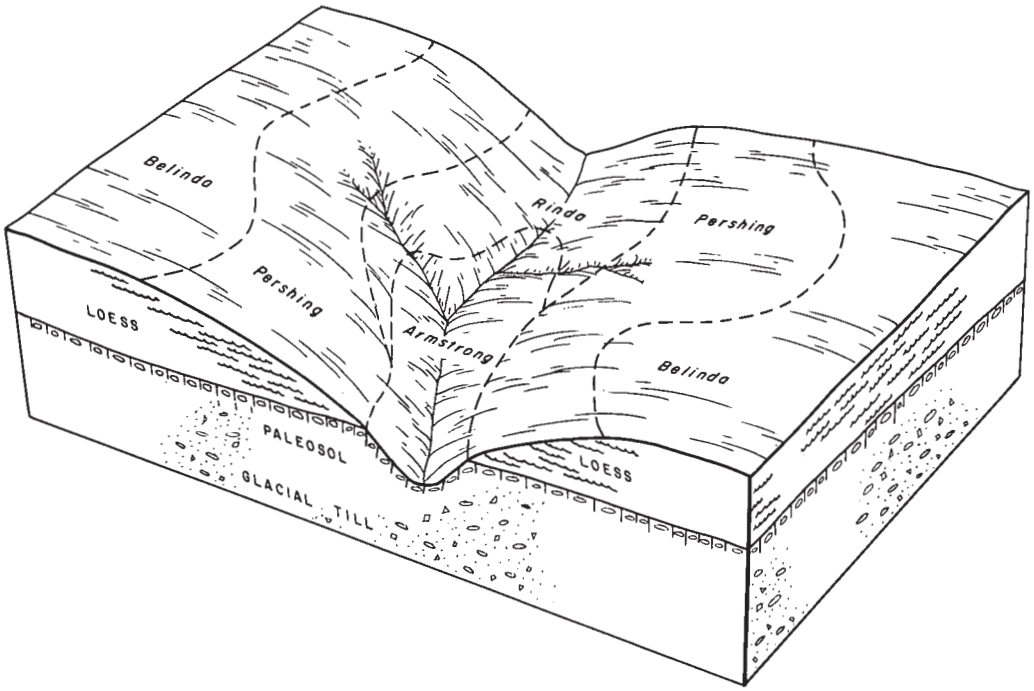

Figure 5.—Typical pattern of soils and parent materials in the Pershing-Belinda association.

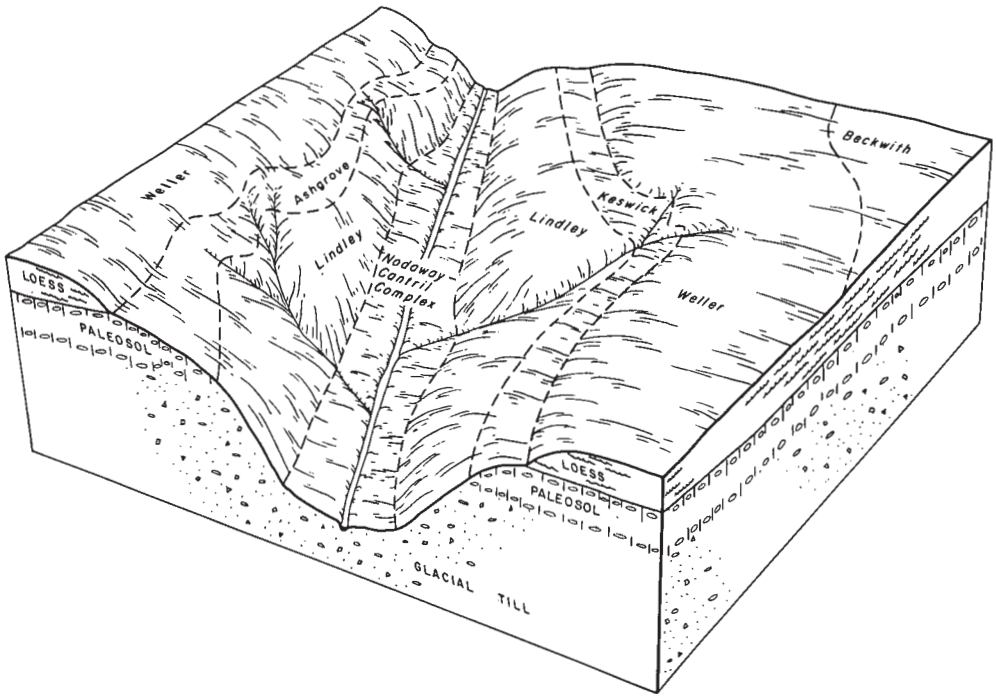

Figure 6.—Typical pattern of soils and parent materials in the Lindley-Weller association.

Figure 7.—Landscape on the Lindley-Weller association.

Figure 8.—Landscape on the Douds-Clinton-Keomah association. Alluvial soils are on benches in background.

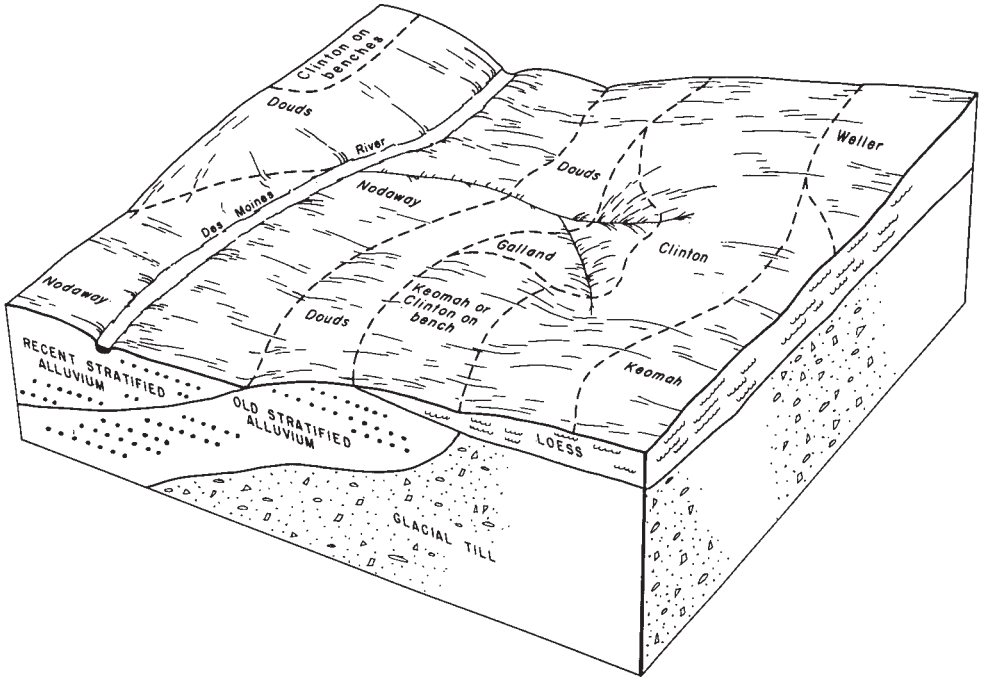

Figure 9.—Typical pattern of soils and parent materials in the Douds-Clinton-Keomah association.

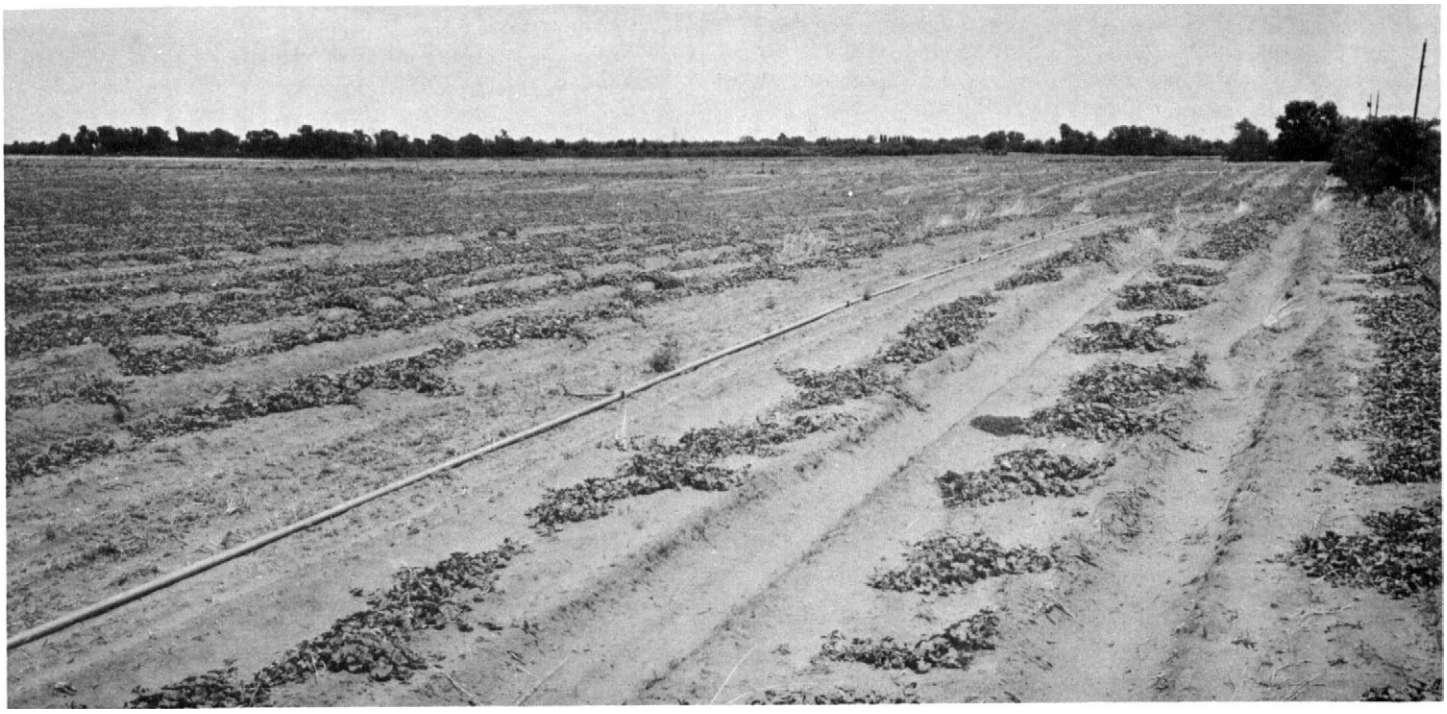

Figure 10.—Melons on Sparta loamy sand.

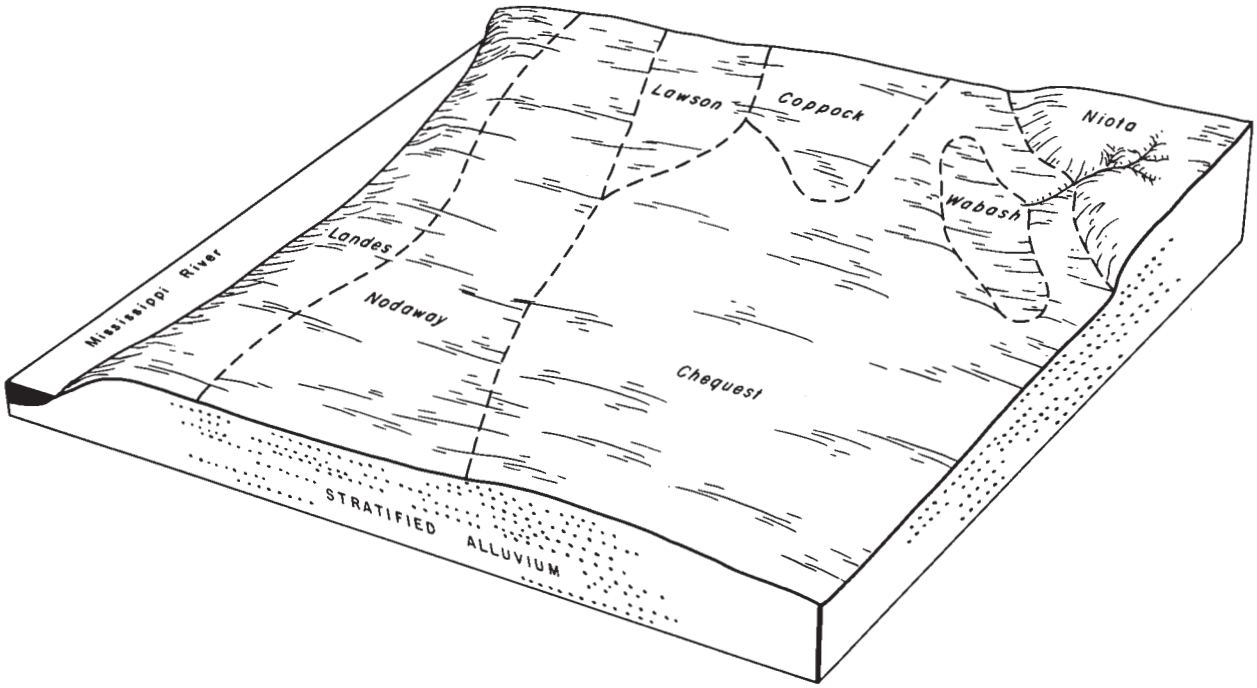

Figure 11.—Typical pattern of soils and parent materials in Chequest-Nodaway-Landes association.

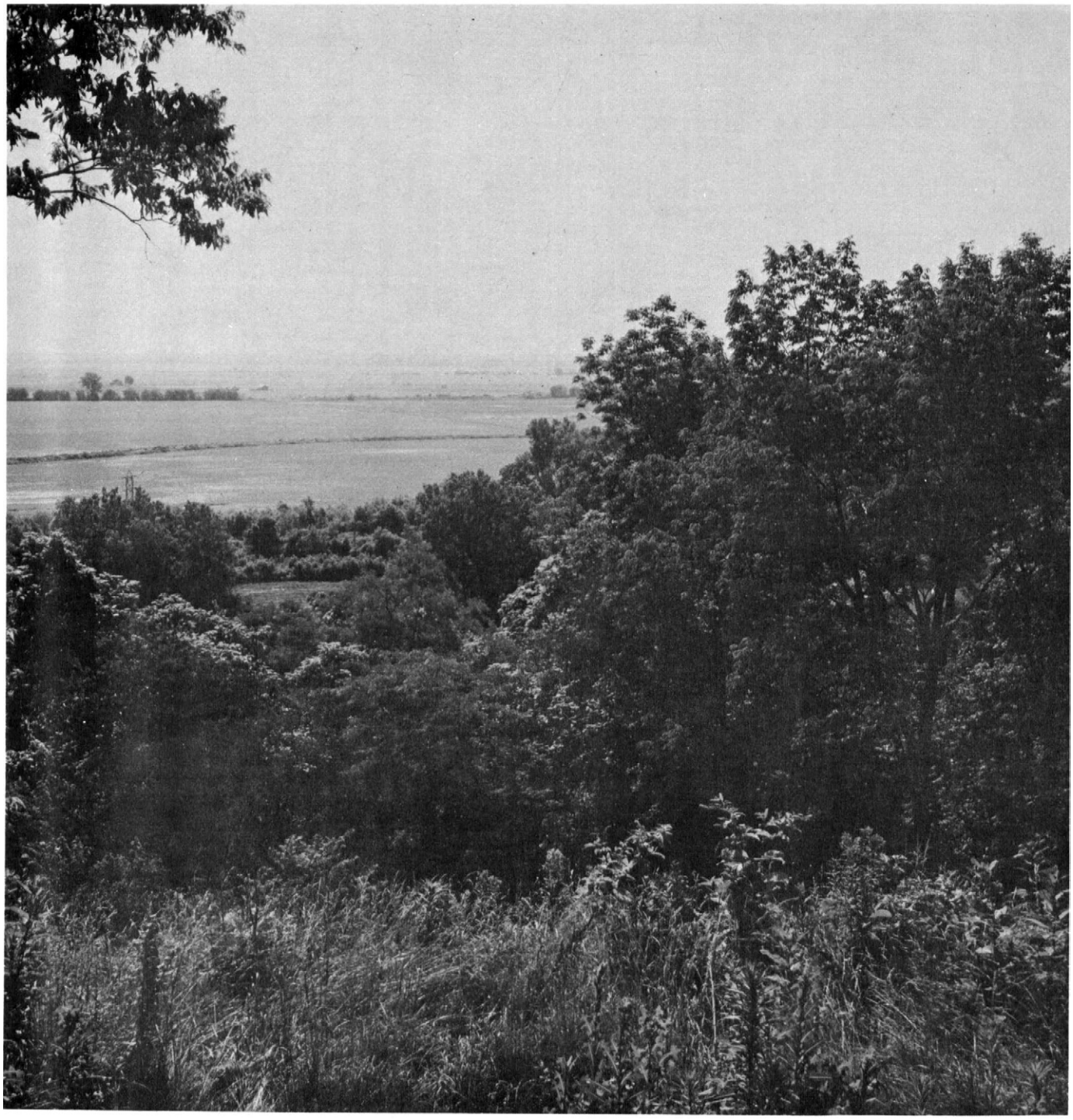

Figure 12.—Steep Lindley soils are used for woodland and wildlife habitat.

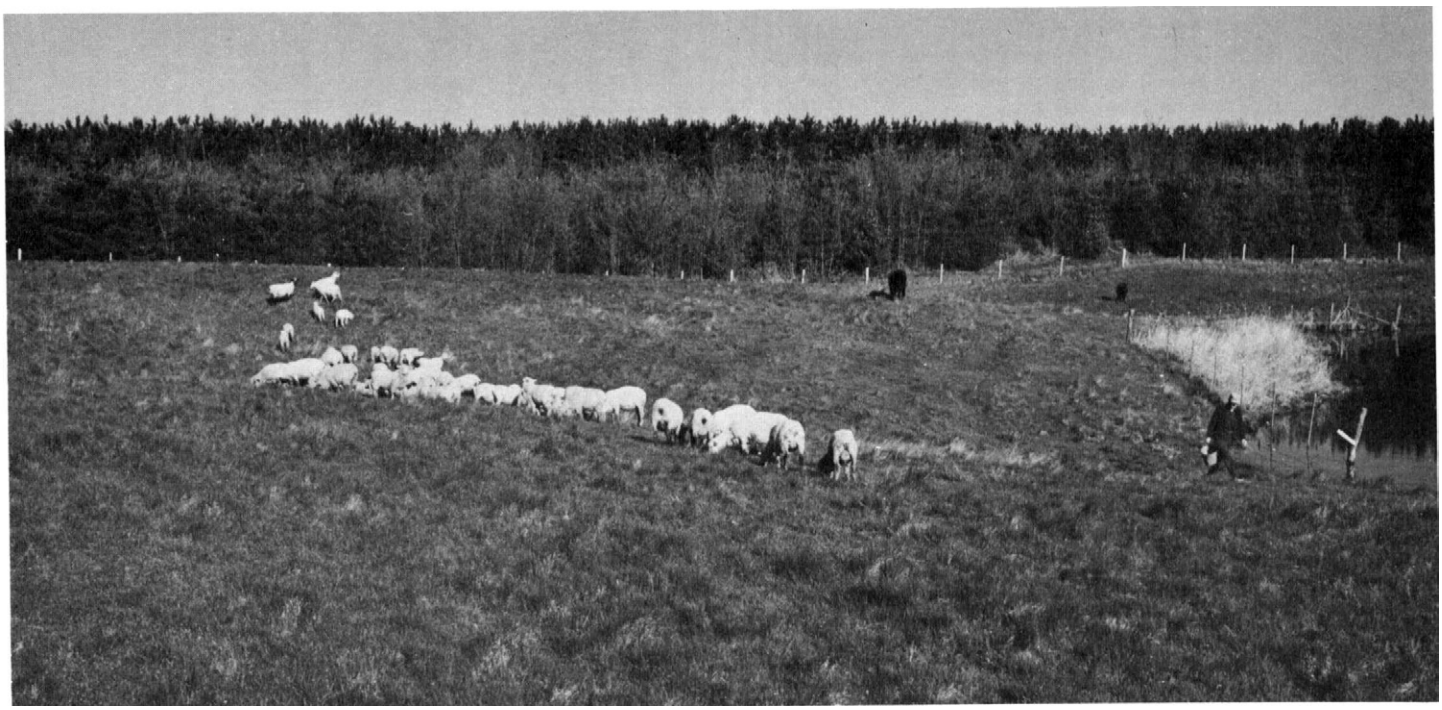

Figure 13.—Pasture and woodland plantings on Pershing silt loam, 2 to 5 percent slopes.

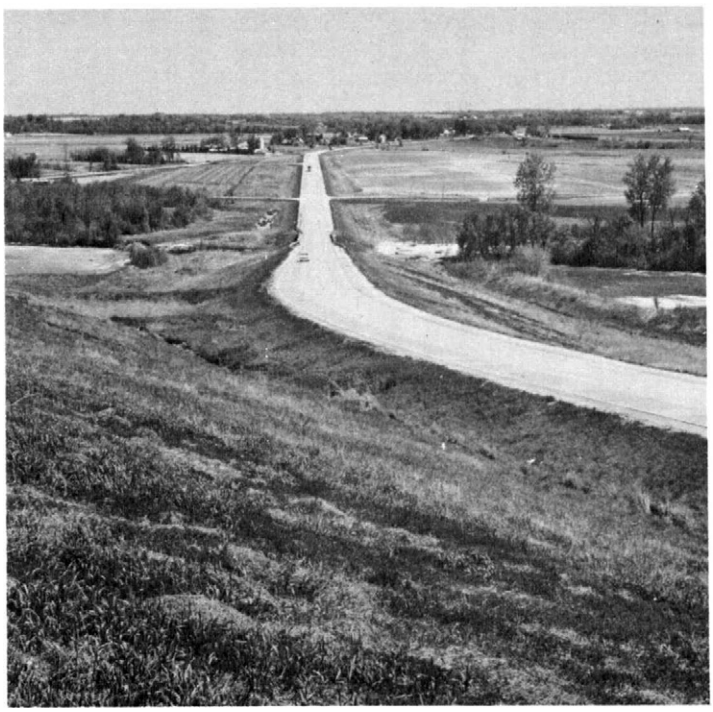

Figure 14.—Landes soils are along the stream channels in background.

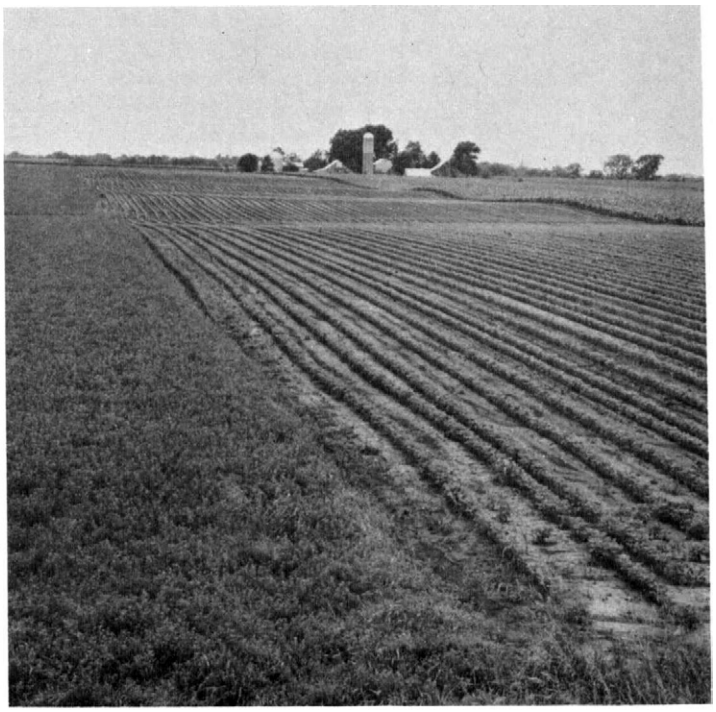

Figure 15.—A stripcropped area of Grundy silt loam, 2 to 5 percent slopes.

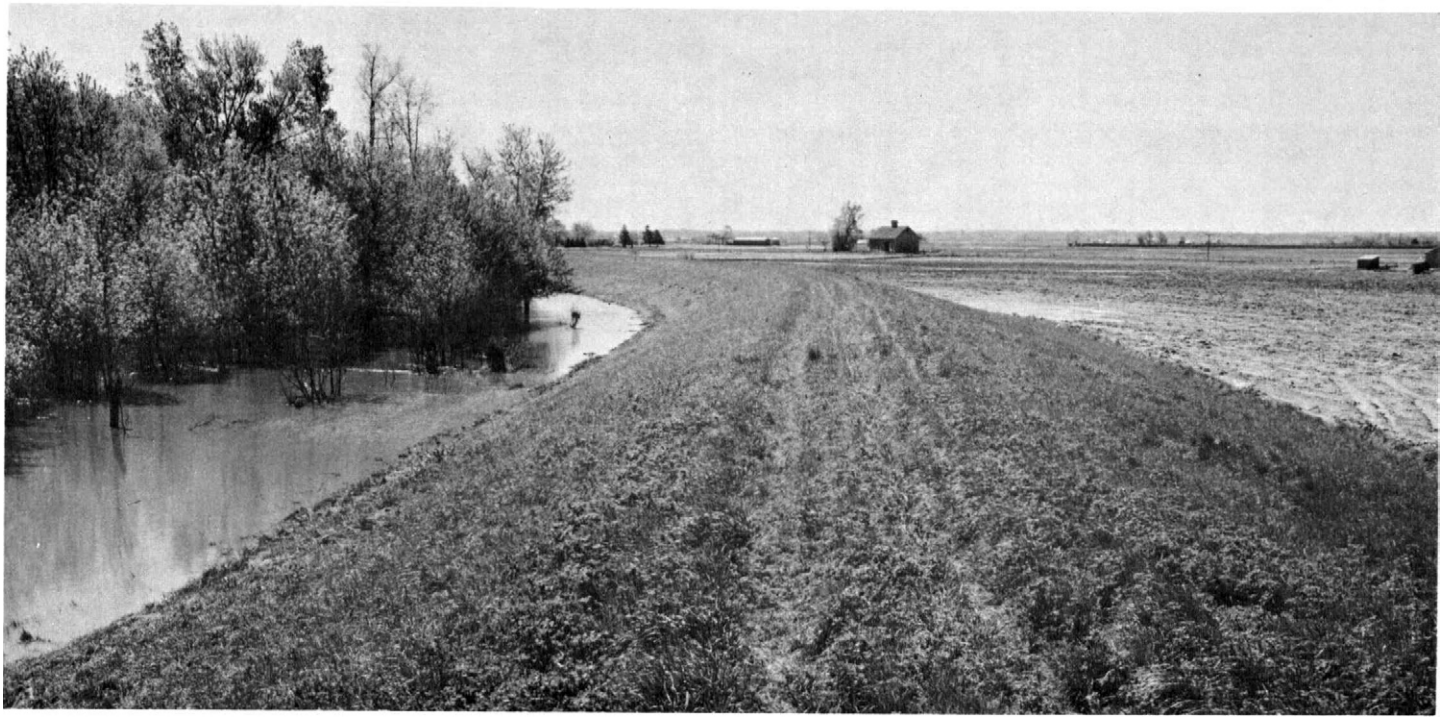

Figure 16.—Lawson soils protected from flooding by dikes.

Figure 17.—Pasture reduces erosion on Pershing soils.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded at Burlington]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Average highest	Average lowest	Average	1 year in 10 will have--		Number of days with 1 inch or more snow	Average depth of snow on days with snow cover
						Less than--	More than--		
	°F	°F	°F	°F	In	In	In		In
January---	33	16	54	-10	1.6	0.4	3.1	15	3
February--	37	19	56	-3	1.4	0.3	2.3	10	3
March-----	47	28	73	8	2.7	1.1	5.2	5	5
April-----	61	40	82	25	3.4	1.2	7.0	*	3
May-------	73	51	88	36	4.0	1.6	5.4	0	0
June------	83	62	94	47	5.0	2.4	8.4	0	0
July------	88	66	97	53	3.4	1.4	7.2	0	0
August----	85	64	96	51	3.6	1.0	7.3	0	0
September-	77	55	91	38	3.2	1.3	6.2	0	0
October---	67	44	84	28	2.7	0.5	5.5	0	0
November--	49	30	71	12	1.9	0.4	3.5	1	1
December--	37	20	59	-2	1.6	0.5	3.1	8	3
Year---	61	41	98	-12	34.6	25.9	41.8	39	3

* Less than 0.5 day.

TABLE 2.--PROBABILITIES OF LAST FREEZING TEMPERATURES IN SPRING AND FIRST IN FALL

[Recorded at Keokuk Lock-Dam]

Probability	Date for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than--	Mar. 23	Mar. 30	Apr. 8	Apr. 19	Apr. 29
2 years in 10 later than--	Mar. 17	Mar. 24	Apr. 3	Apr. 14	Apr. 24
5 years in 10 later than--	Mar. 7	Mar. 13	Mar. 23	Apr. 4	Apr. 14
Fall:					
1 year in 10 earlier than-	Nov. 14	Nov. 9	Oct. 26	Oct. 21	Oct. 14
2 years in 10 earlier than-	Nov. 19	Nov. 14	Nov. 1	Oct. 26	Oct. 19
5 years in 10 earlier than-	Nov. 30	Nov. 25	Nov. 12	Nov. 6	Oct. 29

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
13B	Colo-Vesser complex, 2 to 5 percent slopes	3,685	1.1
23C	Arispe silty clay loam, 5 to 9 percent slopes	2,700	0.8
23C2	Arispe silty clay loam, 5 to 9 percent slopes, moderately eroded	4,480	1.3
41	Sparta loamy sand, 0 to 2 percent slopes	1,675	0.5
41B	Sparta loamy sand, 2 to 7 percent slopes	1,034	0.3
51	Vesser silt loam, 0 to 2 percent slopes	1,087	0.3
56	Cantril loam, 0 to 2 percent slopes	1,840	0.6
56B	Cantril loam, 2 to 5 percent slopes	2,091	0.6
57	Rushville silt loam, 0 to 2 percent slopes	280	0.1
58D2	Douds loam, 9 to 14 percent slopes, moderately eroded	1,158	0.3
58E2	Douds loam, 14 to 18 percent slopes, moderately eroded	3,203	1.0
63	Chelsea loamy fine sand, 0 to 2 percent slopes	555	0.2
63B	Chelsea loamy fine sand, 2 to 7 percent slopes	381	0.1
65E2	Lindley loam, 14 to 18 percent slopes, moderately eroded	8,844	2.6
65E3	Lindley soils, 14 to 18 percent slopes, severely eroded	634	0.2
65F2	Lindley loam, 18 to 25 percent slopes, moderately eroded	22,107	6.6
65G	Lindley loam, 25 to 40 percent slopes	8,329	2.5
75	Givin silt loam, 1 to 3 percent slopes	1,742	0.5
80B	Clinton silt loam, 2 to 5 percent slopes	2,970	0.9
80C2	Clinton silt loam, 5 to 9 percent slopes, moderately eroded	7,396	2.2
80D2	Clinton silt loam, 9 to 14 percent slopes, moderately eroded	674	0.2
81B	Clinton silt loam, bedrock substratum, 2 to 6 percent slopes	240	0.1
81C2	Clinton silt loam, bedrock substratum, 5 to 9 percent slopes, moderately eroded	200	0.1
115D	Chelsea soils, 9 to 18 percent slopes	974	0.3
130	Belinda silt loam, 0 to 2 percent slopes	6,755	2.0
131B	Pershing silt loam, 2 to 5 percent slopes	15,431	4.6
131C2	Pershing silt loam, 5 to 9 percent slopes, moderately eroded	10,879	3.3
132B	Weller silt loam, 2 to 5 percent slopes	12,220	3.7
132C2	Weller silt loam, 5 to 9 percent slopes, moderately eroded	21,234	6.4
132D2	Weller silt loam, 9 to 14 percent slopes, moderately eroded	200	0.1
133	Colo silty clay loam, 0 to 2 percent slopes	1,463	0.4
140	Sparta loamy sand, thick surface, 0 to 2 percent slopes	2,971	0.9
152	Marshan clay loam, deep, 0 to 2 percent slopes	814	0.2
154G	Douds soils, 18 to 40 percent slopes	1,907	0.6
162B	Downs silt loam, 1 to 4 percent slopes	406	0.1
163B	Fayette silt loam, 2 to 5 percent slopes	652	0.2
163C2	Fayette silt loam, 5 to 9 percent slopes, moderately eroded	1,560	0.5
172	Wabash silty clay, 0 to 2 percent slopes	508	0.2
173	Hoopeston sandy loam, 0 to 2 percent slopes	508	0.2
175	Dickinson fine sandy loam, 0 to 2 percent slopes	1,626	0.5
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	494	0.1
177	Saude loam, 0 to 2 percent slopes	261	0.1
179C	Gara loam, 5 to 10 percent slopes	224	0.1
180	Keomah silt loam, 0 to 2 percent slopes	922	0.3
180B	Keomah silt loam, 2 to 5 percent slopes	1,508	0.5
208	Landes sandy loam, 0 to 2 percent slopes	5,124	1.5
211	Edina silt loam, 0 to 1 percent slopes	10,720	3.2
220	Nodaway silt loam, 0 to 2 percent slopes	2,877	0.9
222C	Clarinda silty clay loam, 5 to 9 percent slopes	1,376	0.4
222C2	Clarinda silty clay loam, 5 to 9 percent slopes, moderately eroded	1,977	0.6
223C	Rinda silt loam, 5 to 9 percent slopes	6,753	2.0
223D2	Rinda silt loam, 9 to 14 percent slopes, moderately eroded	984	0.3
226	Lawler loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,673	0.5
260	Beckwith silt loam, 0 to 2 percent slopes	2,588	0.8
263	Okaw silt loam, 0 to 3 percent slopes	816	0.2
291	Atterberry silt loam, 0 to 2 percent slopes	269	0.1
315	Alluvial land, loamy	1,629	0.5
354	Marsh	496	0.1
362	Haig silt loam, 0 to 2 percent slopes	18,844	5.6
363	Haig silty clay loam, 0 to 2 percent slopes	3,636	1.1
364	Grundy silt loam, 0 to 2 percent slopes	1,630	0.5
364B	Grundy silt loam, 2 to 5 percent slopes	22,060	6.6
380	Mahaska silt loam, 1 to 3 percent slopes	2,312	0.7
424D2	Lindley-Keswick complex, 9 to 14 percent slopes, moderately eroded	2,551	0.8
424D3	Lindley-Keswick complex, 9 to 14 percent slopes, severely eroded	370	0.1
425C2	Keswick loam, 5 to 9 percent slopes, moderately eroded	2,181	0.7
425D2	Keswick loam, 9 to 14 percent slopes, moderately eroded	9,718	2.9
425D3	Keswick soils, 9 to 14 percent slopes, severely eroded	693	0.2
452C2	Lineville silt loam, 5 to 9 percent slopes, moderately eroded	309	0.1
453	Tuskeego silt loam, 0 to 2 percent slopes	770	0.2
478G	Nordness-Rock outcrop complex, 25 to 40 percent slopes	1,926	0.6

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
484	Lawson silt loam, 0 to 2 percent slopes	1,878	0.6
485	Spillville loam, 0 to 2 percent slopes	442	0.1
499D2	Nordness silt loam, 9 to 18 percent slopes, moderately eroded	515	0.2
499F	Nordness silt loam, 18 to 30 percent slopes	694	0.2
520	Coppock silt loam, 0 to 2 percent slopes	1,348	0.4
587	Chequest silty clay loam, 0 to 2 percent slopes	6,448	1.9
594C2	Galland loam, 5 to 9 percent slopes, moderately eroded	414	0.1
594D2	Galland loam, 9 to 14 percent slopes, moderately eroded	1,781	0.5
594D3	Galland soils, 9 to 14 percent slopes, severely eroded	296	0.1
594E2	Galland loam, 14 to 18 percent slopes, moderately eroded	696	0.2
687	Watkins silt loam, 1 to 3 percent slopes	499	0.1
688	Koszta silt loam, 0 to 2 percent slopes	2,356	0.7
720	Racoon silt loam, 0 to 2 percent slopes	498	0.1
730B	Nodaway-Cantril complex, 2 to 5 percent slopes	10,058	3.0
763D2	Fayette-Exette silt loams, 9 to 15 percent slopes, moderately eroded	706	0.2
792C2	Armstrong loam, 5 to 9 percent slopes, moderately eroded	770	0.2
792D2	Armstrong loam, 9 to 14 percent slopes, moderately eroded	1,418	0.4
793	Bertrand silt loam, 0 to 2 percent slopes	301	0.1
793B	Bertrand silt loam, 2 to 5 percent slopes	741	0.2
793C2	Bertrand silt loam, 5 to 9 percent slopes, moderately eroded	553	0.2
795C2	Ashgrove silt loam, 5 to 9 percent slopes, moderately eroded	3,670	1.1
795C3	Ashgrove soils, 5 to 9 percent slopes, severely eroded	470	0.1
795D2	Ashgrove silt loam, 9 to 14 percent slopes, moderately eroded	8,826	2.6
795D3	Ashgrove soils, 9 to 14 percent slopes, severely eroded	454	0.1
820	Dockery silt loam, 0 to 2 percent slopes	960	0.3
832B	Weller silt loam, benches, 2 to 5 percent slopes	996	0.3
832C2	Weller silt loam, benches, 5 to 9 percent slopes, moderately eroded	581	0.2
880B	Clinton silt loam, benches, 2 to 5 percent slopes	595	0.2
880C2	Clinton silt loam, benches, 5 to 9 percent slopes, moderately eroded	2,163	0.6
950	Niota silty clay loam, 0 to 2 percent slopes	494	0.1
950B	Niota silty clay loam, 2 to 5 percent slopes	248	0.1
950D2	Niota silty clay loam, 7 to 14 percent slopes, moderately eroded	256	0.1
952	Denrock Variant silt loam, 0 to 2 percent slopes	468	0.1
977	Richwood silt loam, 0 to 2 percent slopes	1,783	0.5
978	Festina silt loam, 1 to 3 percent slopes	2,014	0.6
993D2	Armstrong-Gara loams, 9 to 14 percent slopes, moderately eroded	523	0.2
1057	Rushville silt loam, benches, 0 to 2 percent slopes	467	0.1
1130	Belinda silt loam, benches, 0 to 2 percent slopes	784	0.2
1131B	Pershing silt loam, benches, 2 to 5 percent slopes	788	0.2
1180	Keomah silt loam, benches, 0 to 2 percent slopes	897	0.3
1180B	Keomah silt loam, benches, 2 to 5 percent slopes	1,049	0.3
1181	Keomah silt loam, bedrock substratum, 1 to 3 percent slopes	350	0.1
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes	4,180	1.3
1260	Beckwith silt loam, benches, 0 to 2 percent slopes	248	0.1
1316	Alluvial land, frequently flooded	2,424	0.7
	Made land	693	0.2
	Quarries	148	0.1
	Borrow areas	35	0.1
	Total	334,080	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. The estimates were made in 1976. 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	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
13B---------- Colo	105	40	58	4.4	5.2.	4.0
23C---------- Arispe	102	39	56	4.3	6.3	3.8
23C2---------- Arispe	97	37	53	4.1	6.1	3.7
41---------- Sparta	63	24	35	2.6	3.0	2.0
41B---------- Sparta	61	23	34	2.6	3.0	2.0
51---------- Vesser	95	36	52	4.0	5.0	3.7
56---------- Cantril	96	37	54	4.1	5.3	3.5
56B---------- Cantril	90	35	50	4.0	5.0	3.3
57---------- Rushville	88	33	48	3.7	5.0	3.8
58D2---------- Douds	65	25	36	2.7	2.7	1.9
58E2---------- Douds	---	---	20	1.5	3.0	1.5
63---------- Chelsea	59	22	32	2.0	3.3	2.0
63B---------- Chelsea	57	21	30	2.0	3.3	2.0
65E2---------- Lindley	---	---	---	1.5	3.0	2.0
65E3---------- Lindley	---	---	---	1.0	2.0	1.7
65F2, 65G---------- Lindley	---	---	---	1.0	2.0	1.7
75---------- Givin	108	41	60	4.8	8.1	4.2
80B---------- Clinton	101	38	56	4.2	6.4	4.0
80C2---------- Clinton	93	35	51	3.9	6.0	3.6
80D2---------- Clinton	84	32	46	3.5	5.3	3.5
81B---------- Clinton	101	38	56	4.2	6.4	4.0

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
81C2---------- Clinton	93	35	51	3.9	6.0	3.6
115D---------- Chelsea	---	---	24	1.5	2.5	1.5
130---------- Belinda	87	33	48	3.7	6.2	3.7
131B---------- Pershing	101	38	56	4.2	7.0	3.8
131C2---------- Pershing	91	35	50	3.8	6.4	3.4
132B---------- Weller	95	36	52	4.0	6.7	3.8
132C2---------- Weller	85	32	46	3.2	5.3	3.5
132D2---------- Weller	76	29	42	2.8	4.7	2.7
133---------- Colo	104	40	57	4.2	5.5	4.2
140---------- Sparta	63	24	47	2.6	3.2	2.0
152---------- Marshan	101	38	56	4.0	5.0	4.1
154G---------- Douds	---	---	---	1.3	2.4	1.3
162B---------- Downs	119	45	65	5.0	4.8	4.1
163B---------- Fayette	113	43	62	4.7	6.6	4.0
163C2---------- Fayette	105	40	56	4.4	6.5	3.8
172---------- Wabash	68	26	37	1.8	2.0	1.8
173---------- Hoopeston	90	36	50	3.7	5.2	3.0
175---------- Dickinson	78	30	43	3.0	5.0	2.7
175B---------- Dickinson	76	29	42	3.0	4.8	2.7
177---------- Saude	78	30	43	3.3	4.6	3.0
179C---------- Gara	87	33	48	3.7	5.1	3.3
180---------- Keomah	103	39	57	4.3	6.0	3.3
180B---------- Keomah	101	38	56	4.2	5.8	3.1

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
208---------- Landes	76	29	40	3.4	4.5	2.5
211---------- Edina	90	34	50	3.6	5.0	3.2
220---------- Nodaway	114	43	63	4.8	5.5	4.0
222C---------- Clarinda	70	27	38	2.7	3.7	2.0
222C2---------- Clarinda	60	23	33	2.3	3.3	1.9
223C---------- Rinda	49	20	28	2.2	3.7	2.0
223D2---------- Rinda	40	16	22	1.7	2.8	1.7
226---------- Lawler	100	38	65	4.2	5.8	3.3
260---------- Beckwith	65	25	36	2.6	3.5	2.5
263---------- Okaw	70	27	42	2.9	3.4	3.0
291---------- Atterberry	112	43	62	4.7	6.6	3.9
315**. Alluvial land						
354**. Marsh						
362---------- Haig	105	40	58	4.2	7.0	3.8
363---------- Haig	102	39	56	4.1	6.8	3.7
364---------- Grundy	109	42	60	4.6	7.5	4.0
364B---------- Grundy	107	41	59	4.4	7.3	3.9
380---------- Mahaska	119	45	65	5.0	8.3	4.2
424D2---------- Lindley	50	19	28	2.1	3.8	1.9
424D3---------- Lindley	---	---	---	1.9	2.5	1.5
425C2---------- Keswick	53	20	29	2.2	3.1	1.9
425D2---------- Keswick	44	17	24	1.8	2.7	1.3
425D3---------- Keswick	---	---	---	1.2	1.7	1.0

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
452C2---- Lineville	65	24	34	2.7	3.3	2.5
453---- Tuskeego	82	31	45	3.3	4.3	3.3
478G---- Nordness	---	---	---	---	---	---
484---- Lawson	122	46	67	5.1	7.3	4.2
485---- Spillville	110	42	60	4.6	6.0	3.5
499D2---- Nordness	---	---	20	1.2	---	1.0
499F---- Nordness	---	---	---	0.5	---	0.7
520---- Coppock	89	34	49	3.7	4.7	3.3
587---- Chequest	98	37	54	3.9	5.3	3.7
594C2---- Galland	54	17	30	2.3	4.0	2.5
594D2---- Galland	45	17	25	1.9	3.5	2.1
594D3---- Galland	---	---	20	1.5	3.0	2.0
594E2---- Galland	---	---	---	1.5	3.0	2.0
687---- Watkins	103	39	56	4.3	6.1	3.7
688---- Koszta	108	41	59	4.5	6.5	3.7
720---- Racoon	83	32	45	3.5	4.5	3.0
730B---- Nodaway	89	34	61	3.7	4.6	3.2
763D2---- Fayette	93	35	51	4.0	5.4	3.8
792C2---- Armstrong	59	22	37	2.5	3.1	2.1
792D2---- Armstrong	50	19	28	2.0	2.7	1.7
793---- Bertrand	100	38	55	4.2	5.8	2.9
793B---- Bertrand	98	37	54	4.1	5.6	2.7
793C2---- Bertrand	85	32	47	3.6	4.8	2.6

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
795C2--- Ashgrove	49	18	26	2.0	2.3	2.0
795C3--- Ashgrove	---	---	---	1.0	1.3	1.2
795D2--- Ashgrove	40	---	22	1.8	1.7	1.5
795D3--- Ashgrove	---	---	---	1.0	1.3	1.0
820--- Dockery	105	40	58	4.4	6.0	3.6
832B--- Weller	95	36	52	4.0	6.7	3.8
832C2--- Weller	85	32	46	3.2	5.3	3.5
880B--- Clinton	101	38	56	4.2	6.4	4.0
880C2--- Clinton	93	35	51	3.9	6.0	3.6
950--- Niota	62	24	34	2.5	3.2	2.8
950B--- Niota	60	23	33	2.4	3.0	2.8
950D2--- Niota	38	---	21	1.6	2.5	2.0
952--- Denrock	68	26	37	2.7	3.5	2.5
977--- Richwood	120	45	65	5.0	5.8	4.0
978--- Festina	114	43	62	4.8	5.6	3.6
993D2--- Armstrong	55	21	31	2.3	3.4	2.0
1057--- Rushville	88	33	48	3.7	5.0	3.8
1130--- Belinda	87	33	48	3.7	6.2	3.7
1131B--- Pershing	101	38	56	4.2	7.0	3.8
1180--- Keomah	103	39	57	4.3	6.0	3.3
1180B--- Keomah	101	38	56	4.2	5.8	3.1
1181--- Keomah	103	39	57	4.3	6.0	3.3

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Oats	Grass-legume hay	Smooth bromegrass	Kentucky bluegrass
	Bu	Bu	Bu	Ton	AUM*	AUM*
1220---------- Nodaway	---	---	---	3.0	5.5	4.0
1260---------- Beckwith	65	25	36	2.6	3.5	2.5
1316** Alluvial land						

* 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 a period of 30 days.

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

TABLE 5.--WOODLAND MANAGEMENT AND PRODUCTIVITY

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

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
41, 41B---------- Sparta	3s	Slight	Slight	Severe	Slight	Northern red oak----	70	Eastern white pine, red pine, jack pine.
						Red pine----------	---	
						Eastern white pine--	---	
						Jack pine----------	---	
56, 56B---------- Cantril	2o	Slight	Slight	Slight	Moderate	White oak----------	75	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
57---------- Rushville	---	--------	--------	--------	--------	----------	---	Pin oak, green ash, European larch.
63*, 63B*---------- Chelsea	4s	Slight	Slight	Moderate	Slight	White oak----------	55	Eastern white pine, Scotch pine, European larch, eastern redcedar, red pine, jack pine.
65E2, 65E3*-------- Lindley	5r	Moderate	Moderate	Moderate	Slight	Blackjack oak-------	50	White oak, green ash, yellow-poplar, post oak, blackjack oak, black oak.
						Black oak----------	---	
65F2, 65G---------- Lindley	4r	Moderate	Moderate	Slight	Slight	White oak----------	60	White oak, green ash, yellow-poplar, post oak, blackjack oak, black oak.
						Post oak----------	---	
						Blackjack oak-------	---	
						Black oak----------	---	
						White oak----------	---	
						Post oak----------	---	
80B, 80C2, 80D2---- Clinton	3o	Slight	Slight	Slight	Slight	White oak----------	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut.
						Northern red oak----	65	
81B, 81C2---------- Clinton	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple, poplar.
						Northern red oak----	65	
115D*---------- Chelsea	4s	Slight	Slight	Moderate	Slight	White oak----------	55	Eastern white pine, Scotch pine, European larch, eastern redcedar, red pine, jack pine.

See footnote at end of table.

TABLE 5.--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	Plant competition	Common trees	Site index	
130--Belinda	5w	Slight	Moderate	Moderate	Severe	White oak	45	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern white-cedar.
131B, 131C2--Pershing	4c	Slight	Slight	Slight	Slight	White oak	55	Eastern white pine, Scotch pine, Norway spruce, red pine, white spruce.
132B, 132C2, 132D2--Weller	4c	Slight	Slight	Slight	Slight	White oak	55	Eastern white pine, Scotch pine, Norway spruce, white spruce, red pine, European larch, black walnut, sugar maple.
140--Sparta	3s	Slight	Slight	Severe	Slight	Northern red oak Red pine Eastern white pine Jack pine	70 --- --- ---	Eastern white pine, red pine, jack pine.
154G*--Douds	4r	Moderate	Moderate	Slight	Slight	White oak	55	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
162B--Downs	3o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
163B, 163C2--Fayette	3o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
172--Wabash	4w	Slight	Severe	Severe	Severe	Pin oak	75	Pin oak, pecan, eastern cottonwood.
173--Hoopeston	---	---	---	---	---	---	---	Eastern cottonwood, pin oak, American sycamore, red maple, green ash, eastern white pine, red pine, jack pine.

See footnote at end of table.

TABLE 5.--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	Plant competition	Common trees	Site index	
175, 175B---------- Dickinson	---	---	---	---	---	---	---	Eastern white pine, red pine, jack pine.
179C---------- Gara	4o	Slight	Slight	Slight	Slight	White oak----------	55	Eastern white pine, red pine, Norway spruce, Scotch pine.
						Northern red oak----	55	
180, 180B---------- Keomah	3o	Slight	Slight	Slight	Slight	White oak----------	65	Eastern white pine, Scotch pine, red pine, Norway spruce, European larch, white spruce, black walnut.
208---------- Landes	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood--	105	Eastern cottonwood, yellow-poplar, American sycamore, sweetgum, green ash, black walnut, eastern white pine, sugar maple.
						Yellow-poplar-------	95	
						American sycamore---	---	
						Sweetgum------------	---	
						Green ash----------	---	
220---------- Nodaway	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
223C, 223D2-------- Rinda	5w	Slight	Severe	Moderate	Severe	White oak----------	45	Silver maple, American sycamore, green ash, common hackberry, eastern redcedar, white spruce, Norway spruce.
						Northern red oak----	45	
260---------- Beckwith	5w	Slight	Moderate	Moderate	Severe	White oak----------	45	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern white-cedar.
263---------- Okaw	4w	Slight	Moderate	Moderate	Severe	Pin oak----------	70	Pin oak, baldcypress, green ash, water tupelo, red maple, swamp white oak.
						Blackjack oak-------	60	
						Black oak----------	55	
291---------- Atterberry	3o	Slight	Slight	Slight	Slight	White oak----------	70	Eastern white pine, red pine, Scotch pine, eastern redcedar.
						Northern red oak----	70	
						Green ash----------	---	
						Bur oak----------	---	

See footnote at end of table.

TABLE 5.--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	Plant competition	Common trees	Site index	
364, 364B---------- Grundy	---	---	---	---	---	---	---	Eastern cottonwood, pin oak, silver maple, green ash.
424D2*:								
Lindley----------	5o	Slight	Slight	Slight	Slight	Blackjack oak-------	50	White oak, green ash, yellow-poplar, post oak, blackjack oak, black oak.
						Black oak----------	---	
Keswick----------	4c	Slight	Slight	Slight	Slight	White oak----------	55	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
						Northern red oak----	55	
424D3*:								
Lindley----------	4o	Slight	Slight	Slight	Slight	White oak----------	60	White oak, green ash, yellow-poplar, post oak, blackjack oak, black oak.
						Post oak----------	---	
						Blackjack oak-------	---	
						Black oak----------	---	
						White oak----------	---	
						Post oak----------	---	
Keswick----------	4c	Slight	Slight	Slight	Slight	White oak----------	55	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
						Northern red oak----	55	
425C2, 425D2, 425D3*---------- Keswick	4c	Slight	Slight	Slight	Slight	White oak----------	55	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
						Northern red oak----	55	
452C2---------- Lineville	4o	Slight	Slight	Slight	Slight	White oak----------	55	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
453---------- Tuskeego	3w	Slight	Severe	Moderate	Severe	Eastern cottonwood--	90	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern white-cedar.
						Silver maple--------	80	
478G*:								
Nordness----------	5d	Moderate	Moderate	Severe	Moderate	Northern red oak----	45	
						White oak----------	45	
Rock outcrop.								

See footnote at end of table

TABLE 5.--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	Plant competition	Common trees	Site index	
484---------- Lawson	4o	Slight	Slight	Slight	Slight	Silver maple-------- White ash---------- American elm--------	70 --- ---	White spruce, silver maple, white ash.
499D2, 499F-------- Nordness	5d	Moderate	Moderate	Severe	Moderate	Northern red oak---- White oak----------	45 45	
520---------- Coppock	3o	Slight	Slight	Slight	Slight	White oak----------	65	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
587---------- Chequest	3w	Slight	Severe	Moderate	Severe	Eastern cottonwood-- Silver maple--------	90 80	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern white-cedar.
594C2, 594D2, 594D3*, 594E2----- Galland	3o	Slight	Slight	Slight	Moderate	White oak---------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
688---------- Koszta	3w	Slight	Moderate	Slight	Moderate	White oak---------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.
720---------- Racoon	3w	Slight	Moderate	Moderate	Severe	Pin oak---------- Post oak---------- Green ash---------- White oak----------	80 80 --- ---	Baldcypress, pin oak, water tupelo, red maple.
730B*: Nodaway----------	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
Cantril----------	2o	Slight	Slight	Slight	Moderate	White oak----------	75	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, white spruce, sugar maple.

See footnote at end of table.

TABLE 5.--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	Plant competition	Common trees	Site index	
763D2*: Fayette	3o	Slight	Slight	Slight	Moderate	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
Exette	2o	Slight	Slight	Slight	Moderate	White oak Northern red oak Black walnut Green ash Sugar maple American basswood Black cherry	80 80 --- --- --- --- ---	Eastern white pine, red pine, Norway spruce, Scotch pine, European larch, eastern redcedar, black walnut, green ash.
792C2, 792D2---- Armstrong	4c	Slight	Slight	Slight	Slight	White oak Northern red oak	55 55	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple, poplar.
793, 793B, 793C2--- Bertrand	3o	Slight	Slight	Slight	Moderate	Northern red oak White ash White oak Bur oak Black walnut	70 --- --- --- ---	Red pine, eastern white pine, white spruce, black walnut.
795C2, 795C3*, 795D2, 795D3*---- Ashgrove	3w	Slight	Severe	Moderate	Severe	Eastern cottonwood Silver maple	90 80	Silver maple, American sycamore, green ash, common hackberry, eastern redcedar, white spruce, Norway spruce.
820---------- Dockery	3w	Slight	Moderate	Slight	Moderate	Pin oak	76	Pin oak, pecan, eastern cottonwood.
832B, 832C2---- Weller	4c	Slight	Slight	Slight	Slight	White oak	55	Eastern white pine, Scotch pine, Norway spruce, white spruce, red pine, European larch, black walnut, sugar maple.
880B, 880C2---- Clinton	3o	Slight	Slight	Slight	Slight	White oak Northern red oak	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut.

See footnote at end of table.

TABLE 5.--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	Plant competition	Common trees	Site index	
950, 950B, 950D2--- Niota	3w	Slight	Severe	Moderate	Severe	White oak---------- Pin oak---------- Green ash---------- Yellow-poplar--------	65 80 --- 80	Pin oak, red maple, green ash.
952---------- Denrock	---	--------	--------	--------	--------	----------	---	Eastern cottonwood, pin oak, American sycamore, red maple, green ash.
978---------- Festina	3o	Slight	Slight	Slight	Moderate	White oak---------- Northern red oak----	65 65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
993D2*: Armstrong----------	4c	Slight	Slight	Slight	Slight	White oak---------- Northern red oak----	55 55	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple, poplar.
Gara----------	4o	Slight	Slight	Slight	Slight	White oak---------- Northern red oak----	55 55	Eastern white pine, red pine, Norway spruce, Scotch pine.
1057---------- Rushville	---	--------	--------	--------	--------	----------	---	Pin oak, green ash, European larch.
1130---------- Belinda	5w	Slight	Moderate	Moderate	Severe	White oak----------	45	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern white-cedar.
1131B---------- Pershing	4c	Slight	Slight	Slight	Slight	White oak----------	55	Eastern white pine, Scotch pine, Norway spruce, red pine, white spruce.
1180, 1180B-------- Keomah	3o	Slight	Slight	Slight	Slight	White oak----------	65	Eastern white pine, Scotch pine, red pine, Norway spruce, European larch, white spruce, black walnut.

See footnote at end of table.

TABLE 5.--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	Plant competition	Common trees	Site index	
1181---------- Keomah	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Norway spruce, European larch, white spruce, black walnut, sugar maple.
1220---------- Nodaway	3o	Slight	Slight	Slight	Moderate	White oak----------	65	Eastern white pine, red pine, Norway spruce, Scotch pine, white spruce, European larch, black walnut, sugar maple.
1260---------- Beckwith	5w	Slight	Moderate	Moderate	Severe	White oak----------	45	Eastern cottonwood, silver maple, laurel willow, American sycamore, green ash, northern white-cedar.

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

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

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

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
13B*:					
Colo	Redosier dogwood, silky dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle, Zabel honeysuckle.	Laurel willow, Amur maple, northern white-cedar.	Green ash	Silver maple, eastern cottonwood.
Vesser	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash	Eastern cottonwood, silver maple.
23C, 23C2--- Arispe	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
41, 41B--- Sparta	American hazel, European privet.	Tamarisk, late lilac, forsythia, autumn-olive.	Austrian pine, tall purple willow.	Eastern white pine, red pine, jack pine.	---
51--- Vesser	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash	Eastern cottonwood, silver maple.
56, 56B--- Cantril	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
57--- Rushville	---	Amur maple, silky dogwood, flowering dogwood, American cranberrybush.	---	Pin oak, green ash, European larch.	---
58D2, 58E2--- Douds	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
63*, 63B*--- Chelsea	Russian peashrub, gray dogwood, Koster redcedar.	Eastern redcedar, Russian-olive, Siberian crabapple, nannyberry viburnum.	Common hackberry, eastern white pine, red pine.	---	---
65E2, 65E3*, 65F2, 65G--- Lindley	---	Flowering dogwood, eastern redbud, Amur honeysuckle, autumn-olive, rose-of-sharon, American cranberrybush.	Eastern redcedar, jack pine.	---	---

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
75---------- Givin	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
80B, 80C2, 80D2--- Clinton	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
81B, 81C2--------- Clinton	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Siberian dogwood, Tatarian honeysuckle.	Amur maple, eastern redcedar.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
115D*---------- Chelsea	Russian peashrub, gray dogwood, Koster redcedar.	Eastern redcedar, Russian-olive, Siberian crabapple, nannyberry viburnum.	Common hackberry, eastern white pine, red pine.	---	---
130---------- Belinda	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
131B, 131C2------- Pershing	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
132B, 132C2, 132D2---------- Weller	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
133---------- Colo	Redosier dogwood, silky dogwood.	Siberian dogwood, bloodtwig dogwood, Tatarian honeysuckle, Zabel honeysuckle.	Laurel willow, Amur maple, northern white-cedar.	Green ash---------	Silver maple, eastern cottonwood.
140---------- Sparta	American hazel, European privet.	Tamarisk, late lilac, forsythia, autumn-olive.	Austrian pine, tall purple willow.	Eastern white pine, red pine, jack pine.	---
152. Marshan					
154G*---------- Douds	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
162B---------- Downs	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
163B, 163C2------- Fayette	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
172---------- Wabash	Silky dogwood-----	Medium purple willow, Tatarian honeysuckle, Amur honeysuckle, redosier dogwood.	Oriental arborvitae, eastern redcedar, American basswood.	Green ash, pin oak, pussy willow.	Eastern cottonwood.
173---------- Hoopeston	Silky dogwood-----	Amur maple, autumn-olive, forsythia, tamarisk.	Russian-olive, northern white-cedar.	Norway spruce, eastern white pine, red pine.	---
175, 175B---------- Dickinson	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
177---------- Saude	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
179C---------- Gara	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
180, 180B---------- Keomah	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
208---------- Landes	Silky dogwood, mockorange.	Amur maple, autumn-olive, American cranberrybush, blackhaw, late lilac, Amur honeysuckle.	White spruce------	Red pine----------	Eastern white pine, Norway spruce.
211---------- Edina	---	Tatarian honeysuckle, Amur honeysuckle, redosier dogwood.	Pin oak, baldcypress, medium purple willow.	Eastern cottonwood, oriental arborvitae.	---
220---------- Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
222C, 222C2------- Clarinda	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
223C, 223D2------- Rinda	---	---	Eastern redcedar, white spruce.	Green ash, common hackberry, Norway spruce.	Silver maple.
226---------- Lawler	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
260---------- Beckwith	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
263---------- Okaw	Gray dogwood------	Oriental arborvitae, flowering dogwood, forsythia.	Amur maple--------	---	---
291---------- Atterberry	Gray dogwood, Vanhoutte spirea.	Autumn-olive------	Russian-olive-----	Norway spruce-----	Douglas-fir.
315*. Alluvial land					
354*. Marsh					
362, 363---------- Haig	Redosier dogwood, silky dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Zabel honeysuckle, Siberian dogwood.	Laurel willow, northern white-cedar, Amur maple.	Green ash---------	Eastern cottonwood, silver maple.
364, 364B--------- Grundy	---	Tatarian honeysuckle, Amur honeysuckle, redosier dogwood, autumn-olive.	Pin oak, medium purple willow, eastern redcedar.	Eastern cottonwood, oriental arborvitae, green ash, eastern white pine, Norway spruce.	---
380---------- Mahaska	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
424D2*, 424D3*: Lindley----------	---	Flowering dogwood, eastern redbud, Amur honeysuckle, autumn-olive, rose-of-sharon, American cranberrybush.	Eastern redcedar, jack pine.	---	---
Keswick----------	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
425C2, 425D2, 425D3*---------- Keswick	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
452C2---------- Lineville	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
453---------- Tuskeego	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
478G*: Nordness---------	Russian peashrub, Koster redcedar.	Eastern redcedar, northern bayberry.	Siberian peashrub	---	---
Rock outcrop.					
484---------- Lawson	---	Northern white-cedar, redosier dogwood, nannyberry viburnum.	Green ash, white spruce.	Eastern white pine, jack pine, silver maple.	---
485---------- Spillville	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
499D2, 499F------- Nordness	Russian peashrub, Koster redcedar.	Eastern redcedar, northern bayberry.	Siberian peashrub	---	---
520---------- Coppock	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
587---------- Chequest	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash---------	Eastern cottonwood, silver maple.
594C2, 594D2, 594D3*, 594E2---- Galland	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
687---------- Watkins	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
688---------- Koszta	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
720---------- Racoon	Gray dogwood------	Amur maple, flowering dogwood.	Oriental arborvitae.	Pin oak, water tupelo.	---
730B*: Nodaway----------	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
730B*: Cantril	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
763D2*: Fayette	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
Exette	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
792C2, 792D2 Armstrong	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
793, 793B, 793C2-- Bertrand	---	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
795C2, 795C3*, 795D2, 795D3* Ashgrove	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
820 Dockery	---	Tatarian honeysuckle, Amur honeysuckle, redosier dogwood, autumn-olive.	Medium purple willow.	Oriental arborvitae.	---
832B, 832C2 Weller	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
880B, 880C2 Clinton	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
950, 950B, 950D2-- Niota	Gray dogwood	---	Pin oak	Green ash	---
952 Denrock	---	Silky dogwood, Amur maple.	Pin oak	Green ash	Eastern cottonwood.
977 Richwood	---	Northern white-cedar, lilac, common ninebark, silky dogwood.	White spruce, Norway spruce.	Eastern white pine, red pine.	---
978 Festina	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood,

See footnote at end of table.

TABLE 6.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
993D2*: Armstrong	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
Gara	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
1057 Rushville	---	Amur maple, silky dogwood, flowering dogwood, American cranberrybush.	---	Pin oak, green ash, European larch.	---
1130 Belinda	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash	Eastern cottonwood, silver maple.
1131B Pershing	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
1180, 1180B Keomah	Redosier dogwood, gray dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Eastern cottonwood, silver maple.
1181 Keomah	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Eastern redcedar, Amur maple.	Red pine, Norway spruce, common hackberry.	Silver maple, eastern cottonwood.
1220 Nodaway	Redosier dogwood, gray dogwood.	Tatarian honeysuckle, bloodtwig dogwood, Siberian dogwood.	Amur maple, eastern redcedar.	Common hackberry, red pine, Norway spruce.	Eastern cottonwood, silver maple.
1260 Beckwith	Redosier dogwood, silky dogwood.	Bloodtwig dogwood, Tatarian honeysuckle, Siberian dogwood, Zabel honeysuckle.	Amur maple, northern white-cedar, laurel willow.	Green ash	Eastern cottonwood, silver maple.
1316*. Alluvial land					

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

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
13B*: Colo	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
Vesser	Severe: wetness, floods.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.
23C, 23C2 Arispe	Slight	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, frost action.
41 Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
41B Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
51 Vesser	Severe: wetness, floods.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.
56, 56B Cantril	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, low strength.
57 Rushville	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, low strength, frost action.
58D2 Douds	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: low strength.
58E2 Douds	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, low strength.
63* Chelsea	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
63B* Chelsea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
65E2, 65E3*, 65F2, 65G Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
75 Givin	Severe: wetness.	Moderate: wetness, shrink-swell, low strength.	Severe: wetness.	Moderate: wetness, shrink-swell, low strength.	Severe: frost action, low strength.
80B, 80C2 Clinton	Moderate: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
80D2--- Clinton	Moderate: too clayey, slope.	Severe: low strength.	Severe: low strength.	Severe: slope, low strength.	Severe: low strength.
81B, 81C2--- Clinton	Moderate: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
115D*--- Chelsea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
130--- Belinda	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
131B, 131C2--- Pershing	Moderate: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, frost action.
132B, 132C2--- Weller	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, frost action, low strength.
132D2--- Weller	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, frost action, low strength.
133--- Colo	Severe: wetness, floods.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, low strength, wetness.
140--- Sparta	Severe: cutbanks cave.	Slight---	Slight---	Slight---	Slight.
152--- Marshan	Severe: wetness, cutbanks cave, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.
154G*--- Douds	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, low strength.
162B--- Downs	Slight---	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
163B--- Fayette	Slight---	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
163C2--- Fayette	Slight---	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
172--- Wabash	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
173--- Hoopeston	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
175, 175B--------- Dickinson	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.
177---------- Saude	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: low strength.
179C---------- Gara	Slight----------	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
180, 180B--------- Keomah	Moderate: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, frost action, low strength.
208---------- Landes	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
211---------- Edina	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
220---------- Nodaway	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
222C, 222C2------- Clarinda	Severe: wetness.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.
223C---------- Rinda	Severe: wetness.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell.	Severe: wetness, frost action, low strength.
223D2---------- Rinda	Severe: wetness.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, slope.	Severe: wetness, frost action, low strength.
226---------- Lawler	Severe: wetness, cutbanks cave.	Moderate: wetness, low strength.	Severe: wetness.	Moderate: wetness, low strength.	Severe: frost action, low strength.
260---------- Beckwith	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
263---------- Okaw	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
291---------- Atterberry	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: frost action, low strength.
315*. Alluvial land					

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
354*. Marsh					
362, 363---------- Haig	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: frost action, wetness, low strength.
364, 364B--------- Grundy	Severe: wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness.	Severe: low strength, frost action, shrink-swell.
380---------- Mahaska	Moderate: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, frost action.
424D2*, 424D3*: Lindley----------	Moderate: too clayey, slope.	Moderate: shrink-swell, low strength, slope.	Moderate: shrink-swell, slope, low strength.	Severe: slope.	Severe: low strength.
Keswick----------	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell, frost action.
425C2---------- Keswick	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell, frost action.
425D2, 425D3*----- Keswick	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: wetness, shrink-swell, slope.	Severe: low strength, shrink-swell, frost action.
452C2---------- Lineville	Severe: wetness.	Severe: low strength, wetness, shrink-swell.	Severe: shrink-swell, wetness, low strength.	Severe: wetness, shrink-swell.	Severe: low strength, frost action.
453---------- Tuskeego	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: wetness, low strength, shrink-swell.
478G*: Nordness---------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Rock outcrop.					
484---------- Lawson	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: frost action, low strength, floods.
485---------- Spillville	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
499D2---------- Nordness	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
499F---------- Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
520---------- Coppock	Severe: wetness, floods.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, wetness, low strength.	Severe: floods, low strength, frost action.
587---------- Chequest	Severe: floods, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, low strength.
594C2---------- Galland	Moderate: wetness.	Moderate: shrink-swell, low strength.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
594D2, 594D3*----- Galland	Moderate: wetness, slope.	Moderate: shrink-swell, slope, low strength.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.
594E2---------- Galland	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.
687---------- Watkins	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.
688---------- Koszta	Severe: wetness, floods.	Severe: floods.	Severe: wetness, floods.	Severe: floods.	Severe: low strength, floods, frost action.
720---------- Racoon	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, low strength, frost action.
730B*: Nodaway----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
Cantril----------	Severe: wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Severe: frost action, low strength.
763D2*: Fayette----------	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, low strength, shrink-swell.	Severe: slope.	Severe: frost action, low strength.
Exette----------	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action.
792C2---------- Armstrong	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell, frost action.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
792D2---------- Armstrong	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength, slope.	Severe: low strength, shrink-swell, frost action.
793, 793B--------- Bertrand	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Severe: frost action, low strength.
793C2---------- Bertrand	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell, low strength.	Severe: frost action, low strength.
795C2, 795C3*, 795D2, 795D3*---- Ashgrove	Severe: wetness.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, frost action, low strength.
820---------- Dockery	Severe: floods, wetness.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: wetness, floods, low strength.	Severe: frost action, floods, low strength.
832B, 832C2------- Weller	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, frost action, low strength.
880B, 880C2------- Clinton	Moderate: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
950, 950B, 950D2-- Niota	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, wetness, low strength.
952---------- Denrock	Severe: wetness, floods, cutbanks cave.	Severe: floods, wetness, low strength.	Severe: wetness, floods, low strength.	Severe: floods, low strength, wetness.	Severe: frost action, low strength.
977---------- Richwood	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Severe: frost action.
978---------- Festina	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: frost action, low strength.
993D2*: Armstrong--------	Severe: wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength, slope.	Severe: low strength, shrink-swell, frost action.
Gara----------	Moderate: slope.	Moderate: slope, shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Severe: slope.	Severe: low strength.
1057---------- Rushville	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, low strength, frost action.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1130--------- Belinda	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
1131B--------- Pershing	Moderate: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, frost action.
1180, 1180B------- Keomah	Moderate: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, frost action, low strength.
1181--------- Keomah	Moderate: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength,	Severe: low strength, frost action, shrink-swell.
1220--------- Nodaway	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, frost action.
1260--------- Beckwith	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
1316*. Alluvial land					

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

TABLE 8.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
13B*:					
Colo	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Vesser	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
23C, 23C2 Arispe	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, wetness.	Slight	Fair: too clayey, wetness.
41, 41B Sparta	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
51 Vesser	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
56, 56B Cantril	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
57 Rushville	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
58D2 Douds	Severe: wetness, percs slowly.	Severe: slope, seepage, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
58E2 Douds	Severe: slope, wetness, percs slowly.	Severe: slope, seepage, wetness.	Severe: wetness.	Severe: wetness, slope.	Poor: slope.
63*, 63B* Chelsea	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
65E2, 65E3*, 65F2 Lindley	Severe: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
65G Lindley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
75 Givin	Severe: percs slowly, wetness.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
80B Clinton	Moderate: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 8.--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
80C2---------- Clinton	Moderate: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
80D2---------- Clinton	Moderate: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
81B---------- Clinton	Moderate: percs slowly.	Moderate: slope.	Severe: depth to rock, too clayey.	Slight----------	Poor: too clayey.
81C2---------- Clinton	Moderate: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Slight----------	Poor: too clayey.
115D*---------- Chelsea	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
130---------- Belinda	Severe: percs slowly, wetness.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
131B---------- Pershing	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
131C2---------- Pershing	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
132B---------- Weller	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
132C2---------- Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
132D2---------- Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness, slope.	Poor: too clayey.
133---------- Colo	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
140---------- Sparta	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy, seepage.
152---------- Marshan	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: wetness, too sandy, seepage.
154G*---------- Douds	Severe: slope, wetness, percs slowly.	Severe: slope, seepage, wetness.	Severe: wetness.	Severe: wetness, slope.	Poor: slope.
162B---------- Downs	Slight----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
163B---------- Fayette	S;ight----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.

See footnote at end of table.

TABLE 8.--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
163C2--- Fayette	Slight	Severe: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
172--- Wabash	Severe: percs slowly, floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
173--- Hoopeston	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: too sandy, wetness, seepage.
175, 175B--- Dickinson	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
177--- Saude	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy, seepage.
179C--- Gara	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
180, 180B--- Keomah	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
208--- Landes	Severe: wetness, floods.	Severe: seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Good.
211--- Edina	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
220--- Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
222C, 222C2--- Clarinda	Severe: wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
223C, 223D2--- Rinda	Severe: percs slowly.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
226--- Lawler	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Good.
260--- Beckwith	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
263--- Okaw	Severe: percs slowly, floods, wetness.	Slight	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 8.--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
291---------- Atterberry	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
315*. Alluvial land					
354*. Marsh					
362, 363---------- Haig	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
364---------- Grundy	Severe: percs slowly, wetness.	Slight----------	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
364B---------- Grundy	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
380---------- Mahaska	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
424D2*, 424D3*: Lindley----------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
Keswick----------	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness.
425C2, 425D2, 425D3*---------- Keswick	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness.
452C2---------- Lineville	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness.
453---------- Tuskeego	Severe: wetness.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
478G*: Nordness----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
Rock outcrop.					
484---------- Lawson	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
485---------- Spillville	Severe: wetness, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Severe: wetness, seepage, floods.	Fair: wetness.
499D2---------- Nordness	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 8.--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
499F Nordness	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
520 Coppock	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
587 Chequest	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
594C2 Galland	Severe: percs slowly, wetness.	Severe: wetness, seepage, slope.	Severe: seepage, wetness.	Severe: wetness, seepage.	Fair: too clayey, wetness.
594D2, 594D3* Galland	Severe: percs slowly, wetness.	Severe: wetness, seepage, slope.	Severe: seepage, wetness.	Severe: wetness, seepage.	Fair: too clayey, wetness, slope.
594E2 Galland	Severe: slope, percs slowly, wetness.	Severe: wetness, seepage, slope.	Severe: seepage, wetness.	Severe: wetness, seepage, slope.	Poor: slope.
687 Watkins	Slight	Moderate: slope, seepage.	Slight	Slight	Fair: too clayey.
688 Koszta	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods, seepage.	Severe: floods, wetness, seepage.	Fair: too clayey, wetness.
720 Racoon	Severe: wetness, percs slowly, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
730B*: Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
Cantril	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
763D2*: Fayette	Moderate: slope, percs slowly.	Severe: slope, seepage.	Moderate: too clayey.	Moderate: slope.	Fair: slope, too clayey.
Exette	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
792C2, 792D2 Armstrong	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
793, 793B Bertrand	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.

See footnote at end of table.

TABLE 8.--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
793C2---------- Bertrand	Slight----------	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
795C2, 795C3*, 795D2, 795D3*------ Ashgrove	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
820---------- Dockery	Severe: wetness, percs slowly, floods.	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Poor: wetness.
832B---------- Weller	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
832C2---------- Weller	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
880B---------- Clinton	Moderate: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
880C2---------- Clinton	Moderate: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey.
950, 950B, 950D2---- Niota	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness.
952---------- Denrock	Severe: percs slowly, wetness, floods.	Severe: floods, seepage, wetness.	Severe: wetness, floods, seepage.	Severe: floods, wetness.	Poor: wetness.
977---------- Richwood	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
978---------- Festina	Moderate: floods.	Moderate: seepage.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
993D2*:					
Armstrong----------	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Gara----------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
1057---------- Rushville	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
1130---------- Belinda	Severe: percs slowly, wetness.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
1131B---------- Pershing	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.

See footnote at end of table.

TABLE 8.--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
1180, 1180B--------- Keomah	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
1181---------- Keomah	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, depth to rock.	Moderate: wetness.	Fair: too clayey, wetness.
1220---------- Nodaway	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: wetness.
1260---------- Beckwith	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
1316*. Alluvial land					

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

TABLE 9.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
13B*: Colo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Vesser	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
23C, 23C2 Arispe	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
41, 41B Sparta	Good	Good	Unsuited: excess fines.	Fair: too sandy.
51 Vesser	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
56, 56B Cantril	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
57 Rushville	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
58D2 Douds	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
58E2 Douds	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
63*, 63B* Chelsea	Good	Good	Unsuited: excess fines.	Poor: too sandy.
65E2, 65E3*, 65F2 Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
65G Lindley	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
75 Givin	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
80B, 80C2 Clinton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
80D2 Clinton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
81B, 81C2 Clinton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
115D* Chelsea	Good	Good	Unsuited: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
130--Belinda	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
131B, 131C2--Pershing	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
132B, 132C2--Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
132D2--Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
133--Colo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
140--Sparta	Good	Good	Unsuited: excess fines.	Fair: too sandy.
152--Marshan	Poor: wetness.	Good	Unsuited: excess fines.	Poor: wetness.
154G*--Douds	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
162B--Downs	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
163B, 163C2--Fayette	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
172--Wabash	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, too clayey.
173--Hoopeston	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Good.
175, 175B--Dickinson	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
177--Saude	Good	Good	Good	Good.
179C--Gara	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
180, 180B--Keomah	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
208--Landes	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
211--Edina	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
220--Nodaway	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
222C, 222C2--Clarinda	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
223C--Rinda	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
223D2--Rinda	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
226--Lawler	Good	Good	Good	Good.
260--Beckwith	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
263--Okaw	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
291--Atterberry	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
315*. Alluvial land				
354*. Marsh				
362, 363--Haig	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, thin layer.
364, 364B--Grundy	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
380--Mahaska	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
424D2*: Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Keswick	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
424D3*:				
Lindley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
Keswick	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
425C2				
Keswick	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
425D2, 425D3*				
Keswick	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
452C2				
Lineville	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
453				
Tuskeego	Poor: low strength, wetness, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
478G*:				
Nordness	Poor: area reclaim, thin layer, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				
484				
Lawson	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
485				
Spillville	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
499D2				
Nordness	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
499F				
Nordness	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim, slope.
520				
Coppock	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
587				
Chequest	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
594C2				
Galland	Poor: frost action.	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer.
594D2				
Galland	Poor: frost action.	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
594D3*				
Galland	Poor: frost action.	Fair: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
594E2---------- Galland	Poor: frost action.	Fair: excess fines.	Unsuited: excess fines.	Poor: slope.
687---------- Watkins	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
688---------- Koszta	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
720---------- Racoon	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
730B*: Nodaway----------	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Cantril----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
763D2*: Fayette----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Exette----------	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
792C2---------- Armstrong	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
792D2---------- Armstrong	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
793, 793B, 793C2------ Bertrand	Poor: low strength.	Good----------	Unsuited: excess fines.	Fair: thin layer.
795C2---------- Ashgrove	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
795C3*---------- Ashgrove	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
795D2---------- Ashgrove	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
795D3*---------- Ashgrove	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
820---------- Dockery	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
832B, 832C2 Weller	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
880B, 880C2 Clinton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
950, 950B, 950D2 Niota	Poor: wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
952 Denrock	Poor: frost action, low strength, wetness.	Fair: excess fines.	Unsuited: excess fines.	Fair: thin layer.
977 Richwood	Good	Good	Unsuited: excess fines.	Good.
978 Festina	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
993D2*: Armstrong	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Gara	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
1057 Rushville	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
1130 Belinda	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
1131B Pershing	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
1180, 1180B Keomah	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
1181 Keomah	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
1220 Nodaway	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
1260 Beckwith	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
1316*. Alluvial land				

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

TABLE 10.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
13B*: Colo	Favorable	Hard to pack, wetness.	Floods, frost action.	Floods, wetness.	Wetness	Wetness.
Vesser	Favorable	Wetness, hard to pack.	Floods, frost action.	Floods, wetness.	Wetness, erodes easily.	Erodes easily, wetness.
23C, 23C2 Arispe	Slope	Hard to pack	Not needed	Slope	Erodes easily	Erodes easily.
41 Sparta	Seepage	Piping, seepage.	Not needed	Fast intake, droughty.	Not needed	Droughty.
41B Sparta	Seepage	Piping, seepage.	Not needed	Fast intake, droughty.	Too sandy, soil blowing.	Droughty.
51 Vesser	Favorable	Wetness, hard to pack.	Floods, frost action.	Floods, wetness.	Not needed	Erodes easily, wetness.
56 Cantril	Seepage	Wetness	Frost action	Wetness	Not needed	Favorable.
56B Cantril	Seepage	Wetness	Frost action	Wetness	Wetness	Favorable.
57 Rushville	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Not needed	Wetness, erodes easily, percs slowly.
58D2 Douds	Slope, seepage.	Wetness	Favorable	Slope, wetness.	Wetness	Slope, wetness.
58E2 Douds	Slope, seepage.	Wetness	Favorable	Slope, wetness.	Slope, wetness.	Slope, wetness.
63* Chelsea	Seepage	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Not needed	Droughty.
63B* Chelsea	Seepage	Piping, seepage.	Not needed	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
65E2, 65E3*, 65F2, 65G Lindley	Slope	Favorable	Not needed	Slope	Slope	Slope.
75 Givin	Favorable	Wetness, hard to pack.	Frost action	Wetness	Not needed	Erodes easily.
80B Clinton	Favorable	Hard to pack	Not needed	Erodes easily	Favorable	Erodes easily.
80C2 Clinton	Slope	Hard to pack	Not needed	Erodes easily, slope.	Favorable	Erodes easily.
80D2 Clinton	Slope	Hard to pack	Not needed	Erodes easily, slope.	Favorable	Slope, erodes easily.
81B Clinton	Favorable	Hard to pack	Not needed	Erodes easily	Favorable	Erodes easily.
81C2 Clinton	Slope	Hard to pack	Not needed	Slope, erodes easily.	Favorable	Erodes easily.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
115D*---------- Chelsea	Slope, seepage.	Piping, seepage.	Not needed-----	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
130---------- Belinda	Favorable------	Wetness, hard to pack.	Percs slowly---	Wetness, percs slowly, erodes easily.	Not needed-----	Wetness, erodes easily.
131B---------- Pershing	Favorable------	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly, wetness.	Erodes easily, percs slowly.
131C2---------- Pershing	Slope----------	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness.	Erodes easily, percs slowly.
132B---------- Weller	Favorable------	Wetness, hard to pack.	Percs slowly, frost action.	Percs slowly, wetness.	Wetness, erodes easily.	Percs slowly, erodes easily.
132C2---------- Weller	Slope, seepage.	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily.	Percs slowly, erodes easily.
132D2---------- Weller	Slope, seepage.	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily.	Slope, percs slowly, erodes easily.
133---------- Colo	Favorable------	Hard to pack, wetness.	Floods, frost action.	Floods, wetness.	Not needed-----	Wetness.
140---------- Sparta	Seepage--------	Piping, seepage.	Not needed-----	Fast intake, droughty.	Not needed-----	Droughty.
152---------- Marshan	Seepage--------	Wetness, seepage.	Floods, frost action.	Wetness, floods.	Not needed-----	Wetness.
154G*---------- Douds	Slope, seepage.	Wetness--------	Favorable------	Slope, wetness.	Slope, wetness.	Slope, wetness.
162B---------- Downs	Seepage--------	Favorable------	Not needed-----	Favorable------	Erodes easily	Erodes easily.
163B---------- Fayette	Seepage--------	Favorable------	Not needed-----	Erodes easily	Favorable------	Erodes easily.
163C2---------- Fayette	Slope, seepage.	Favorable------	Not needed-----	Slope, erodes easily.	Favorable------	Erodes easily.
172---------- Wabash	Favorable------	Wetness, hard to pack.	Floods, percs slowly.	Wetness, slow intake, percs slowly.	Not needed-----	Percs slowly, wetness.
173---------- Hoopeston	Seepage--------	Seepage--------	Frost action---	Wetness, soil blowing.	Not needed-----	Wetness.
175---------- Dickinson	Seepage--------	Seepage--------	Not needed-----	Soil blowing---	Not needed-----	Droughty.
175B---------- Dickinson	Seepage--------	Seepage--------	Not needed-----	Soil blowing---	Soil blowing---	Droughty.
177---------- Saude	Seepage--------	Seepage--------	Not needed-----	Favorable------	Not needed-----	Favorable.
179C---------- Gara	Slope----------	Favorable------	Not needed-----	Slope----------	Favorable------	Erodes easily.
180---------- Keomah	Favorable------	Wetness, hard to pack.	Frost action---	Wetness, erodes easily.	Not needed-----	Erodes easily.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
180B---------- Keomah	Favorable------	Wetness, hard to pack.	Frost action---	Wetness, erodes easily.	Wetness--------	Erodes easily.
208---------- Landes	Seepage--------	Seepage, piping.	Not needed-----	Soil blowing---	Not needed-----	Favorable.
211---------- Edina	Favorable------	Wetness, hard to pack.	Percs slowly---	Wetness, percs slowly, erodes easily.	Not needed-----	Wetness, erodes easily, percs slowly.
220---------- Nodaway	Seepage--------	Favorable------	Not needed-----	Floods, erodes easily.	Not needed-----	Erodes easily.
222C, 222C2------- Clarinda	Slope----------	Wetness, hard to pack.	Percs slowly, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness.	Wetness, erodes easily.
223C---------- Rinda	Slope----------	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, wetness.
223D2---------- Rinda	Slope----------	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, slope, erodes easily.
226---------- Lawler	Seepage--------	Seepage--------	Frost action---	Wetness--------	Not needed-----	Favorable.
260---------- Beckwith	Favorable------	Wetness, hard to pack.	Percs slowly---	Wetness, percs slowly, erodes easily.	Not needed-----	Wetness, erodes easily.
263---------- Okaw	Favorable------	Wetness, hard to pack.	Floods, percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Not needed-----	Percs slowly, wetness, erodes easily.
291---------- Atterberry	Favorable------	Hard to pack, wetness.	Frost action---	Wetness--------	Not needed-----	Wetness, erodes easily.
315*. Alluvial land						
354*. Marsh						
362, 363---------- Haig	Favorable------	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Not needed-----	Wetness, percs slowly, erodes easily.
364---------- Grundy	Favorable------	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness.	Not needed-----	Wetness, erodes easily.
364B---------- Grundy	Favorable------	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness.	Wetness, percs slowly.	Wetness, erodes easily.
380---------- Mahaska	Seepage--------	Wetness, hard to pack.	Frost action---	Wetness--------	Wetness, erodes easily.	Erodes easily.
424D2*, 424D3*: Lindley----------	Slope----------	Favorable------	Not needed-----	Slope----------	Favorable------	Slope.
Keswick----------	Slope----------	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness, slope.	Percs slowly, wetness.	Wetness, slope, erodes easily.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
425C2---------- Keswick	Slope----------	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness, slope.	Percs slowly, wetness.	Erodes easily, wetness.
425D2, 425D3*----- Keswick	Slope----------	Hard to pack, wetness.	Percs slowly, frost action.	Percs slowly, wetness, slope.	Percs slowly, wetness.	Wetness, slope, erodes easily.
452C2---------- Lineville	Slope----------	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, percs slowly.	Erodes easily, wetness.
453---------- Tuskeego	Favorable------	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Not needed-----	Wetness, percs slowly.
478G*: Nordness--------- Rock outcrop.	Slope, depth to rock.	Thin layer-----	Not needed-----	Droughty, rooting depth, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
484---------- Lawson	Seepage--------	Wetness--------	Floods, frost action.	Wetness, floods.	Not needed-----	Wetness.
485---------- Spillville	Seepage--------	Favorable------	Not needed-----	Floods---------	Not needed-----	Favorable.
499D2, 499F------- Nordness	Slope, depth to rock.	Thin layer-----	Not needed-----	Droughty, rooting depth, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
520---------- Coppock	Favorable------	Wetness, hard to pack.	Floods, frost action.	Floods, wetness.	Not needed-----	Wetness, erodes easily.
587---------- Chequest	Favorable------	Wetness--------	Floods, frost action.	Floods, wetness.	Not needed-----	Wetness, erodes easily.
594C2---------- Galland	Slope, seepage.	Favorable------	Not needed-----	Erodes easily, percs slowly, slope.	Percs slowly----	Erodes easily, percs slowly.
594D2, 594D3*----- Galland	Slope, seepage.	Favorable------	Not needed-----	Erodes easily, percs slowly, slope.	Percs slowly----	Slope, erodes easily, percs slowly.
594E2---------- Galland	Slope, seepage.	Favorable------	Not needed-----	Erodes easily, percs slowly, slope.	Slope, percs slowly.	Slope, erodes easily, percs slowly.
687---------- Watkins	Seepage--------	Favorable------	Not needed-----	Favorable------	Erodes easily	Erodes easily.
688---------- Koszta	Seepage--------	Wetness--------	Floods, frost action.	Wetness, floods.	Not needed-----	Erodes easily.
720---------- Racoon	Favorable------	Wetness--------	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Not needed-----	Wetness, erodes easily, percs slowly.
730B*: Nodaway---------- Cantril----------	Seepage--------	Favorable------	Not needed-----	Floods, erodes easily.	Not needed-----	Erodes easily.
	Seepage--------	Wetness--------	Frost action---	Wetness--------	Wetness--------	Favorable.
763D2*: Fayette----------	Slope, seepage.	Favorable------	Not needed-----	Slope, erodes easily.	Slope----------	Slope, erodes easily.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
763D2*: Exette	Slope, seepage.	Favorable	Not needed	Erodes easily, slope.	Slope	Slope, erodes easily.
792C2--Armstrong	Slope	Wetness	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness.	Percs slowly.
792D2--Armstrong	Slope	Wetness	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness.	Percs slowly, slope.
793--Bertrand	Seepage	Piping	Not needed	Erodes easily	Not needed	Erodes easily.
793B--Bertrand	Seepage	Piping	Not needed	Erodes easily	Too sandy	Erodes easily.
793C2--Bertrand	Slope, seepage.	Piping	Not needed	Slope, erodes easily.	Too sandy	Erodes easily.
795C2, 795C3*--Ashgrove	Slope	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, wetness.
795D2, 795D3*--Ashgrove	Slope	Wetness, hard to pack.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Slope, wetness, erodes easily.
820--Dockery	Seepage	Piping, wetness.	Floods, frost action.	Wetness, erodes easily, floods.	Not needed	Wetness, erodes easily.
832B--Weller	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Percs slowly, wetness.	Wetness, erodes easily.	Percs slowly, erodes easily.
832C2--Weller	Slope, seepage.	Wetness, hard to pack.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily.	Percs slowly, erodes easily.
880B--Clinton	Favorable	Hard to pack	Not needed	Erodes easily	Favorable	Erodes easily.
880C2--Clinton	Slope	Hard to pack	Not needed	Erodes easily, slope.	Favorable	Erodes easily.
950--Niota	Seepage	Wetness	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Not needed	Wetness, erodes easily.
950B, 950D2--Niota	Seepage	Wetness	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Not needed	Wetness, erodes easily.
952--Denrock	Seepage	Wetness	Percs slowly, floods, frost action.	Wetness, percs slowly, erodes easily.	Not needed	Wetness, erodes easily.
977--Richwood	Seepage	Piping	Not needed	Favorable	Not needed	Erodes easily.
978--Festina	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
993D2*: Armstrong	Slope	Wetness	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness.	Percs slowly, slope.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
993D2*: Gara	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily, slope.
1057 Rushville	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Not needed	Wetness, erodes easily, percs slowly.
1130 Belinda	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly, erodes easily.	Not needed	Wetness, erodes easily.
1131B Pershing	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Wetness, percs slowly.	Percs slowly, wetness.	Erodes easily, percs slowly.
1180 Keomah	Favorable	Wetness, hard to pack.	Frost action	Wetness, erodes easily.	Not needed	Erodes easily.
1180B Keomah	Favorable	Wetness, hard to pack.	Frost action	Wetness, erodes easily.	Wetness	Erodes easily.
1181 Keomah	Favorable	Hard to pack, wetness.	Frost action	Erodes easily, wetness.	Not needed	Erodes easily.
1220 Nodaway	Seepage	Favorable	Not needed	Floods, erodes easily.	Not needed	Erodes easily.
1260 Beckwith	Favorable	Wetness, hard to pack.	Percs slowly	Wetness, percs slowly, erodes easily.	Not needed	Wetness, erodes easily.
1316*. Alluvial land						

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

TABLE 11.--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
13B*:				
Colo	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Vesser	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
23C, 23C2 Arispe	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
41 Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
41B Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
51 Vesser	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
56 Cantril	Severe: floods.	Moderate: wetness.	Moderate: wetness.	Slight.
56B Cantril	Severe: floods.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
57 Rushville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.
58D2 Douds	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Moderate: wetness.
58E2 Douds	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Moderate: slope, wetness.
63* Chelsea	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
63B* Chelsea	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
65E2 Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
65E3* Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too clayey, slope.
65F2 Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
65G Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
75--- Givin	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Slight.
80B--- Clinton	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
80C2--- Clinton	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
80D2--- Clinton	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
81B--- Clinton	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
81C2--- Clinton	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
115D*--- Chelsea	Moderate: too sandy, slope.	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.
130--- Belinda	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
131B--- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight.
131C2--- Pershing	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: slope.	Slight.
132B--- Weller	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
132C2--- Weller	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: slope.	Slight.
132D2--- Weller	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness.	Severe: slope.	Slight.
133--- Colo	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
140--- Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
152--- Marshan	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
154G*--- Douds	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Moderate: slope, wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
162B---------- Downs	Slight----------	Slight----------	Moderate: slope.	Slight.
163B---------- Fayette	Slight----------	Slight----------	Moderate: slope.	Slight.
163C2---------- Fayette	Slight----------	Slight----------	Severe: slope.	Slight.
172---------- Wabash	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.
173---------- Hoopeston	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
175---------- Dickinson	Slight----------	Slight----------	Slight----------	Slight.
175B---------- Dickinson	Slight----------	Slight----------	Moderate: slope.	Slight.
177---------- Saude	Slight----------	Slight----------	Slight----------	Slight.
179C---------- Gara	Moderate: percs slowly.	Slight----------	Severe: slope.	Slight.
180---------- Keomah	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, percs slowly.	Slight.
180B---------- Keomah	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight.
208---------- Landes	Severe: floods.	Slight----------	Slight----------	Slight.
211---------- Edina	Severe: percs slowly, wetness.	Severe: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
220---------- Nodaway	Severe: floods.	Slight----------	Moderate: floods.	Slight.
222C, 222C2---------- Clarinda	Severe: percs slowly, wetness.	Severe: wetness.	Severe: slope, wetness, percs slowly.	Severe: wetness.
223C---------- Rinda	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: slope, wetness, percs slowly.	Moderate: wetness.
223D2---------- Rinda	Severe: wetness, percs slowly.	Moderate: slope, wetness.	Severe: slope, wetness, percs slowly.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
226--Lawler	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
260--Beckwith	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
263--Okaw	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
291--Atterberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
315*. Alluvial land				
354*. Marsh				
362, 363--Haig	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
364, 364B--Grundy	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
380--Mahaska	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
424D2*: Lindley	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
Keswick	Severe: wetness.	Moderate: wetness, slope.	Severe: slope, wetness.	Moderate: wetness.
424D3*: Lindley	Moderate: slope, percs slowly.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
Keswick	Severe: wetness.	Moderate: wetness, slope.	Severe: slope, wetness.	Moderate: wetness.
425C2--Keswick	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.
425D2, 425D3*--Keswick	Severe: wetness.	Moderate: wetness, slope.	Severe: slope, wetness.	Moderate: wetness.
452C2--Lineville	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: slope.	Moderate: wetness.
453--Tuskeego	Severe: wetness, percs slowly, floods.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
478G*:				
Nordness	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.
Rock outcrop.				
484 Lawson	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
485 Spillville	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
499D2 Nordness	Severe: depth to rock.	Moderate: slope.	Severe: slope, depth to rock.	Slight.
499F Nordness	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.
520 Coppock	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Moderate: wetness, floods.
587 Chequest	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
594C2 Galland	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
594D2 Galland	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Slight.
594D3* Galland	Moderate: slope, percs slowly.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.
594E2 Galland	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
687 Watkins	Slight	Slight	Moderate: slope.	Slight.
688 Koszta	Severe: floods.	Moderate: wetness.	Moderate: wetness, floods.	Slight.
720 Racoon	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.
730B*:				
Nodaway	Severe: floods.	Slight	Moderate: floods.	Slight.
Cantril	Slight	Moderate: wetness.	Moderate: slope, wetness.	Slight.
763D2*:				
Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
763D2*: Exette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
792C2--- Armstrong	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: slope.	Slight.
792D2--- Armstrong	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness.	Severe: slope.	Slight.
793--- Bertrand	Slight---	Slight---	Slight---	Slight.
793B--- Bertrand	Slight---	Slight---	Moderate: slope.	Slight.
793C2--- Bertrand	Slight---	Slight---	Severe: slope.	Slight.
795C2--- Ashgrove	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: slope, wetness, percs slowly.	Moderate: wetness.
795C3*--- Ashgrove	Severe: percs slowly, wetness.	Moderate: wetness, too clayey.	Severe: slope, wetness, percs slowly.	Moderate: wetness, too clayey.
795D2--- Ashgrove	Severe: percs slowly, wetness.	Moderate: slope, wetness.	Severe: slope, wetness, percs slowly.	Moderate: wetness.
795D3*--- Ashgrove	Severe: percs slowly, wetness.	Moderate: slope, wetness, too clayey.	Severe: slope, wetness, percs slowly.	Moderate: wetness, too clayey.
820--- Dockery	Severe: floods, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
832B--- Weller	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
832C2--- Weller	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: slope.	Slight.
880B--- Clinton	Moderate: percs slowly.	Slight---	Moderate: slope, percs slowly.	Slight.
880C2--- Clinton	Moderate: percs slowly.	Slight---	Severe: slope.	Slight.
950, 950B, 950D2--- Niota	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
952--Denrock	Severe: percs slowly, floods, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
977--Richwood	Slight	Slight	Slight	Slight.
978--Festina	Severe: floods.	Slight	Moderate: slope.	Slight.
993D2*:				
Armstrong	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness.	Severe: slope.	Slight.
Gara	Moderate: percs slowly, slope.	Moderate: slope.	Severe: slope.	Slight.
1057--Rushville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1130--Belinda	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
1131B--Pershing	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight.
1180--Keomah	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, percs slowly.	Slight.
1180B--Keomah	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: slope, wetness, percs slowly.	Slight.
1181--Keomah	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: percs slowly wetness.	Slight.
1220--Nodaway	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
1260--Beckwith	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
1316*. Alluvial land				

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

TABLE 12.--WILDLIFE HABITAT POTENTIALS

[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*: Colo	Good	Fair	Good	Fair	Poor	Fair	Very poor.	Fair	Fair	Poor.
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.
41, 41B--- Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
51--- Vesser	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
56, 56B--- Cantril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
57--- Rushville	Fair	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
58D2--- Douds	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
58E2--- Douds	Very poor.	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
63*, 63B*--- Chelsea	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
65E2, 65E3*, 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.
75--- Givin	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
80B--- Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
80C2, 80D2--- Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
81B--- Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
81C2--- Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
115D*--- Chelsea	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
130--- Belinda	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
131B--- Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
131C2--- Pershing	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--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
132B---------- Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
132C2, 132D2------- Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
133---------- Colo	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
140---------- Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
152---------- Marshan	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
154G*---------- Douds	Very poor.	Good	Fair	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.
162B---------- Downs	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163B---------- Fayette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
163C2---------- Fayette	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
172---------- Wabash	Poor	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
173---------- Hoopeston	Fair	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
175, 175B---------- Dickinson	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
177---------- Saude	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
179C---------- Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
180, 180B---------- Keomah	Good	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair.
208---------- Landes	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-------- Clarinda	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
223C, 223D2-------- Rinda	Poor	Fair	Poor	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
226---------- Lawler	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
260---------- Beckwith	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--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
263---------- Okaw	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
291---------- Atterberry	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
315*. Alluvial land										
354*. Marsh										
362, 363---------- Haig	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
364, 364B---------- Grundy	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
380---------- Mahaska	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
424D2*, 424D3*: Lindley----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Keswick----------	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
425C2, 425D2, 425D3*---------- Keswick	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
452C2---------- Lineville	Fair	Good	Fair	Good	Fair	Poor	Poor	Fair	Good	Poor.
453---------- Tuskeego	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
478G*: Nordness----------	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
484---------- Lawson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
485---------- Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
499D2---------- Nordness	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
499F---------- Nordness	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
520---------- Coppock	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
587---------- Chequest	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
594C2, 594D2, 594D3*, 594E2----- Galland	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--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
687---------- Watkins	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
688---------- Koszta	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
720---------- Racoon	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
730B*:										
Nodaway----------	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
Cantril----------	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
763D2*:										
Fayette----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Exette----------	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
792C2, 792D2------- Armstrong	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
793, 793B---------- Bertrand	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
793C2---------- Bertrand	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
795C2, 795C3*, 795D2, 795D3*----- Ashgrove	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Fair	Poor.
820---------- Dockery	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
832B---------- Weller	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
832C2---------- Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
880B---------- Clinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
880C2---------- Clinton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
950, 950B, 950D2--- Niota	Fair	Good	Good	Good	Good	Good	Good	Good	Good	Good.
952---------- Denrock	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
977---------- Richwood	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
978---------- Festina	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
993D2*:										
Armstrong----------	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--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
993D2*: Gara	Fair	Good	Fair	Good	Good	Very poor.	Poor	Fair	Good	Poor.
1057 Rushville	Fair	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
1130 Belinda	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
1131B Pershing	Good	Good	Fair	Fair	Fair	Poor	Poor	Good	Fair	Poor.
1180, 1180B Keomah	Good	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair.
1181 Keomah	Good	Good	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair.
1220 Nodaway	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Good	Fair.
1260 Beckwith	Good	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
1316*. Alluvial land										

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

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

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

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
13B*:											
Colo	0-37	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	37-60	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
Vesser	0-10	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	10-33	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	33-60	Silty clay loam	CL, CH	A-7	0	100	100	98-100	95-100	40-55	20-30
23C, 23C2	0-13	Silty clay loam	CL, CH	A-7	0	100	100	100	95-100	41-55	20-30
Arispe	13-27	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-60	25-35
	27-60	Silty clay loam	CL	A-7	0	100	100	100	95-100	41-50	20-30
41, 41B	0-20	Loamy sand	SM, ML	A-2, A-4	0	100	100	60-90	20-55	---	NP
Sparta	20-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	100	100	60-95	5-50	---	NP
51	0-10	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
Vesser	10-33	Silt loam	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	33-60	Silty clay loam	CL, CH	A-7	0	100	100	98-100	95-100	40-55	20-30
56, 56B	0-44	Loam	CL	A-6	0	100	100	85-95	65-75	30-40	11-20
Cantril	44-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-90	35-45	15-25
57	0-13	Silt loam	CL, CL-ML	A-4	0	100	100	95-100	90-100	25-32	5-10
Rushville	13-52	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	95-100	57-77	33-56
	52-60	Silt loam	CL	A-6, A-7	0	100	100	95-100	90-100	32-50	21-32
58D2, 58E2	0-14	Loam	CL	A-6	0	90-100	80-100	70-90	60-80	25-35	10-20
Douds	14-48	Clay loam, loam, sandy clay loam.	CL, SC	A-6	0	85-100	80-100	70-80	35-60	30-40	15-25
	48-60	Stratified loam to loamy sand.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	80-100	65-85	35-45	15-30	5-15
63*, 63B*	0-4	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
Chelsea	4-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
65E2	0-11	Loam	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	50-65	15-30	5-15
Lindley	11-62	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	30-40	15-25
65E3*	0-11	Clay loam	CL	A-6	0	95-100	90-100	85-95	55-75	30-40	10-20
Lindley	11-62	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	30-40	15-25
65F2, 65G	0-11	Loam	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	50-65	15-30	5-15
Lindley	11-62	Loam, clay loam	CL	A-6	0	95-100	90-100	85-95	50-70	30-40	15-25
75	0-12	Silt loam	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
Givin	12-50	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	100	95-100	45-60	25-35
	50-60	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	20-30
80B, 80C2, 80D2	0-12	Silt loam	ML	A-4	0	100	100	100	95-100	30-40	5-10
Clinton	12-48	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	48-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
81B---------- Clinton	0-12	Silt loam-------	ML	A-4	0	100	100	100	95-100	25-40	2-10
	12-60	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	41-55	25-35
	60-96	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
81C2---------- Clinton	0-12	Silt loam-------	ML	A-4	0	100	100	100	95-100	25-40	2-10
	12-60	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	41-55	25-35
	60-90	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
115D*---------- Chelsea	0-4	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	4-60	Fine sand, sand, loamy sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
130---------- Belinda	0-7	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	7-18	Silt loam-------	CL-ML, CL	A-4	0	100	100	100	95-100	25-35	5-10
	18-37	Silty clay------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	37-60	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-65	25-35
131B, 131C2-------- Pershing	0-11	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	11-20
	11-52	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	52-68	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
132B, 132C2, 132D2- Weller	0-16	Silt loam-------	ML, CL	A-6, A-4	0	100	100	100	95-100	30-40	5-15
	16-50	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	50-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
133---------- Colo	0-37	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-60	15-30
	37-60	Silty clay loam, clay loam.	CL, CH	A-7	0	100	100	95-100	80-100	40-55	15-30
140---------- Sparta	0-20	Loamy sand------	SM, ML	A-2, A-4	0	100	100	60-90	20-55	---	NP
	20-60	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	100	100	60-95	5-50	---	NP
152---------- Marshan	0-19	Clay loam-------	CL	A-7	0	95-100	95-100	95-100	85-95	40-50	15-25
	19-42	Loam, clay loam, sandy loam.	CL, SC	A-7, A-6	0	95-100	75-100	70-90	40-75	25-50	10-25
	42-60	Loamy sand, sand.	SP, SW, SP-SM	A-1	0-3	65-95	45-95	20-45	2-5	---	NP
154G*---------- Douds	0-14	Loam------------	CL	A-6	0	90-100	80-100	70-90	60-80	25-35	10-20
	14-48	Clay loam, loam, sandy clay loam.	CL, SC	A-6	0	85-100	80-100	70-80	35-60	30-40	15-25
	48-60	Stratified loam to loamy sand.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	80-100	55-85	35-45	15-30	5-15
162B---------- Downs	0-13	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	13-46	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	46-68	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
163B, 163C2-------- Fayette	0-15	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	15-38	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	38-60	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
172---------- Wabash	0-20	Silty clay------	CH	A-7	0	100	100	100	95-100	50-75	30-55
	20-60	Silty clay, clay	CH	A-7	0	100	100	100	95-100	52-78	30-55

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
173---------- Hoopeston	0-36	Sandy loam------	SM, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-90	25-45	20-35	NP-10
	36-60	Loamy sand, sand	SP-SM, SM, SC, SM-SC	A-2, A-3	0	90-100	90-100	50-80	5-20	<25	NP-10
175, 175B---------- Dickinson	0-31	Fine sandy loam	SM, SC, SM-SC	A-4, A-2	0	100	100	85-95	30-50	15-30	NP-10
	31-50	Loamy sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2, A-3	0	100	100	80-95	5-20	10-20	NP-5
	50-60	Sand, fine sand	SM, SP-SM	A-3, A-2	0	100	100	70-90	5-20	---	NP
177---------- Saude	0-14	Loam----------	CL	A-6	0	100	90-100	70-90	50-75	25-35	10-15
	14-33	Loam, sandy loam	CL, SC, CL-ML, SM-SC	A-4, A-6	0-5	85-95	80-95	70-85	36-60	20-30	5-15
	33-60	Loamy sand, gravelly coarse sand, sand.	SW, SM, GP, GM	A-1	2-10	50-90	50-85	20-40	3-25	---	NP
179C---------- Gara	0-7	Loam----------	CL, CL-ML	A-4, A-6	0	85-95	80-90	70-80	55-70	20-30	5-15
	7-46	Clay loam-------	CL	A-6	0	85-95	80-90	70-85	55-75	30-40	15-25
	46-60	Loam, clay loam	CL	A-6, A-7	0	85-95	80-90	70-85	55-75	35-45	15-25
180, 180B---------- Keomah	0-9	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	9-30	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-60	30-45
	30-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
208---------- Landes	0-22	Sandy loam------	SM, ML	A-4	0	100	95-100	85-95	35-55	25-40	NP-10
	22-70	Stratified fine sand to silt loam.	SM, ML, SC, SW-SM	A-2, A-4, A-3	0	100	95-100	60-95	3-70	<30	NP-10
211---------- Edina	0-14	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	5-15
	14-38	Silty clay------	CH	A-7	0	100	100	95-100	90-100	55-75	30-45
	38-65	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---------- Clarinda	0-13	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-100	40-50	20-30
	13-68	Silty clay, clay	CH	A-7	0	100	95-100	85-100	80-100	55-70	30-40
223C, 223D2---------- Rinda	0-13	Silt loam-------	CL	A-6	0	100	95-100	90-100	85-100	30-40	11-20
	13-17	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	85-100	45-55	20-30
	17-60	Clay----------	CH	A-7	0	95-100	95-100	80-95	75-90	55-70	35-45
226---------- Lawler	0-17	Loam----------	OL, CL, ML	A-6, A-7	0	100	90-100	70-90	55-75	35-45	10-25
	17-33	Loam, sandy clay loam.	CL, SC	A-6	0-5	85-95	80-95	70-85	45-65	25-40	10-20
	33-60	Stratified sandy loam to gravelly coarse sand.	SW, GP, SP, SW-SM	A-1	2-10	50-90	50-85	20-40	3-10	---	NP
260---------- Beckwith	0-6	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	6-17	Silt loam-------	CL-ML, CL, ML	A-4	0	100	100	100	95-100	25-35	5-10
	17-36	Silty clay------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	36-60	Silty clay loam	CH	A-7	0	100	100	100			

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
263----------	0-10	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
Okaw	10-60	Silty clay, clay loam, silty clay loam.	CH	A-7	0	100	95-100	90-95	80-90	50-80	30-55
291----------	0-17	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
Atterberry	17-50	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	40-55	20-30
	50-66	Silt loam-------	CL	A-6, A-4	0	100	100	95-100	95-100	35-40	10-20
315*. Alluvial land											
354*. Marsh											
362----------	0-16	Silt loam-------	CL, OL	A-6, A-7	0	100	100	95-100	90-100	35-45	10-20
Haig	16-27	Silty clay------	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	27-60	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	90-100	35-55	20-30
363----------	0-16	Silty clay loam	CL, OL	A-6, A-7	0	100	100	95-100	90-100	35-45	10-20
Haig	16-27	Silty clay------	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	27-60	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	90-100	35-55	20-30
364, 364B----------	0-10	Silt loam-------	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	10-20
Grundy	10-23	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	95-100	90-100	45-55	25-35
	23-36	Silty clay.	CH	A-7	0	100	100	95-100	90-100	50-70	30-45
	36-65	Silty clay loam	CH, CL	A-7	0	100	100	90-100	90-100	40-55	25-35
380----------	0-16	Silt loam-------	CL	A-7, A-6	0	100	100	100	95-100	35-50	15-25
Mahaska	16-58	Silty clay loam, silty clay.	CH, MH	A-7	0	100	100	100	95-100	50-60	20-30
	58-72	Silty clay loam, silt loam.	CL	A-7	0	100	100	100	95-100	40-50	15-25
424D2*:											
Lindley----------	0-11	Loam----------	CL-ML, CL	A-4, A-6	0	95-100	90-100	85-95	50-65	15-30	5-15
	11-62	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	15-25
Keswick----------	0-12	Loam----------	CL, CL-ML	A-6, A-4	0	95-100	80-100	75-90	60-80	20-30	5-15
	12-29	Clay loam, clay	CH, MH	A-7	0	95-100	80-100	70-90	55-80	50-60	20-30
	29-60	Clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	80-100	65-85	40-70	30-40	15-25
424D3*:											
Lindley----------	0-11	Clay loam-------	CL	A-6	0	95-100	90-100	85-95	55-75	30-40	10-20
	11-62	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	85-95	55-75	30-45	15-25
Keswick----------	0-12	Clay loam-------	CL	A-6, A-7	0	95-100	80-100	75-90	60-80	35-45	15-25
	12-29	Clay loam, clay	CH, MH	A-7	0	95-100	80-100	70-90	55-80	50-60	20-30
	29-60	Clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	80-100	65-85	40-70	30-40	15-25
425C2, 425D2-------	0-12	Loam----------	CL, CL-ML	A-6, A-4	0	95-100	80-100	75-90	60-80	20-30	5-15
Keswick	12-29	Clay loam, clay	CH, MH	A-7	0	95-100	80-100	70-90	55-80	50-60	20-30
	29-60	Clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	80-100	65-85	40-70	30-40	15-25
425D3*----------	0-12	Clay loam-------	CL	A-6, A-7	0	95-100	80-100	75-90	60-80	35-45	15-25
Keswick	12-29	Clay loam, clay	CH	A-7	0	95-100	80-100	70-90	55-80	50-60	20-30
	29-60	Clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	80-100	65-85	40-70	30-40	15-25

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
452C2---------- Lineville	0-14	Silt loam-------	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	11-20
	14-34	Silty clay loam	CL, CH	A-7	0	100	100	95-100	95-100	45-55	25-35
	34-41	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	75-95	65-90	35-50	20-35
	41-60	Clay loam, clay	CH, CL	A-7, A-6	0	95-100	80-100	70-90	55-80	35-60	20-35
453---------- Tuskeego	0-16	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	98-100	95-100	25-35	5-15
	16-40	Silty clay loam, silty clay.	CH	A-7	0	100	100	98-100	95-100	50-60	25-35
	40-60	Clay loam, sandy clay loam.	CH, CL	A-7	0	100	100	90-95	85-90	40-55	15-25
478G*:											
Nordness----------	0-11	Silt loam-------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	11-16	Silty clay loam	CL, CH	A-7	2-10	85-95	80-90	70-85	65-85	45-60	30-40
	16-96	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
484---------- Lawson	0-29	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	80-100	20-30	5-10
	29-60	Silt loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-100	20-40	5-20
485---------- Spillville	0-60	Loam------------	CL	A-6	0	100	95-100	85-95	60-80	25-40	10-20
499D2, 499F-------- Nordness	0-11	Silt loam-------	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	11-16	Silty clay loam	CL, CH	A-7	2-10	85-95	80-90	70-85	65-85	45-60	30-40
	16-96	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
520---------- Coppock	0-9	Silt loam-------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	9-26	Silt loam-------	CL	A-6	0	100	100	98-100	95-100	30-40	10-20
	26-50	Silty clay loam	CL, CH,	A-6, A-7	0	100	100	98-100	95-100	35-55	15-25
	50-60	Silty clay loam	CL	A-7	0	100	100	98-100	95-100	40-50	15-25
587---------- Chequest	0-17	Silty clay loam	CL, ML	A-7	0	100	100	98-100	95-100	40-50	15-25
	17-60	Silty clay loam	CL, ML	A-7	0	100	100	98-100	90-100	40-50	15-25
594C2, 594D2------- Galland	0-9	Loam------------	CL	A-6	0	100	95-100	95-100	65-100	30-40	11-20
	9-48	Clay loam, clay	CL	A-6, A-7	0	100	95-100	95-100	65-80	35-50	20-30
	48-60	Sandy loam------	SM-SC, SC	A-4, A-2, A-6	0	100	95-100	85-95	30-45	20-35	5-15
594D3*---------- Galland	0-9	Clay loam-------	CL	A-6	0	100	95-100	95-100	65-100	30-40	11-20
	9-48	Clay loam, clay	CL	A-6, A-7	0	100	95-100	95-100	65-80	35-50	20-30
	48-60	Sandy loam------	SM-SC, SC	A-4, A-2, A-6	0	100	95-100	85-95	30-45	20-35	5-15
594E2---------- Galland	0-9	Loam------------	CL	A-6	0	100	95-100	95-100	65-100	30-40	11-20
	9-48	Clay loam, clay	CL	A-6, A-7	0	100	95-100	95-100	65-80	35-50	20-30
	48-60	Sandy loam------	SM-SC, SC	A-4, A-2, A-6	0	100	95-100	85-95	30-45	20-35	5-15
687---------- Watkins	0-11	Silt loam-------	CL, CL-ML	A-6, A-4	0	100	100	95-100	85-95	25-35	5-15
	11-48	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-45	10-20
	48-60	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
688---------- Koszta	0-18	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
	18-60	Silty clay loam	CL	A-7	0	100	100	95-100	95-100	40-50	20-30

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
720---------- Racoon	0-24	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15
	24-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	90-100	35-50	15-30
730B*:											
Nodaway----------	0-60	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
Cantril----------	0-44	Loam------------	CL	A-6	0	100	100	85-95	65-75	30-40	11-20
	44-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-90	35-45	15-25
763D2*:											
Fayette----------	0-15	Silt loam-------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	15-38	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	38-60	Silt loam-------	CL	A-6	0	100	100	100	95-100	30-40	10-20
Exette----------	0-6	Silt loam-------	ML, CL-ML, CL	A-4	0	100	100	100	95-100	25-35	5-10
	6-20	Silt loam-------	ML, CL	A-6	0	100	100	100	95-100	30-40	7-15
	20-60	Silt loam-------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	7-15
792C2, 792D2------- Armstrong	0-12	Loam------------	CL, CL-ML	A-6, A-4	0	95-100	80-95	75-90	55-80	20-40	5-20
	12-33	Clay loam, clay, silty clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	45-60	20-30
	33-60	Clay loam-------	CL	A-6	0	95-100	80-95	70-90	55-80	30-40	15-20
793, 793B, 793C2--- Bertrand	0-8	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	90-100	75-90	15-25	3-10
	8-15	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	75-95	25-40	10-25
	15-40	Stratified silt loam to loamy sand.	ML, SM, CL, SC	A-4	0	100	100	70-80	35-55	10-25	2-10
	40-60	Sandy loam to clay loam.	SP-SM, SM SC	A-2, A-4, A-6	0	100	100	70-80	10-50	10-35	2-15
795C2---------- Ashgrove	0-5	Silt loam-------	CL	A-6	0	100	95-100	90-100	85-100	30-40	10-20
	5-31	Silty clay, silty clay loam, clay.	CH	A-7	0	100	95-100	85-100	85-100	55-70	30-40
	31-60	Silty clay loam, silty clay.	CH	A-7	0	95-100	95-100	75-90	75-90	50-60	25-35
795C3*---------- Ashgrove	0-5	Silty clay loam	CL	A-6	0	100	95-100	90-100	85-100	30-40	10-20
	5-31	Silty clay, silty clay loam, clay.	CH	A-7	0	100	95-100	85-100	85-100	55-70	30-40
	31-60	Silt, silty clay	CH	A-7	0	95-100	95-100	75-90	75-90	50-60	25-35
795D2---------- Ashgrove	0-5	Silt loam-------	CL	A-6	0	100	95-100	90-100	85-100	30-40	10-20
	5-31	Silty clay, silty clay loam, clay.	CH	A-7	0	100	95-100	85-100	85-100	55-70	30-40
	31-60	Silty clay loam, silty clay.	CH	A-7	0	95-100	95-100	75-90	75-90	50-60	25-35
795D3*---------- Ashgrove	0-5	Silty clay loam	CL	A-6	0	100	95-100	90-100	85-100	30-40	10-20
	5-31	Silty clay, silty clay loam, clay.	CH	A-7	0	100	95-100	85-100	85-100	55-70	30-40
	31-60	Silty clay loam, silty clay.	CH	A-7	0	95-100	95-100	75-90	75-90	50-60	25-35
820---------- Dockery	0-9	Silt loam-------	CL-ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-95	25-45	5-20
	9-60	Stratified silt loam to silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	90-100	80-95	25-45	5-20

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
832B, 832C2-------- Weller	0-16	Silt loam--------	ML, CL	A-6, A-4	0	100	100	100	95-100	30-40	5-15
	16-50	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	50-60	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	20-30
880B, 880C2-------- Clinton	0-12	Silt loam--------	ML	A-4	0	100	100	100	95-100	30-40	5-10
	12-48	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	100	95-100	40-55	25-35
	48-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
950, 950B, 950D2--- Niota	0-15	Silty clay loam, silt loam.	CL, ML	A-6, A-4	0	100	100	95-100	90-100	31-40	9-20
	15-60	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	52-76	26-42
952---------- Denrock	0-15	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	90-100	30-40	9-20
	15-65	Silty clay loam, silty clay, clay.	CH	A-7	0	100	95-100	95-100	90-100	50-75	25-40
977---------- Richwood	0-19	Silt loam--------	ML	A-4	0	100	100	90-100	85-95	25-35	3-10
	19-60	Silt loam, silty clay loam, loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	85-95	20-30	5-12
978---------- Festina	0-14	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	14-37	Silt loam, silty clay loam.	CL	A-6	0	100	100	100	95-100	30-40	10-20
	37-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	10-20
993D2*: Armstrong----------	0-12	Loam------------	CL, CL-ML	A-6, A-4	0	95-100	80-95	75-90	55-80	20-40	5-20
	12-33	Clay loam, clay, silty clay loam.	CL, CH	A-7	0	95-100	80-95	70-90	55-80	45-60	20-30
	33-60	Clay loam--------	CL	A-6	0	95-100	80-95	70-90	55-80	30-40	15-20
Gara----------	0-7	Loam------------	CL, CL-ML	A-4, A-6	0	85-95	80-90	70-80	55-70	20-30	5-15
	7-46	Clay loam--------	CL	A-6	0	85-95	80-90	70-85	55-75	30-40	15-25
	46-60	Loam, clay loam	CL	A-6, A-7	0	85-95	80-90	70-85	55-75	35-45	15-25
1057---------- Rushville	0-13	Silt loam--------	CL, CL-ML	A-4	0	100	100	95-100	90-100	25-32	5-10
	13-52	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	95-100	57-77	33-56
	52-60	Silt loam--------	CL	A-6, A-7	0	100	100	95-100	90-100	32-50	21-32
1130---------- Belinda	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	7-18	Silt loam--------	CL-ML, CL	A-4	0	100	100	100	95-100	25-35	5-10
	18-37	Silty clay-------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	37-60	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-65	25-35
1131B---------- Pershing	0-11	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	11-20
	11-52	Silty clay loam, silty clay.	CH	A-7	0	100	100	100	95-100	50-65	30-40
	52-68	Silty clay loam	CH, CL	A-7	0	100	100	100	95-100	45-55	25-35
1180, 1180B-------- Keomah	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	9-30	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-60	30-45
	30-60	Silty clay loam	CL	A-7, A-6	0	100	100	100	95-100	35-50	20-30
1181---------- Keomah	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	9-30	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-60	25-35
	30-60	Silty clay loam	CL	A-7	0	100	100	100	95-100	41-50	20-30
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
1220---------- Nodaway	0-60	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	95-100	95-100	90-100	25-35	5-15
1260---------- Beckwith	0-6	Silt loam-------	CL, CL-ML, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	6-17	Silt loam-------	CL-ML, CL, ML	A-4	0	100	100	100	95-100	25-35	5-10
	17-36	Silty clay------	CH	A-7	0	100	100	100	95-100	55-70	30-40
	36-60	Silty clay loam	CH	A-7	0	100	100	100	95-100	50-65	25-35
1316*. Alluvial land											

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

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" 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	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
13B*:								
Colo	0-37	0.2-0.6	0.21-0.23	5.6-7.3	High	0.28	5	7
	37-60	0.2-0.6	0.18-0.20	6.1-7.3	High	0.28		
Vesser	0-10	0.6-2.0	0.20-0.24	5.6-7.3	Moderate	0.32	5	7
	10-33	0.6-2.0	0.18-0.22	5.1-6.0	Moderate	0.43		
	33-60	0.6-2.0	0.17-0.21	5.6-6.5	Moderate	0.43		
23C, 23C2	0-13	0.6-2.0	0.21-0.23	5.6-6.0	High	0.32	5	4
Arispe	13-27	0.2-0.6	0.18-0.20	5.6-7.3	High	0.43		
	27-60	0.2-0.6	0.18-0.20	6.6-7.3	High	0.43		
41, 41B	0-20	2.0-6.0	0.10-0.12	5.1-7.3	Low	0.17	5	2
Sparta	20-60	6.0-20	0.06-0.11	5.1-6.5	Low	0.17		
51	0-10	0.6-2.0	0.20-0.24	5.6-7.3	Moderate	0.32	5	7
Vesser	10-33	0.6-2.0	0.18-0.22	5.1-6.0	Moderate	0.43		
	33-60	0.6-2.0	0.17-0.21	5.6-6.5	Moderate	0.43		
56, 56B	0-44	0.6-2.0	0.17-0.19	5.1-6.5	Low	0.32	5	6
Cantril	44-60	0.6-2.0	0.14-0.16	5.1-6.5	Moderate	0.32		
57	0-13	0.06-0.2	0.22-0.24	4.5-6.0	Moderate	0.43	3	6
Rushville	13-52	<0.2	0.11-0.20	4.5-6.5	High	0.43		
	52-60	0.06-0.2	0.20-0.22	5.6-8.4	Moderate	0.43		
58D2, 58E2	0-14	0.6-2.0	0.15-0.17	5.1-6.0	Low	0.32	5-4	6
Douds	14-48	0.6-2.0	0.15-0.17	4.5-6.0	Moderate	0.32		
	48-60	2.0-6.0	0.11-0.13	5.1-6.0	Low	0.32		
63*, 63B*	0-4	6.0-20	0.10-0.15	5.6-7.3	Low	0.17	5	2
Chelsea	4-60	6.0-20	0.06-0.08	5.1-5.5	Low	0.17		
65E2	0-11	0.6-2.0	0.16-0.18	4.5-6.0	Low	0.32	5	6
Lindley	11-62	0.2-0.6	0.12-0.16	6.1-7.8	Moderate	0.32		
65E3*	0-11	0.2-0.6	0.14-0.18	4.5-6.0	Moderate	0.32	4	6
Lindley	11-62	0.2-0.6	0.12-0.16	6.1-7.8	Moderate	0.32		
65F2, 65G	0-11	0.6-2.0	0.16-0.18	4.5-6.0	Low	0.32	5	6
Lindley	11-62	0.2-0.6	0.12-0.16	6.1-7.8	Moderate	0.32		
75	0-12	0.6-2.0	0.22-0.24	5.6-6.0	Moderate	0.32	5	6
Givin	12-50	0.2-0.6	0.18-0.20	5.1-5.5	Moderate	0.43		
	50-60	0.2-0.6	0.18-0.20	5.1-5.5	Moderate	0.43		
80B, 80C2, 80D2	0-12	0.6-2.0	0.20-0.22	5.6-6.5	Low	0.37	5	6
Clinton	12-48	0.6-2.0	0.16-0.20	5.1-6.0	Moderate	0.37		
	48-60	0.6-2.0	0.18-0.20	6.1-6.5	Moderate	0.37		
81B	0-12	0.6-2.0	0.20-0.22	5.6-6.5	Low	0.37	---	6
Clinton	12-60	0.6-2.0	0.16-0.20	5.1-6.0	Moderate	0.37		
	60-96	---	---	---	---	---		
81C2	0-12	0.6-2.0	0.20-0.22	5.6-6.5	Low	0.37	---	6
Clinton	12-60	0.6-2.0	0.16-0.20	5.1-6.0	Moderate	0.37		
	60-90	---	---	---	---	---		
115D*	0-4	6.0-20	0.10-0.15	5.6-7.3	Low	0.17	5	2
Chelsea	4-60	6.0-20	0.06-0.08	5.1-5.5	Low	0.17		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
130----------	0-7	0.6-2.0	0.22-0.24	5.6-6.5	Low----------	0.37	5	6
Belinda	7-18	0.6-2.0	0.20-0.22	4.5-6.0	Low----------	0.37		
	18-37	<0.06	0.12-0.14	4.5-5.5	High----------	0.28		
	37-60	0.06-0.6	0.18-0.20	5.1-6.0	High----------	0.28		
131B, 131C2------	0-11	0.6-2.0	0.22-0.24	4.5-6.5	Low----------	0.37	3	6
Pershing	11-52	0.06-0.2	0.18-0.20	5.1-6.0	High----------	0.37		
	52-68	0.2-0.6	0.18-0.20	5.1-6.0	Moderate------	0.37		
132B, 132C2, 132D2----------	0-16	0.6-2.0	0.22-0.24	4.5-6.0	Low----------	0.28	5	6
Weller	16-50	0.06-0.2	0.12-0.18	4.5-6.0	High----------	0.43		
	50-60	0.2-0.6	0.18-0.20	5.1-6.0	High----------	0.43		
133----------	0-37	0.2-0.6	0.21-0.23	5.6-7.3	High----------	0.28	5	7
Colo	37-60	0.2-0.6	0.18-0.20	6.1-7.3	High----------	0.28		
140----------	0-20	2.0-6.0	0.10-0.12	5.1-7.3	Low----------	0.17	5	2
Sparta	20-60	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17		
152----------	0-19	0.6-2.0	0.20-0.22	6.1-7.3	Moderate------	0.28	4	7
Marshan	19-42	0.6-2.0	0.15-0.19	6.1-7.3	Moderate------	0.28		
	42-60	6.0-20	0.02-0.05	6.1-7.3	Low----------	0.15		
154G*----------	0-14	0.6-2.0	0.15-0.17	5.1-6.0	Low----------	0.32	5-4	6
Douds	14-48	0.2-0.6	0.15-0.17	4.5-6.0	Moderate------	0.32		
	48-60	2.0-6.0	0.11-0.13	5.1-6.0	Low----------	0.32		
162B----------	0-13	2.0-6.0	0.21-0.23	5.1-7.3	Low----------	0.32	5-4	6
Downs	13-46	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.43		
	46-68	0.6-2.0	0.18-0.20	5.6-6.6	Moderate------	0.43		
163B, 163C2------	0-15	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6
Fayette	15-38	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	38-60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		
172----------	0-20	<0.06	0.12-0.14	5.6-7.3	High----------	0.28	5	4
Wabash	20-60	<0.06	0.08-0.12	5.6-7.8	High----------	0.28		
173----------	0-36	2.0-6.0	0.12-0.15	5.1-6.5	Low----------	0.28	4	3
Hoopeston	36-60	6.0-20.0	0.05-0.10	5.6-7.8	Low----------	0.28		
175, 175B--------	0-31	2.0-6.0	0.12-0.15	5.6-6.5	Low----------	0.20	4-3	3
Dickinson	31-50	6.0-20	0.08-0.10	5.6-6.5	Low----------	0.20		
	50-60	6.0-20	0.02-0.04	5.6-6.5	Low----------	0.15		
177----------	0-14	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.28	4	5
Saude	14-33	0.6-6.0	0.15-0.19	5.1-6.0	Low----------	0.28		
	33-60	>20	0.02-0.06	5.1-6.5	Very low------	0.10		
179C----------	0-7	0.6-2.0	0.20-0.22	5.6-6.0	Moderate------	0.28	5	6
Gara	7-46	0.2-0.6	0.16-0.18	5.1-6.5	Moderate------	0.28		
	46-60	0.2-0.6	0.16-0.18	6.6-7.8	Moderate------	0.37		
180, 180B--------	0-9	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.37	5	6
Keomah	9-30	0.2-0.6	0.18-0.20	5.1-5.5	High----------	0.37		
	30-60	0.2-0.6	0.18-0.20	5.1-6.5	High----------	0.37		
208----------	0-22	2.0-6.0	0.16-0.18	6.1-7.3	Low----------	0.20	5	3
Landes	22-70	6.0-20	0.05-0.20	6.1-7.3	Low----------	0.20		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
211----------	0-14	0.6-2.0	0.22-0.24	5.1-7.3	Moderate------	0.37	4	6
Edina	14-38	<0.06	0.11-0.13	5.6-7.3	Very high-----	0.37		
	38-65	0.06-0.2	0.18-0.20	6.6-7.3	High----------	0.37		
220----------	0-60	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
Nodaway								
222C, 222C2------	0-13	0.2-0.6	0.17-0.19	5.1-6.5	Moderate------	0.37	3	7
Clarinda	13-68	<0.06	0.14-0.16	5.1-6.5	High----------	0.37		
223C, 223D2------	0-13	0.6-2.0	0.22-0.24	5.1-6.5	Moderate------	0.43	3	6
Rinda	13-17	0.2-0.6	0.18-0.20	5.1-6.5	Moderate------	0.43		
	17-60	<0.06	0.14-0.16	5.1-7.3	High----------	0.32		
226----------	0-17	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.28	4	6
Lawler	17-33	0.6-2.0	0.16-0.18	5.6-6.5	Low-----------	0.28		
	33-60	6.0-20	0.02-0.04	6.1-6.5	Low-----------	0.10		
260----------	0-6	0.6-2.0	0.22-0.24	4.5-5.5	Low-----------	0.37	5	6
Beckwith	6-17	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.37		
	17-36	<0.06	0.12-0.14	5.1-6.0	High----------	0.28		
	36-60	0.2-0.6	0.18-0.20	5.6-6.5	High----------	0.28		
263----------	0-10	0.2-0.6	0.22-0.24	4.5-6.5	Low-----------	0.43	3	6
Okaw	10-60	<0.06	0.09-0.18	3.6-6.0	High----------	0.32		
291----------	0-17	0.6-2.0	0.22-0.24	5.6-6.5	Low-----------	0.32	5	6
Atterberry	17-50	0.2-2.0	0.18-0.20	5.1-6.0	Moderate------	0.43		
	50-66	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.43		
315*.								
Alluvial land								
354*.								
Marsh								
362, 363---------	0-16	0.6-2.0	0.22-0.24	5.6-6.5	Moderate------	0.32	3	6
Haig	16-27	<0.2	0.12-0.14	5.1-6.0	High----------	0.32		
	27-60	0.2-0.6	0.18-0.20	6.1-7.3	High----------	0.32		
364, 364B--------	0-10	0.6-2.0	0.22-0.24	5.6-7.3	Moderate------	0.37	3-2	6
Grundy	10-23	0.2-0.6	0.18-0.20	5.6-6.5	High----------	0.37		
	23-36	0.06-0.2	0.11-0.13	5.1-7.3	High----------	0.37		
	36-65	0.06-0.2	0.18-0.20	5.6-7.3	High----------	0.37		
380----------	0-16	0.6-2.0	0.21-0.23	5.1-6.0	Moderate------	0.37	4	7
Mahaska	16-58	0.2-0.6	0.14-0.18	4.5-6.0	High----------	0.43		
	58-72	0.6-2.0	0.18-0.20	5.6-7.3	High----------	0.43		
424D2*:								
Lindley---------	0-11	0.6-2.0	0.16-0.18	4.5-6.0	Low-----------	0.32	5	6
	11-62	0.2-0.6	0.14-0.18	4.5-6.5	Moderate------	0.32		
Keswick---------	0-12	0.6-2.0	0.14-0.18	4.5-6.0	Moderate------	0.37	3	6
	12-29	0.06-2.0	0.11-0.15	4.5-6.0	High----------	0.37		
	29-60	0.2-0.6	0.12-0.16	4.5-6.0	Moderate------	0.37		
424D3*:								
Lindley---------	0-11	0.2-0.6	0.14-0.18	4.5-6.0	Moderate------	0.32	4	6
	11-62	0.2-0.6	0.14-0.18	4.5-6.5	Moderate------	0.32		
Keswick---------	0-12	0.06-2.0	0.14-0.18	4.5-6.0	Moderate------	0.37	2	6
	12-29	0.06-2.0	0.11-0.15	4.5-6.0	High----------	0.37		
	29-60	0.2-0.6	0.12-0.16	4.5-6.0	Moderate------	0.37		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
425C2, 425D2-----	0-12	0.6-2.0	0.14-0.18	4.5-6.0	Moderate------	0.37	3	6
Keswick	12-29	0.06-2.0	0.11-0.15	4.5-6.0	High----------	0.37		
	29-60	0.2-0.6	0.12-0.16	4.5-6.0	Moderate------	0.37		
425D3*----------	0-12	0.06-2.0	0.14-0.18	4.5-6.0	Moderate------	0.37	2	6
Keswick	12-29	0.06-2.0	0.11-0.15	4.5-6.0	High----------	0.37		
	29-60	0.2-0.6	0.12-0.16	4.5-6.0	Moderate------	0.37		
452C2----------	0-14	0.6-2.0	0.16-0.20	6.1-6.5	Moderate------	0.37	3-2	6
Lineville	14-34	0.2-0.6	0.17-0.21	5.1-6.0	Moderate------	0.37		
	34-41	0.06-0.2	0.17-0.21	5.6-6.0	Moderate------	0.37		
	41-60	<0.06	0.13-0.21	5.6-7.3	High----------	0.37		
453----------	0-16	0.6-2.0	0.19-0.23	5.1-7.3	Moderate------	0.32	3	7
Tuskeego	16-40	<0.06	0.13-0.17	5.1-6.0	High----------	0.32		
	40-60	0.06-0.2	0.16-0.19	5.6-6.5	Moderate------	0.32		
478G*:								
Nordness--------	0-11	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43	2	6
	11-16	0.06-0.2	0.12-0.15	6.6-7.3	High----------	0.43		
	16-96	---	---	---	----------	---		
Rock outcrop.								
484----------	0-29	0.6-2.0	0.22-0.24	6.1-7.8	Low-----------	0.28	5	6
Lawson	29-60	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.28		
485----------	0-60	0.6-2.0	0.19-0.21	5.6-7.3	Moderate------	0.28	5	6
Spillville								
499D2, 499F------	0-11	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.43	2	6
Nordness	11-16	0.06-0.2	0.12-0.15	6.6-7.3	High----------	0.43		
	16-96	---	---	---	----------	---		
520----------	0-9	0.6-2.0	0.20-0.24	6.1-7.3	Moderate------	0.32	5	7
Coppock	9-26	0.6-2.0	0.18-0.22	5.6-7.3	Moderate------	0.43		
	26-50	0.6-2.0	0.17-0.21	4.5-6.0	Moderate------	0.43		
	50-60	0.6-2.0	0.15-0.19	4.5-6.0	Moderate------	0.43		
587----------	0-17	0.2-0.6	0.18-0.20	5.6-6.5	High----------	0.28	5	7
Chequest	17-60	0.2-0.6	0.14-0.18	5.1-6.0	High----------	0.43		
594C2, 594D2,								
594D3*, 594E2---	0-9	0.6-2.0	0.19-0.21	5.6-7.3	Moderate------	0.37	3	6
Galland	9-48	0.06-0.2	0.14-0.19	5.1-6.0	Moderate------	0.37		
	48-60	2.0-6.0	0.11-0.13	6.1-6.5	Low-----------	0.24		
687----------	0-11	0.6-2.0	0.20-0.24	5.6-6.5	Moderate------	0.32	5	7
Watkins	11-48	0.6-2.0	0.15-0.19	5.1-6.5	Moderate------	0.43		
	48-60	0.6-2.0	0.14-0.18	5.6-6.5	Moderate------	0.43		
688----------	0-18	0.6-2.0	0.20-0.24	5.6-7.3	Moderate------	0.32	5	7
Koszta	18-60	0.6-2.0	0.15-0.19	5.1-7.3	Moderate------	0.43		
720----------	0-24	0.2-0.6	0.22-0.24	5.1-7.3	Moderate------	0.43	3	6
Racoon	24-60	0.06-0.2	0.18-0.20	4.5-5.5	High----------	0.43		
730B*:								
Nodaway---------	0-60	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
Cantril---------	0-44	0.6-2.0	0.17-0.19	5.1-6.5	Low-----------	0.32	5	6
	44-60	0.2-2.0	0.14-0.16	5.1-6.5	Moderate------	0.32		
763D2*:								
Fayette---------	0-15	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	6
	15-38	0.6-2.0	0.18-0.20	4.5-6.0	Moderate------	0.37		
	38-60	0.6-2.0	0.18-0.20	5.1-6.5	Moderate------	0.37		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
763D2*:								
Exette	0-6	0.6-2.0	0.21-0.23	6.6-7.3	Low	0.37	5-4	6
	6-20	0.6-2.0	0.20-0.22	5.6-6.5	Moderate	0.37		
	20-60	0.6-2.0	0.20-0.22	6.6-7.8	Moderate	0.37		
792C2, 792D2	0-12	0.6-2.0	0.20-0.22	5.6-6.5	Moderate	0.32	3-2	6
Armstrong	12-33	0.06-0.2	0.11-0.16	5.1-6.5	High	0.32		
	33-60	0.2-0.6	0.14-0.16	5.1-6.5	Moderate	0.32		
793, 793B, 793C2-	0-8	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.37	5	5
Bertrand	8-15	0.6-2.0	0.18-0.22	5.1-6.5	Moderate	0.37		
	15-40	0.6-2.0	0.06-0.22	5.1-6.5	Low	0.37		
	40-60	6.0-20	0.05-0.07	5.1-6.5	Low	0.15		
795C2, 795C3*,								
795D2, 795D3*-	0-5	0.2-0.6	0.20-0.22	4.5-5.0	Moderate	0.43	3	7
Ashgrove	5-31	<0.06	0.12-0.14	5.1-6.5	High	0.32		
	31-60	<0.06	0.12-0.14	5.6-7.3	High	0.32		
820	0-9	0.6-2.0	0.20-0.24	6.1-7.3	Moderate	0.37	5	6
Dockery	9-60	0.2-2.0	0.20-0.24	6.1-7.3	Moderate	0.37		
832B, 832C2	0-16	0.6-2.0	0.22-0.24	4.5-6.0	Low	0.28	5	6
Weller	16-50	0.06-0.2	0.12-0.18	4.5-6.0	High	0.43		
	50-60	0.2-0.6	0.18-0.20	5.1-6.0	High	0.43		
880B, 880C2	0-12	0.6-2.0	0.20-0.22	5.6-6.5	Low	0.37	5	6
Clinton	12-48	0.6-2.0	0.16-0.20	5.1-6.0	Moderate	0.37		
	48-60	0.6-2.0	0.18-0.20	6.1-6.5	Moderate	0.37		
950, 950B, 950D2-	0-15	0.2-0.6	0.22-0.24	5.1-7.3	Low	0.37	3	6
Niota	15-60	<0.06	0.09-0.13	3.6-5.0	High	0.37		
952	0-15	0.2-0.6	0.22-0.24	5.6-7.8	Low	0.37	3	6
Denrock	15-65	<0.06	0.09-0.13	5.1-6.0	Moderate	0.37		
977	0-19	0.6-2.0	0.22-0.24	5.6-7.3	Low	0.28	5	5
Richwood	19-60	0.6-2.0	0.18-0.22	5.6-7.3	Low	0.43		
978	0-14	0.6-2.0	0.22-0.24	5.6-6.0	Low	0.32	5	6
Festina	14-37	0.6-2.0	0.20-0.22	5.6-6.0	Moderate	0.43		
	37-60	0.6-2.0	0.20-0.22	6.1-6.5	Moderate	0.43		
993D2*:								
Armstrong	0-12	0.6-2.0	0.20-0.22	5.6-6.5	Moderate	0.32	3-2	6
	12-33	0.06-0.2	0.11-0.16	5.1-6.5	High	0.32		
	33-60	0.2-0.6	0.14-0.16	5.1-6.5	Moderate	0.32		
Gara	0-7	0.6-2.0	0.20-0.22	5.6-6.0	Moderate	0.28	5	6
	7-46	0.2-0.6	0.16-0.18	5.1-6.5	Moderate	0.28		
	46-60	0.2-0.6	0.16-0.18	6.6-7.8	Moderate	0.37		
1057	0-16	0.06-0.2	0.22-0.24	4.5-6.0	Moderate	0.43	3	6
Rushville	16-52	<0.2	0.11-0.20	4.5-6.5	High	0.43		
	52-60	0.06-0.2	0.20-0.22	5.6-8.4	Moderate	0.43		
1130	0-7	0.6-2.0	0.22-0.24	5.6-6.5	Low	0.37	5	6
Belinda	7-18	0.6-2.0	0.20-0.22	4.5-6.0	Low	0.37		
	18-37	<0.06	0.12-0.14	4.5-5.5	High	0.28		
	37-60	0.06-0.6	0.18-0.20	5.1-6.0	High	0.28		
1131B	0-11	0.6-2.0	0.22-0.24	4.5-6.5	Low	0.37	3	6
Pershing	11-52	0.06-0.2	0.18-0.20	5.1-6.0	High	0.37		
	52-68	0.2-0.6	0.18-0.20	5.1-6.0	Moderate	0.37		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
1180, 1180B------	0-9	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.37	5	6
Keomah	9-30	0.2-0.6	0.18-0.20	5.1-5.5	High----------	0.37		
	30-60	0.2-0.6	0.18-0.20	5.1-6.5	High----------	0.37		
1181-------------	0-9	0.6-2.0	0.22-0.24	6.1-6.5	Low----------	0.37	5	6
Keomah	9-30	0.2-0.6	0.18-0.20	5.1-5.5	High----------	0.37		
	30-60	0.2-0.6	0.18-0.20	5.1-6.5	High----------	0.37		
1220-------------	0-60	0.6-2.0	0.20-0.23	6.1-7.3	Moderate------	0.37	5	7
Nodaway								
1260-------------	0-6	0.6-2.0	0.22-0.24	4.5-5.5	Low----------	0.37	5	6
Beckwith	6-17	0.6-2.0	0.20-0.22	4.5-5.5	Low----------	0.37		
	17-36	<0.06	0.12-0.14	5.1-6.0	High----------	0.28		
	36-60	0.2-0.6	0.18-0.20	5.6-6.5	High----------	0.28		
1316*.								
Alluvial land								

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

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

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*: Colo	B/D	Common	Very brief to long.	Feb-Nov	0-1.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
Vesser	C	Common	Brief to long.	Feb-Nov	0-1.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
23C, 23C2 Arispe	C	None	---	---	3.0-5.0	Perched	Apr-Jun	>60	---	High	High	Moderate.
41, 41B Sparta	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Moderate.
51 Vesser	C	Common	Brief to long.	Feb-Nov	0-1.0	Apparent	Nov-Jul	>60	---	High	High	Moderate.
56, 56B Cantril	B	Rare	---	---	1.5-3.0	Apparent	Nov-Jun	>60	---	High	Moderate	Low.
57 Rushville	D	None	---	---	0-1.0	Perched	Mar-Jun	>60	---	High	High	High.
58D2, 58E2 Douds	B	None	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	Moderate	Moderate	Moderate.
63*, 63B* Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
65E2, 65E3*, 65F2, 65G Lindley	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
75 Givin	C	None	---	---	2.0-3.0	Perched	Apr-Jul	>60	---	High	High	Moderate.
80B, 80C2, 80D2, 81B, 81C2 Clinton	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
115D* Chelsea	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
130 Belinda	D	None	---	---	0-1.0	Perched	Apr-Jul	>60	---	Moderate	High	Moderate.
131B, 131C2 Pershing	C	None	---	---	2.0-3.0	Perched	Apr-Jul	>60	---	High	High	Moderate.

See footnote at end of table.

TABLE 15.--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				
132B, 132C2, 132D2---------- Weller	C	None--------	---	---	2.0-4.0	Perched	Apr-Jul	>60	---	High-----	High-----	High.
133---------- Colo	B/D	Common------	Very brief to long.	Feb-Nov	0-1.0	Apparent	Nov-Jul	>60	---	High-----	High-----	Moderate.
140---------- Sparta	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
152---------- Marshan	B/D	None to common.	Very brief	Mar-Nov	0-1.0	Apparent	Jan-Dec	>60	---	High-----	High-----	Moderate.
154G*---------- Douds	B	None--------	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	Moderate	Moderate	Moderate.
162B---------- Downs	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
163B, 163C2------- Fayette	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
172---------- Wabash	D	Common------	Brief to long.	Feb-Nov	0-1.0	Perched	Nov-May	>60	---	Moderate	High-----	Moderate.
173---------- Hoopeston	B	None--------	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High-----	Low------	Moderate.
175, 175B--------- Dickinson	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
177---------- Saude	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Moderate.
179C---------- Gara	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
180, 180B--------- Keomah	C	None--------	---	---	2.0-4.0	Perched	Apr-Jul	>60	---	High-----	High-----	Moderate.
208---------- Landes	B	Common------	Brief-----	Feb-Nov	3.0-6.0	Apparent	Mar-May	>60	---	Moderate	Low------	Low.
211---------- Edina	D	None--------	---	---	0.5-2.0	Perched	Nov-Apr	>60	---	Moderate	High-----	Moderate.
220---------- Nodaway	B	Common------	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	>60	---	High-----	Moderate	Low.
222C, 222C2------- Clarinda	D	None--------	---	---	0-1.0	Perched	Nov-May	>60	---	Moderate	High-----	Moderate.
223C, 223D2------- Rinda	D	None--------	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	High-----	High-----	Moderate.

See footnote at end of table.

TABLE 15.--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				
226--- Lawler	B	None	---	---	2.0-3.0	Apparent	Nov-May	>60	---	High	High	Moderate.
260--- Beckwith	D	None	---	---	0-1.0	Perched	Apr-Jul	>60	---	Moderate	High	Moderate.
263--- Okaw	D	Occasional	Brief	Apr-Jun	0-1.0	Apparent	Mar-Jun	>60	---	High	High	High.
291--- Atterberry	B	None	---	---	1.0-3.0	Apparent	Mar-Jun	>60	---	High	High	Moderate.
315*. Alluvial land												
354*. Marsh												
362, 363--- Haig	C/D	None	---	---	0-1.0	Perched	Apr-Jul	>60	---	High	High	Moderate.
364, 364B--- Grundy	C	None	---	---	1.0-3.0	Perched	Mar-May	>60	---	High	High	Moderate.
380--- Mahaska	B	None	---	---	2.0-3.0	Perched	Apr-Jul	>60	---	High	High	Moderate.
424D2*, 424D3*: Lindley---	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Keswick---	D	None	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	High	High	Moderate.
425C2, 425D2, 425D3*--- Keswick	D	None	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	High	High	Moderate.
452C2--- Lineville	C	None	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	High	High	Moderate.
453--- Tuskeego	C/D	Rare	---	---	0-1.0	Apparent	Nov-Apr	>60	---	High	High	Moderate.
478G*: Nordness---	B	None	---	---	>6.0	---	---	8-20	Hard	Low	Low	Low.
Rock outcrop.												
484--- Lawson	B	Occasional	Brief	Mar-Nov	1.0-3.0	Apparent	Nov-May	>60	---	High	Moderate	Low.
485--- Spillville	B	Common	Very brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	>60	---	Moderate	High	Moderate.

See footnote at end of table.

TABLE 15.--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				
499D2, 499F---- Nordness	B	None----	---	---	>6.0	---	---	8-20	Hard	Low----	Low----	Low.
520---- Coppock	B	Common----	Long----	Feb-Nov	1.0-3.0	Apparent	Nov-Mar	>60	---	High----	High----	Moderate.
587---- Chequest	C	Common----	Long----	Feb-Nov	0-1.0	Apparent	Nov-May	>60	---	High----	High----	Moderate.
594C2, 594D2, 594D3*, 594E2---- Galland	D	None----	---	---	3.0-5.0	Perched	Nov-Mar	>60	---	High----	High----	Moderate.
687---- Watkins	B	None to rare	---	---	>6.0	---	---	>60	---	High----	Moderate	Moderate.
688---- Koszta	B	Rare to occasional.	Very brief	Apr-Oct	2.0-3.0	Apparent	Nov-Mar	>60	---	High----	Moderate	Moderate.
720---- Racoon	C/D	Occasional	Brief----	Feb-Nov	0-1.0	Apparent	Mar-Jun	>60	---	High----	High----	High.
730B*: Nodaway----	B	Common----	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	>60	---	High----	Moderate	Low.
Cantril----	B	Rare----	---	---	1.5-3.0	Apparent	Nov-Jun	>60	---	High----	Moderate	Low.
763D2*: Fayette----	B	None----	---	---	>6.0	---	---	>60	---	High----	Moderate	Moderate.
Exette----	B	None----	---	---	>6.0	---	---	>60	---	High----	Low----	Low.
792C2, 792D2---- Armstrong	D	None----	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	High----	High----	Moderate.
793, 793B, 793C2-- Bertrand	B	None----	---	---	>6.0	---	---	>60	---	High----	Low----	Moderate.
795C2, 795C3*, 795D2, 795D3*---- Ashgrove	D	None----	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	High----	High----	Moderate.
820---- Dockery	C	Occasional	Brief----	Feb-Nov	1.0-3.0	Apparent	Nov-Apr	>60	---	High----	Moderate	Low.
832B, 832C2---- Weller	C	None----	---	---	2.0-4.0	Perched	Apr-Jul	>60	---	High----	High----	High.
880B, 880C2---- Clinton	B	None----	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
950, 950B, 950D2-- Niota	D	None----	---	---	0-2.0	Perched	Mar-Jun	>60	---	High----	High----	High.

See footnote at end of table.

TABLE 15.--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				
952---------- Denrock	D	Common------	Long------	Feb-Nov	1.0-3.0	Perched	Mar-Jun	>60	---	High-----	High-----	Moderate.
977---------- Richwood	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
978---------- Festina	B	None to rare	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
993D2*:												
Armstrong--------	D	None--------	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	High-----	High-----	Moderate.
Gara----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
1057---------- Rushville	D	None--------	---	---	0-1.0	Perched	Mar-Jun	>60	---	High-----	High-----	High.
1130---------- Belinda	D	None--------	---	---	0-1.0	Perched	Apr-Jul	>60	---	Moderate	High-----	Moderate.
1131B---------- Pershing	C	None--------	---	---	2.0-3.0	Perched	Apr-Jul	>60	---	High-----	High-----	Moderate.
1180, 1180B------- Keomah	C	None--------	---	---	2.0-4.0	Perched	Apr-Jul	>60	---	High-----	High-----	Moderate.
1181---------- Keomah	C	None--------	---	---	2.0-4.0	Perched	Apr-Jul	>60	---	High-----	High-----	Moderate.
1220---------- Nodaway	B	Common------	Very brief to brief.	Feb-Nov	3.0-5.0	Apparent	Apr-Jul	>60	---	High-----	Moderate	Low.
1260---------- Beckwith	D	None--------	---	---	0-1.0	Perched	Apr-Jul	>60	---	Moderate	High-----	Moderate.
1316*. Alluvial land												

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

TABLE 16.--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
Arispe	Fine, montmorillonitic, mesic Aquic Argiudolls
Armstrong	Fine, montmorillonitic, mesic Aquollic Hapludalfs
Ashgrove	Fine, montmorillonitic, mesic, sloping Aeric Ochraqualfs
Atterberry	Fine-silty, mixed, mesic Udollic Ochraqualfs
Beckwith	Fine, montmorillonitic, mesic Typic Albaqualfs
Belinda	Fine, montmorillonitic, mesic Mollic Albaqualfs
Bertrand	Fine-silty, mixed, mesic Typic Hapludalfs
Cantril	Fine-loamy, mixed, mesic Udollic Ochraqualfs
Chelsea	Mixed, mesic Alfic Udipsamments
Chequest	Fine, montmorillonitic, mesic Typic Haplaquolls
Clarinda	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Clinton	Fine, montmorillonitic, mesic Typic Hapludalfs
Colo	Fine-silty, mixed, mesic Cumulic Haplaquolls
Coppock	Fine-silty, mixed, mesic Mollic Ochraqualfs
Denrock Variant	Fine, mixed, mesic Typic Argiaquolls
Dickinson	Coarse-loamy, mixed, mesic Typic Hapludolls
*Dockery	Fine-silty, mixed, nonacid, mesic Aquic Udifluvents
Douds	Fine-loamy, mixed, mesic Typic Hapludalfs
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Edina	Fine, montmorillonitic, mesic Typic Argialbolls
Exette	Fine-silty, mixed, mesic Dystric Eutrochrepts
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
Festina	Fine-silty, mixed, mesic Mollic Hapludalfs
Galland	Fine, montmorillonitic, mesic Aquic Hapludalfs
Gara	Fine-loamy, mixed, mesic Mollic Hapludalfs
Givin	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Grundy	Fine, montmorillonitic, mesic Aquic Argiudolls
Haig	Fine, montmorillonitic, mesic Typic Argiaquolls
Hoopeston	Coarse-loamy, mixed, mesic Aquic Hapludolls
Keomah	Fine, montmorillonitic, mesic Aeric Ochraqualfs
Keswick	Fine, montmorillonitic, mesic Aquic Hapludalfs
Koszta	Fine-silty, mixed, mesic Udollic Ochraqualfs
*Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Lawler	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aquic Hapludolls
Lawson	Fine-silty, mixed, mesic Cumulic Hapludolls
Lindley	Fine-loamy, mixed, mesic Typic Hapludalfs
*Lineville	Fine-loamy, mixed, mesic Aquollic Hapludalfs
Mahaska	Fine, montmorillonitic, mesic Aquic Argiudolls
*Marshan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplaquolls
*Niota	Fine, mixed, mesic Mollic Albaqualfs
Nodaway	Fine-silty, mixed, nonacid, mesic Mollic Udifluvents
Nordness	Loamy, mixed, mesic Lithic Hapludalfs
Okaw	Fine, montmorillonitic, mesic Typic Albaqualfs
Pershing	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Racoon	Fine-silty, mixed, mesic Typic Ochraqualfs
Richwood	Fine-silty, mixed, mesic Typic Argiudolls
Rinda	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Rushville	Fine, montmorillonitic, mesic Typic Albaqualfs
Saude	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Typic Hapludolls
*Sparta	Sandy, mixed, mesic Entic Hapludolls
Spillville	Fine-loamy, mixed, mesic Cumulic Hapludolls
Tuskeego	Fine, montmorillonitic, mesic Mollic Ochraqualfs
Vesser	Fine-silty, mixed, mesic Argiaquic Argialbolls
Wabash	Fine, montmorillonitic, mesic Vertic Haplaquolls
Watkins	Fine-silty, mixed, mesic Mollic Hapludalfs
Weller	Fine, montmorillonitic, mesic Aquic Hapludalfs

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